

THE CITY OF WINNIPEG

SPECIFICATION MANUAL

**Bid Opportunity No. 313-2024B
Redevelopment of the Old Ex Arena
80 Sinclair Street, Winnipeg, MB**

January 2025

Prime Consultant & Contract Administrator:	1x1 architecture inc.
Civil Consultant:	Sison Blackburn Consulting Inc.
Landscape Consultant:	HTFC Planning & Design
Structural Consultant:	Crosier Kilgour
Mechanical Consultant:	Nova 3 Engineering Ltd.
Electrical Consultant:	Nova 3 Engineering Ltd.
Commissioning Consultant:	Crosier Kilgour
Energy Modelling:	Crosier Kilgour
LEED Consultant:	Crosier Kilgour

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Part 1 General

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Part 2 Products - Not Used

Part 3 Execution - Not Used

END OF SECTION

Part 1 General

1.1 Section includes

- .1 Documents and terminology.
- .2 Associated requirements.
- .3 Work expectations.
- .4 Work by other parties.
- .5 Occupancy and premises usage.

1.2 Related requirements

- .1 Section 01 21 00 - Allowances.
- .2 Section 01 35 20 - LEED Sustainable Requirements.
- .3 Section 01 78 00 - Closeout Submittals.
- .4 This section describes requirements applicable to all Sections within Divisions 02 to 49.

1.3 Related documents

- .1 City of Winnipeg Bid Opportunity Document
- .2 City of Winnipeg General Conditions
- .3 All other Division 01 specification sections.
- .4 Division 01 sections describe requirements applicable to all Sections within Divisions 02 to 49 inclusive.

1.4 Complementary documents

- .1 Drawings, specifications, and schedules are complementary each to the other and what is called for by one to be binding as if called for by all. Should any discrepancy appear between documents that leave doubt as to the intent or meaning, abide by priority of documents established in the General Conditions or obtain direction from the Contract Administrator.
- .2 Drawings indicate general location and route of building services. Install building services not shown or indicated diagrammatically in schematic or riser diagrams to provide an operational assembly or system.
- .3 Examine all discipline drawings, specifications, and schedules and related Work to ensure that Work can be satisfactorily executed. Conflicts or additional work beyond work described to be brought to attention of Contract Administrator.

1.5 Description of the work

- .1 Work of this Contract comprises of the construction of: a redevelopment of the existing Old Exhibition Arena at 80 Sinclair Street, as described in the contract documents. This includes the demolition of the existing arena lobby, the construction of a new building addition, the renovation of the existing arena and zamboni garage, and exterior site works.

- .2 Division of the Work among other Subcontractors is solely the Contractor's responsibility. Neither the City of Winnipeg nor Contract Administrator assumes any responsibility to act as an arbiter to establish subcontract terms between sectors or disciplines of work.

1.6 Contract Method

- .1 Construct Work under a stipulated price contract. Refer to City of Winnipeg Bid Opportunity Document.

1.7 Documents provided

- .1 City of Winnipeg will supply the Contractor with:
 - .1 Electronic documents, in electronically delivered Adobe PDF formats.
 - .2 An electronic set of documents will be provided near the end of the Project for purposes of transferring changed information recorded on as-built documents to the electronic Record Documents.

1.8 Performance of the work

- .1 Substantial Performance of the Work is required before November 5, 2026.

1.9 Ready-for-Takeover

- .1 Ready-for-Takeover is required for City of Winnipeg occupancy before December 7, 2026.
- .2 Perform all prerequisite activities identified in the General Conditions, including a list of incomplete items, before applying for Ready-for-Takeover.

1.10 City of Winnipeg supplied products

- .1 Obtain the necessary information from the Contract Administrator and proceed to coordinate details for installation. Receive, unload, install, connect and test the specified equipment.
- .2 Receive City of Winnipeg supplied Products and equipment F.O.B. and store and process Products and equipment until installation.
- .3 City of Winnipeg Responsibilities:
 - .1 Arrange for delivery of information, product data, manufacturer's instructions, and certificates (as applicable) to the Contractor.
 - .2 Deliver supplier's bill of materials to Contractor.
 - .3 Arrange and pay for delivery to the Place of the Work in accordance with Progress Schedule.
 - .4 Inspect deliveries jointly with Contractor.
 - .5 Submit claims for transportation damage.
 - .6 Arrange for replacement of damaged, defective or missing items.
 - .7 Arrange for manufacturer's field services; arrange for and deliver manufacturer's warranties and bonds to Contractor.
- .4 Contractor Responsibilities:
 - .1 Designate submittals and delivery date for each Product in progress schedule.

- .2 Review information, product data, samples, and other submittals. Submit to Contract Administrator, notification of any observed discrepancies or problems anticipated due to non-conformance with Contract Documents.
- .3 Receive and unload Products at site.
- .4 Inspect deliveries jointly with City of Winnipeg; record shortages, and damaged or defective items.
- .5 Handle Products at site, including uncrating and storage.
- .6 Protect Products from damage, and from exposure to elements.
- .7 Assemble, install, connect, adjust, and finish Products.
- .8 Arrange for installation inspections required by public authorities.
- .9 Repair or replace items damaged by Contractor or Subcontractor on site (under their control).
- .5 Schedule of City of Winnipeg-supplied Products.
 - .1 Exterior Plantings (trees, shrubs - see Landscape drawings)
 - .2 Exterior Furniture (bike racks, picnic tables)
 - .3 Interior Furniture (desks, tables, chairs, filing cabinets).
 - .4 Kitchen Appliances (fridges, freezers, microwaves)
 - .5 Office Equipment (computers, phones, photocopiers, whiteboards, key storage)
 - .6 Stores Equipment (pressure washer, air compressor, existing shelving)
 - .7 Security System & Assistive Listening System Devices (see Electrical Drawings)

1.11 Work by others

- .1 As noted on drawings.

1.12 Contractor use of premises

- .1 Contractor has unrestricted use of site until Substantial Performance of the Work.
 - .1 The Contractor must provide continuous access to the existing shed on site by the City's Parks Department. Coordinate access during the shed's relocation.
 - .2 The Contractor will be responsible for coordinating construction access, laydown areas, site offices, site fencing, etc. as required to accommodate the work of the tennis court redevelopment project.
 - .3 The Contractor must allow access to Sgt. Tommy Prince Place (including the associated parking lot spaces) by City of Winnipeg staff and by the public. Access to Sgt. Tommy Prince Place must be maintained at all times during its operating hours.
 - .4 Coordinate laydown areas, site offices, and site fencing to allow for minimal interruption to City of Winnipeg staff and public users of Sgt. Tommy Prince Place.
 - .5 Obtain and pay for use of additional storage or work areas needed for operations under this Contract.

1.13 City of Winnipeg occupancy

- .1 City of Winnipeg will not occupy the premises (at 80 Sinclair Street) during the entire construction period.

END OF SECTION

Part 1 General

1.1 Section includes

- .1 Cash allowances.
- .2 Inspection and testing allowances.

1.2 Related requirements

- .1 Section 01 35 20 - LEED Sustainable Design Requirements.
- .2 Section 01 91 13 - General Commissioning Requirements
- .3 This section describes requirements applicable to all Sections within Divisions 02 to 49.

1.3 Cash allowances

- .1 Include in the Contract Price, all cash allowances as stated herein.
- .2 Cash allowances, unless otherwise specified, cover the net cost to the Contractor of services, products, construction machinery and equipment, freight, handling, unloading, storage installation and other authorized expenses incurred in performing the Work.
- .3 The Contract price, and not the cash allowance, shall include the Contractor's overhead and profit in connection with such cash allowance.
- .4 The Contract Price will be adjusted by written order to provide for an excess or deficit to each cash allowance.
- .5 Where costs under a cash allowance exceed the amount of the allowance, the Contractor will be compensated for any excess incurred and substantiated plus an allowance for overhead and profit as set out in the Contract Documents.
- .6 Progress payments on accounts of work authorized under cash allowances shall be included in the Contract Administrator's monthly certificate for payment.
- .7 A schedule shall be prepared jointly by the Contract Administrator and Contractor to show when items called for under cash allowances must be authorized by the Contract Administrator for ordering purposes so that the progress of the Work will not be delayed.
- .8 Allowances Schedule:
 - .1 The Contractor shall include in the Contract Price, all cash allowances as follows:
 - .1 Cash Allowance #1: Signage (interior and exterior)
 - .1 Amount: \$15,000.00
 - .2 Description: Cost for supply and installation of new room identification signage, wayfinding signage, washroom signage, window films, and any other visual signage or graphic requirements as may be required for the project.
 - .2 Cash Allowance #2: Hazardous Materials
 - .1 Amount: \$85,000
 - .2 Description: Cost for abatement of existing hazardous building materials and any testing and abatement of materials discovered

on site that are suspected to be hazardous in nature (such as asbestos, mould, lead, mercury, or PCBs).

- .3 Cash Allowance #3: Piling and Shoring Inspections
 - .1 Amount: \$5,000
 - .2 Description: Cost for inspection and testing by an independent certified testing agency, as may be determined to be required.
- .4 Cash Allowance #4: Concrete and Compaction Testing
 - .1 Amount: \$5,000
 - .2 Description: Cost for inspection and testing by an independent certified testing agency, as may be determined to be required.
- .5 Cash Allowance #5: Asphalt and Compaction Testing
 - .1 Amount: \$5,000
 - .2 Description: Cost for inspection and testing by an independent certified testing agency, as may be determined to be required.
- .6 Cash Allowance #6: Shelving and racking
 - .1 Amount: \$136,500
 - .2 Description: Cost to supply and install all shelving and racking in multiple spaces throughout building. Refer to the finish plans and specification section 10 56 13.
- .7 Cash Allowance #7: Roof Inspections
 - .1 Amount: \$2,500
 - .2 Description: Cost for inspection and testing by an independent certified testing agency, as may be determined to be required.

END OF SECTION

Part 1 General

1.1 Related requirements

- .1 Section 01 32 16.19 - Construction Progress Schedule - Bar (GANTT) Chart.
- .2 Section 01 33 00 - Submittal Procedures
- .3 Section 01 52 00 - Construction Facilities
- .4 Section 01 78 00 - Closeout Submittals

1.2 Administrative

- .1 Schedule and administer project meetings bi-weekly throughout the course of the project.
- .2 Prepare agenda for meetings.
- .3 Provide physical space and make arrangements for meetings.
- .4 Preside at meetings.
- .5 Record the meeting minutes. Include significant proceedings and decisions. Identify actions by parties.
- .6 Reproduce and distribute copies of minutes within three days after meetings and transmit to meeting participants and, affected parties not in attendance.
- .7 Representative of Contractor, Subcontractor and suppliers attending meetings will be qualified and authorized to act on behalf of party each represents.

1.3 Preconstruction meeting

- .1 Within 15 days after award of Contract, request a meeting of parties in contract to discuss and resolve administrative procedures and responsibilities.
- .2 City of Winnipeg Representative, Contract Administrator, Contractor, major Subcontractors will be in attendance.
- .3 Establish time and location of meeting and notify parties concerned minimum 5 days before meeting.
- .4 Incorporate mutually agreed variations to Contract Documents into Agreement, prior to signing.
- .5 Agenda to include:
 - .1 Appointment of official representative of participants in the Work.
 - .2 Schedule of Work: in accordance with 01 32 16.19 - Construction Progress Schedule - Bar (GANTT) Chart.
 - .3 Schedule of submission of shop drawings, samples, colour chips. Submit submittals 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 52 00 - Construction Facilities.
 - .5 Delivery schedule of specified equipment in accordance with pertinent Sections.
 - .6 Site security in accordance with Section 01 56 00 - Temporary Barriers and Enclosures.

- .7 Proposed changes, change orders, procedures, approvals required, mark-up percentages permitted, time extensions, overtime, administrative requirements.
- .8 City of Winnipeg provided products.
- .9 Record drawings in accordance with Section 01 33 00 - Submittal Procedures.
- .10 Maintenance manuals in accordance with Section 01 78 00 - Closeout Submittals.
- .11 Take-over procedures, acceptance, warranties in accordance with Section 01 78 00 - Closeout Submittals.
- .12 Monthly progress claims, administrative procedures, photographs, hold backs.
- .13 Appointment of inspection and testing agencies or firms.
- .14 Insurances, transcript of policies.

1.4 Progress meetings

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

Part 2 Products - Not Used

Part 3 Execution - Not Used

END OF SECTION

Part 1 General

1.1 Related requirements

- .1 Section 01 31 19 Project Meetings.
- .2 Section 01 33 00 - Submittal Procedures.

1.2 Definitions

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

1.3 Requirements

- .1 Ensure Master Plan and Detail Schedules are practical and remain within specified Contract duration.
- .2 Plan to complete Work in accordance with prescribed milestones and time frame.
- .3 Ensure that it is understood that Award of Contract or time of beginning, rate of progress, Interim Certificate and Final Certificate as defined times of completion are of essence of this contract.

1.4 Action and informational submittals

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit to City of Winnipeg Representative and Contract Administrator within seven working days of Award of Contract a Bar (GANTT) Chart as Master Plan for planning, monitoring and reporting of project progress.

- .1 Submit a separate schedule of asbestos abatement work to the City of Winnipeg Representative and Contract Administrator within seven working days of Award of Contract. The abatement schedule is required prior to any demolition work. Immediately report any disruptions or revisions to the abatement schedule to the Contract Administrator.

1.5 Project milestones

- .1 Project milestones form interim targets for Project Schedule.
 - .1 Interim Certificate (Substantial Completion) by November 5, 2026.
 - .2 Total Performance by December 7, 2026.

1.6 Master plan

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

1.7 Project schedule

- .1 Develop detailed Project Schedule derived from Master Plan.
- .2 Ensure detailed Project Schedule includes as minimum milestone and activity types as follows:
 - .1 Award.
 - .2 Shop Drawings, Samples.
 - .3 Permits.
 - .4 Mobilization.
 - .5 Asbestos Abatement.
 - .6 Demolition.
 - .7 Excavation.
 - .8 Backfill.
 - .9 Building footings.
 - .10 Slab on grade.
 - .11 Structural Steel.
 - .12 Siding and Roofing.
 - .13 Interior Architecture (Walls, Floors and Ceiling).
 - .14 Plumbing.
 - .15 Lighting.
 - .16 Electrical.
 - .17 Piping.
 - .18 Controls.

- .19 Heating, Ventilating, and Air Conditioning.
- .20 Millwork.
- .21 Fire Systems.
- .22 Testing and Commissioning.
- .23 Supplied equipment long delivery items.
- .24 Engineer supplied equipment required dates.

1.8 Project schedule reporting

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

1.9 Project meetings

- .1 Discuss Project Schedule at regular site meetings, identify activities that are behind schedule and provide measures to regain slippage. Activities considered behind schedule are those with projected start or completion dates later than current approved dates shown on baseline schedule.

Part 2 Products - Not Used

Part 3 Execution - Not Used

END OF SECTION

Part 1 General

1.1 Related requirements

- .1 Section 01 45 00 - Quality Control
- .2 Section 01 78 00 - Closeout Submittals

1.2 Administrative requirements

- .1 Submit to Contract Administrator submittals listed for review. Submit promptly and in orderly sequence to not cause delay in Work. Failure to submit in ample time is not considered sufficient reason for extension of Contract Time and no claim for extension by reason of such default will be allowed.
- .2 Do not proceed with Work affected by submittal until review is complete.
- .3 Present shop drawings, product data, samples and mock-ups in SI Metric units.
- .4 Where items or information is not produced in SI Metric units converted values are acceptable.
- .5 Review submittals before 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 coordinated with requirements of Work and Contract Documents. Submittals not stamped, signed, dated and identified as to specific project will be returned without being examined and considered rejected.
- .6 Notify Contract Administrator, in writing at time of submission, identifying deviations from requirements of Contract Documents stating reasons for deviations.
- .7 Verify site measurements and affected adjacent Work are coordinated.
- .8 Contractor's responsibility for errors and omissions in submission is not relieved by Contract Administrator review of submittals.
- .9 Contractor's responsibility for deviations in submission from requirements of Contract Documents is not relieved by Contract Administrator review.
- .10 Keep one reviewed copy of each submission on site.

1.3 Shop drawings and product data

- .1 The term "shop drawings" means drawings, diagrams, illustrations, schedules, performance charts, brochures and other data which are to be provided by Contractor to illustrate details of a portion of Work.
- .2 Submit drawings stamped and signed by professional engineer registered or licensed in Manitoba, Canada, where indicated.
- .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 Contract drawings and specifications.
- .4 Allow seven days for Contract Administrator's 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 before proceeding with Work.
- .6 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 name and address.
 - .4 Identification and quantity of each shop drawing, product data, and sample.
 - .5 Other pertinent data.
- .8 Submissions to include:
 - .1 Date and revision dates.
 - .2 Project title and number.
 - .3 Name and address of:
 - .1 Subcontractor.
 - .2 Supplier.
 - .3 Manufacturer.
 - .4 Contractor's stamp, signed by Contractor's authorized representative certifying approval of submissions, verification of site measurements and compliance with Contract Documents.
 - .5 Details of appropriate portions of Work as applicable:
 - .1 Fabrication.
 - .2 Layout, showing dimensions, including identified site 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's review, distribute copies.
- .10 Submit electronic copy of shop drawings for each requirement requested in specification Sections and as Contract Administrator may reasonably request.
- .11 Submit electronic copies 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 Submit electronic copies of test reports for requirements requested in specification Sections and as requested by Contract Administrator.
 - .1 Report signed by authorized official of testing laboratory that material, product or system identical to material, product or system to be provided has been tested in accord with specified requirements.
 - .2 Testing must have been within 3 years of date of Contract award for project.
- .13 Submit electronic copies of certificates for requirements requested in specification Sections and as requested by Contract Administrator.
 - .1 Statements printed on manufacturer's letterhead and signed by responsible officials of manufacturer of product, system or material attesting that product, system or material meets specification requirements.
 - .2 Certificates must be dated after award of Contract complete with project name.
- .14 Submit electronic copies of manufacturers instructions for requirements requested in specification Sections and as requested by Contract Administrator.
 - .1 Pre-printed material describing installation of product, system or material, including special notices and Safety Data Sheets concerning impedances, hazards and safety precautions.
- .15 Submit electronic copies of Manufacturer's Site Reports for requirements requested in specification Sections and as requested by Contract Administrator.
- .16 Documentation of the testing and verification actions taken by manufacturer's representative to confirm compliance with manufacturer's standards or instructions.
- .17 Submit electronic copies of Operation and Maintenance Data for requirements requested in specification Sections and as requested by Contract Administrator.
- .18 Delete information not applicable to project.
- .19 Supplement standard information to provide details applicable to project.
- .20 If upon review by Contract Administrator, no errors or omissions are discovered or if only minor corrections are made, electronic copy 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.

1.4 Samples

- .1 Submit for review samples in duplicate as requested in respective specification Sections. Label samples with origin and intended use.
- .2 Deliver samples prepaid to Contract Administrator's business address.
- .3 Notify Contract Administrator in writing, at time of submission of deviations in samples from requirements of Contract Documents.
- .4 Where colour, pattern or texture is criterion, submit full range of samples.
- .5 Adjustments made on samples by Contract Administrator are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to Contract Administrator before proceeding with Work.
- .6 Make changes in samples which Contract Administrator may require, consistent with Contract Documents.

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

1.5 Mock-ups

- .1 Erect mock-ups in accordance with section 01 45 00 - Quality Control.

1.6 Photographic documentation

- .1 Submit electronic and hard copy of colour digital photography in jpg format, standard resolution as directed by Contract Administrator.
- .2 Project identification: name and number of project and date of exposure indicated.
- .3 Number of viewpoints to be commensurate with the extent of work complete.
- .4 Frequency of photographic documentation: weekly.

1.7 Certificates and transcripts

- .1 Immediately after award of Contract, submit Workers' Compensation Board status.
- .2 Submit transcription of insurance immediately after award of Contract.

Part 2 Products - Not Used

Part 3 Execution - Not Used

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 LEED® relates to ALL Sections
- .2 Section 01 56 15 Temporary Indoor Air Quality
- .3 Section 01 57 13 Temporary Erosion and Sediment Control
- .4 Section 01 74 19 Waste Management and Disposal
- .5 Section 03 10 00 Concrete Forms
- .6 Section 03 20 00 Concrete Reinforcing
- .7 Section 03 30 00 Cast-in-Place Concrete
- .8 Section 03 35 11 Concrete Floor Sealing and Polishing
- .9 Section 04 05 12 Masonry Mortar and Grout
- .10 Section 04 21 00 Clay Unit Masonry
- .11 Section 04 22 00 Concrete Unit Masonry
- .12 Section 05 12 23 Structural Steel
- .13 Section 05 21 12 Steel Joists
- .14 Section 05 31 00 Steel Decking
- .15 Section 06 10 00 Rough Carpentry
- .16 Section 06 40 00 Architectural Woodwork
- .17 Section 07 21 13 Board and Semi Rigid Insulation
- .18 Section 07 52 00 Modified Bituminous Membrane Roofing
- .19 Section 07 92 00 Joint Sealants
- .20 Section 09 51 13 Acoustical Panel Ceilings
- .21 Section 09 65 16 Resilient Flooring
- .22 Section 09 68 13 Tile Carpeting
- .23 Section 09 91 00 Painting
- .24 Division 22 Plumbing
- .25 Section 31 63 23 Bored Piles

1.2 REFERENCES

- .1 LEED® Canada Reference Guide for Green Building Design and Construction v4 Edition.
 - .2 LEED Canada Reference Guide for Green Building Design and Construction v4.1 Edition with addenda.
 - .3 Credit Interpretation Requests relating to the credits specified in this Section may apply in projects exhibiting exceptional circumstances as deemed necessary by the Contract Administrator.
 - .4 www.cagbc.org
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1.3 INTRODUCTION

- .1 The City of Winnipeg and Contract Administrator will be submitting and finalizing the LEED® documentation, with the goal of LEED® Silver.

1.4 REQUIREMENTS

- .1 The Contractor shall be responsible in part or in whole for ensuring that the following LEED® credits are achieved:
 - .1 SSp Construction Activity Pollution Prevention
 - .2 WEp/WEc Outdoor Water Use Reduction
 - .3 EAp Fundamental Commissioning and Verification
 - .4 EAc Enhanced Commissioning
 - .5 MRp Construction and Demolition Waste Management Planning
 - .6 MRc Building Life-Cycle Impact Reduction
 - .7 MRc Building Product Disclosure and Optimization, including:
 - .1 Environmental Product Declarations
 - .2 Sourcing Raw Materials
 - .3 Material Ingredients
 - .8 MRc Construction and Demolition Waste Management
 - .9 EQc Low-Emitting Materials
 - .10 EQc Construction Indoor Air Quality Management Plan
 - .11 EQc Indoor Air Quality Assessment
- .2 The Contractor shall assist with all LEED® prerequisites and credits by helping to gather required information and documentation.
- .3 All submittals as required by Article 3.2.
- .4 The Contractor shall provide bi-weekly reports, as specified in Article 3.1 LEED® Tracking, to the City of Winnipeg and Contract Administrator on the status and progress of the credits specified in paragraph 1.4.1 and 1.4.2.
 - .1 Where required for clarification purposes, dated and labelled digital photographs shall be included.

1.5 ENVIRONMENTAL PERFORMANCE

- .1 The following paragraphs apply to adhesives and sealants, paints and coatings, flooring, ceilings, walls, thermal and acoustic insulation, and composite wood and agrifibre products used within the outermost weather-proofing layer of the wall/roof assembly:
 - .1 Adhesives and sealants must have a General Emissions Evaluation as defined by the California Department of Public Health (CDPH) Standard Method v1.2-2017 AND conform to following standard:
 - .1 State of California's South Coast Air Quality Management District (SCAQMD) Rule #1168, amended October 6, 2017.
 - .2 The VOC content of the adhesives, sealants, and sealant primers used must be less than the VOC content limits of the State of California's South Coast Air Quality Management District (SCAQMD) Rule #1168 (amended October 6, 2017). The following are the VOC limits from Rule 1168:
 - .1 Architectural Sealants – 250 g/L

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- .2 Non-membrane Roof Sealant – 300 g/L
 - .3 Roadway – 250 g/L
 - .4 Other Sealants – 420 g/L
 - .5 Non-porous Architectural Sealant Primer – 250 g/L
 - .6 Porous Architectural Sealant Primer – 775 g/L
 - .7 Modified Bituminous Sealant Primer – 500 g/L
 - .8 Other Sealant Primer – 750 g/L
 - .9 Indoor Carpet and Carpet Pad Adhesives – 50 g/L
 - .10 Wood Flooring Adhesives – 100 g/L
 - .11 Rubber Floor Adhesives – 60 g/L
 - .12 Subfloor Adhesives – 50 g/L
 - .13 Ceramic Tile Adhesives – 65 g/L
 - .14 VCT and Asphalt Tile Adhesives – 50 g/L
 - .15 Gypsum Board and Panel Adhesives – 50 g/L
 - .16 Cove Base Adhesive – 50 g/L
 - .17 Multipurpose Construction Adhesives – 70 g/L
 - .18 Structural Glazing Adhesive – 100 g/L
 - .19 PVC Welding – 510 g/L
 - .20 CPVC Welding – 490 g/L
 - .21 ABS Welding – 325 g/L
 - .22 Plastic Cement Welding – 250 g/L
 - .23 Adhesive Primer for Plastic – 550 g/L
 - .24 Contact Adhesive – 80 g/L
 - .25 Special Purpose Contact Adhesive – 250 g/L
 - .26 Structural Wood Member Adhesive – 140 g/L
 - .27 Sheet Applied Rubber Lining Operations – 850 g/L
 - .28 Top and Trim Adhesive – 250 g/L
 - .29 Metal to Metal Adhesive – 30 g/L
 - .30 Plastic Foams Adhesive – 50 g/L
 - .31 Porous Material Adhesive (except wood) – 50 g/L
 - .32 Wood Adhesive – 30 g/L
 - .33 Fiberglass Adhesive – 80 g/L
 - .34 Duct Sealants – 250 g/L
- .3 Paints and Coatings must have a General Emissions Evaluation AND conform to the following standards in order of descending importance:
- .1 California Air Resources Board (CARB) 2007, Suggested Control Measure (SCM) for Architectural Coatings, or the South Coast Air Quality Management District (SCAQMD) Rule #1113, amended February 5, 2016, effective date January 1, 2019.
 - .2 The following is a list of applicable VOC limits
 - .1 Interior Flat Coating or Primer – 50 g/L
 - .2 Interior Non Flat Coating or Primer – 150 g/L
 - .3 Anti-Corrosive/Anti Rust Paint – 250 g/L
 - .4 Clear Wood Finishes: Lacquer – 550 g/L
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- .5 Clear Wood Finishes: Sanding Sealers – 350 g/L
 - .6 Clear Wood Finishes: Varnishes – 350 g/L
 - .7 Clear Brushing Lacquer- 680 g/L
 - .8 Floor coatings – 100 g/L
 - .9 Sealers and Undercoaters – 200 g/L
 - .10 Shellac: Clear – 730 g/L
 - .11 Shellac: Pigmented – 550 g/L
 - .12 Stain – 250 g/L
 - .13 Concrete Curing Compounds – 350 g/L
 - .14 Japans/Faux Finishing Coatings – 350 g/L
 - .15 Magnesite Cement Coatings – 450 g/L
 - .16 Pigmented Lacquer – 550 g/L
 - .17 Waterproofing Sealers – 250 g/L
 - .18 Waterproofing Concrete/masonry Sealers – 400 g/L
 - .19 Wood Preservatives – 350 g/L
 - .20 Low – Solids Coatings – 120 g/L (including water)
- .4 All hard surface flooring covered must be tested and determined compliant with the General Emissions Evaluation criteria. Products covered include vinyl, linoleum, laminate flooring, engineered wood flooring, ceramic flooring, rubber flooring and wall base.
 - .5 All composite woods as defined by the California Air Resources Board, Airborne Toxic Measure to Reduce Formaldehyde Emissions from Composite Wood Products Regulation, must be documented to have low formaldehyde emissions that meet the California Air Resources Board ATCM for formaldehyde requirements for ultra-low-emitting formaldehyde (ULEF) resins or no added formaldehyde resins.
 - .6 Ceilings, walls, thermal and acoustic insulation (if applicable to project) must be tested and determined compliant with the General Emissions Evaluation criteria.
 - .7 Furniture (if applicable to project) must be tested in accordance with ANSI/BIFMA Standard Method M7.1-2011. Comply with ANSI/BIFMA e3-2011 Furniture Sustainability Standard, Sections 7.6.1 (for half credit, by cost) OR 7.6.2. (for full credit, by cost), using either the concentration modeling approach or the emissions factor approach.
- .2 Trade Subcontractors shall ensure all products incorporated into the work meet the specified VOC limits as described above.
 - .3 All landscaping planting material shall be native or adaptive mixes.
 - .1 Irrigation of planting material is acceptable during establishment period only, maximum two years.
-

Part 2 Products

NOT USED

Part 3 Execution

3.1 LEED® TRACKING

.1 Submit bi-weekly reports to the City of Winnipeg and Contract Administrator, including up to date status of the credit progress.

.1 SSp Construction Activity Pollution Prevention

.1 Details on the inspection of erosion and sedimentation control measures.

.2 Dated and labelled photos per Section 01 57 13

.2 EQc Construction Indoor Air Quality Management Plan

.1 Dated and labelled photos per Section 01 56 15

.3 MRc Construction and Demolition Waste Management Planning:

.1 The following is a list of items that must be included in the Construction Waste Management Plan:

.1 Identify at least five construction or demolition material streams for diversion from landfill

.2 Specify the means and methods of diversion for each of the five selected material streams

.3 Plan must account for all materials including land clearing debris

.4 Safe removal of hazardous materials must be included

.5 Create a final waste report on the total construction and demolition waste produced by the project and the total waste diverted

.2 The Construction and Demolition Waste Management Tracking Table is to include a minimum of the following information (measurement units are to be metric tonnes):

.1 Material Stream Description

.2 Destination (including company information)

.3 Description (landfill, recycle, crush for rubble, re-use, waste-to-energy etc.)

.4 Weight Reused

.5 Weight Recycled

.6 Weight Sent to Landfill

.7 Sum of the Total Weight Diverted from the Landfill

.8 Sum of the Total Weight Sent to the Landfill

.9 Percentage of Materials Diverted from the Landfill

.10 Dated and labelled photos per Section 01 74 19

3.2 LEED® SUBMITTALS

.1 Submit technical data sheets and completed LEED® Product Check Sheets for:

.1 Materials with recycled content

.2 Materials with regional content

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- .3 Materials with life-cycle information: Manufacturer Inventory, Health Product Declaration (HPD), Environmental Product Declaration (EPD), Cradle to Cradle, Declare labels designated as Red List Free or Declared, ANSI/BIFMA e3 Furniture Sustainability Standard, Product Lens Certification, Facts – NSF/ANSI 336: Sustainability Assessment for Commercial Furnishing Fabric at any certification level, or USGBC Approved Program.
 - .2 Submit summary letter containing calculated cost of any supplementary cementitious materials. Cost should be calculated using the CaGBC approved Ready Mixed Concrete Association of Ontario's Portland Cement Reduction Calculator spreadsheet.
 - .3 Submit MSDS and completed LEED Product Check Sheets for the following products to be approved by the LEED Consultant PRIOR to use on site:
 - .1 Adhesives and Sealants
 - .2 Paints and Coatings
 - .3 Thermal and Acoustic Insulation
 - .4 Acoustic Ceilings
 - .5 Flooring
 - .6 Composite Woods
 - .4 Submit technical data sheets, supporting documentation and completed LEED® Product Check Sheets for all wood and composite wood products. Information required on the Product Check Sheet includes:
 - .1 Product Name
 - .2 Company
 - .3 Product Cost
 - .4 Forest Stewardship Council (FSC) Certified Wood %
 - .5 Invoices showing complete Forest Stewardship Council Chain of Custody for all the vendors and for each step in the supply chain from forest to final product
 - .6 Total cost of FSC Certified Woods
 - .7 Total Cost of all Wood Based Products
 - .5 EQc Indoor Air Quality Assessment
 - .1 Indicated compliance path in IAQ Plan: Testing Prior to Occupancy or Building Flush
 - .2 If testing, submit test results report.
 - .6 Submit complete list of landscaping plant material including seed mixes or sod variety to LEED Consultant for review prior to installation.
 - .7 Complete set of electronic as-built drawings for LEED submission.
 - .8 At completion of construction provide photos of; all exterior elevations, typical interior room spaces, water meter, energy meter, completed landscaping.
 - .9 Signed LEED Letter Templates for the following credits:
 - .1 SSp Construction Activity Pollution Prevention
 - .2 MRp Storage and Collection of Recyclables
 - .3 MRp Construction and Demolition Waste Management Planning
 - .4 MRc Construction and Demolition Waste Management
 - .5 IEQc Construction IAQ Management Plan
 - .6 IEQc Indoor Air Quality Assessment
-

LEED® v4 PRODUCT CHECK SHEET			
PROJECT NAME:		DATE (yyyy mm dd):	
GENERAL INFORMATION:			
Note: Each different product requires a separate check sheet.			
Subtrade/Installer:		Contact Name:	
Manufacturer:		Contact Phone Number:	
Product Name:		Product Description/Use:	
Total Material Cost:	OR	Unit Cost:	Quantity Used:
ENVIRONMENTAL PRODUCT DECLARATION (EPD):			
Does the product have an EPD?		<input type="checkbox"/> Yes <input type="checkbox"/> No (If no, skip this section)	
Attach a copy of product specific or industry wide EPD to this form.			
RECYCLED CONTENT:			
Does this product contain recycled content?		<input type="checkbox"/> Yes <input type="checkbox"/> No (If no, skip this section)	
Post Consumer Recycled Content (%):		Pre Consumer Recycled Content (%):	
Information Source: (i.e. data sheet, letter from manufacturer, etc.):			
Attach above information source to this form.			
SOURCING OF RAW MATERIALS			
Does this manufacturer participate in an extended producer program?:		<input type="checkbox"/> Yes <input type="checkbox"/> No	
Is the product a bio-based material (other than wood)		<input type="checkbox"/> Yes <input type="checkbox"/> No	
Is the wood product FSC certified/Sustainable Forestry Initiative (SFI) /American Tree Farm System (ATFS) /Canadian Standards Association (CSA) or Programme for the Endorsement of Forest Certification (PEFC)		<input type="checkbox"/> Yes <input type="checkbox"/> No	
Has the product been salvaged, refurbished or reused:		<input type="checkbox"/> Yes <input type="checkbox"/> No	
Is the product sourced (extracted, manufactured and purchased) within 160 km of the project site?		<input type="checkbox"/> Yes <input type="checkbox"/> No	
Manufacture Location (city, province/state):			
Distance from Manufacture to project site: km			
Extraction/Harvest/Collection Location (city, province/state):			
Distance from Extraction to project site: km			
Information Source: (letter from manufacturer, chain of custody certificate, etc.):			
Attach above information source to this form.			
MATERIAL INGREDIENTS			
Does this manufacturer report the chemical inventory of the product through either CASRN, Greenscreen List Translator score, Full GreenScreen or Benchmark, Globally Harmonized System of Classification and Labelling (GHS)?		<input type="checkbox"/> Yes <input type="checkbox"/> No	
Is there a Health Product Declaration?		<input type="checkbox"/> Yes <input type="checkbox"/> No	
Is the product Cradle to Cradle certified?		<input type="checkbox"/> Yes <input type="checkbox"/> No	
Does the product have a Declared or Red List Free Declare label?:		<input type="checkbox"/> Yes <input type="checkbox"/> No	
Is the product sourced (extracted, manufactured and purchased) within 160 km of the project site?		<input type="checkbox"/> Yes <input type="checkbox"/> No	
Does the furniture meet ANSI/BIFMA e3 Sustainability Standard? (at least 3 points under 7.5.1.3 in e3-2014)		<input type="checkbox"/> Yes <input type="checkbox"/> No	
Does the product have a Product Lens Certification?		<input type="checkbox"/> Yes <input type="checkbox"/> No	
Is the product sourced (extracted, manufactured and purchased) within 160 km of the project site?		<input type="checkbox"/> Yes <input type="checkbox"/> No	
Information Source: Attach verification of above certification with this form.			

LOW EMITTING MATERIALS:		
Is this product a paint, or coating?,	<input type="checkbox"/> Yes <input type="checkbox"/> No	VOC Content:
Is this product an adhesive or sealant?	<input type="checkbox"/> Yes <input type="checkbox"/> No	VOC Content:
Is this product flooring?	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Is this product a wall panel?	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Is this product a ceiling product?	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Is this product thermal or acoustic insulation?	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Is this product furniture?	<input type="checkbox"/> Yes <input type="checkbox"/> No	
For any product above, does the product have a general emissions evaluation?	<input type="checkbox"/> Yes <input type="checkbox"/> No	
If the product is composite wood, does it meet the formaldehyde emissions evaluation (NAUF or ULEF) or salvaged and reused materials criteria??	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Information Source: (i.e. MSDS, data sheet, letter from manufacturer, etc.): Attach above information source to this form.		

Column C – Base Concrete Design Strength @ 28 Days

- Indicate the design strength indicated in the contract documents.
- If the design strength isn't based on 28 days (say 7, or 56 days) request written clarification from the project designer as to the equivalent 28 day strength to be used.
- If the governing factor for the concrete mix designs is the specified W/CM ratio and project designers specified 28 day compressive strength doesn't conform to this value (i.e. $W/CM \leq 0.45$ but the specified strength is 15 MPa at 28 Days), request written clarification from the project designer as to the appropriate 28 day compressive strength. CSA A23.1 Table 2 may be a useful guide (i.e. Suggest that CSA A23.1 indicates the 28 day strength for air entrained concrete should be 32 MPa @ 28 days rather than the 15 MPa currently indicated).
- Ultimately, it is the value specified by the project designer that must be used in the spreadsheet and you can only suggest clarifications.
- **Note regarding contractor early strength requirements** – Modifications to the 28 day strength values should not be made due to contractor requirements for early form removal. The strength values used in this table are based on the designer's strength requirements for structural adequacy, not the contractor's preferences for constructability.

Column D – Air Entrainment

- "Yes" or "No" based upon the presence of an air entraining admixture in the mix design. Your selection results in the use of the appropriate "Base Portland Cement" curve.

Column E – Base Portland Cement (kg/m³)

- Automatically calculated by the spreadsheet based on the specified compressive strength of the concrete and the use of an air entraining admixture in the mix design.

Column F – Portland Cement Used (kg/m³)

- The concrete producer must enter the actual amount of Portland cement used in the mix design. Excluded from this amount are all supplementary cementing materials (recycled cementing materials).
- Based upon Note 2 in the table the concrete producer should modify this value according to the following:
 - For pre-blended cements the concrete producer must remove the supplementary cementing material component. **For example:** if your mix design contains 400 kg/m³ of GUB-25S then you would enter = $400 \times (1.0 - 0.25) = 300$ kg/m³.
 - For Contempra (PLC) cements the concrete producer must remove the limestone component, however since this value varies between 5 to 15% you will have to obtain the replacement value from your cement supplier. **For example:** if your mix design contains 400 kg/m³ of PLC and the Limestone replacement value is 12%, then you would enter = $400 \times (1.0 - 0.12) = 352$ kg/m³.
- *This value is confidential information and is not to be disclosed to third parties at any time.*

Column G – Pre-Consumer Recycled Content of Cementitious Materials (%)

- Automatically calculated by the spreadsheet based upon the difference between the Base Portland Cement (Column E) and the Portland Cement Used (Column F).

Column H – Cost of Concrete (\$/m³)

- Full selling price of the concrete to your customer including all extra charges and fees (e.g. products such as super plasticizer and corrosion inhibitors).
- This price is based upon concrete delivered to the actual jobsite and includes any delivery charges.
- *This value is confidential information and is not to be disclosed to third parties at any time.*

Column I - % Cementitious Materials in Concrete Mix (% by weight)

- The percentage of the mix design that is composed of the cementitious material (base Portland cement plus all
-

recycled cementitious products).

- The simplest way to calculate this value is to take a basic concrete mix design and add up all the cementitious materials on a per cubic metre basis and divide by the density of the concrete. **For example:** assume a mix design includes 300 kg/m³ of GU, 75 kg/m³ of Slag and 50 kg/m³ of Fly Ash and has a concrete density of 2,350 kg/m³. The % of cementitious material in the mix design would be = (300+75+50)/2350 = 18.08%.
- *This value is confidential information and is not to be disclosed to third parties at any time.*

Column J – Cost of All Cementitious Materials (\$/m³ of concrete)

- This represents the costs of all cementitious (Portland and all supplementary cementing materials) used in the concrete mix design.
- This cost represents the cost of the cementitious materials delivered to the final jobsite. Unfortunately, most concrete producers only know the costs delivered to the concrete plant so we will have to address this fact later in the calculations.
- Most concrete producers are used to describing cement costs based on the cost per metric tonne of cementitious material (\$/MT). Please note that the units for this calculation are \$/m³ and that you will have to use the conversion factor of 1 Metric Ton = 1,000 kg to convert the units correctly.
 - **Step 1** – Converting cement costs from \$/MT to \$/m³. For example, if your mix design contains 400 kg/m³ of GU cement and the cement costs \$170/MT then your cost of cementitious materials would be = 400*170/1000 = \$68/m³.
 - **Step 2** – Converting plant cement costs to jobsite cement costs. Since the standard cement costs are based upon **transportation to the concrete plant, not the jobsite**, we must now factor in the cement portion of the concrete transportation costs into this value. The suggested industry method is as follows: Jobsite Cement Costs = Plant Cement Costs + Transportation Costs prorated for the cement component only. **For example:** If the cement costs at the plant are \$68/m³ (see above) and the shipping costs are \$30/m³ and the density of the concrete is 2,350 kg/m³, we are left with the following: = 68 + 30*400/2350 = \$73.11/m³. That is \$30 x (400/2350) or \$5.11 above the cementing material cost to account for the cement delivery to the site.

Column K – Recycled Content Value (\$/m³ of concrete)

- Assuming that you have entered both methods of calculation, the spreadsheet will automatically calculate the recycled content value based on:
 - The cost of the concrete delivered to the jobsite (this assumes that all raw materials have an equal value based on weight, which is incorrect and normally not an advantageous assumption)
 - The cost of the cementitious materials actually used in the concrete mix design (this is normally the most advantageous calculation method, however requires significant cost inputs)
- When both calculation methods are used, the program automatically utilizes the most beneficial calculation method (highest \$/m³ value).
- If the value is negative due to the fact that the base Portland cement content is exceeded, then the program automatically “zeros” this mix design from the calculations (so you don’t need to worry about excluding it from the calculations as was done in the past).

Column L – Volume of Mix (m³)

- You enter the actual volume of concrete used on the project for each mix design in this box.

Column M – Total Recycled Value (\$)

- The program determines the recycled value of each concrete mix design by multiplying the Recycled Content Value (Column K) by the Volume of Mix (Column L) to produce a final dollar value.

This completes a basic overview of the calculator, but the real question is how do we use it! The best way we can demonstrate this is to use an example to show you the type of information that you will required to complete the calculations and then provide you with a link to the sample spreadsheet that shows the actual calculations (just click on

each cell of the spreadsheet to see the actual formulas we used to complete the calculations).

Again we must stress that this example is strictly hypothetical. The numbers used are not intended to represent past, current or future industry values. They are only for the purpose of demonstrating the proper use of the calculator. When completed for an actual project the form includes mix design information and raw material costs that should never be shared with anyone outside your company. The final submission to the project team will consist of the [summary letter](#) only, **NOT THE ACTUAL CALCULATOR!!!!!!**

SAMPLE PROJECT – Stand Alone Parking Garage

Mix #1 – C-1 Concrete for Decks and Columns and Shear Walls

- 35 MPa @ 28 Days
- Air Entrained Concrete
- \$250/m³ selling price to contractor
- \$170/MT Cement Cost FOB Plant
- \$30/m³ delivery cost to jobsite
- **Concrete Mix Design:**
 - GU Cement = 300 kg/m³
 - Slag Cement = 125 kg/m³
 - Stone = 1,060 kg/m³
 - Sand = 700 kg/m³
 - Water = 165 kg/m³
 - Density of mix design = 2,350 kg/m³ (sum of all ingredients in the mix)
- Actual quantity delivered to project 4,600 m³

Mix #2 – C-2 Concrete for Curbs, Sidewalks and Interior Slabs on Grade

- 32 MPa @ 28 Days
- Air Entrained Concrete
- \$230/m³ selling price to contractor
- \$170/MT Cement Cost FOB Plant
- \$30/m³ delivery cost to jobsite
- **Concrete Mix Design:**
 - GU Cement = 295 kg/m³
 - Slag Cement = 95 kg/m³
 - Stone = 1,010 kg/m³
 - Sand = 800 kg/m³
 - Water = 175 kg/m³
 - Density of mix design = 2,375 kg/m³ (sum of all ingredients in the mix)
- Actual quantity delivered to project 385 m³

Mix #3 – Non-Structural Mud Slab “A”

- 15 MPa @ 28 Days
- Non Air Entrained Concrete
- \$185/m³ selling price to contractor
- \$170/MT Cement Cost FOB Plant
- \$30/m³ delivery cost to jobsite
- **Concrete Mix Design:**
 - GU Cement = 150 kg/m³
 - Slag Cement = 50 kg/m³
 - Stone = 1,075 kg/m³
 - Sand = 850 kg/m³

- Water = 175 kg/m³
- Density of mix design = 2,300 kg/m³ (sum of all ingredients in the mix)
- Actual quantity delivered to project 100 m³

Mix #4 – Non-Structural Mud Slab “B”

- 15 MPa @ 28 Days
- Non Air Entrained Concrete
- \$200/m³ selling price to contractor
- \$170/MT Cement Cost FOB Plant
- \$30/m³ delivery cost to jobsite
- **Concrete Mix Design:**
 - GU Cement = 245 kg/m³
 - Stone = 1,075 kg/m³
 - Sand = 850 kg/m³
 - Water = 175 kg/m³
 - Density of mix design = 2,345 kg/m³ (sum of all ingredients in the mix)
- Actual quantity delivered to project 100 m³

Click "[HERE](#)" to download the example spreadsheet that has been created for this sample project.

Portland Cement Reduction Calculator

for use when pursuing MR credit 4

Project: Project name

Date or Period: Date

Enter the Mix No., Concrete Design Strength, whether concrete is Air-Entrained, actual Portland Cement Used in the Mix, Cost of all Cementitious Materials and Volume of Mix.
 Note: Recycled content is based on the cost of cementitious materials rather than the concrete cost.
 If it is not possible to obtain the cost of cementitious materials, the cost of the concrete mix is apportioned based on the weight of the each component.

Mix No.	Base Mix Concrete Design Strength @28d (MPa)	Air-Entrained (Y/N)	¹ Base Portland Cement (kg/m ³ of concrete)	² Portland Cement Used (kg/m ³ of concrete)	Pre-Consumer Recycled Content of Cementitious Materials (%)	Cost of Concrete (\$/m ³ of concrete)	³ Input Either		Recycled Content Value (\$/m ³ of concrete)	Volume of Mix (m ³ of concrete)	Total Recycled Value (\$)
							% Cementitious materials in Concrete Mix (% by weight)	Cost of all cementitious materials (\$/m ³ of concrete)			

Footnotes
 1: Base Portland Cement calculated from the table found in the CAC & PCA publications EB101.0&T, Design & Control of Concrete Mixtures.
 2: This column includes any cementitious ingredient not recycled. It should exclude the recycled and limestone component(s) of a blended cement or a PLC.
 3: If both values are entered, the calculation method that is most beneficial is used.

Total Recycled Content Value of Cementitious Materials:

This calculator is to be completed by the supplier/contractor and the resulting value declared in a signed letter, printed on company letterhead and provided to the party responsible for the certification documentation. The resulting value will be entered into the cost column of the MR credit 4 letter template. The row will be designated as "SCM Cement," and the % Post-consumer column will be set to 100%.

END OF SECTION

Part 1 General

1.1 Related requirements

- .1 Section 01 33 00 Submittal Procedures.
- .2 Section 01 41 00 Regulatory Requirements.
- .3 Section 02 81 00 - Hazardous Materials

1.2 Reference standards

- .1 Canada Labour Code, Part 2, Canada Occupational Safety and Health Regulations
- .2 Province of Manitoba
 - .1 The Workers Compensation Act RSM 1987 - Updated 2013.

1.3 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 prior to commencement of Work. Health and Safety Plan must include:
 - .1 Results of site specific safety hazard assessment.
 - .2 Results of safety and health risk or hazard analysis for site tasks and operation found in work plan.
- .3 Submit electronic copies of Contractor's authorized representative's work site health and safety inspection reports to City of Winnipeg Representative.
- .4 Submit copies of reports or directions issued by Federal, Provincial and Territorial health and safety inspectors.
- .5 Submit copies of incident and accident reports.
- .6 Submit WHMIS Safety Data Sheets (SDS) in accordance with Section 02 81 00 Hazardous Materials.
- .7 City of Winnipeg Representative will review Contractor's site-specific Health and Safety Plan and provide comments to Contractor within seven days after receipt of plan. Revise plan as appropriate and resubmit plan to City of Winnipeg Representative within three days after receipt of comments from City of Winnipeg Representative.
- .8 City of Winnipeg Representative 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.
- .9 Medical Surveillance: where prescribed by legislation, regulation or safety program, submit certification of medical surveillance for site personnel prior to commencement of Work, and submit additional certifications for any new site personnel to City of Winnipeg Representative.
- .10 On-site Contingency and Emergency Response Plan: address standard operating procedures to be implemented during emergency situations.

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 City of Winnipeg Representative prior to commencement of Work.

1.6 Regulatory requirements

- .1 Do Work in accordance with Section 01 41 00 - Regulatory Requirements.

1.7 General requirements

- .1 Develop written site-specific Health and Safety Plan based on hazard assessment prior to beginning site Work and continue to implement, maintain, and enforce plan until final demobilization from site. Health and Safety Plan must address project specifications.
- .2 City of Winnipeg Representative may respond in writing, where deficiencies or concerns are noted and may request re-submission with correction of deficiencies or concerns.

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 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 The Workers Compensation Act, Workplace Safety Regulation, Manitoba Reg. C.C.S.M. c. W200.
- .2 Comply with Occupational Health and Safety Regulations, 1996.
- .3 Comply with Canada Labour Code, Canada Occupational Safety and Health Regulations.

1.10 Unforeseen hazards

- .1 When unforeseen or peculiar safety-related factor, hazard, or condition occur during performance of Work, follow procedures in place for Employee's Right to Refuse Work in accordance with Acts and Regulations of Province having jurisdiction and advise City of Winnipeg Representative verbally and in writing.
- .2 When unforeseen or peculiar safety-related factor, hazard, or condition occur during performance of Work, advise Safety Officer and follow procedures in accordance with Acts and Regulations of Province having jurisdiction and advise City of Winnipeg Representative 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 working knowledge of occupational safety and health regulations.

- .2 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.
- .3 Be responsible for implementing, enforcing daily and monitoring site-specific Contractor's Health and Safety Plan.
- .4 Be on site during execution of Work and report directly to and be under direction of 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 City of Winnipeg Representative.

1.13 Correction of non-compliance

- .1 Immediately address health and safety non-compliance issues identified by authority having jurisdiction or by Contract Administrator or City of Winnipeg Representative.
- .2 Provide City of Winnipeg Representative with written report of action taken to correct non-compliance of health and safety issues identified.
- .3 Contract Administrator or City of Winnipeg Representative 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 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 - Not Used

Part 3 Execution - Not Used

END OF SECTION

Part 1 General

1.1 Summary

- .1 This Section references to laws, by laws, ordinances, rules, regulations, codes, orders of Authority Having Jurisdiction, and other legally enforceable requirements applicable to Work and that are; or become, in force during performance of Work.

1.2 References to regulatory requirements

- .1 Department of Justice Canada (Jus):
 - .1 SOR/2018-196 Prohibition of Asbestos and Products Containing Asbestos Regulations
 - .2 Perform Work in accordance with National Building Code of Canada (NBC) including amendments up to bid closing date and other codes of provincial or local application provided that in case of conflict or discrepancy, more stringent requirements apply.
 - .3 Specific design and performance requirements listed in specifications or indicated on Drawings may exceed minimum requirements established by referenced Building Code; these requirements will govern over the minimum requirements listed in Building Code
 - .1 Meet or exceed requirements of:
 - .1 Contract Documents.
 - .2 Specified standards, codes, and referenced documents.

1.3 Hazardous material discovery

- .1 Asbestos: Demolition of spray or trowel-applied asbestos is hazardous to health. Stop work immediately when material resembling spray or trowel-applied asbestos is encountered during demolition work. Notify Contract Administrator. Refer to Section 02 81 00 - Hazardous Materials - General Provisions, Section 02 82 00.01 - Asbestos Abatement - Type 1 (Low Risk) Precautions, Section 02 82 00.03 - Asbestos Abatement - Type 3 (High Risk) Precautions, and Section 02 82 00.04 - Asbestos Abatement - Glove Bag.
- .2 Mould: Stop work immediately when material resembling mould is encountered during demolition work. Notify Contract Administrator.

1.4 Building smoking environment

- .1 Comply with smoking restrictions and municipal by-laws.

1.5 Quality assurance

- .1 Regulatory Requirements: Except as otherwise specified, Contractor shall apply for, obtain, and pay fees associated with, permits, licenses, certificates, and approvals required by regulatory requirements and Contract Documents, based on General Conditions of Contract and the following:
 - .1 Regulatory requirements and fees in force on date of Bid submission, and

- .2 A change in regulatory requirements or fees scheduled to become effective after date of bid submission and of which public notice has been given before date of bid submission

Part 2 Products

2.1 Easements and notices

- .1 City of Winnipeg will obtain permanent easements and rights of servitude that may be required for performance of Work.
- .2 Contractor shall give notices required by regulatory requirements.

2.2 Permits

- .1 Development Permit: City of Winnipeg has applied for, obtained, and paid for development permit.
- .2 Building Permit:
 - .1 City of Winnipeg has applied for and will be paying for building permit. Contractor is responsible for obtaining or coordinating other permits required for Work and its various parts.
 - .2 Contractor shall display building permit and other permits in a conspicuous location at Place of Work.
- .3 Occupancy Permits:
 - .1 Contractor shall apply for, obtain, and pay for occupancy permits, including partial occupancy permits where required by authority having jurisdiction.
 - .2 Contract Administrator will issue appropriate instructions to Contractor for correction to Work where Contract Document deficiencies are required to be corrected in order to obtain occupancy permits, including partial occupancy permits.
 - .3 Contractor shall correct deficiencies in accordance with Contract Administrator's instructions. Where deficiency is not corrected, City of Winnipeg reserves the right to make correction and charge Contractor for costs incurred.
 - .4 Contractor shall turn occupancy permits over to City of Winnipeg.

Part 3 Execution - Not Used

END OF SECTION

Part 1 General

1.1 Summary

- .1 This Section describes administrative and procedural requirements for reactive activities to verify that completed Work conforms to Contract Documents requirements.
- .2 Having inspection and testing agencies by Contractor or City of Winnipeg does not relieve the Contractor of their responsibility to perform Work in accordance with Contract Documents.

1.2 Related requirements

- .1 Section 01 33 00 - Submittal Procedures.

1.3 Administrative requirements

- .1 Allow and coordinate access to Work on site, manufacturing off site, and fabrication off site with inspection and testing agencies.
- .2 Give advanced notice to Contract Administrator and to each inspection/testing agency for inspection and testing required by Contract Documents or by AHJ.
- .3 In advance of each test, notify appropriate agency and Contract Administrator in the order that attendance arrangements can be made.

1.4 Action and informational submittals

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit schedule of testing and inspection activities to Contract Administrator, City of Winnipeg, applicable Subcontractors, testing agencies, and other affected parties. Include the following:
 - .1 List each testing and inspection agency
 - .2 Identify types of tests and inspections for each agency, and cross reference to applicable specification Section number-title in Contract Documents
 - .3 Description of test and inspection
 - .4 Identify applicable reference standard
 - .5 Identify test and inspection method
 - .6 Indicate number of each test and inspection required
- .3 Submit one digital copy of each quality assurance inspection and test report to Contract Administrator, except where a technical specification Section indicates otherwise.
- .4 Submit reports for inspection and testing required by Contract Documents or by AHJ and performed by Contractor-retained inspection and testing agencies within ten days after inspection or test is completed, except where a technical specification Section indicates a different time period.
- .5 Submit one digital copy of each quality control inspection and test report to Contract Administrator, except where a technical specification Section indicates otherwise.

- .6 Deliver copies of quality control reports to Subcontractor of work being inspected or tested.

1.5 Site quality control procedures

- .1 Provide labour, Construction Equipment, Plant, and temporary facilities to obtain and handle test samples and materials on site. Arrange for sufficient space to store and cure test samples.
- .2 Deliver samples and materials required for testing, as requested in technical specification Sections. Submit with reasonable promptness and in an orderly sequence to avoid delays in Work.

1.6 Testing and inspection services

- .1 City of Winnipeg will retain and pay for independent inspection and testing agencies to inspect, test, or perform other quality control reviews of parts of the work, except where indicated otherwise.
- .2 Provide equipment required for executing inspection and testing by appointed agencies.
- .3 Correct defects and deficiencies when they are revealed during inspection or testing as advised by Contract Administrator at no change to Contract Price or Contract Time. Pay costs for retesting and re-inspection. Appointed agency will request additional inspections or tests to ensure full degree of defects or deficiencies are revealed and corrected.
- .4 Quality control testing and inspection reports to include the following:
 - .1 Project name and number
 - .2 Testing/Inspection agency's name, address, telephone number, and website
 - .3 Date of issuing report
 - .4 Dates and locations of tests, inspections, or samples
 - .5 Description of the Work and test and inspection method
 - .6 Numbers and titles of associated specification Sections
 - .7 Test and inspection data and interpretation of test results (e.g., pass or fail)
 - .8 Ambient conditions at time of test, inspection, or sampling
 - .9 Recommendations on re-testing and re-inspecting, if applicable

Part 2 Products - Not Used

Part 3 Execution - Not Used

END OF SECTION

Part 1 General

1.1 Related requirements

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 52 00 - Construction Facilities
- .3 Section 01 57 13 Temporary Erosion and Sedimentation Control

1.2 Reference standards

- .1 Canada Green Building Council (CaGBC)
 - .1 LEED Canada-NC Version 4/4.1, LEED (Leadership in Energy and Environmental Design): Green Building Rating System Reference Guide for New Construction and Major Renovations (including Addendum July 2022 and later).

1.3 Action and informational submittals

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 LEED Submittals:
 - .1 Submit erosion and sedimentation control plan. Refer to Section 01 57 13 Temporary Erosion and Sedimentation Control.

1.4 Installation and removal

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

1.5 Water supply

- .1 Provide continuous supply of potable water for construction use.
- .2 Arrange for connection with appropriate utility company and pay costs for installation, maintenance and removal.
- .3 Pay for utility charges at prevailing rates, based on General Conditions of Contract.

1.6 Temporary heating and ventilation

- .1 Provide temporary heating required during construction period, including attendance, maintenance and fuel.
- .2 Construction heaters used inside building must be vented to outside or be flameless (vent free) type. Solid fuel salamanders are not permitted.
- .3 Provide temporary heat and ventilation in enclosed areas as required to:
 - .1 Facilitate progress of Work.
 - .2 Protect Work and products against dampness and cold.
 - .3 Prevent moisture condensation on surfaces.
 - .4 Provide ambient temperatures and humidity levels for storage, installation and curing of materials.

- .5 Provide adequate ventilation to meet health regulations for safe working environment.
- .4 Maintain temperatures of minimum 10 degrees Celsius in areas where construction is in progress.
- .5 Ventilating:
 - .1 Prevent accumulations of dust, fumes, mists, vapours or gases in areas occupied during construction.
 - .2 Provide local exhaust ventilation to prevent harmful accumulation of hazardous substances into atmosphere of occupied areas.
 - .3 Dispose of exhaust materials in manner that will not result in harmful exposure to persons.
 - .4 Ventilate storage spaces containing hazardous or volatile materials.
 - .5 Ventilate temporary sanitary facilities.
 - .6 Continue operation of ventilation and exhaust system for time after cessation of work process to assure removal of harmful contaminants.
- .6 Permanent heating system of building, to be used when available. Be responsible for damage to heating system if use is permitted.
- .7 On completion of Work for which permanent heating system is used, clean.
- .8 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.
- .9 Be responsible for damage to Work due to failure in providing adequate heat and protection during construction.

1.7 Temporary power and light

- .1 Contractor will provide a source for, and pay the costs of temporary power during construction for temporary lighting and operating of power tools.
- .2 Arrange for connection with appropriate utility company. Pay costs for installation, maintenance and removal.
- .3 Temporary power for electric cranes and other equipment requiring in excess of above is responsibility of Contractor based on General Conditions of Contract.
- .4 Provide and maintain temporary lighting throughout project. Ensure level of illumination on all floors and stairs is not less than 162 lx.
- .5 Electrical power and lighting systems installed under this Contract may be used for construction requirements only with prior approval of Contract Administrator provided that guarantees are not affected.
 - .1 Repair damage to electrical system caused by use under this Contract.
 - .2 Replace lamps which have been used for more than 3 months.

1.8 Temporary communication facilities

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

1.9 Fire protection

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

Part 2 Products - Not Used

Part 3 Execution - Not Used

END OF SECTION

Part 1 General

1.1 Related requirements

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 51 00 - Temporary Utilities.
- .3 This section describes requirements applicable to all Sections within all Divisions.

1.2 Reference standards

- .1 Canada Green Building Council (CaGBC)
 - .1 LEED Canada-NC Version 4/4.1, LEED (Leadership in Energy and Environmental Design): Green Building Rating System Reference Guide for New Construction and Major Renovations (including Addendum July 2022 and later).
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB 1.189-00, Exterior Alkyd Primer for Wood.
 - .2 CGSB 1.59-97, Alkyd Exterior Gloss Enamel.
- .3 CSA Group (CSA)
 - .1 CSA-A23.1/A23.2-04, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
 - .2 CSA-0121-M1978(R2003), Douglas Fir Plywood.
 - .3 CAN/CSA-S269.2-M1987(R2003), Access Scaffolding for Construction Purposes.
 - .4 CAN/CSA-Z321-96(R2001), Signs and Symbols for the Occupational Environment.

1.3 Action and informational submittals

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 LEED Submittals:
 - .1 Submit erosion and sedimentation control plan in accordance with 01 57 13 Temporary Erosion and Sedimentation Control.

1.4 Installation and removal

- .1 Prepare site plan indicating proposed location and dimensions of area to be fenced and used by Contractor, number of trailers to be used, avenues of ingress/egress to fenced area and details of fence installation.
- .2 Identify areas which have to be gravelled to prevent tracking of mud.
- .3 Indicate use of supplemental or other staging area.
- .4 Provide construction facilities in order to execute work expeditiously.
- .5 Remove from site all such work after use.

1.5 Scaffolding

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

1.6 Hoisting

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

1.7 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 weight or force that will endanger Work.

1.8 Construction parking

- .1 Parking will be permitted on site provided it does not disrupt or interfere with access to adjacent facilities (Sgt. Tommy Prince Place, WASAC admin offices, football fields / baseball fields, tennis court redevelopment, or North District Police Station).
- .2 Provide and maintain adequate access to project site.
- .3 Clean runways and taxi areas where used by Contractor's equipment.

1.9 Offices

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

1.10 Equipment, tool and materials storage

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

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.
- .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 City of Winnipeg Representative.

1.12 Construction signage

- .1 Provide and erect project sign, within three weeks of signing Contract, in a location designated by City of Winnipeg.
- .2 Indicate on sign, name of Contract Administrator and Contractor and City of Winnipeg logo.
- .3 Signs and notices for safety and instruction in both official languages Graphic symbols to CAN/CSA-Z321.
- .4 Maintain approved signs and notices in good condition for duration of project, and dispose of off site on completion of project or earlier if directed by City of Winnipeg.

1.13 Protection and maintenance of traffic

- .1 Maintain and protect traffic on affected roads during construction.
- .2 Provide measures for protection and diversion of traffic, including provision of watch-persons and flag-persons, erection of barricades, placing of lights around and in front of equipment and work, and erection and maintenance of adequate warning, danger, and direction signs
- .3 Protect travelling public from damage to person and property.
- .4 Contractor's traffic on roads selected for hauling material to and from site to interfere as little as possible with public traffic.
- .5 Verify adequacy of existing roads and allowable load limit on these roads. Contractor: responsible for repair of damage to roads caused by construction operations.
- .6 Provide necessary lighting, signs, barricades, and distinctive markings for safe movement of traffic.
- .7 Dust control: adequate to ensure safe operation at all times.

1.14 Clean-up

- .1 Remove construction debris, waste materials, packaging material from work site daily.
- .2 Clean dirt or mud tracked onto paved or surfaced roadways.
- .3 Store materials resulting from demolition activities that are salvageable.
- .4 Stack stored new or salvaged material not in construction facilities.

Part 2 Products - Not Used

Part 3 Execution

3.1 Temporary erosion and sedimentation control

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

- .3 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.
- .4 In accordance with Section 01 57 13 Temporary Erosion and Sedimentation Control.

END OF SECTION

Part 1 General

1.1 Related requirements

- .1 Section 06 10 00 - Rough Carpentry.

1.2 Reference standards

- .1 CSA Group (CSA)
 - .1 CSA-O121-M1978(R2003), Douglas Fir Plywood.

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 Hoarding

- .1 Erect temporary site enclosures using 38 x 89 mm construction grade lumber framing at 600 mm centres and 1200 x 2400 x 13 mm exterior grade fir plywood to CSA O121.
- .2 Apply plywood panels vertically flush and butt jointed.

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, and open windows.

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 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.

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 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 City of Winnipeg Representative locations and installation schedule 3 days prior to installation.
- .4 Be responsible for damage incurred due to lack of or improper protection.

1.13 Waste management and disposal

- .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 19 - Construction Waste Management and Disposal.

Part 2 Products - Not Used

Part 3 Execution - Not Used

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 01 35 20 - LEED® Sustainable Requirements

1.2 REFERENCES

- .1 LEED® Canada Reference Guide for Green Building Design and Construction V4 Edition
 - .1 Indoor Environmental Quality Credit Construction Indoor Air Quality Management Plan
 - .2 Indoor Environmental Quality Credit Indoor Air Quality Assessment
- .2 Sheet Metal and Air Conditioning National Contractors Association (SMACNA) IAQ Guideline for Occupied Buildings Under Construction, 2nd Edition, 2007, ANSI/SMACNA 008-2008, Chapter 3.
- .3 American Society of Heating, Refrigeration, and Air-Conditioning Engineers Inc. (ASHRAE).
 - .1 ASHRAE 52.2-2007: Methods of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size.
- .4 Credit Interpretation Requests relating to the credits specified in 1.2.1.1 and 1.2.1.2 of this Section may apply in projects exhibiting exceptional circumstances as deemed necessary by the Contract Administrator.
- .5 www.cagbc.org

1.3 REQUIREMENTS

- .1 The Contractor shall develop and implement an *Indoor Air Quality (IAQ) Management Plan* for the construction of the project. A preliminary IAQ plan has been appended to section 01 56 15. The *IAQ Management Plan* is to be approved by the City of Winnipeg and Contract Administrator and must include the following:
 - .1 During construction meet or exceed the recommended control measures of the SMACNA IAQ Guideline for Occupied Buildings Under Construction, 2nd Edition, 2007, ANSI/SMACNA 008-2008, Chapter 3.
 - .2 Protect stored on-site or installed absorptive materials from moisture damage.
 - .3 Ensure installation of absorbent materials, such as ceiling tiles, gypsum, carpet etc., are sequenced such that VOC-emitting materials have off-gassed their air contaminants.
 - .4 If air handlers must be used during construction, filtration media with a Minimum Efficiency Reporting Value (MERV) of 8 must be used at each return air grille and return or transfer duct inlet opening such that there is no bypass around the filtration media, as determined by ASHRAE 52.2-2017.
 - .5 Install new air filtration media in regularly occupied areas immediately prior to occupancy for all air handling equipment with a maximum flow rate of more than 283/L/s. These filters must provide a minimum efficiency reporting value (MERV) 8 or higher.

-
- .6 Prohibit the use of tobacco and vaping (including cannabis) inside the building and within 25 feet (8 meters) of the building entrance during construction.
 - .7 Make provisions for inspections, to be coordinated with the commissioning authority, of building and HVAC systems for deficiencies that could adversely affect the IAQ and correct any of these deficiencies.
 - .8 Ensure all return and supply grilles are completely sealed off in areas of high dust and pollution activities for the duration of the task.
 - .9 Ensure that adequate time is allocated in the construction schedule for building air flush and or air quality testing. If air quality testing is planned, ensure there is adequate time for a flush-out and retesting if a sampling point exceeds the concentration limit.

1.4 SUBMITTALS

- .1 Submit the IAQ Management Plan to City of Winnipeg and Contract Administrator for approval.
- .2 Submit a list of air filters to be used, include the MERV value, manufacturer name and model number.
- .3 Submit at least 6 dated digital photographs on a minimum of 3 different occasions throughout the construction process (minimum 18 photos total). Include identification of SMACNA approach featured by each photograph, examples include:
 - .1 Protection of the HVAC System - photograph the ductwork and HVAC taped and protected from being contaminated with dust and debris.
 - .2 Pathway Interruption - photograph tarps that separate spaces where drywall sanding, painting, or any tasks producing a high dust or VOC load is taking place.
 - .3 House Keeping - photograph housekeeping procedures that minimize the accumulation of dust and prevent it from becoming airborne: ie sweeping, vacuuming, removing packaging.
 - .4 Scheduling - photograph the construction sequences as it has been scheduled in order to reduce absorption of VOCs and dust by porous materials. See examples below:
 - .1 Application of paints, sealants, and coatings being completed before installation of ceiling tiles, or fabric covered furnishings.
 - .2 Furnishings that are expected to off-gas VOCs (i.e. cubical systems, etc.) will not be stored on site prior to installation.
 - .5 Source Control - photograph Low Emitting Materials also make sure they are closed when not in use and remove used containers from the site promptly.
- .4 Submit product volume or surface area for adhesives and sealants, paints and coatings, flooring, ceilings, wall panels, thermal and acoustic insulation, and composite wood and agrifibre products used within the outermost weather-proofing layer of the wall/roof assembly.
- .5 If testing, submit test results report.
- .6 If flush-out, submit flush-out report that includes:
 - .1 Flush-out duration calculations based on capacity of HVAC units used. Indicate which HVAC units are permanent and which are temporary.

-
- .2 Describe the flush-out procedure and include a log of dates, hours, and recorded temperature and humidity.

Part 2 Products

NOT USED

Part 3 Execution

3.1 IMPLEMENTATION

- .1 Implement and follow the IAQ plan to meet requirements of LEED credit EQ Construction Indoor Air Quality Management Plan and EQ Indoor Air Quality Assessment.
- .2 Provide at least 6 digital photographs on a minimum of 3 different occasions (minimum 18 total) throughout the construction process. Include identification of SMACNA approach featured by each photograph. Refer to Section 1.4.3 for detailed photographing requirements.
- .3 Record filtration media used in HVAC equipment during construction and date of filter change.
- .4 Install all finishes, furniture, and furnishings before performing tests or beginning a flush-out.
 - .1 All punch list items that would generate VOCs or other contaminants must be completed.
 - .2 Complete testing and balancing of the HVAC system before testing.
- .5 Provide test results report or flush-out report.

SAMPLE - Construction Indoor Air Quality Management Plan

Project Name:
Project Location:
Contractor:
Reviewed By:

Date:

Responsible Party

Teams and individuals involved in activities pertaining to the policy:

Facility Manager: TBD
Contractor: TBD
Building Representative: TBD

Scope

This document has been developed to meet the LEED® requirement for an Indoor Air Quality (IAQ) Management Plan during the construction and pre-occupancy phases. The following plan highlights measures that will be implemented to prevent IAQ problems and prevent the potential delays related to IAQ issues by the construction workers and future occupants.

Intent: To promote the wellbeing of construction workers and building occupants by minimizing indoor air quality problems associated with construction and renovation.

EQ c3.1 Construction IAQ Management Plan: During Construction

LEED® Indoor Environmental Quality Credit Construction Indoor Air Quality Management Plan requires attention to the following five areas proposed by the SMACNA¹ IAQ Guidelines for Occupied Buildings under Construction, 2nd edition, 2007, ANSI/SMACNA 008-2008, Chapter 3:

- Protection of the HVAC System
- Pathway Interruption
- Housekeeping
- Scheduling
- Source Control

The Contractor will employ the following strategies to effectively manage the IAQ throughout the construction process.

Protection of the HVAC System

These procedures will be used to prevent ductwork and HVAC equipment from being contaminated with dust and debris:

¹ Sheet Metal and Air Conditioning National Contractors Association

- The return air system will be isolated by closing dampers, installing temporary filters and temporarily sealing air intakes.
- If the HVAC system will be used during construction, each return air grill must be fitted with a MERV 8 filter as per ASHRAE 52.2-2007.
- If the HVAC system is not being used during construction, all air intakes will be temporarily sealed to prevent the accumulation of dust.
- HVAC equipment is to be inspected for dust or other contaminants regularly and is to be cleaned as needed and prior to occupancy. This may include professional cleaning.
- The ceiling plenum will be inspected for dust and debris and cleaned if necessary.
- All leaks will be sealed on the return air system before activation.
- All temporary filters will be replaced prior to occupancy.
- HVAC equipment will be cleaned prior to occupancy.

Pathway Interruption

These procedures will be used to reduce the flow of contaminants through out the buildings:

- 100% outside air will be used for ventilation during drywall sanding, painting, or any tasks producing a high dust or VOC load, to exhaust contamination directly outside.

These procedures will be used to minimize contamination at the source:

- Subcontractors, Suppliers, and Trades will be asked to clean dirty building supplies and equipment before bringing it into the building.
- Wrapped supplies (i.e. carpet rolls, ceiling tiles, etc.) will not be unwrapped until just prior to installation to prevent dust contamination or absorption of VOCs.
- Mechanical equipment and building supplies stored in the building will be kept in packaging or wrapped to minimize dust contamination and reduce the need for cleaning.
- Contractor and Trades will construct temporary barriers that contain construction dust and debris.

House Keeping

The following house keeping procedures will be observed to minimize the accumulation of dust and prevent it from becoming airborne:

- Workers engaged in dust generating activities will be asked to clean up as quickly as possible to prevent it from becoming airborne or being tracked throughout the site.
- Workers will be asked to clean areas before they are enclosed. Coring dust, insulation debris, packaging, etc., can provide a medium for mold growth and will be removed.
- The Contractor's Site Supervisor will require immediate clean up of areas that have the potential to create IAQ problems.
- The Contractor will provide and maintain shop vacuums equipped with HEPA filters to facilitate the above procedures.

Scheduling

The following construction sequences will be attempted in order to reduce absorption of VOCs and dust by porous materials.

- Application of paints, sealants, and coatings will be completed before installation of ceiling tiles, carpets or fabric covered furnishings.
- Carpet will be installed after the bulk of drywall sanding has been completed.
- Carpet will be covered with plastic until the pre-occupancy clean-up.
- Furnishings that are expected to off-gas VOCs (i.e. cubical systems, etc.) will not be stored on site prior to installation. To reduce exposure of site workers these furnishings will be assembled later in the week and allowed to off-gas over the weekend.

Source Control

In addition to the requirements of LEED® credit EQ Credit Low-Emitting Materials the following procedure will be implemented.

- To reduce VOC emissions workers will be asked to keep paint, solvent and sealant containers closed when not in use and remove used containers from the site promptly.

Additional Requirements

LEED® credit EQ Credit Construction Indoor Air Quality Management Plan requires that all stored or installed adsorptive materials be protected from moisture damage. The Contractor will implement the following procedures to prevent IAQ problems relating to moisture-damaged material.

- In addition to being wrapped (see *Pathway Interruption*), building materials stored on site will be located away from areas where they could get wet.
- Any incidents of moisture damage will be reported to the Site Supervisor.
- Moisture damaged materials will not be installed.
- The Contractor will ensure that Subcontractors, Suppliers, and Trades are aware of this requirement by incorporating IAQ requirements into the mandatory safety training.

Prior to completion of the building, and prior to the building flush out, an IAQ inspection of the building and HVAC system will be conducted. Any deficiencies will be corrected before occupancy. The following points will be inspected:

- All HVAC equipment has been properly sealed and cleaned,
- All temporary filters have been replaced,
- All paint, solvent and sealant containers have been removed from the building,
- All construction debris has been removed from the building (including from the ceiling plenum),
- Materials affecting IAQ are not located near air intakes, and
- Any moisture damage will be noted.

EQ Credit Indoor Air Quality Assessment

LEED Credit EQ Indoor Air Quality Assessment requires the building to be either flushed with outdoor air or the indoor air quality be tested prior to occupancy. The building flush or testing is completed after all construction activities are completed, including the installation of interior finishes.

Requirements

- **Building Flush**
 - 4300 cubic meters of outdoor air per square meter of floor area must pass through all spaces. Flush can be done all prior to occupancy or split between pre and post occupancy. However, if split between pre and post occupancy, a minimum of 1,075 cubic metres must pass through spaces prior to occupancy with the remainder after occupancy. If shorter duration is desired, or if the HVAC system is unable to provide at least 1.5 L/s/m² for an occupied flush-out, supplemental units may be used.
 - Space temperature must maintain 15-27 degrees Celsius, and relative humidity shall remain less than 60% during the building flush for 24 hours per day.
 - The mechanical subcontractor or controls subcontractor must keep a log of when the flush began and ended, when filters were changed and total volume of outdoor air that was used.
 - If the flush was stopped for anytime during the flush period, additional time must be added to compensate for the stoppage.

- **Air Quality Testing**
 - If the testing option is chosen, a third-party testing agent should be employed.
 - Testing must be done after construction is complete but prior to occupancy.
 - Testing should be done in accordance to the requirements outlined in LEED credit Indoor Air Quality Assessment, Option 2. Air Testing.
 - If the maximum concentrations are exceeded on any of the test points, the building should be flushed with outdoor air and the noncompliant concentrations should be retested.

Quality Assurance and Quality Control Processes:

During any construction or renovation project the following strategies will be utilized to ensure the implementation of this plan:

- A list of filtration media utilized, including the manufacturer, model number, MERV rating, date of installation and date of replacement.
- Bi-weekly date-stamped photographs documenting the IAQ control measures implemented during the project. The photos will be labeled to highlight the approach taken.
- Provide a minimum of 18 Photographs-six photographs taken on 3 separate occasions during construction. The photos will be labeled to highlight each of the following approaches taken; protection of the HVAC system, pathway interruption, housekeeping, scheduling, or source control.
- Provide air balancing report to verify actual air flows through air handling units.
- Provide narrative documenting the flush-out procedure utilized, including, building temperature, relative humidity total outdoor air volume and duration of flush.
- If air quality testing is completed as an alternative to building air flush, provide air quality testing report as proof that all requirements are met as outlined in the credit requirements for LEED EQ Credit Indoor Air Quality Assessment.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 01 35 20 – LEED® Sustainable Requirements
- .2 Division 31 – Earthwork
- .3 Division 32 – Exterior Improvements

1.2 REFERENCES

- .1 LEED® Canada Reference Guide for Green Building Design and Construction V4 Edition
 - .1 Sustainable Sites Prerequisite 1 Construction Activity Pollution Prevention
 - .2 www.cagbc.org
- .2 2017 United States Environmental Protection Agency (EPA) Construction General Permit (CGP)
- .3 Credit Interpretation Requests relating to the credits specified in this Section may apply in projects exhibiting exceptional circumstances as deemed necessary by the Contract Administrator.

1.3 INTRODUCTION

- .1 Site clearing and earth moving during construction often results in significant soil erosion if adequate environmental protection strategies are not put into practice. Develop and implement a *Construction Activity Pollution Prevention Plan* to prevent these problems from occurring.

1.4 REQUIREMENTS

- .1 The Contractor shall design and implement a *Construction Activity Pollution Prevention Plan* which must describe the measures implemented specific to the site that conforms to 2017 EPA Construction General Permit, or local erosion and sedimentation control standards and codes, whichever is more stringent. The preliminary plan has been attached to the spec section 01 57 13; however, more measures may be added or removed dependent on changing site conditions. Measures will be reviewed on an ongoing basis during construction to ensure the plan adequately meets the following objectives in accordance with the 2017 EPA Construction General Permit:
 - .1 Prevent loss of soil during construction by storm water runoff and/or wind erosion, including protecting topsoil by stockpiling for reuse.
 - .2 Prevent sedimentation of storm sewer or receiving streams.
 - .3 Prevent polluting the air with dust and particulate matter.

Part 2 Products

NOT USED

Part 3 Execution

3.1 IMPLEMENTATION

- .1 Implement and follow the *Construction Activity Pollution Prevention Plan*. Plan must be approved prior to the start of construction and include a site plan with the location of the CAPP measures clearly marked.
- .2 CAPP measures must be in place prior to the start of any construction on site.
- .3 Provide dated digital photographs of the various erosion and sedimentation control measures implemented biweekly throughout the project. Photographs could include, as applicable, but not limited to:
 - .1 *Preconstruction* – Photos showing site’s preconstruction condition, and proof that CAPP measures were in place prior to start of construction.
 - .2 *Sediment Control (Silt Fencing, or equivalent)* - routine checks of the silt fencing will be made at least every 14 days and prior to any anticipated storm to maintain its effectiveness. Photograph any deficiencies before and after fixing them.
 - .3 *Storm Drain Inlet Protection* - photograph the catch basins and manholes protected with filters used to prevent sediment from entering the storm drainage systems.
 - .4 *Dewatering of Site* - Capture the settling ponds that water is pumped into prior to entering the water drainage system.
 - .5 *Dust Control* - If dust becomes excessive or a concern the problem areas will be moistened to prevent the dust. Photograph all piles of soil and how dust is mitigated.
 - .6 *Construction Exit* - Photograph the gravel strip in place at the exit of the construction site and the dirt-free roadway.
 - .7 *Storage and Collection of Materials* - Photograph on-site facilities for collection, handling, and storage of anticipated quantities of reusable and/or recyclable materials.
 - .8 *Soil Stockpile* – Photograph any sediment barriers, covering or seeding of stockpile if soil is to remain for more than 2 weeks.
 - .9 *Any added measures due to unusual weather events or spills.*
 - .10 *Others as appropriate to sufficiently document all CAPP measures.*

SAMPLE CAPP Plan

Project Name:
Project Location:
Contractor:
Reviewed by:

Date:

Construction Activity Pollution Prevention Plan

This Construction Activity Pollution Prevention (CAPP) Plan is designed to meet the requirements as put forth in the LEED Canada for New Construction and Major Renovations v4/v4.1 Green Building Rating System.

According to Sustainable sites prerequisite, Construction Activity Pollution Prevention requirements, the plan must conform to the more stringent of the 2017 United States Environmental Protection Agency (EPA) Construction General Permit OR Local erosion and sedimentation control standards and codes. While the EPA does not have jurisdiction in Canada, the EPA's Construction General Permit, Section 2.2 forms the basis of the following plan.

This CAPP Plan has the following objectives:

- To prevent loss of soil during construction by runoff and/or wind erosion, including protecting topsoil by stockpiling for reuse.
- To prevent sedimentation of storm sewer or receiving streams.
- To prevent pollution of the air with dust and particulate matter.

1. Site Description and Site Plan:

Include detailed site description and site plan here.

2. Erosion and Sedimentation Control Measures:

2.1 Provide and maintain natural buffers and/or equivalent erosion and sediment control when a water body is located within 50 feet of the site's earth disturbances.

Describe control measures that meet one of the options below:

- *Provide and maintain a 50 foot (15 m) undisturbed natural buffer; or*
- *Provide and maintain an undisturbed natural buffer that is less than 50 feet (15 m) and is supplemented by erosion and sediment controls that achieve, in combination, the sediment load reduction equivalent to a 50 foot (15 m) undisturbed natural buffer or;*
- *If infeasible to provide and maintain an undisturbed natural buffer of any size, implement erosion and sediment controls to achieve the sediment load reduction equivalent to a 50-foot undisturbed natural buffer.*
- *If no body of water present within 50 feet (15m) of disturbed area of the site, mark as not applicable.*

2.2 Direct stormwater to vegetated areas and maximize stormwater infiltration and filtering to reduce pollutant discharges, unless infeasible.

Describe how this measure is, or is not, appropriate and applicable to the project site.

2.3 Install sediment controls (i.e. silt fence, berms, dikes, fiber rolls, strawbales etc.) along any perimeter areas of the site that will receive pollutant discharges.

The silt fence will be constructed of geotextile fencing, connected to wooded posts, with the bottom of the silt fence buried or otherwise secured at the bottom. Routine checks of the fencing will be made at least every 14 days and prior to any anticipated storm. Sediment will be removed before it has accumulated to one-half of the above ground height of any perimeter control. If specific areas have greater water flow than anticipated, straw bales will be added to increase the effectiveness of the filtration

- For areas at linear construction sites where perimeter controls are infeasible, (e.g. due to a limited or restricted right-of-way), implement other practices as necessary to minimize pollutant discharges to perimeter areas of the site.

2.4 Minimize Sediment Track-Out

- A gravel strip will be placed at the exit of the construction site and all vehicles exiting the site will pass over the strip before they enter the public roadway. The gravel strip will help dislodge material from the vehicles. If the vehicles are excessively dirty, and the gravel track is not sufficient, the tires and wheel wells will be washed down prior to leaving site. Daily inspections will be made of the gravel strip and will be maintained as needed.
- Vehicles entering the site will be restricted to use designated entrances and exits.
- Where sediment has been tracked out of the site onto paved roads, sediment will be removed via shovelling, sweeping, scraping, or street sweeper. Debris will not be hosed or swept into stormwater conveyance, stormwater inlet.
- Exception: Stabilization is not required for exit points at linear utility construction sites that are used only episodically and for very short durations of the life of the project, provided other exit points controls are implemented to minimize sediment track-out.

- *Describe how this measure is, or is not, appropriate and applicable to the project site.*

2.5 Soil Stockpile

- Any soil that is excavated for the project will be stockpiled on site.
- Piles will be located outside any natural buffers
- A sediment barrier will be installed along all downgradient perimeter areas.
- The pile will be covered with a tarp, blown straw or grassed if it is to remain for longer than 14 days.
- Accumulated sediment will not be hosed or swept to any stormwater conveyance or inlet.

- *Describe how this measure is, or is not, appropriate and applicable to the project site*

2.6 Minimize Dust

- For areas with exposed soil, dust will be minimized through the appropriate application of water or other dust suppression techniques to control the generation of pollutants that could be discharged in stormwater from
- Describe any existing slopes and any that are expected to be created during construction.

- *Describe how this measure is, or is not, appropriate and applicable to the project site.*

2.7 Minimize Steep Slope Disturbances

- For this plan, a steep slope is considered anything greater than 15% grade.
- Disturbance on steep slopes will be kept to a minimum.
- *Describe how this measure is, or is not, appropriate and applicable to the project site.*

2.8 Preserve Native Topsoil, Unless Infeasible

- If topsoil is to be used as part of the landscaping, any topsoil that is scraped off as part of excavation will be stockpiled for future onsite use either on an area of the project site, or at an off-site location.
- *Describe how this measure is, or is not, appropriate and applicable to the project site.*

2.9 Minimize soil compaction

- In areas of the site where final vegetative stabilization will occur or where infiltration practices will be installed:
 - Vehicle and equipment use in these areas will be restricted to avoid soil compaction and
 - Before seeding or planting areas of exposed soil that have been compacted, techniques that rehabilitate and condition the soils as necessary to support vegetative growth will be used.

2.10 Storm Drain Inlet Protection

- Inlet protection measures will be installed that remove sediment from discharges prior to entry into any storm drain inlet that carries stormwater flow from the site to a body of water. In the event of flood conditions.
- The project site and adjacent area catch basins and manholes will have filters put in place to prevent sediment from entering the storm drainage systems. The filter will consist of a geotextile fabric that will be placed underneath the grate.
- Checks of the sediment level and possible damage to filters will be made at least 14 days. Checks will also be made prior to any anticipated storm. Any visible sediment will be removed and returned to an appropriate place on site.
- *Describe how this measure is, or is not, appropriate and applicable to the project site.*

2.11 Control Stormwater discharges

- Peak flow rate and total stormwater will be managed to minimize channel and streambank erosion and scour in the immediate vicinity. Measures may include erosion controls and or velocity dissipation devices (e.g. check dams, sediment traps) within and along the length of a stormwater conveyance and at the outfall to slow down runoff.
- *Describe how this measure is, or is not, appropriate and applicable to the project site.*

2.12 Sediment Basin

- Any sediment basin or similar impoundment will be situated outside of any water body and any natural buffers established under 2.1.
- The basin will be designed to avoid collecting water from wetlands.
- The basin will be designed to provide storage for either:

- The calculated volume of runoff from a 2-year, 24-hour storm or 3600 cubic feet (101 cubic metres)
- Outlet structures that withdraw water from the surface of the sediment basin will be used unless infeasible.
- Erosion controls and velocity dissipation devices to prevent erosion will be used.
- Any accumulated sediment will be removed to maintain at least one-half of the design capacity in order to ensure the basin remains in effective operating condition.

- *Describe how this measure is or is not appropriate and applicable to the project site.*

2.13 Stabilizing Exposed Portions of the Site

- Stabilization measures (e.g. seeding protected by erosion controls until vegetation is established, sodding, mulching, erosion control blankets, hydro-mulch, gravel) that minimize erosion from exposed portions of the site will be implemented.
- For areas of disturbance 5 acres (2.02 ha), or less:
 - Stabilization will be initiated immediately in any areas of exposed soil where construction activities have permanently ceased or will be temporarily inactive for 14 or more calendar days.
 - Installation of the stabilization measures will be completed as soon as practicable, but no later than 14 days after initiation.
- For areas of disturbance greater than 5 acres (2.02 ha)
 - Stabilization measures will be initiated immediately in any areas of exposed soil where construction activities have permanently ceased or will be temporarily inactive for 14 or more calendar days.
 - Installation of the stabilization measures will be completed as soon as practicable but no later than 7 days after initiation.
 - If installation is not practicable within stated timeline, explain circumstances or unforeseen challenges.

3. Pollution Prevention Requirements

Pollution prevention controls will be implemented in accordance with the following requirements to minimize the discharge of pollutants in stormwater and to prevent discharge or pollutants from spilled or leaked materials from construction activities.

3.1 Equipment and Vehicle Fueling Maintenance

- Any vehicle fueling or maintenance activities will be located away from bodies of water and stormwater inlets or conveyance.
- Secondary containment such as spill berms, decks, spill containment pallets will be used where appropriate.
- A spill kit will be available on site and personnel will be available to respond expeditiously in the event of a leak or spill.
- Drip pans or absorbents will be placed under or around leaky vehicles.
- Vehicle oil or oily wastes will be recycled or disposed of in accordance with Provincial regulations.
- Dry measures only will be used to clean up contaminated surfaces.

3.2 Equipment and Vehicle Washing

- Any vehicle washing, including wheel washing, that may happen on site will be located away from bodies of water or stormwater inlets or conveyance.

- Wash waters will be directed to a sediment basin, sediment trap and will be filtered appropriately so that there is no discharge of soaps, solvents or detergents.
- Any soaps or detergents used on site will be stored in a secure covered container to eliminate the risk of exposure to precipitation or stormwater.

3.3 Storage and Handling and Disposal of Building Products, Materials and Waste

- For building products where exposure to precipitation will result in a discharge of pollutants, and possible contamination of stormwater, building products will be covered to minimize risk.
- For pesticides, herbicides, insecticides, fertilizers and landscape materials:
 - Covered storage (plastic sheeting, temporary roofing) will be provided to minimize exposure to precipitation and stormwater.
 - All application and disposal requirements included on the pesticide, herbicide, insecticide or fertilizer label will be followed.
- For diesel fuel oil, hydraulic fluids, other petroleum products and other chemicals
 - Chemicals will be stored in water-tight chemicals and covered to minimize exposure to precipitation or stormwater.
 - Spills will be cleaned up immediately using dry clean-up methods where possible. Spills will not be hosed down as part of the cleaning process.
- For hazardous or toxic wastes:
 - Hazardous or toxic waste will be separated from construction and domestic waste.
 - Waste will be stored in sealed containers constructed out of suitable materials to prevent leakage and corrosion and which are properly labelled.
 - Outside containers will be properly stored in suitable secondary containment such as spill berms, decks, spill containment pallets).
 - Hazardous or toxic wastes will be disposed of in accordance to manufacturer's recommended method of disposal and in compliance with applicable Provincial or local laws.
 - Spills will be cleaned up immediately using dry clean-up methods.
- For construction and domestic wastes:
 - Waste containers of appropriate sizes will be provided for recyclable material and waste as per the Construction Waste Management Plan. Containers will be clearly marked to prevent contamination, and all on-site workers will be educated on the procedures.
 - Spills will be cleaned up immediately if containers overflow.
- For sanitary waste
 - Portable toilets will be positioned so that they are secure, will not be tipped or knocked over, and will be away from bodies of water or possible stormwater conveyance
- For washing applicators and containers used for stucco, paint, concrete form release oils, curing compounds or other materials.
 - Wastewater will be directed into a leak-proof container, or leak-proof lined pit.
 - Wastewater will not be dumped in storm sewers or bodies of water.
 - Liquid waste will be disposed of in accordance with local requirements.
 - Hardened concrete will be recycled as per the construction waste management plan.
- For fertilization application
 - Fertilizers will be applied at a rate and in amounts consistent to manufacturer's specifications.
 - Fertilizers will be applied at the appropriate time of year for the project location, and preferable time to coincide as closely as possible to the period of maximum vegetation update and growth.
 - Application of fertilizers prior to heavy rains will be avoided if possible.
 - Fertilizers will not be applied to frozen ground.

- Fertilizers will not be applied to stormwater conveyance channels.

3.4 Emergency Spill Notification

- In the event of a toxic or hazardous material immediately contact the appropriate Provincial Authority:
 - Alberta: Environmental Response Line: 1-800-222-6564
 - Saskatchewan: Spill Control Centre: 1-800-667-7525
 - Manitoba: Environmental Emergency: 204.944.4888
 - Ontario: Spill Action Centre: 1-800-268-6060

4. Dewatering of Site Requirements

If dewatering is required of any excavated areas, trenches or foundations, or similar points of accumulation of the site, the following requirements will apply:

- The water will be pumped through filters prior to entering the water drainage system
- Rainwater that collects in the excavation/drilling areas will be pumped out and filtered before entering the catch basin or emptied towards the grassed field where it will naturally percolate/filter into the ground.
- Visible solids or foam will not be discharged off site.
- An oil water separator will be used if dewatering water is found to contain oil, grease, or other similar contaminants.
- As all points where dewatering water is discharged, velocity dissipation requirement will be followed.
- Backwash water will either be hauled away for disposal or returned to the beginning of the treatment process.
- Any filter media used in dewatering devices will be replaced or cleaned when the pressure differential equals or exceeds the manufacturer's specifications.

5. Site Inspection Requirements

5.1 Person Responsible for Inspecting Site

- The Contractor shall be responsible for either performing site inspections or hiring a third-party qualified inspector.

5.2 Inspection Frequency

- At minimum, inspections will occur every seven days OR once every two weeks and within 24 hours of a storm event 0.25 inches (6 mm) or greater, will check all CAPP measures. Any deficiencies will be noted and rectified within 7 days. Daily inspections will be made of the gravel strip and will be maintained as needed.
- Reduced frequency of every 14 days may be followed for stabilized areas for the first month then monthly thereafter. If construction activity resumes in this portion of the site, then inspections will resume the minimum inspection time as above.
- In drought areas, inspections may be reduced to monthly and within 24 hours of a storm event greater than 0.25 inches (6 mm).
- If construction activities are suspended due to frozen conditions, inspections may be suspended until thaw occurs. If construction activities are continuing during frozen conditions, then inspection frequency may be reduced to once a month. Time of frozen conditions should be documented.

5.3 Areas of Inspection

- At minimum, the following area will be inspected;
 - All areas that have been cleared, graded, or excavated and that have not yet completed stabilization techniques as described in 2.13.
 - All stormwater controls (including pollution prevention controls) installed at the site to comply with this permit;
 - Material, waste, borrow, and equipment storage and maintenance areas that are covered by this plan;
 - All areas where stormwater typically flows within the site, including drainageways designed to divert, convey and or treat stormwater;
 - All points of discharge from the site; and
 - All locations where stabilization measures have been implemented.
 - Any areas that are considered unsafe to personnel to inspect are not required to be inspected.

5.4 Requirements for Inspections

- During inspections the following will be performed:
 - Check whether all stormwater controls are properly installed, appear to be operational, and are working as intended to minimize pollutant discharges;
 - Check for the presence of conditions that could lead to spills, leaks, or other accumulations of pollutants on site.
 - Identify any locations where new or modified stormwater controls are necessary.
 - Check for signs of visible erosion and sedimentation that have occurred and are attributable to project discharge at points of discharge.
 - Identify any incidents of noncompliance observed.
 - If a discharge is occurring during an inspection, document the visual quality including color, odor, floating, settled or suspended solids, foam, oil sheen and other indicators of stormwater pollutants.
- Based on inspection results, any corrective actions must be made no later than 7 days of discovery.
- Dated inspection reports including photo evidence and documented corrective actions will be created after each inspection. Reports will be made available to the LEED Consultant and upon request to other acceptable parties.

END OF SECTION

Part 1 General

1.1 Reference standards

- .1 Within text of each specifications section, reference may be made to reference standards.
- .2 Conform to these reference standards, in whole or in part as specifically requested in specifications.
- .3 If there is question as to whether products or systems are in conformance with applicable standards, Contract Administrator reserves right to have such products or systems tested to prove or disprove conformance.
- .4 Cost for such testing will be born by City of Winnipeg in event of conformance with Contract Documents or by Contractor in event of non-conformance.

1.2 Quality

- .1 Products, materials, equipment and articles incorporated in Work shall be new, not damaged or defective, and of best quality for purpose intended. If requested, furnish evidence as to type, source and quality of products provided.
- .2 Procurement policy is to acquire, in cost effective manner, items containing highest percentage of recycled and recovered materials practicable consistent with maintaining satisfactory levels of competition. Make reasonable efforts to use recycled and recovered materials and in otherwise utilizing recycled and recovered materials in execution of work.
- .3 Defective products, whenever identified prior to completion of Work, will be rejected, regardless of previous inspections. Inspection does not relieve responsibility, but is precaution against oversight or error. Remove and replace defective products at own expense and be responsible for delays and expenses caused by rejection.
- .4 Should disputes arise as to quality or fitness of products, decision rests strictly with Contract Administrator based upon requirements of Contract Documents.
- .5 Unless otherwise indicated in specifications, maintain uniformity of manufacture for any particular or like item throughout building.
- .6 Permanent labels, trademarks and nameplates on products are not acceptable in prominent locations, except where required for operating instructions, or when located in mechanical or electrical rooms.

1.3 Availability

- .1 Immediately upon signing Contract, review product delivery requirements and anticipate foreseeable supply delays for 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.

1.4 Storage, handling and protection

- .1 Handle and store products in manner to prevent damage, adulteration, deterioration and soiling and in accordance with manufacturer's instructions when applicable.
- .2 Store packaged or bundled products in original and undamaged condition with manufacturer's seal and labels intact. Do not remove from packaging or bundling until required in Work.
- .3 Store products subject to damage from weather in weatherproof enclosures.
- .4 Store cementitious products clear of earth or concrete floors, and away from walls.
- .5 Keep sand, when used for grout or mortar materials, clean and dry. Store sand on wooden platforms and cover with waterproof tarpaulins during inclement weather.
- .6 Store sheet materials, lumber etc. 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.
- .9 Touch-up damaged factory finished surfaces to Contract Administrator's satisfaction. Use touch-up materials to match original. Do not paint over name plates.

1.5 Transportation

- .1 Pay costs of transportation of products required in performance of Work.
- .2 Transportation arrangements and costs of products supplied by City of Winnipeg will be paid for by the City of Winnipeg. Unload, handle and store such products.

1.6 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 will 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.

1.7 Quality of work

- .1 Ensure Quality of Work is of highest standard, executed by workers experienced and skilled in respective duties for which they are employed. Immediately notify 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.

1.8 Co-ordination

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

1.9 Concealment

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

1.10 Remedial work

- .1 Perform remedial work required to repair or replace parts or portions of Work identified as defective or unacceptable. Co-ordinate 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.

1.11 Location of fixtures

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

1.12 Fastenings

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

1.13 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.

1.14 Protection of work in progress

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

1.15 Existing utilities

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

Part 2 Products - Not Used

Part 3 Execution - Not Used

END OF SECTION

Part 1 General

1.1 Action and informational submittals

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit the following before work begins at the Place of the Work:
 - .1 Service locations: Document locations and extents of service lines in the work area.
- .3 Submit the following informational submittals as work progresses:
 - .1 Land surveyor information: Name, address, and registration information.
 - .2 Test reports: For manufacturer-recommended pre-installation site tests.
 - .1 Indicate test results meet manufacturer's requirements and recommendations.
 - .2 When manufacturer's requirements are not met, submit manufacturer's corrective recommendations for review.
 - .3 Land surveys: Prepared and issued by a qualified land surveyor.
 - .1 Maintain a log of control and land survey work as it progresses. Record locations with horizontal and vertical data.
 - .2 Submit when required by authority having jurisdiction (AHJ) and on completion of building footings and foundations.
 - .4 Submit the following when requested by the Contract Administrator:
 - .1 Site quality control submittals: Documentation to verify accuracy of site engineering work.

1.2 Closeout submittals

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Land Surveys: Prepared and issued by a qualified land surveyor.
 - .1 Document locations of maintained, re-routed, and abandoned service lines.
- .3 Land Survey Certificate: Indicate where elevations and locations of completed Work are in conformance, or non-conformance, with Contract Documents.

1.3 Qualification assurance

- .1 Surveyor Qualifications: Registered land surveyor, licensed to practice at the Place of the Work.

Part 2 Products - Not Used

Part 3 Execution

3.1 Examination

- .1 Existing Services:

- .1 Confirm locations and extent of service lines in work area before beginning work on site. Submit findings.
- .2 Immediately notify the Contract Administrator if unknown services are encountered. Confirm findings in writing.
- .3 Record locations of maintained, re-routed, and abandoned service lines after completion of the Work. Submit findings.
- .2 Verify substrate and other conditions are acceptable for installation of materials, assemblies, and systems in accordance with required tolerances and manufacturer's instructions and recommendations.
 - .1 Examine conditions, with installers, for defects affecting performance of the Work. Where work of one Section depends on work of other Sections being properly completed, verify that work is complete and suitable to receive the subsequent work.
 - .2 Verify substrate surfaces are clean, dimensionally-stable, cured, and free of contaminants.
 - .3 Proceed with installation after unacceptable conditions are remedied.
 - .4 Starting to cut, patch, or install work will be considered Contractor's acceptance of existing conditions.
 - .5 Monitor conditions as Work proceeds, including items subject to damage or movement during cutting and patching.
- .3 Perform manufacturer-recommended pre-installation site tests.

3.2 Preparation

- .1 Protection of In-Place Conditions:
 - .1 Protect Work and items to remain from damage.
 - .2 Do not load, or permit to be loaded, anything with a weight or force that may endanger the safety or integrity of the Work or items to remain.
 - .3 Support structural integrity of surroundings.
 - .4 Protect exposed work from weather and other potentially damaging conditions. Keep excavations free of water.
 - .5 Promptly remove, replace, clean, or repair elements damaged due to inadequate protection, as acceptable to the Contract Administrator, and at no change to the Contract Price or Contract Time.
- .2 Surface Preparation:
 - .1 Clean surfaces thoroughly before installation.
 - .2 Prepare surfaces using manufacturer-recommended methods to achieve acceptable substrates under project conditions.

END OF SECTION

Part 1 General

1.1 Related requirements

- .1 Section 01 33 00 - Submittal Procedures

1.2 Section includes

- .1 Common requirements for installing, applying, and erecting products. Includes procedures and submittals for cutting and patching to existing conditions, and required repairs arising from tests and destructive inspections.

1.3 Action and informational submittals

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit proof of anchor and fastener load carrying capacity for a work result, when requested.
- .3 Submit written request before cutting or altering to existing conditions which may affect the following:
 - .1 structural integrity of existing elements: Submit structural details and calculations performed by a professional structural engineer registered or licensed in Manitoba, Canada. Include evidence of unsatisfactory structural integrity of the elements according to Contract Administrator.
 - .2 integrity of weather-exposed and moisture-resistant elements
 - .3 efficiency, maintenance, safety, or accessibility of operational elements
 - .4 visual qualities of sight-exposed elements.
 - .5 Work of City of Winnipeg and/or other Contractor(s)
- .4 Submit a request for cutting or altering which includes:
 - .1 identification of the Project; and
 - .2 location and description of affected existing conditions including changes to structural elements, function of elements, and visual appearance of existing elements; and the location and identification of utilities that will be temporarily out of service during cutting and patching activities.
- .5 Submit site plan drawings indicating relative location of various services and equipment upon the request of Contract Administrator.
- .6 Submit a work plan including:
 - .1 a statement why cutting or altering is unavoidable and describe alternatives to cutting and patching if available;
 - .2 a description of proposed work and proposed Products;
 - .3 the effect of cutting or altering on work by City of Winnipeg or other Contractors;
 - .4 written acknowledgement by other Contractors affected by cutting or altering, if applicable; and
 - .5 proposed date(s) and time(s) work will be executed.

1.4 Qualifications

- .1 Licensed Professionals: Engage a structural engineer licensed at the Place of the Work, to submit details and calculations when altering existing structural elements.

Part 2 Products

2.1 Materials

- .1 Patching Materials: If possible, use the same materials found in the existing conditions, except in fire-resistance rated materials and assemblies.
- .2 Materials Visible from the Floor Area: Use materials that visually match existing adjacent surfaces, and match existing functional performance.

Part 3 Execution

3.1 Common installation/application/erection requirements

- .1 Fit several parts together, to integrate with other Work.
- .2 Remove and replace defective and non-conforming Work.
- .3 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.
- .4 Notify Contract Administrator in writing, of conflicts between specifications and manufacturer's instructions, so that Contract Administrator will establish course of action.
- .5 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.
- .6 Provide openings in non-structural elements for penetrations of mechanical and electrical work.
- .7 Conceal pipes, ducts and wiring in floor, wall, partition, and ceiling assemblies in finished areas, except where indicated otherwise.
- .8 In addition to the manufacturer's recommendations for safety, access, accessibility, and maintenance, locate equipment, fixtures, and distribution systems where it shall provide minimal interference and shall maximize on usable space.
 - .1 Location of equipment, fixtures, and outlets indicated on Drawings and specifications are approximate.
 - .2 Notify City of Winnipeg Representative and Contract Administrator of impending installation and obtain approval for actual locations.

3.2 Bracing and anchoring

- .1 Anchors and Fasteners: Unless otherwise indicated elsewhere:
 - .1 Provide any necessary anchors and fasteners to fasten each component securely for its intended purpose. Allow for building movement, including from thermal expansion and contraction of materials and assemblies;
 - .2 prevent electrolytic reaction between dissimilar metals and materials;
 - .3 Provide stainless steel anchors and fasteners for securing exterior work;

- .4 locate anchors and fasteners within individual load limit or shear capacity. Ensure anchors and fasteners are permanently secured;
 - .5 Where exposed to view, evenly distribute anchors and fasteners in a single area; and
 - .6 Where exposed to view, provide metal anchors, fasteners, and related accessories with the same texture, colour, and finish as adjacent materials.
- .2 Non-Conforming Work: Anchors and fasteners installed which cause substrate cracks or spalling is not acceptable.

3.3 Cutting and patching

- .1 Proceed with cutting and patching after the review and acceptance by the City of Winnipeg Representative and Contract Administrator of all submittals listed in Article 1.03, Actions and Informational Submittals.
- .2 Perform cutting, fitting, and patching including excavation and fill, to complete Work in accordance with related technical specification Sections.
- .3 Use special techniques to avoid damaging existing conditions that will remain, and which will result in proper surfaces to receive patching and finishing.
- .4 Employ original installer to perform cutting and patching for weather-exposed elements, moisture-resistant elements, and surfaces exposed to view.
- .5 Cut rigid materials using masonry saw, core drill, or other tool recommended by the product manufacturer or applicable industry association. Pneumatic or impact tools are not allowed on masonry work without the approval of Contract Administrator.
- .6 Fit Work airtight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.
- .7 Refinish surfaces to match adjacent finishes. Refinish continuous surfaces to nearest intersection (e.g., edges of partition). Refinish assemblies by refinishing entire unit. Provide entire surface with uniform finish, colour, and texture.

3.4 Adjusting

- .1 Remove and replace patching that is visually unsatisfactory to Contract Administrator.

END OF SECTION

Part 1 General

1.1 Reference standards

- .1 Canadian Construction Documents Committee (CCDC)
 - .1 CCDC 5B-10, Construction Management Contract.

1.2 Project cleanliness

- .1 Maintain Work in tidy condition, free from accumulation of waste products and debris, including that caused by City of Winnipeg or other Contractors.
- .2 Remove waste materials from site at daily regularly scheduled times or dispose of as directed by Contract Administrator. Do not burn waste materials on site.
- .3 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.
- .4 Provide on-site appropriate containers for collection of waste materials and debris.
- .5 Provide and use marked separate bins for recycling. Refer to Section 01 74 19 - Construction Waste Management and Disposal.
- .6 Dispose of waste materials and debris off site.
- .7 Clean interior areas prior to start of finishing work, and maintain areas free of dust and other contaminants during finishing operations.
- .8 Store volatile waste in covered metal containers, and remove from premises at end of each working day.
- .9 Provide adequate ventilation during use of volatile or noxious substances. Use of building ventilation systems is not permitted for this purpose.
- .10 Use only cleaning materials recommended by manufacturer of surface to be cleaned, and as recommended by cleaning material manufacturer.
- .11 Schedule cleaning operations so that resulting dust, debris and other contaminants will not fall on wet, newly painted surfaces nor contaminate building systems.

1.3 Final cleaning

- .1 When Work is Substantially Performed remove surplus products, tools, construction machinery and equipment not required for performance of remaining Work.
- .2 Remove waste products and debris other than that caused by others, and leave Work clean and suitable for occupancy.
- .3 Prior to final review remove surplus products, tools, construction machinery and equipment.
- .4 Remove waste products and debris including that caused by City of Winnipeg or other Contractors.
- .5 Remove waste materials from site at regularly scheduled times or dispose of as directed by Contract Administrator. Do not burn waste materials on site.
- .6 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.

- .7 Clean and polish glass, mirrors, hardware, wall tile, stainless steel, chrome, porcelain enamel, baked enamel, plastic laminate, and mechanical and electrical fixtures. Replace broken, scratched or disfigured glass.
- .8 Remove stains, spots, marks and dirt from decorative work, electrical and mechanical fixtures, furniture fitments, walls, and floors and ceilings.
- .9 Clean lighting reflectors, lenses, and other lighting surfaces.
- .10 Vacuum clean and dust building interiors, behind grilles, louvres and screens.
- .11 Wax, seal, shampoo or prepare floor finishes, as recommended by manufacturer.
- .12 Inspect finishes, fitments and equipment and ensure specified workmanship and operation.
- .13 Remove dirt and other disfiguration from exterior surfaces.
- .14 Clean equipment and fixtures to sanitary condition; clean or replace filters of mechanical equipment.

1.4 Waste management and disposal

- .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 19 - Construction Waste Management and Disposal.

Part 2 Products - Not Used

Part 3 Execution - Not Used

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Construction Waste Management - Relates to ALL Sections
- .2 Section 01 35 20 - LEED® Sustainable Requirements
- .3 Section 01 57 13 Construction Activity Pollution Prevention

1.2 REFERENCES

- .1 LEED® Canada Reference Guide for Green Building Design and Construction V4 Edition
 - .1 Materials and Resources Prerequisite Construction and Demolition Waste Management Planning
 - .2 Materials and Resources Credit Construction and Demolition Waste Management
- .2 Credit Interpretation Requests relating to the prerequisite and credit outlined in 1.2.1 and 1.2.2 may apply in projects exhibiting exceptional circumstances as deemed necessary by the LEED® consultant.
- .3 www.cagbc.org

1.3 INTRODUCTION

- .1 The Contractor is to identify at least five material waste streams (both structural and non-structural) targeted for diversion. Divert a minimum of 75% of the total construction and demolition material from the landfill by recycling and salvaging. Diverted materials must include at least four different material streams during demolition and construction.
- .2 A waste stream is defined by where the material is going. A single type of material could go to two different waste streams or alternatively two separate materials could go to a single waste stream. For example; if wood is partially being sent to a local building supply store and a power generation facility, that would count as two waste streams OR if comingled waste is sent to one single facility, that would count as one waste stream. Each material sent to a separate facility counts as one waste stream. There are a multiple diversion strategies to achieve the waste diversion goals: source separation, comingled waste, deconstructed materials sent to reuse markets, reuse of deconstructed materials on-site and take back programs.

1.4 REQUIREMENTS

- .1 All sub-trades are to conform to the Construction and Demolition Waste Management requirements.
- .2 The Contractor is to develop and implement a *Construction Waste Management Plan*. The plan must include the following:
 - .1 An overall project waste diversion goal.
 - .2 At least five kinds of materials streams that will be diverted from landfills or incineration.
 - .3 Specify whether materials will be separated or comingled.
 - .4 Expected diversion rate for each material.
 - .5 Describe diversion strategies planned for the project. Describe where the materials will be taken and how the recycling facility will process the material.

- .3 The Contractor shall be responsible for sourcing appropriate recycling and reuse facilities. A draft preliminary plan has been attached to spec 01 74 19.
- .4 Weekly construction waste progress reports, as described in Section 01 35 20 clause 3.1.4, are to be submitted to the LEED® consultant and City of Winnipeg Representative during both demolition and construction.
- .5 A consistent method of measurement is to be used; all information is to be provided in metric tonnes.

1.5 INFORMATIONAL SUBMITTALS

- .1 Waste Reduction Progress Reports: Concurrent with each Application for Payment, submit report. Include the following information on the tracking template:
 - .1 Date.
 - .2 Type of waste.
 - .3 Diversion location or recycler and end use .
 - .4 Total quantity of waste, in tonnes.
 - .5 Quantity of waste salvaged or recycled, in tonnes.
 - .6 Total quantity of waste recovered, as a percentage of total waste.
- .2 Records of Donations: Indicate receipt and acceptance of salvageable waste donated to individuals and organizations. Indicate whether organization is tax exempt. Include End Use Letters indicating name of reuse/recycling facility and how the salvageable waste was reused/recycled.
- .3 Records of Sales: Indicate receipt and acceptance of salvageable waste sold to individuals and organizations. Include End Use Letters indicating name of reuse/recycling facility and how the salvageable waste was reused/recycled.
- .4 Recycling and Processing Facility Records: Indicate receipt and acceptance of recyclable waste by recycling and processing facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices. Include End Use Letters indicating name of reuse/recycling facility and how the salvageable waste was reused/recycled.
- .5 Landfill and Incinerator Disposal Records: Indicate receipt and acceptance of waste by landfills and incinerator facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.
- .6 Date stamped photographs of separated and marked stockpile areas.

1.6 STORAGE AND HANDLING

- .1 Provide on-site facilities for collection, handling, and storage of anticipated quantities of reusable and/or recyclable materials.
- .2 Provide containers to deposit reusable and/or recyclable materials.
- .3 Place containers in strategic locations to facilitate deposit of materials without hindering daily operations. Recycle/Salvage containers are to be located closer to the work area and be more readily accessible than waste containers to encourage recycling.
- .4 Separate salvaged materials into separate piles or containers on site and protect them from damage. Transport offsite to approved and authorized recycling facility.
- .5 Mark containers and/or stockpile areas.

- .6 Stockpile areas to be consistent with applicable fire regulations.
- .7 Unless otherwise specified, materials for removal becomes Contractor's property.
- .8 On site sale of salvaged, reusable, or recyclable materials is not permitted.
- .9 Material destined for the landfill to be used as alternative daily cover cannot be counted as diverted material.
- .10 Land clearing debris is not considered construction, demolition or renovation waste and therefore should not be counted as waste or diverted material.
- .11 Asbestos or other hazardous materials having specific disposal requirements as governed by Provincial regulations should not be counted as waste or diverted materials.

1.7 CLEANING

- .1 Remove tools and waste materials upon completion of work and leave work area in a clean, orderly condition.
- .2 Maintain a clean and safe work area as work progresses.

Part 2 Products

2.1 NOT USED

Part 3 Execution

3.1 APPLICATION

- .1 Handle waste materials not reused, salvaged, or recycled in accordance with appropriate regulations and codes.
- .2 Burning and incineration of rubbish and waste cannot be used as an alternative method for diverting waste from the landfill.
- .3 Burying of waste and rubbish is prohibited, unless approved by the sustainability consultant.

3.2 DIVERSION OF MATERIALS

- .1 Provide instruction regarding disposal practices to all sub-trades.
- .2 It is required that every effort be taken to divert 100% of the following materials acquired during construction from the landfill as long as recycling facilities exist:
 - 1. Cardboard
 - 2. Plastic Packaging
 - 3. Rubble
 - 4. Steel
 - 5. Wood (clean)
 - 6. Wood (used)
 - 7. Concrete
 - 8. Other metals

9. Brick/Masonry
10. Other materials if recycling facilities exist.

3.3 DISPOSAL OF WASTES

- .1 Hazardous materials are to be disposed of in accordance with Section 01 35 43, and 0157 13.
- .2 Disposal of waste, volatile materials, mineral spirits, oil, and/or paint thinner into waterways, water table, storm, and/or sanitary sewers is prohibited.

SAMPLE - Construction Waste Management Plan

Project Name:
Project Location:
Contractor:
Reviewed By:

Date:

Waste Management Goal

The goal for the project is to divert a minimum of 75% by weight, of the construction waste from the landfill. This goal will be achieved by reducing the amount of unnecessary material from arriving onsite, recycling, and salvaging for reuse. The Contractor has identified at least five material waste streams (both structural and non-structural) targeted for diversion.

- Wood
- Concrete
- Drywall
- Carpet
- Metal
- Steel

Divert a minimum of 75% of the total construction and demolition material from the landfill by recycling and salvaging. Diverted materials must include at least four different material streams during demolition and construction.

Education and Awareness

To ensure that all trades and sub trades are aware of the Construction Waste Management (CWM) requirements for this project.

- CWM training will be incorporated into the mandatory safety training for all workers on site. This will include instruction on appropriate separation, handling, recycling, and salvaging methods during each stage of the work.
- Each Subcontractor will be given a copy of the Construction Waste Management Plan and will be expected to make sure their crews comply with it.
- Bins will be provided for all materials and each bin will be clearly marked for its contents. The waste bins can be used for any combination of: source separated, comingled waste, deconstructed materials sent to reuse markets, reuse of deconstructed materials on-site and take back programs.

Material Waste and End Use

The Contractor will be responsible for sourcing appropriate recyclers to take at minimum the waste listed in the table below. All waste will be stored on site in marked bins and will be collected and taken to the landfill or appropriate recycling facility.

Type of Waste	Recycler – End Use	Separate or Comingled?	Expected Diversion Rate (0-100%)
General Waste Wood Drywall Concrete/Brick Metal Plastic Cardboard/ Paper Carpet Other			

Required Documentation

The Contractor will provide Crosier Kilgour with:

- A copy of this plan prior to the start of construction.
- Copies of the waybills with the weight of the waste in metric tonnes and destination for each load hauled during construction. If waste is comingled the recycling facility may provide individual weights for the individual material separated at the facility.
- If the Contractor chooses to track the loads themselves, then monthly updates of the diversion rates and a final report at the end of construction is required.
- Letters from the recycling facilities which indicate the end use of the recycled materials by the end of the project construction.
- A reuse form. Waste that is reused will be weighed and the form will state what the material will be used for and where it's going.
- Photographs of separated and marked stockpile areas.

Tracking

CWM will be tracked using a table similar to the one shown below and provided in the specifications.

Date	Landfill		Clean Wood		Concrete		Metals		Plastics		Cardboard/Paper	
	Weight (tonnes)	Location	Weight (tonnes)	Location	Weight (tonnes)	Location	Weight (tonnes)	Location	Weight (tonnes)	Location	Weight (tonnes)	Location

Total Waste =
 Total Diverted Materials =
 % Diverted =

END OF SECTION

Part 1 General

1.1 Related requirements

- .1 Section 01 35 20 - LEED Sustainable Requirements.
- .2 Section 01 74 00 - Cleaning.

1.2 Reference standards

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 45 00 - Quality Control.
- .3 Section 01 74 11 - Cleaning
- .4 Section 01 79 00 - Demonstration and Training.

1.3 Administrative requirements

- .1 Acceptance of Work Procedures:
 - .1 Contractor's Inspection: Contractor: conduct inspection of Work, identify deficiencies and defects, and repair as required to conform to Contract Documents.
 - .1 Notify Contract Administrator in writing of satisfactory completion of Contractor's inspection and submit verification that corrections have been made.
 - .2 Request Contract Administrator's review.
 - .2 Contract Administrator's Review:
 - .1 Contract Administrator and Contractor to review Work and identify defects and deficiencies.
 - .2 Contractor to correct Work as directed.
 - .3 Completion Tasks: submit written certificates in English that tasks have been performed as follows:
 - .1 Work: completed and inspected for compliance with Contract Documents.
 - .2 Defects: corrected and deficiencies completed.
 - .3 Equipment and systems: tested, adjusted and balanced and fully operational.
 - .4 Certificates required by AHJ, Fire Commissioner and/or Utility companies: submitted.
 - .5 Operation of systems: demonstrated to City of Winnipeg's personnel.
 - .6 Commissioning of mechanical systems: completed in accordance with Section 01 91 13 - General Commissioning Requirements and copies of final Commissioning Report submitted to Contract Administrator.
 - .7 Work: complete and ready for final inspection.
- .4 Final Review:

- .1 When completion tasks are done, request final inspection of Work by City of Winnipeg Representative, and Contract Administrator.
- .2 When Work incomplete according to Contract Administrator, complete outstanding items and request re-review.
- .5 Declaration of Substantial Performance: when Contract Administrator considers deficiencies and defects corrected and requirements of Contract substantially performed, make application for Certificate of Substantial Performance.
- .6 Commencement of Lien and Warranty Periods: date of City of Winnipeg's acceptance of submitted declaration of Substantial Performance to be date for commencement for warranty period and commencement of lien period unless required otherwise by lien statute of Place of Work.
- .7 Final Payment:
 - .1 When Contract Administrator considers final deficiencies and defects corrected and requirements of Contract met, make application for final payment.
- .8 Payment of Holdback: after issuance of Certificate of Substantial Performance of Work, submit application for payment of holdback amount in accordance with contractual agreement.

1.4 Final cleaning

- .1 Clean in accordance with Section 01 74 00 - Cleaning.
 - .1 Remove surplus materials, excess materials, rubbish, tools and equipment.
 - .2 Waste Management: separate waste materials for recycling in accordance with Section 01 74 19 - Waste Management and Disposal.

Part 2 Products - Not Used

Part 3 Execution - Not Used

END OF SECTION

Part 1 General

1.1 Related requirements

- .1 Section 01 31 19 - Project Meetings
- .2 Section 01 33 00 - Submittal Procedures
- .3 Section 01 45 00 - Quality Control
- .4 Section 01 77 00 - Closeout Procedures

1.2 Administrative requirements

- .1 Pre-warranty Meeting:
 - .1 Convene meeting one week before Contract completion with City of Winnipeg Representative and Contract Administrator, in accordance with 01 31 19 - Project Meetings to:
 - .1 Verify Project requirements.
 - .2 Review installation instructions and warranty requirements.
 - .2 Contract Administrator to establish communication procedures for:
 - .1 Notifying construction warranty defects.
 - .2 Determine priorities for type of defects.
 - .3 Determine reasonable response time.
 - .3 Contact information for bonded and licensed company for warranty work action: provide name, telephone number and address of company authorized for construction warranty work action.
 - .4 Ensure contact is located within local service area of warranted construction, is continuously available, and is responsive to inquiries for warranty work action.

1.3 Action and informational submittals

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Two weeks before Substantial Performance of the Work, submit to the Contract Administrator, electronic final copies of operating and maintenance manuals in English.
- .3 Provide spare parts, maintenance materials and special tools of same quality and manufacture as products provided in Work.
- .4 Provide evidence, if requested, for type, source and quality of products supplied.

1.4 Format

- .1 Organize data as instructional manual in both physical binder and electronic pdf format.
 - .1 Provide two (2) physical binders and one (1) digital copy on USB.
- .2 Binders: Vinyl, hard covered, 3 'D' ring, loose leaf 219 x 279 mm with spine and face pockets.
- .3 When multiple binders are used correlate data into related consistent groupings.
 - .1 Identify contents of each binder on spine.

- .4 Cover: Identify each binder with type or printed title 'Project Record Documents'; list title of project and identify subject matter of contents.
- .5 Arrange content by systems, under Section numbers and sequence of Table of Contents.
- .6 Provide tabbed fly leaf for each separate product and system, with typed description of product and major component parts of equipment.
- .7 Provide tabbed bookmark for each separate product and system, with typed description of product and major component parts of equipment.
- .8 Text: manufacturer's printed data, or typewritten data.
- .9 Drawings: Provide with reinforced punched binder tab.
 - .1 Bind in with text; fold larger drawings to size of text pages.
- .10 Drawings: Provide two (2) physical copies of drawings (one per binder) and one (1) digital copy on USB with electronic drawing files in pdf format.
 - .1 Electronic record/as-built drawings provided by the Contractor must include all changes made during construction.

1.5 Contents - project record documents

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

1.6 As-built documents and samples

- .1 Maintain, at site for Contract Administrator one record copy of:
 - .1 Contract Drawings.
 - .2 Specifications.
 - .3 Addenda.
 - .4 Change Orders and other modifications to Contract.
 - .5 Reviewed shop drawings, product data, and samples.
 - .6 Site test records.

- .7 Inspection certificates.
- .8 Manufacturer's certificates.
- .2 Store record documents and samples in site office apart from documents used for construction.
 - .1 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.
 - .1 Label each document "PROJECT RECORD" in neat, large, printed letters.
- .4 Maintain record documents in clean, dry and legible condition.
 - .1 Do not use record documents for construction purposes.
- .5 Keep record documents and samples available for review by Contract Administrator.
- .6 As-built drawings provided by the Contractor must include all changes made during construction.

1.7 Recording information on project record documents

- .1 Record information on set of black line opaque drawings, and in copy of Project Manual.
- .2 Use felt tip marking pens, maintaining separate colours for each major system, for recording information.
- .3 Record information concurrently with construction progress.
 - .1 Do not conceal Work until required information is recorded.
- .4 Contract Drawings and shop drawings: mark each item to record actual construction, including:
 - .1 Measured depths of elements of foundation in relation to finish first floor datum.
 - .2 Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
 - .3 Measured locations of internal utilities and appurtenances, referenced to visible and accessible features of construction.
 - .4 Site changes of dimension and detail.
 - .5 Changes made by change orders.
 - .6 Details not on original Contract Drawings.
 - .7 Referenced Standards to related shop drawings and modifications.
- .5 Specifications: mark each item to record actual construction, including:
 - .1 Manufacturer, trade name, and catalogue number of each product actually installed, particularly optional items and substitute items.
 - .2 Changes made by Addenda and change orders.
- .6 Contractor to provide record information digitally on final pdf and dwg files.
- .7 Other Documents: Maintain manufacturer's certifications, and site test records, required by individual specifications Sections.
- .8 Provide digital photos, if requested, for site records.

1.8 Equipment and systems

- .1 For 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.
 - .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 as specified in Section 01 45 00 - Quality Control and Section 01 91 13 - General Commissioning Requirements.
- .15 Additional requirements: As specified in individual specification Sections.

1.9 Materials and finishes

- .1 Building products, applied materials, and finishes: Include product data, with catalogue number, size, composition, and colour and texture designations.
 - .1 Provide information for re-ordering custom manufactured products.
- .2 Instructions for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.
- .3 Moisture-protection and weather-exposed products: Include manufacturer's recommendations for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.
- .4 Additional requirements: As specified in individual specifications Sections.

1.10 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 site; place and store.
 - .4 Receive and catalogue items.
 - .1 Submit inventory listing to Contract Administrator.
 - .2 Include approved listings in Maintenance Manual.
 - .5 Obtain receipt for delivered products and submit before 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 site; place and store.
 - .4 Receive and catalogue items.
 - .1 Submit inventory listing to Contract Administrator.
 - .2 Include approved listings in Maintenance Manual.
 - .5 Obtain receipt for delivered products and submit before to final payment.
- .3 Special Tools:
 - .1 Provide special tools, in quantities specified in individual specification Section.
 - .2 Provide items with tags identifying their associated function and equipment.
 - .3 Deliver to site; place and store.
 - .4 Receive and catalogue items.
 - .1 Submit inventory listing to Contract Administrator.
 - .2 Include approved listings in Maintenance Manual.

1.11 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.
- .5 Remove and replace damaged products at own expense and for review by Contract Administrator.

1.12 Warranties and bonds

- .1 Develop warranty management plan to contain information relevant to Warranties.
- .2 Submit warranty management plan, 30 days before planned pre-warranty conference, to Contract Administrator for approval.

- .3 Warranty management plan to include required actions and documents to assure that City of Winnipeg Representative receives warranties to which it is entitled.
- .4 Provide plan in narrative form and contain sufficient detail to make it suitable for use by future maintenance and repair personnel.
- .5 Submit, warranty information made available during construction phase, to Contract Administrator for approval before each monthly pay estimate.
- .6 Assemble approved information in electronic pdf format, submit upon acceptance of work and organize as follows:
 - .1 Separate each warranty or bond with bookmarks keyed to Table of Contents listing.
 - .2 List Subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.
 - .3 Obtain warranties and bonds, executed in duplicate by Subcontractors, suppliers, and manufacturers, within ten days after completion of applicable item of work.
 - .4 Verify that documents are in proper form, contain full information, and are notarized.
 - .5 Co-execute submittals when required.
 - .6 Retain warranties and bonds until time specified for submittal.
- .7 Except for items put into use with City of Winnipeg's permission, leave date of beginning of time of warranty until Date of Substantial Performance is determined.
- .8 Conduct joint 11 month warranty review, measured from time of acceptance, by Contract Administrator.
- .9 Include information contained in warranty management plan as follows:
 - .1 Roles and responsibilities of personnel associated with warranty process, including points of contact and telephone numbers within the organizations of Contractors, Subcontractors, manufacturers, or suppliers involved.
 - .2 Provide list for each warranted equipment, item, feature of construction or system indicating:
 - .1 Name of item.
 - .2 Model and serial numbers.
 - .3 Location where installed.
 - .4 Name and phone numbers of manufacturers or suppliers.
 - .5 Names, addresses and telephone numbers of sources of spare parts.
 - .6 Warranties and terms of warranty: include one-year overall warranty of construction. Indicate items that have extended warranties and show separate warranty expiration dates.
 - .7 Cross-reference to warranty certificates as applicable.
 - .8 Starting point and duration of warranty period.
 - .9 Summary of maintenance procedures required to continue warranty in force.
 - .10 Cross-Reference to specific pertinent Operation and Maintenance manuals.

- .11 Organization, names and phone numbers of persons to call for warranty service.
- .12 Typical response time and repair time expected for various warranted equipment.
- .3 Contractor's plans for attendance at 11 month post-construction warranty review.
- .4 Procedure and status of tagging of equipment covered by extended warranties.
- .5 Post copies of instructions near selected pieces of equipment where operation is critical for warranty and/or safety reasons.
- .10 Respond in timely manner to oral or written notification of required construction warranty repair work.
- .11 Written verification to follow oral instructions.
 - .1 Failure to respond will be cause for the Contract Administrator to proceed with action against Contractor.

1.13 Warranty tags

- .1 Tag, at time of installation, each warranted item. Provide durable, oil- and water-resistant tag approved by Contract Administrator.
- .2 Attach tags with copper wire and spray with waterproof silicone coating.
- .3 Leave date of acceptance until project is accepted for occupancy.
- .4 Indicate the following information on tag:
 - .1 Type of product/material.
 - .2 Model number.
 - .3 Serial number.
 - .4 Contract number.
 - .5 Warranty period.
 - .6 Inspector's signature.
 - .7 Construction Contractor.

Part 2 Products - Not Used

Part 3 Execution - Not Used

END OF SECTION

Part 1 General

1.1 Section includes

- .1 Procedures for demonstration and instruction of Products, equipment and systems to City of Winnipeg's personnel.
- .2 Seminars and demonstrations.

1.2 Related requirements

- .1 Section 01 35 20 - LEED Sustainable Requirements.
- .2 Section 01 91 13 - General Commissioning Requirements.
- .3 This section describes requirements applicable to all Sections within Divisions 02 to 49.

1.3 Description

- .1 Demonstrate scheduled operation and maintenance of equipment, building envelope, and systems to City of Winnipeg's personnel two (2) weeks prior to date of substantial performance.
- .2 City of Winnipeg will provide list of personnel to receive instructions, and will coordinate their attendance at agreed-upon times.

1.4 Component demonstration

- .1 Manufacturer to provide authorized representative to demonstrate operation of equipment and systems.
- .2 Instruct City of Winnipeg's personnel, and provide written report that demonstration and instructions have been completed.

1.5 Submittals

- .1 Submit schedule of time and date for demonstration of each item of equipment and each system two (2) weeks prior to designated dates, for Contract Administrator's approval.
- .2 Submit reports within one (1) week after completion of demonstration, that demonstration and instructions have been satisfactorily completed.
- .3 Give time and date of each demonstration, with list of persons present.

1.6 Conditions for demonstrations

- .1 Testing, adjusting, and balancing have been performed in accordance with Section 01 91 13, and equipment and systems are fully operational.
- .2 Provide copies of completed operation and maintenance manuals for use in demonstrations and instructions.

Part 2 Products - Not Used

Part 3 Execution

3.1 Preparation

- .1 Verify that suitable conditions for demonstration and instructions are available.
- .2 Verify that designated personnel are present.
- .3 Prepare agendas and outlines.
- .4 Establish seminar organization.
- .5 Explain component design and operational philosophy and strategy.
- .6 Develop equipment presentations.
- .7 Present system demonstrations.
- .8 Accept and respond to seminar and demonstration questions with appropriate answers.

3.2 Preparation of agendas and outlines

- .1 Prepare agendas and outlines including the following:
 - .1 Equipment and systems to be included in seminar presentations.
 - .2 Name of companies and representatives presenting at seminars.
 - .3 Outline of each seminar's content.
 - .4 Time and date allocated to each system and item of equipment.
 - .5 Provide separate agenda for each system.

3.3 Seminar organization

- .1 Coordinate content and presentations for seminars.
- .2 Coordinate individual presentations and ensure representatives scheduled to present at seminars are in attendance.
- .3 Arrange for presentation leaders familiar with the design, operation, maintenance and troubleshooting of the equipment and systems. Where a single person is not familiar with all aspects of the equipment or system, arrange for specialists familiar with each aspect.
- .4 Coordinate proposed dates for seminars with City of Winnipeg and select mutually agreeable dates.

3.4 Explanation of design strategy

- .1 Explain design philosophy of each system. Include following information:
 - .1 An overview of how system is intended to operate.
 - .2 Description of design parameters, constraints and operational requirements.
 - .3 Description of system operation strategies.
 - .4 Information to help in identifying and troubleshooting system problems.

3.5 Demonstration and instructions

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

- .2 Instruct personnel in all phases of operation and maintenance using operation and maintenance manuals as the basis of instruction.
- .3 Instruct personnel on control and maintenance of sensory equipment and operational equipment associated with maintaining energy efficiency and longevity of service.
- .4 Review contents of manual in detail to explain all aspects of operation and maintenance.
- .5 Prepare and insert additional data in operations and maintenance manuals when the need for additional data becomes apparent during instructions.

3.6 Time allocated for instruction

- .1 Ensure adequate time is provided to the City of Winnipeg representative for instruction of each item of equipment or system as follows:
 - .1 Plumbing System
 - .2 Filtering Equipment
 - .3 Heating System
 - .4 Cooling System
 - .5 Ventilation System
 - .6 Control System
 - .7 Electrical System
 - .8 Door Hardware
 - .9 Sectional Overhead Doors
 - .10 Overhead Coiling Doors and Grilles

END OF SECTION

Part 1 General

1.1 SUMMARY

- .1 Section Includes:
 - .1 General requirements relating to commissioning of project's components and systems, specifying general requirements to performance verification of components, equipment, sub-systems, systems, and integrated systems.
 - .2 Acronyms:
 - .1 Cx - Commissioning
 - .2 CxA - Commissioning Authority
 - .3 O&M - Operation and Maintenance
 - .4 CVF - Component Verification Form
 - .5 FT – Functional Test
 - .6 TAB - Testing, Adjusting and Balancing

1.2 GENERAL

- .1 Commissioning is a formal, systematic process of ensuring that building systems perform interactively according to the design intent and the City of Winnipeg’s operational needs.
- .2 Commissioning during the construction phase is intended to achieve the following specific objectives according to the Contract Documents:
 - .1 Applicable equipment and systems are installed according to the manufacturer’s recommendations and to industry accepted standards and that they receive adequate operational checkout by installing Subcontractors.
 - .2 Proper performance of equipment and systems is documented.
 - .3 O&M documentation left on site is complete.
 - .4 City of Winnipeg’s operation and maintenance staff are adequately trained.
- .3 The Contractor is responsible for demonstrating equipment and systems, troubleshooting and making adjustments as required to the satisfaction of the CxA.
 - .1 Systems to be operated at full capacity under various modes to determine if they function correctly and consistently at peak efficiency. Systems to be interactively tested with each other as intended in accordance with Contract Documents and design criteria.
 - .2 During these checks, adjustments to be made to enhance performance to meet environmental or user requirements.

1.3 NON-CONFORMANCE TO PERFORMANCE VERIFICATION REQUIREMENTS

- .1 Should equipment, system components, and associated controls be incorrectly installed or malfunction during Cx, the Contractor shall correct deficiencies, re-verify equipment and components within the non-functional system, including related systems as deemed required by the CxA and/or related design authority, to ensure effective performance.
- .2 Contractor costs for corrective work, additional tests, and inspections to ensure proper performance of such items to be borne by Contractor.

-
- .3 Contractor shall pay for CxA labour associated with excessive retesting of systems.

1.4 COORDINATION

- .1 The following are members of the commissioning team:
 - .1 City of Winnipeg Representative
 - .2 Commissioning Authority (CxA)
 - .3 Project Manager
 - .4 Contract Administrator and Sub-consultants
 - .5 Contractor
 - .6 Mechanical Subcontractor
 - .7 Electrical Subcontractor
 - .8 TAB representative
 - .9 Controls Subcontractor
 - .10 Any other installing subcontractors or suppliers of equipment.

1.5 CONFLICTS (BETWEEN SPECIFICATION SECTIONS)

- .1 Report conflicts between requirements of this section and other specification sections to the Contractor before start-up and obtain clarification.
- .2 Failure to report conflict and obtain clarification (through RFI process) will result in application of the design authority's intent on the issue.

1.6 COMMISSIONING SCHEDULE

- .1 The Contractor will provide Cx schedule to CxA for review and comment.
- .2 The Contractor will provide adequate time for Cx activities prescribed in technical sections and commissioning sections including:
 - .1 Commissioning site visits
 - .2 Component verification completion
 - .3 Startup and pre-functional testing activities
 - .4 Functional testing dates
 - .5 City of Winnipeg operation and maintenance staff training
 - .6 Seasonal or deferred testing.
 - .7 10-Month occupancy review
- .3 All parties are responsible to address scheduling problems and make necessary notifications in a timely manner in order to expedite the commissioning process.

1.7 SYSTEMS TO BE COMMISSIONED

- .1 The following systems will be commissioned for this project (if applicable):
 - Electrical**
 - Lighting and Lighting Controls
 - Distribution
 - Electric Heaters
 - Plumbing**
 - Domestic hot water heaters
 - Recirculation pumps

Plumbing fixtures
HVAC
Energy Recovery Ventilators
Air Handling Units
Make-up Air Unit
Exhaust Fan
Ceiling Fans
Condensing Units
Humidifier
VRF Heat Pump
VRF Fan Coil Units w/ Electric Heating Coils
Fan Coil Units
Split A/C Unit
Testing, Adjusting and Balancing Work
Direct Digital Controls (DDC)
Central Building Automation System

1.8 MEETINGS

- .1 Commissioning Kickoff Meeting. The CxA will schedule, plan and conduct a commissioning scoping meeting with the entire commissioning team in attendance.
- .2 Miscellaneous Meetings. Other meetings will be planned and conducted by the CxA at the discretion of the CxA as construction progresses. These meetings will cover coordination, deficiency resolution and planning issues with particular Subcontractors.

1.9 SUBMITTALS (SHOP DRAWINGS)

- .1 The CxA requires submittal documentation for facilitating the commissioning work. These requests will be integrated into the normal submittal process and protocol of the construction team.
- .2 These submittals to the CxA do not constitute compliance for O&M manual documentation. The O&M manuals are the responsibility of the Contractor, though the CxA will review them and provide feedback, where in the opinion of the CxA, correction is required. O&M manuals must be submitted in electronic (pdf) format.

1.10 COMPONENT VERIFICATION FORM CHECKLISTS and INITIAL CHECKOUT

- .1 The following procedures apply to all equipment to be commissioned (see Section 1.7 for list of equipment and systems).
- .2 Component Verification Forms (CVF). CVF checklists document that the equipment and systems are installed as per the design intent and good practice. Component Verification Forms for a given system must be successfully completed prior to functional testing.
 - .1 CVFs will be developed in an electronic format (pdf) by the CxA and electronic copies will be provided to Subcontractors. Subcontractors are responsible to execute and document the CVF checklist on site, and return to the CxA for inclusion in the final report. The CxA will verify the installation and accuracy of the CVFs using an audit process.
 - .2 CVFs are used to track and document that the proper equipment has been specified, submitted and installed. The forms capture typical maintenance information such as tag #, model, service, location, nameplate data, static submittal data, etc.

-
- .3 A Sample CVF has been attached (Section 1.11) for bid purposes.
 - .3 Issues identified during commissioning inspections will be documented by the CxA on the issue tracking log.
 - .1 Subcontractors shall respond to issues and ensure correction.

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1.11 SAMPLE COMPONENT VERIFICATION FORM

Project Name		Component Verification Form		
Owner		Unit Tag: AHU-#		
City, Province		Equipment Type: Air Handling Unit		
		System: HVAC		
		Location: Rooftop		
		Area Serviced: East Wing		
This box for CKP use only.		Form Audited?	YES <input type="checkbox"/>	
CxA reviewer: _____			NO <input type="checkbox"/>	
Signature	Contractor (include company and print name)	Date		
Mechanical:	_____	_____		
Electrical:	_____	_____		
Controls:	_____	_____		
General:	_____	_____		
CKP Audit Verification				
Nameplate Data	IFC Schedule	Approved Submittal <i>note any changes</i>	Installed <i>note any changes</i>	Installer Verify
Manufacturer	AHU Maker			<input type="checkbox"/>
Model	AHU 12AB-24CD			<input type="checkbox"/>
DX Cooling Coil Model	CC-101			<input type="checkbox"/>
Total Cooling Capacity (MBH)	2500			<input type="checkbox"/>
Hot Water Coil Model	HW-102			<input type="checkbox"/>
Heating Capacity (MBH)	2500			<input type="checkbox"/>
Supply Fan Motor (HP)	5			<input type="checkbox"/>
Return Fan Motor (HP)	5			<input type="checkbox"/>
Electrical [V/Ph/Hz]	575/3/60			<input type="checkbox"/>
Details/Notes: Sample AHU				
Inspection Items	Comments	Installer Verify		
General Installation & Cleanliness				
Equipment is clean and free of debris		<input type="checkbox"/>	<input type="checkbox"/>	
Equipment is properly mounted and vibration isolation equipment is installed on motors		<input type="checkbox"/>	<input type="checkbox"/>	
Service hatches & filter access is not hindered by surrounding equipment		<input type="checkbox"/>	<input type="checkbox"/>	
Record the MERV rating of the filters in the unit		<input type="checkbox"/>	<input type="checkbox"/>	
Shipping mounts are removed		<input type="checkbox"/>	<input type="checkbox"/>	
Air filters installed correctly and clean		<input type="checkbox"/>	<input type="checkbox"/>	
Duct Installation				
Duct layout matches drawings and duct connections are sealed		<input type="checkbox"/>	<input type="checkbox"/>	
Smoke and fire dampers are properly installed according to contract documents		<input type="checkbox"/>	<input type="checkbox"/>	
Piping/Coil Installation				
Hydronic piping and accessories installed		<input type="checkbox"/>	<input type="checkbox"/>	
Piping is adequately supported		<input type="checkbox"/>	<input type="checkbox"/>	
Condensate piping installed to floor drain		<input type="checkbox"/>	<input type="checkbox"/>	
Coil has been combed with no visible damage		<input type="checkbox"/>	<input type="checkbox"/>	
Electrical Installation				
Wiring complete and electrical connections are tight		<input type="checkbox"/>	<input type="checkbox"/>	
Verify that overload breakers are installed and sized correctly		<input type="checkbox"/>	<input type="checkbox"/>	
Local disconnects are installed and labelled		<input type="checkbox"/>	<input type="checkbox"/>	
VFDs for fans installed per contract documents		<input type="checkbox"/>	<input type="checkbox"/>	
Controls Installation				
Controls wiring complete and electrical connections are tight		<input type="checkbox"/>	<input type="checkbox"/>	

Project Name		Component Verification Form	
Owner	Unit Tag: AHU-#		
City, Province	Equipment Type: Air Handling Unit		
	System: HVAC		
	Location: Rooftop		
	Area Served: East Wing		
Control actuator and sensor locations match contract documents		<input type="checkbox"/>	<input type="checkbox"/>
Control actuators and sensors labelled/tagged per contract documents		<input type="checkbox"/>	<input type="checkbox"/>
Insulation & Labelling			
Thermal Insulation complete as per contract documents		<input type="checkbox"/>	<input type="checkbox"/>
Unit is correctly labelled		<input type="checkbox"/>	<input type="checkbox"/>
Ducts and piping are labelled per contract documents and direction of flow is indicated		<input type="checkbox"/>	<input type="checkbox"/>
Startup			
Manufacturer startup report completed and provided		<input type="checkbox"/>	<input type="checkbox"/>
VFD startup report completed and provided		<input type="checkbox"/>	<input type="checkbox"/>
Verify fan rotation		<input type="checkbox"/>	<input type="checkbox"/>

1.12 SYSTEM START-UP

- .1 Start-up Plan. The Contractor will provide a detailed startup plan for all commissioned equipment for review by the CxA.
- .2 The startup plan will include blank startups forms (provided by manufacturer, or otherwise) for commissioned systems.
 - .1 The CxA may attend startups at their discretion to ensure that startup documentation and procedures are being followed as required.
 - .2 The Subcontractors and vendors shall execute start-up.
 - .3 Provide the CxA with a signed and dated copy of the completed start-up report.
- .3 Start-up documentation to include:
 - .1 Factory and on-site test certificates for specified equipment.
 - .2 Pre-start-up inspection reports.
 - .3 Signed installation/start-up check lists.
 - .4 Start-up reports,
 - .5 Step-by-step description of complete start-up procedures, to permit Contract Administrator to repeat start-up at any time.
- .4 Submit required startup documentation including, but not limited to:
 - .1 Mechanical Systems
 - .1 Major equipment manufacturers startup reports (AHUs, HRVs, VRF System, Condensing Units, etc.)
 - .2 TAB report
 - .2 Electrical Systems
 - .1 Electrical equipment test reports (megger tests, harmonic distortion testing)
 - .2 Low voltage lighting system test report
 - .3 Fire Alarm verification report.
 - .3 Controls
 - .1 Control point end-to-end verification report

1.13 FUNCTIONAL TESTING

- .1 Refer to Section 1.7 for the list of systems to be commissioned.
- .2 Functional testing demonstrates that each system is operating according to the documented design intent and Contract documents. Each system should be operated through all modes of operation (seasonal, occupied, unoccupied, warm-up, cool-down, part and full load). Verifying the sequences of operation is required for all modes. Proper responses to modes and conditions such as power failure, freeze conditions, fire alarm conditions, equipment failure, etc. may also be tested.
- .3 Functional Tests will be developed in an electronic format (pdf) by the CxA and electronic copies will be provided to Subcontractors.
- .4 The CVFs for a given system's equipment must be completed prior to the functional test.
- .5 The Subcontractors and/or vendors shall execute the functional tests as a pre-functional test to verify correct system operation and provide the CxA with a signed and dated copy of the completed tests prior to formal functional testing with the CxA present.

-
- .6 Issues identified during functional testing will be documented by the CxA on the issue tracking log.
 - .1 Subcontractors shall respond to issues and ensure correction.
 - .7 A Sample functional test has been attached (Section 1.14) for bid purposes.

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1.14 SAMPLE FUNCTIONAL TEST

Project Name		Functional Testing Procedure	
Project Owner		New Addition HVAC	
Project Location			
New Addition HVAC			
Components: Air handling unit (AHU-#) consisting of supply and return fans with VFDs, a DX cooling coil and associated condenser, hydronic heating coil, filter section and motorized dampers, variable air volume terminal units (VAV-#), hydronic baseboards (BB-#)			
Description: AHU-# located on the rooftop provides ventilation and temperature control to the new addition. VAVs and perimeter baseboard heaters provide zone level temperature control. The system operates on an occupancy schedule. AHU discharge air temperature is reset based on the average room temperature and setpoint. Economizer damper modulates open to provide free cooling when OA conditions allow it or when CO2 levels rise above setpoint. The BMS monitors the operation of the system and generates alarms if required.			
Notes:			
	Test and Expectation	Remarks	Sign-Off
001	Occupancy Schedule The system operates based on an occupancy schedule. Verify user can adjust or override the schedule on the BMS.	Record occupancy schedule:	Date: Initials:
002	Unoccupied Mode Supply and return fans are disabled, outdoor air dampers are closed and return air damper is open. If any zone temperature drops below 13°C (adj.), AHU fans enable, motorized dampers remain in recirculation position (full return air) and unit operates in heating mode until the space temperatures rise above 15°C (adj.). Verify by adjusting schedule and heating setback temperature and operational check.		Date: Initials:
003	Occupied Mode Supply and return fans operate continuously. Verify by adjusting schedule and operational check.		Date: Initials:
004	Supply Fan Control Supply fan VFD modulates speed to maintain supply pressure setpoint, determined during air balancing. Verify by adjusting pressure setpoint and operational check.	Record pressure setpoint:	Date: Initials:
005	Return Fan Control Return fan VFD modulates speed to maintain building pressure at 5 Pa. Verify by adjusting pressure setpoint and operational check.		Date: Initials:
006	Heating Mode Heating mode enables when OAT<13°C. Glycol heating coil control valve modulates to maintain discharge air temperature setpoint. Setpoint is reset between 13°C and 22°C, based on average zone heating demand. Verify by adjusting setpoint and operational check.		Date: Initials:

	Test and Expectation	Remarks	Sign-Off
007	<p>Cooling Mode Cooling mode enables when OAT>13°C.</p> <p>Factory installed controls modulate cooling output to maintain discharge air temperature setpoint. Setpoint is reset between 13°C and 22°C so that the most open VAV damper position is 90% (adj.) open.</p> <p>Verify by adjusting setpoint and operational check.</p>		Date: Initials:
008	<p>Economizer Mode Economizer mode enables when OAT≤13°C (adj.) and there is a call for cooling.</p> <p>Outdoor air, return air and relief air dampers modulate as required to maintain discharge air temperature setpoint.</p> <p>Economizer mode is locked out when the outdoor air enthalpy is greater than the indoor air enthalpy.</p> <p>Verify by adjusting setpoint and operational check.</p>		Date: Initials:
009	<p>Minimum OA Damper Position Minimum outdoor air position determined during air balancing to maintain minimum ventilation requirements.</p> <p>Verify minimum OA damper position is set up in unit's control program.</p>	Record minimum OA damper position:	Date: Initials:
010	<p>CO2 Control The outside air damper modulates open from minimum position when required to maintain zone CO2 levels below setpoint 1000ppm (adj.).</p> <p>Relief air damper modulates to the same position and return air damper modulates opposite of the OA and relief damper positions.</p> <p>Adjust CO2 setpoint and verify motorized dampers response correctly.</p>		Date: Initials:
011	Classroom ## - VAV-#, BB-#		
012	<p>Zone Temperature Control - Heating VAV damper position remains constant to maintain design airflow (388 L/s).</p> <p>Hydronic baseboard heater 2-way control valve modulates to satisfy zone thermostat.</p> <p>Verify by adjusting setpoint and operational check.</p>		Date: Initials:
013	<p>Zone Temperature Control - Cooling VAV damper position modulates between minimum and maximum position to satisfy zone thermostat (156 to 637 L/s).</p> <p>Hydronic baseboard heater 2-way control valve remains closed.</p> <p>Verify by adjusting setpoint and operational check.</p>		Date: Initials:
014	Classroom ## & Corridor ## - VAV-#, BB-#		

	Test and Expectation	Remarks	Sign-Off
015	<p>Zone Temperature Control - Heating VAV damper position remains constant to maintain design airflow (467 L/s).</p> <p>Hydronic baseboard heater 2-way control valve modulates to satisfy zone thermostat.</p> <p>Verify by adjusting setpoint and operational check.</p>		Date: Initials:
016	<p>Zone Temperature Control - Cooling VAV damper position modulates between minimum and maximum position to satisfy zone thermostat (187 to 637 L/s).</p> <p>Hydronic baseboard heater 2-way control valve remains closed.</p> <p>Verify by adjusting setpoint and operational check.</p>		Date: Initials:
017	<p>Alarms: Supply Fan Failure Verify alarm at the operator interface for supply fan failure and shut down return fan.</p>		Date: Initials:
018	<p>Alarms: Return Fan Failure Verify alarm at the operator interface for return fan failure and shut down supply fan.</p>		Date: Initials:
019	<p>Alarms: Low Supply Air Temperature Verify alarm at the operator interface for non-critical low supply air temperature.</p>	Record low limit:	Date: Initials:
020	<p>Alarms: Dirty Filter Verify alarm at the operator interface for dirty filter alarm. Record differential pressure setpoint for a dirty filter.</p>		Date: Initials:
021	<p>Alarms: High CO2 levels Verify alarm at the operator interface for high space CO2 levels (10% above setpoint).</p>		Date: Initials:
022	<p>Operator Interface Graphics and Trends Verify the operator interface accurately represents the installed system. The following points are displayed and trended:</p> <ul style="list-style-type: none"> - AHU supply air temperature and setpoint - Return air temperature - Mixed air temperature - Supply duct pressure and setpoint - Building pressure - Supply fan command, status and speed - Return fan command, status and speed - Zone temperature and setpoint (x2) - Hydronic control valve positions (x2) - VAV damper position (x2) - Zone CO2 level (x2) 		Date: Initials:
023	<p>Operation Meets Generally Accepted Good Practice Record any discrepancies noted during testing and operation of the system.</p>		Date: Initials:

1.15 SEVEN (7) DAY INTEGRATED SYSTEM TESTING

- .1 A 7-Day Integrated Systems Test will be completed to ensure proper building performance and operation. An additional test will be completed during seasonal testing.
- .2 General Acceptance requires that the systems operate as one entity as intended and that documentation is provided indicating such.
- .3 Issues identified during seven day testing will be documented by the CxA on the issue tracking log.
 - .1 Subcontractors shall respond to issues and ensure correction.

1.16 DEFERRED/SEASONAL TESTING

- .1 Functional tests requiring specific environmental conditions (seasonal tests) will be deferred until after occupancy
- .2 The Subcontractors and/or vendors shall execute the deferred/seasonal tests as a pre-functional test to verify correct system operation and provide the CxA with a signed and dated copy of the completed tests prior to formal functional testing with the CxA present.
- .3 Issues identified during deferred/seasonal testing will be documented by the CxA on the issue tracking log.
 - .1 Subcontractors shall respond to issues and ensure correction.

1.17 ISSUE TRACKING LOG

- .1 Subcontractors shall respond to issues noted on the issue tracking log within 7 days indicating the corrective action taken.
- .2 CxA may request the Subcontractor demonstrate successful resolution of items noted on the tracking log.

1.18 OPERATION & MAINTENANCE STAFF TRAINING

- .1 The Contractor is responsible for training of O & M staff to ensure they have all information necessary to operate and maintain commissioned features and systems. Refer to Section 01 79 00 for City of Winnipeg training requirements.
- .2 Submit a training plan and schedule to CxA for review.
- .3 Training plan will address the following topics (at a minimum)
 - .1 Design intent
 - .2 Use of Operations and Maintenance (O&M) Manuals
 - .3 Control Drawings and Schematics
 - .4 Startup and Shutdown
 - .5 Unoccupied operations
 - .6 Seasonal changeover
 - .7 Manual operations
 - .8 Alarms
 - .9 System interactions
 - .10 Energy conservation optimizations

-
- .11 Health and safety
 - .12 Special maintenance or replacement
 - .13 Occupant interaction
 - .14 Systems response to operating conditions
 - .15 Contractor shall document training sessions with attendance sheets.
 - .16 A training evaluation form has been attached (Section 1.19) for bid purposes.

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1.19 SAMPLE TRAINING EVALUATION FORM



Owner Training Survey
Project Number: "[Click here and type]"
"[Click here and type date]"

[Project Name]
[Location]

Owner Training Survey

Date:

Name:

Training Covered:

1. Was the Instructor familiar with the equipment? Yes No
2. Was the topic covered completely? Yes No
3. Were your questions answered? Yes No
(if No, list questions?)

4. Overall, are you satisfied? Yes No
Comments

1.20 SYSTEMS MANUAL

- .1 Contractor to provide the following documentation to the CxA for inclusion in the systems manual:
 - .1 As-built architectural drawings (electronic copy)
 - .2 As-built mechanical drawings (electronic copy)
 - .3 As-built electrical drawings (electronic copy)
 - .4 As-built controls drawings and cut sheets (electronic copy)
 - .5 Operations and Maintenance manuals (electronic copy)
 - .6 Occupancy and building permits.

1.21 AUTHORITIES HAVING JURISDICTION (I.E. GOVERNMENT AND UTILITY AUTHORITIES)

- .1 Where specified start-up, testing or commissioning procedures duplicate verification requirements of authority having jurisdiction, arrange for CxA to witness procedures so as to avoid duplication of tests and to facilitate expedient acceptance of facility.
- .2 Obtain certificates of approval, acceptance and compliance with rules and regulation of authority having jurisdiction.
- .3 Provide copies to Contract Administrator and CxA within 5 days of test.

Part 2 Products

2.1 Not used.

Part 3 Execution

3.1 Not used.

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 01 33 00 - Submittal Procedures
- .2 Section 01 45 00 - Quality Control
- .3 Section 02 41 19 Selective Demolition
- .4 City of Winnipeg Standard Specifications

1.3 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.
- .3 Draft Construction Waste Management Plan (Draft CWM Plan): Detailed inventory of materials in building indicating estimated quantities of reuse, recycling and landfill, prepared in accordance with Section 01 74 19 - Construction Waste Management and Disposal and as follows:
 - .1 Involves quantifying by volume/weight amounts of materials and wastes generated during construction, demolition, deconstruction, or renovation project.
- .4 Waste Management Coordinator (WMC): Contractor's representative responsible for supervising waste management activities as well as coordinating related, required submittal and reporting requirements.
- .5 Construction Waste Management Plan (CWM Plan): Written plan addressing opportunities for reduction, reuse, or recycling of materials prepared in accordance with Section 01 74 19 - Construction Waste Management and Disposal
- .6 Construction Waste Management Report (CWM Report): Written report identifying actual materials that formed CWM Plan for reduction, reuse, or recycling of materials prepared in accordance with Section 01 74 19 - Construction Waste Management and Disposal

1.4 Reference standards

- .1 Canada Green Building Council (CaGBC)
 - .1 LEED Reference Guide for Building Design and Construction, Version 4/4.1
- .2 Department of Justice Canada (Jus)

- .1 Canadian Environmental Assessment Act (CEAA), 2012
- .2 Canadian Environmental Protection Act (CEPA), 2012
 - .1 SOR/2003-2, On-Road Vehicle and Engine Emission Regulations
 - .2 SOR/2006-268, Regulations Amending the On-Road Vehicle and Engine Emission Regulations
 - .3 Transportation of Dangerous Goods Act (TDGA), 1992, c. 34
 - .4 Motor Vehicle Safety Act (MVSA), 1995
 - .5 Hazardous Materials Information Review Act, 1985
- .3 Underwriters' Laboratories of Canada (ULC)
 - .1 CAN/ULC-S660-08, Standard for Nonmetallic Underground Piping for Flammable and Combustible Liquids
 - .2 ULC/ORD-C58.15-1992, Overfill Protection Devices for Flammable Liquid Storage Tanks
 - .3 ULC/ORD-C58.19-1992, Spill Containment Devices for Underground Flammable Liquid Storage Tanks
- .4 City of Winnipeg Standard Specifications.

1.5 Administrative requirements

- .1 Coordination: Coordinate with City of Winnipeg for the material ownership including the following:
 - .1 Except for items or materials indicated to be reused, salvaged, reinstalled, or otherwise indicated to remain City of Winnipeg's property, demolished materials shall become Contractor's property and shall be removed from Project site.
 - .2 Historic items, relics, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, antiques, and other items of interest or value to City of Winnipeg that may be encountered during demolition remain City of Winnipeg's property:
 - .1 Carefully remove and salvage each item or object in a manner to prevent damage and deliver promptly to City of Winnipeg.
- .2 Pre-Demolition Meetings.
 - .1 Convene pre-installation meeting 1 week before beginning work of this Section, with Contractor and Contract Administrator 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 Waste reporting requirements
 - .2 Hold project meetings every week.
 - .3 Ensure key personnel attend.
 - .4 WMC will provide verbal report on status of waste diversion activity at each meeting.

- .5 Contract Administrator will provide written notification of change of meeting schedule established upon contract award 24 hours prior to scheduled meeting.
- .3 Scheduling:
 - .1 Employ necessary means to meet project time lines without compromising specified minimum rates of material diversion.
 - .2 In event of unforeseen delay notify Contract Administrator.

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 Manitoba, 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 01 33 00 - Submittal Procedures.
 - .3 WMC is responsible for fulfilment of reporting requirements.
 - .2 Schedule of Selective Site Demolition Activities: Coordinate with Section 01 32 16.19 - Construction Schedule - Bar (GANTT) Chart, 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 Construction Waste Management Plan (CWM Plan): 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:
 - .1 Submit calculations on end of project recycling, salvage and landfill rates.
 - .4 Proposed Dust Control and 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 Landfill Records: Indicate receipt and acceptance of hazardous wastes by a landfill facility licensed to accept hazardous wastes.
 - .2 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.
- .2 Informational Submittals: Provide the following submittals when requested by the Contract Administrator:

- .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, name and address of Contract Administrator, for work of similar complexity and extent.
- .3 Sustainable Design Submittals:
 - .1 LEED Canada Submittals: Submit in accordance with 01 35 20 - LEED Sustainable Requirements.
 - .2 Construction Waste Management: Refer to Section 01 74 19 - Construction Waste Management and Disposal.
 - .3 Material Product Attribute Documentation: Refer to Product Check Sheet as listed in 01 35 20 - LEED Sustainable Requirements to determine applicable type of documentation required for each product.
 - .4 Low-Emitting Materials:
 - .1 Submittals are required for any sealants, adhesives, paints, coatings, composite wood, flooring, wall panels, insulation or ceiling components within the inner most weather proofing barrier.
 - .2 Refer to Product Check Sheet as listed in 01 35 20 – LEED Sustainable Requirements to determine applicable type of documentation required for each product.

1.7 Quality assurance

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

1.8 Site conditions

- .1 Environmental protection:
 - .1 Ensure Work does not adversely affect adjacent watercourses, groundwater and wildlife, or contribute to excess air and noise pollution.
 - .2 Fires and burning of waste or materials is not permitted on site.
 - .3 Burying of rubbish waste materials is not permitted.
 - .4 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.
 - .5 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 where indicated.
- .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 City of Winnipeg will occupy another building immediately adjacent to demolition area.
- .8 Conduct selective site demolition so City of Winnipeg's operations will not be disrupted:
 - .1 Provide not less than 72 hours' notice to City of Winnipeg 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 Contract Administrator is not permitted.
- .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 City of Winnipeg as far as practical.
 - .2 Before selective site demolition, remove, protect and store salvaged items as directed by Representative:
 - .1 Salvage items as identified by Contract Administrator.
 - .2 Deliver to City of Winnipeg as directed.

1.9 Existing conditions

- .1 Hazardous Materials: It is expected that hazardous materials will be encountered in the Work:
 - .1 Refer to the hazardous materials inventory in the Appendix.
 - .2 Refer to Section 02 81 00 Hazardous Materials - General Provisions.
- .2 If additional materials (not identified in the inventory) suspected of containing hazardous materials are encountered, do not disturb; immediately notify Contract Administrator. Hazardous materials will be removed by City of Winnipeg under a separate contract or as a change to the Work.
- .3 If material resembling spray or trowel applied asbestos or other designated substance listed as hazardous be encountered in course of demolition, stop work, take preventative measures, and notify 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/2006-268.
 - .2 Off-road vehicles to: EPA CFR 86.098-11.

- .3 Machinery running only while in use, except where extreme temperatures prohibit shutting machinery down.

Part 3 Execution

3.1 Examination

- .1 Survey existing conditions and correlate with requirements indicated to determine extent of selective site demolition required.
- .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 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, according to: requirements of authorities having jurisdiction.
 - .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 Prevent movement, settlement or damage of adjacent structures, services, walks, paving, trees, landscaping, properties .
 - .1 Provide bracing, shoring and underpinning as required.
 - .2 Repair damage caused by demolition as directed by Contract Administrator.
 - .2 Support affected site elements and, if safety of site element being demolished or services appears to be endangered, take preventative measures, stop Work and immediately notify Contract Administrator.
 - .3 Prevent debris from blocking surface drainage system, elevators, mechanical and electrical systems which must remain in operation.
- .3 Surface Preparation:
 - .1 Disconnect and re-route 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 designated mechanical services.
 - .1 Natural gas supply lines: remove in accordance with gas company requirements.
 - .2 Sewer and water lines: remove as directed by Contract Administrator.
 - .3 Other underground services: Refer to drawings.
- .3 Disruption of active or energized utilities designated to remain undisturbed is not permitted.

3.3 Removal and demolition operations

- .1 Remove items as indicated.
- .2 Disruption of items designated to remain in place is not permitted.
- .3 Removal of pavements, curbs and gutters:
 - .1 Square up adjacent surfaces to remain in place by saw cutting or other method approved by Contract Administrator.
 - .2 Protect adjacent joints and load transfer devices.
 - .3 Protect underlying and adjacent granular materials.
 - .4 Prevent contamination with base course aggregates, when removing asphalt pavement for subsequent incorporation into hot mix asphalt concrete paving.
- .4 Excavate at least 300 mm below pipe invert, when removing pipes under existing or future pavement area.
- .5 Remove designated trees during demolition.
 - .1 Obtain written approval of Contract Administrator prior to removal of trees not designated.
- .6 Stockpile topsoil for final grading and landscaping:
 - .1 Provide erosion control and seeding if not immediately used.
- .7 Salvage:
 - .1 Dismantle items containing materials for salvage and stockpile salvaged materials at locations as indicated.
- .8 Disposal of Material:
 - .1 Dispose of materials not designated for salvage or reuse on site at authorized facilities approved in Waste Reduction Workplan.
- .9 Excavation and Backfill: Backfill in areas as indicated and in accordance with City of Winnipeg Standard Specifications.

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 Contract Administrator, when it interferes with operations of project.
- .2 Remove stockpiles of like materials by alternate disposal option once collection of materials is complete.
- .3 Dispose of materials not designated for alternate disposal in accordance with applicable regulations.
 - .1 Disposal Facilities: approved and listed in Waste Reduction Workplan.
 - .2 Written authorization from Contract Administrator is required to deviate from disposal facilities listed in Waste Reduction Workplan.

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
 - .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 reuse and recycling in accordance with Section 01 74 19 - Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Methods and procedures for deconstruction of structures and parts of structures.
- .2 This section does not include the removal of hazardous materials or asbestos abatement.

1.2 RELATED REQUIREMENTS

- .1 Section 01 74 19 – Waste Management and Disposal
- .2 Section 02 41 13 – Selective Site Demolition

1.3 DEFINITIONS

- .1 Demolish: Detach items from existing construction and legally dispose of them off site, unless indicated to be removed and salvaged or removed and reinstalled.
- .2 Remove and Salvage: Detach items from existing construction and deliver them to City of Winnipeg.
- .3 Remove and Reinstall: Detach items from existing construction, prepare them for reuse, and reinstall them where indicated.
- .4 Existing to Remain: Existing items of construction that are not removed and that are not otherwise indicated as being removed, removed and salvaged, or removed and reinstalled.
- .5 Hazardous Substances: Dangerous substances, dangerous goods, hazardous commodities and hazardous products may include asbestos, mercury and lead, PCB's, poisons, corrosive agents, flammable substances, radioactive substances, or other material that can endanger human health or wellbeing or environment if handled improperly as defined by the Federal Hazardous Products Act (RSC 1985) including latest amendments.

1.4 REFERENCES

- .1 Reference Standards:
 - .1 American National Standards Institute (ANSI)
 - .2 [ANSI A10.8](#) 2011, Safety Requirements for Scaffolding
 - .3 Canadian Green Building Council (CaGBC)
 - .1 LEED Reference Guide for Building Design and Construction, Version 4/4.1
 - .4 Canadian Standards Association (CSA International)
 - .1 CSA G40.20-13/G40.21-13 (R2018) - General requirements for rolled or welded structural quality steel / Structural quality steel.
 - .2 CAN/CSA-O80 SERIES-15 (R2020) CONSOLIDATED - Wood Preservation.
 - .3 CSA O86.1S1-98 - Supplement No. 1 to O86.1-94, Engineering Design in Wood (Limit States Design).
 - .4 CSA O121-17 - Douglas Fir Plywood.
 - .5 CSA O151-17 - Canadian softwood plywood.
 - .6 CSA O153-19 - Poplar plywood.
 - .7 CSA S16-19 - Design of steel structures, Includes Update No. 1 (2010), Update No. 2 (2010), Update No. 3 (2013).

- .8 CSA S136-12 PACKAGE - Consists of S136-12 - North American specification for the design of cold-formed steel structural members and S136.1-12 - Commentary on North American specification for the design of cold-formed steel structural members.
- .9 CSA W59-18 - Welded steel construction (metal arc welding).
- .5 American Society for Testing and Materials (ASTM)
 - .1 ASTM F3125 / F3125M - 19e2, Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength.
 - .2 ASTM D1761 20, Standard Test Methods for Mechanical Fasteners in Wood.
- .6 Department of Justice Canada (Jus)
 - .1 Canadian Environmental Assessment Act (CEAA), 2012
 - .2 Canadian Environmental Protection Act (CEPA), 2012
 - .3 SOR/2003-2, On-Road Vehicle and Engine Emission Regulations
 - .4 SOR/2006-268, Regulations Amending the On-Road Vehicle and Engine Emission Regulations
 - .5 Transportation of Dangerous Goods Act (TDGA), 1992, c. 34
 - .6 Motor Vehicle Safety Act (MVSA), 1995
 - .7 Hazardous Materials Information Review Act, 1985
- .7 Manitoba Regulation 217/2006, Workplace Safety and Health Regulation.
- .8 National Building Code 2020, Part 8 - Safety Measures at Construction and Demolition Sites.
- .9 National Fire Protection Association (NFPA)
 - .1 [NFPA 241](#) 13, Standard for Safeguarding Construction, Alteration, and Demolition Operations

1.5 MEASUREMENT PROCEDURE

- .1 No measurement will be made for demolition of items to facilitate Work identified as fixed price component.
- .2 Include demolition costs for demolition required to facilitate Work identified as a unit price component.
- .3 Shoring:
 - .1 No measurement will be made for shoring. Include costs for shoring in the fixed price component.

1.6 ADMINISTRATIVE REQUIREMENTS

- .1 Coordination: Coordinate selective demolition work so that work of this Section adheres to aesthetic criteria established by the Drawings and specified dimensions with all elements in planes as drawn, maintaining their relationships with all other building elements.
- .2 Coordination: Coordinate with City of Winnipeg for the material ownership as follows:
 - .1 Except for items or materials indicated to be reused, salvaged, reinstalled, or otherwise indicated to remain City of Winnipeg's property, demolished materials shall become Contractor's property and shall be removed from Project site.
 - .2 Historic items, relics, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, antiques,

and other items of interest or value to City of Winnipeg that may be encountered during selective demolition remain City of Winnipeg's property:

- .1 Carefully remove and salvage each item or object in a manner to prevent damage and deliver promptly to City of Winnipeg.
- .3 Pre-Demolition Meeting: Conduct a pre demolition meeting at Project site in accordance with requirements listed in Section 01 31 19 - Project Meetings to confirm extent of salvaged and demolished materials; and to review Contractor's demolition plan prepared by a professional engineer.

1.7 SUBMITTALS

- .1 Submittals in accordance with Section 01 33 00 Submittal Procedures.
- .2 Action Submittals: Provide the following submittals before starting any work of this Section:
 - .1 Schedule of Selective Demolition Activities: Coordinate with Section 01 32 16.19 - Construction Progress Schedule - Bar (GANTT) Chart, and indicate the following:
 - .1 Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity.
 - .2 Coordinate with City of Winnipeg's ongoing site operations and limit the number of interruptions to adjacent facilities during regular business hours.
 - .3 Interruption of utility services.
 - .4 Coordination for shutoff, capping, and continuation of utility services.
 - .5 Locations of temporary partitions and means of egress, including for others affected by selective demolition operations.
 - .6 Coordination with City of Winnipeg's continuing occupancy of adjacent facilities.
 - .2 Demolition Plan: 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:
 - .1 Proposed Dust Control and Noise Control Measures: Submit statement or drawing that indicates the measures proposed for use, proposed locations, and proposed time frame for their operation. Contract Administrator reserves the right to make modifications where proposed methods interfere with the City of Winnipeg's ongoing operations.
 - .2 Inventory: Submit a list of items that have been removed and salvaged after selective demolition is complete.
 - .3 Landfill Records: Indicate receipt and acceptance of hazardous wastes by a landfill facility licensed to accept hazardous wastes.
 - .4 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 demolition operations.
- .3 Informational Submittals: Provide the following submittals when requested by the Contract Administrator:
 - .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 architects and owners, for work of similar complexity and extent.

- .3 Shoring Shop Drawings:
 - .1 Submit Shop Drawings for shoring designed by an Engineer registered in the Province of Manitoba.
 - .2 Show loads and attach calculations.
 - .3 Seal shop drawings showing anchor and shim methods and materials by an engineer registered in the Province of Manitoba
- .4 Shoring Schedule
 - .1 Submit, on a monthly basis:
 - .1 Quantity and duration of shoring used.
 - .2 Labour hours to install and remove shoring.
 - .2 Include rates and total costs associated with shoring.

1.8 QUALITY ASSURANCE

- .1 Regulatory Requirements: Comply with governing environmental notification requirements and regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction and in accordance with the following:
 - .1 Provincial/Territorial Workers' Compensation Boards/Commissions.
 - .2 Provincial/Territorial Occupational Health and Safety Standards and Programs.
- .2 Qualifications:
 - .1 Train workers and subcontractors to carry out work in accordance with appropriate deconstruction techniques.
 - .2 Project supervisor to have previous deconstruction experience and must be present on site throughout project.

1.9 SITE CONDITIONS

- .1 City of Winnipeg will occupy facilities immediately adjacent to selective demolition area:
 - .1 Conduct selective demolition so that City of Winnipeg's operations will not be disrupted.
 - .2 Provide not less than 72 hours notice to City of Winnipeg of activities that will affect City of Winnipeg's operations.
- .2 Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities and as follows:
 - .1 Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from authorities having jurisdiction.
- .3 City of Winnipeg assumes no responsibility for condition of areas to be selectively demolished:
 - .1 Conditions existing at time of Pre-Bid Site Review will be maintained by City of Winnipeg as far as practical.
- .4 Hazardous Materials:
 - .1 Hazardous Materials: Hazardous materials are present in building to be selectively demolished. A report on the presence of hazardous materials is attached as an information document in an appendix for review and use:
 - .1 Examine report to become aware of locations where hazardous materials are present.

- .2 Coordinate with Section 02 81 00 - Hazardous Materials
- .3 Do not disturb hazardous materials or items suspected of containing hazardous materials.
- .2 Should material resembling asbestos or other hazardous material be encountered, stop work, take preventative measures, and notify Contract Administrator immediately.
 - .1 Do not proceed until written instructions have been received from Contract Administrator.
- .3 Notify Contract Administrator before disrupting building access or services.
- .5 Existing Conditions:
 - .1 Ensure that materials, equipment, and procedures safely supporting existing structure and construction live loads; that allow work to be accomplished and that minimize risk of damage to historic and archaeological elements.
 - .2 The existing building will not be occupied over the duration of the Work.
- .6 Protection:
 - .1 Protect existing structures and services designated to remain and items designated for salvage. In event of damage to such items, immediately replace or make repairs to approval of Contract Administrator and at no cost to the City of Winnipeg.
 - .2 In all circumstances ensure that demolition work does not adversely affect adjacent areas and operations below Work Area.
 - .3 Do not dispose of waste of 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 the project.
 - .4 Do not pump water containing suspended materials into watercourses, storm or sanitary sewers or onto adjacent properties.
 - .5 Control disposal or runoff of water containing suspended materials or other harmful substances in accordance with local authorities.
 - .6 Prevent movement, settlement or damage of adjacent structures, services. Provide bracing, shoring. Repair damage caused by deconstruction.
 - .7 Support affected structures and, if safety of structure being deconstructed and adjacent structures appears to be endangered, take preventative measures. Cease operations and immediately notify Contract Administrator.
 - .8 Prevent debris from blocking surface drainage system, elevators, mechanical and electrical systems.
- .7 Storage or sale of removed items or materials on site will not be permitted.
- .8 Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.
- .9 Maintain fire protection facilities in service during selective demolition operations.

Part 2 Products

2.1 EQUIPMENT

- .1 Leave equipment and machinery running only while in use, except where extreme temperatures prohibit shutting down.
- .2 Where possible use water efficient wetting equipment/attachments when minimizing dust.

- .3 Protect existing items designated to remain and materials designated for salvage. In event of damage to such items, immediately replace or make repairs to approval of Contract Administrator and at no cost to the City of Winnipeg.
- .4 Demonstrate that tools are being used in manner which allows for salvage of materials in best condition possible.
- .5 Locate and protect any utility lines which may be affected by the work and if necessary, notify utility companies before starting demolition.

2.2 SHORING

- .1 Design shoring by an Engineer registered in the Province of Manitoba.
- .2 Structural members:
 - .1 Timber:
 - .1 Grade: Select structural.
 - .2 Preservative: To CSA O80 Series.
 - .2 Steel: to CAN/CSA G40.21, grade 350, type T.
 - .3 Wood connections:
 - .1 Canadian soft wood plywood to CSA O151.
 - .2 Douglas Fir plywood to CSA O121.
 - .3 Poplar plywood to CSA O153.
 - .4 Steel connections: steel gusset plates and angles to CAN/CSA G40.21, grade 350, type T.
 - .5 Nails: to ASTM D1761.
 - .6 Bolts: lag screws, nuts and washers to CSA O86.1.
 - .7 High tensile bolts: to ASTM F3125M.
 - .8 Welding materials: CSA W59.

2.3 REPAIR MATERIALS

- .1 If identical materials are unavailable or cannot be used for exposed surfaces, use materials that visually match existing adjacent surfaces to the fullest extent possible.
- .2 Use materials whose installed performance equal or surpasses that of existing materials.
- .3 Floor Patching and Levelling Compounds: Cement based, trowelable, self levelling compounds compatible with specified floor finishes; gypsum based products are not acceptable for work of this Section.
- .4 Gypsum Board Patching Compounds: Joint compound to ASTM C475/C475M, bedding and finishing types thinned to provide skim coat consistency to patch and prepare existing gypsum board walls ready for new finishes in accordance with Section 09 21 16 - Gypsum Board Assemblies
- .5 Comply with material and installation requirements specified in individual technical specification Sections.

Part 3 Execution

3.1 EXAMINATION

- .1 Before starting work, verify existing conditions and variations. Notify Contract Administrator of discrepancies.

- .2 Conduct inspection with Contract Administrator to determine extent of masonry and concrete repair areas.
- .3 Verify that utilities have been disconnected and capped.
- .4 Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.
- .5 Inventory and record the condition of items to be removed and reinstalled and items to be removed and salvaged.
- .6 Notify the Contract Administrator where existing mechanical, electrical, or structural elements conflict with intended function or design:
 - .1 Investigate and measure the nature and extent of conflict and submit a written report to Contract Administrator.
 - .2 Contract Administrator will issue additional instructions or revise drawings as required to correct conflict.
- .7 Perform surveys as the Work progresses to detect hazards resulting from selective demolition activities.

3.2 UTILITY SERVICES

- .1 Coordinate existing services indicated to remain and protect them against damage during selective demolition operations.
- .2 Locate, identify, disconnect, and seal or cap off indicated utilities serving areas to be selectively demolished.
 - .1 Arrange to shut off affected utilities with utility companies.
 - .2 If utility services are required to be removed, relocated, or abandoned, before proceeding with selective demolition provide temporary utilities that bypass area of selective demolition and that maintain continuity of service to other parts of building.
 - .3 Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit after bypassing.
 - .4 Cut off pipe or conduit to a minimum of 25 mm below slab and remove concrete mound.
- .3 Coordinate with Mechanical and Electrical Divisions for shutting off, disconnecting, removing, and sealing or capping utilities.
- .4 Do not start selective demolition work until utility disconnecting and sealing have been completed and verified in writing.

3.3 PREPARATION

- .1 Remove items adjacent to area of demolition to provide clear workspace. Store in area designated by Contract Administrator.
- .2 Take pre-demolition photographs of Work Area prior to demolition.
- .3 Before shoring has begun, drain areas adjacent to shoring. Maintain area free of standing water for the duration of the contract.
- .4 Treat wood in contact with ground with preservative: to CSA O80 Series.
- .5 Drain, purge, or otherwise remove, collect, and dispose of chemicals, gases, explosives, acids, flammables, or other dangerous materials before proceeding with selective demolition operations.

- .6 Conduct selective demolition and debris removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities:
 - .1 Do not close or obstruct streets, walks, walkways, or other adjacent occupied or used facilities without permission from City of Winnipeg and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by governing regulations.
 - .2 Erect temporary protection, such as walks, fences, railings, canopies, and covered passageways, where required by authorities having jurisdiction.
 - .3 Protect existing site improvements, appurtenances, and landscaping to remain.
 - .4 Erect a plainly visible fence around drip line of individual trees or around perimeter drip line of groups of trees to remain.
- .7 Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain in accordance with Section 01 51 00 - Temporary Utilities, and as follows:
 - .1 Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
 - .2 Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
 - .3 Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
 - .4 Cover and protect furniture, furnishings, and equipment that have not been removed.
- .8 Provide temporary enclosures for protection of existing building and construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities in accordance with Section 01 52 00 - Construction Facilities
 - .1 Provide temporary weather tight enclosure for building exterior.
 - .2 Where heating or cooling is needed and permanent enclosure is not complete, provide insulated temporary enclosures.
 - .3 Coordinate enclosure with ventilating and material drying or curing requirements to avoid dangerous conditions and effects.
- .9 Erect and maintain dustproof partitions and temporary enclosures to limit dust and dirt migration and to separate areas from fumes and noise in accordance with Section 01 51 00 - Temporary Utilities

3.4 POLLUTION CONTROLS

- .1 Dust Control: Provide water mist, temporary enclosures or other suitable methods reviewed and accepted by the Contract Administrator to limit spread of dust and dirt. Comply with governing environmental protection regulations, and as limited below:
 - .1 Do not use water when it may damage existing construction or create hazardous or objectionable conditions, such as ice, flooding, and pollution.
 - .2 Wet mop floors to eliminate tracking of dirt, wipe down walls and doors of demolition enclosure. Vacuum carpeted areas.
- .2 Remove and transport debris to prevent spillage on adjacent surfaces and areas.
- .3 Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.

- .4 Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

3.5 SELECTIVE DEMOLITION

- .1 Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:
 - .1 Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.
 - .2 Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping, to minimize disturbance of adjacent surfaces. Temporarily cover openings to remain.
 - .3 Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
 - .4 Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame cutting operations. Maintain fire watch and portable fire suppression devices during flame cutting operations.
 - .5 Maintain adequate ventilation when using cutting torches.
 - .6 Remove decayed, vermin infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
 - .7 Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
 - .8 Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
 - .9 Dispose of demolished items and materials promptly.
 - .10 Return elements of construction and surfaces that are to remain to condition existing before selective demolition operations began.
- .2 Comply with City of Winnipeg's requirements for using and protecting elevators, stairs, walkways, loading docks, building entries, and other building facilities during selective demolition operations.
- .3 Removed and Salvaged Items:
 - .1 Clean salvaged items
 - .2 Pack or crate items after cleaning
 - .3 Identify contents of containers
 - .4 Store items in a secure area until delivery to City of Winnipeg
 - .5 Transport items to City of Winnipeg's storage area designated by City of Winnipeg
 - .6 Protect items from damage during transport and storage
- .4 Removed and Reinstalled Items:
 - .1 Clean and repair items to functional condition adequate for intended re use. Paint equipment to match new equipment
 - .2 Pack or crate items after cleaning and repairing
 - .3 Identify contents of containers
 - .4 Protect items from damage during transport and storage

- .5 Reinstall items in locations indicated
- .6 Comply with installation requirements for new materials and equipment
- .7 Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated
- .5 Existing Items to Remain:
 - .1 Protect construction indicated to remain against damage and soiling during selective demolition
 - .2 Items may be removed to a suitable, protected storage location during selective demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete
- .6 Concrete:
 - .1 Demolish in small sections
 - .2 Cut concrete full depth at junctures with construction to remain and at regular intervals, using power driven saw, then remove concrete between saw cuts.
 - .3 Dislodge concrete from reinforcement at perimeter of areas being demolished, cut reinforcement, and then remove remainder of concrete indicated for selective demolition
 - .4 Neatly trim openings to dimensions indicated
- .7 Concrete Slab Reinforcing:
 - .1 Locate location of reinforcing steel in concrete slabs prior to cutting or coring using non destructive, non ionizing radio frequency locators.
 - .2 Core concrete slabs to avoid reinforcing steel, electrical conduit or water pipes; adjust core location and coordinate with Contract Administrator where slab features interfere with core drilling.
 - .3 Notify the Contract Administrator immediately for further instructions where coring or cutting will damage existing slab features.
- .8 Concrete Slabs on Grade: Saw cut perimeter of area to be demolished, then break up and remove.
- .9 Below Grade Construction: Demolish foundation walls and other below grade construction including; but not limited to, the following:
 - .1 Foundation walls
 - .2 Footings
 - .3 Piles to depths indicated.
- .10 Masonry:
 - .1 Demolish in small sections
 - .2 Cut masonry at junctures with construction to remain, using power driven saw, then remove masonry between saw cuts
- .11 Roofing: Remove no more existing roofing than can be covered in one day by new roofing. Refer to Section Applicable Division 7 Section for new roofing requirements.
- .12 Air Conditioning Equipment: Remove equipment without releasing refrigerants.

3.6 SHORING INSTALLATION

- .1 Shoring of structures:
 - .1 Support individual elements that become loose during shoring installation.
 - .2 Provide shoring to support balcony slabs where shear wall masonry units are being repaired in accordance with shoring engineer design.

- .3 Erect structural timber to CSA O86.1.
- .4 Erect structural steel work to CAN/CSA S16 and CSA S136.
- .5 Weld to CSA W59.
- .6 Install shoring in accordance with shoring engineered shop drawings.
- .7 Maintain shoring in place until designated repairs completed.

3.7 SHORING DISASSEMBLY

- .1 Conduct demolition to minimize interference with adjacent building areas.
- .2 Maintain protected, wheelchair accessible egress and access at all times to the building entrance.
- .3 Remove debris created by the execution of the Work progressively from the site to appropriate disposal grounds. Do not damage adjacent finishes or surfaces.
- .4 Do not disturb adjacent items designated to remain in place.
- .5 Salvage Materials:
 - .1 Carefully remove and store reusable site materials.
 - .2 Dismantle items containing materials for salvage.
 - .3 Stockpile salvaged materials at locations as approved by the Contract Administrator.
- .6 Deconstruct in accordance with Manitoba Regulation 217/2006 and other applicable safety standards.

3.8 REMOVAL FROM SITE

- .1 Transport material designated for disposal to approved facilities in accordance with applicable regulations.
- .2 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.

3.9 PATCHING AND REPAIRING (INTERIOR DEMOLITION)

- .1 Floors and Walls:
 - .1 Where walls or partitions that are demolished extend from one finished area into another, patch and repair floor and wall surfaces in the new space.
 - .2 Provide a level and smooth surface having uniform finish colour, texture, and appearance.
 - .3 Remove existing floor and wall coverings and replace with new materials, if necessary, to achieve uniform colour and appearance.
 - .4 Patch with durable seams that are as invisible as possible.
 - .5 Provide materials and comply with installation requirements specified in other Sections of these Specifications.
 - .6 Where patching occurs in a painted surface, apply primer and intermediate paint coats over patch and apply final paint coat over entire unbroken surface containing patch. Provide additional coats until patch blends with adjacent surfaces.
 - .7 Where feasible, test and inspect patched areas after completion to demonstrate integrity of installation.
- .2 Ceilings: patch, repair, or re hang existing ceilings as necessary to provide an even plane surface of uniform appearance.

3.10 CLEANING AND RESTORATION

- .1 Keep site clean and organized throughout deconstruction.
- .2 Upon completion of demolition, remove debris, trim surfaces and leave work site clean.
- .3 Upon completion of project, reinstate parking surfaces, walkways, affected by Work to condition which existed prior to beginning of Work and match condition of adjacent, undisturbed areas.
- .4 In addition to the progressive removal of waste materials and debris from building and site, leave the site clean, perform the following before final inspection by the Contract Administrator.
 - .1 spray-wash all exterior building finishes in construction area and any adjacent building areas soiled by the construction processes.
 - .2 Broom clean and wash exterior walks, steps and platforms soiled from delivery or removal materials.
 - .3 Remove all dirt and other disfigurations from exterior surfaces.
 - .4 Sweep clean all paved areas.

3.11 CLOSEOUT ACTIVITIES

- .1 Patching and Repairs: Promptly repair damage to adjacent construction caused by selective demolition operations and as follows:
 - .1 Patch to produce surfaces suitable for new materials where repairs to existing surfaces are required,
 - .2 Completely fill holes and depressions in remaining existing masonry walls remain with an approved masonry patching material applied according to manufacturer's written recommendations.
 - .3 Restore exposed finishes of patched areas and extend restoration into adjoining construction in a manner that eliminates evidence of patching and refinishing.
- .2 Demolition Waste Disposal: Arrange for legal disposal and remove demolished materials to accredited provincial landfill site or alternative disposal site (recycle centre) and as follows:
 - .1 Promptly dispose of demolished materials.
 - .2 Do not allow demolished materials to accumulate onsite.
 - .3 Do not burn demolished materials.

END OF SECTION

PART 1 GENERAL

1.1 General and Related Work

- .1 Read this Section in conjunction with all drawings and all other Sections so as to comply with the requirements of Division 1 and the General Conditions of the Contract.
- .2 Related work specified elsewhere:
 - Section 02 82 00.01 Asbestos Abatement – Type 1 (Low Risk) Procedures.
 - Section 02 82 00.03 Asbestos Abatement – Type 3 (High Risk) Procedures.
 - Section 02 82 00.04 Asbestos Abatement – Type 2 Glove Bag Method.
- .3 Site Conditions identifies all known hazardous building materials within the Project Area. The information provided is for general reference only.
 - .1 The specification fulfils the requirements of Part 36 and 37 of Manitoba Workplace Safety and Health Regulation 217/2006.
- .4 The Outline of Work identifies the location, condition and quantities of hazardous building materials to be removed as part of this project.
 - .1 It is the intent that work prescribed this Section will result in the removal of all hazardous materials as outlined and the decontamination of all surfaces or materials which may have been or become contaminated by hazardous materials either during or prior to work of this Contract.

1.2 Site Conditions

- .1 Refer to the City of Winnipeg Asbestos Inventory dated March 18, 2022.
- .2 Refer to the City of Winnipeg asbestos location drawings for the locations of asbestos-containing drywall joint compound, vermiculite, parging cement on pipe fittings, asphalt plank flooring, vinyl floor tiles and transite hard board.
 - .1 The following materials are presumed to contain asbestos:
 - .1 Built-up roofing materials.
- .3 General Building Conditions
 - .1 Heat and smoke detectors to remain live throughout work.
 - .2 Sprinklers to remain live throughout work.

1.3 Outline of Work

- .1 Coordinate the following items with the City of Winnipeg’s Project Manager and the Construction Manager, including but not limited to: electrical isolations, GFI connection, water connections, HVAC and exhaust ventilation system isolation, bin placement, schedule, disconnects, etc.
- .2 Install Hoarding Walls between Abatement Work Areas and Occupied Areas where required.
- .3 Using procedures prescribed in the Sections identified in Related Work, remove and dispose of the following:
 - .1 Asbestos-containing parging cement on pipe fittings throughout the building, excluding the Ice Shed.
 - .2 Asbestos-containing vermiculite within hollow core block walls at locations as identified in the City of Winnipeg asbestos location drawings.
 - .3 Asbestos-containing asphalt plank flooring throughout the building, at locations identified in the City of Winnipeg asbestos location drawings.
 - .4 Asbestos-containing vinyl floor tiles at locations as identified in the City of Winnipeg asbestos location drawings.
 - .5 Drywall with drywall joint compound containing chrysotile asbestos, at locations as identified in the City of Winnipeg asbestos inventory.
 - .6 Asbestos-containing transite hardboard at locations as identified in the City of Winnipeg asbestos location drawings.
- .4 Refer to Specification Sections identified in the Related Work for specified personnel protective measures for the safe handling, removal or clean-up of hazardous materials in each phase or work area.
- .5 Protect surfaces, building fabrics and items remaining within the Abatement Work Area.
- .6 Without disturbing hazardous materials, perform removals where required, prior to abatement work.
 - .1 Maximize waste diversion by use of resale of building materials, or recycling.
- .7 Isolate the Abatement Work Area from adjoining Occupied and Non-Occupied Areas whether present at an interior or exterior location.
- .8 Maintain emergency and fire exits from Abatement Work Area, or establish alternative exits satisfactory to Provincial Fire Marshall and local authorities having jurisdiction. Maintain extra routes from occupied areas. Place emergency exit signs at locations to clearly mark exit route. Seal emergency exit doors so as not to impede use of door during emergency evacuation.

- .9 Perform selective demolition of mechanical and electrical equipment, building components, materials and items scheduled for demolition at locations required to facilitate asbestos removal. Refer to all Contract Documents for responsibility of demolition work and disposal.
- .10 Remove and dispose of as appropriate waste, building components, materials and items contaminated by hazardous materials that cannot be effectively cleaned.
- .11 Final clean work area to remove visible signs of asbestos and other hazardous materials, other debris or settled dust.
- .12 Apply lock-down agent to exposed surfaces throughout the work area and to surfaces from which any hazardous materials have been removed.
- .13 Unless otherwise specified, the handling, removal, clean-up or repair of hazardous materials or surfaces contaminated with hazardous materials is to be performed following wet removal techniques.

1.4 Schedule

- .1 Provide necessary manpower, supervision, equipment and materials to maintain and complete the project on schedule.
- .2 Work Hours:
 - .1 Coordinate all work, scheduling and phasing with the City of Winnipeg.
 - .2 NOTE: Duration for which HVAC systems may remain shutdown to accommodate quiet hours work will vary in accordance with outside weather conditions and internal demand. Duration of quiet hours work will have to be scheduled accordingly and in consultation with the Abatement Consultant.
- .3 Provide 48 hours written notice to the Abatement Consultant of any request to work outside normal working hours. Obtain written approval before proceeding.

1.5 Definitions

- .1 Abatement Consultant: City of Winnipeg's Representative providing inspection and air monitoring.
- .2 Abatement Subcontractor: Subcontractor performing work of this section.
- .3 Abatement Work Area: Area where work takes place which will, or may, disturb hazardous materials.
- .4 Amended Water: Water with wetting agent added for the purpose of reducing surface tension to allow thorough wetting of materials.
- .5 Asbestos: Any of the fibrous silicates defined in Regulation 217/2006 including: actinolite, amosite, anthophyllite, chrysotile, crocidolite and tremolite.

- .6 Asbestos-Containing Material (ACM): Material identified under Site Conditions including any debris, overspray, fallen material and settled dust.
- .7 Authorized Visitors: City of Winnipeg, Abatement Consultant, or designated representative, and persons representing regulatory agencies.
- .8 Competent Worker: A worker who is qualified because of knowledge, training and experience to perform the work, is familiar with applicable regulations and guidelines, and has knowledge of the potential or actual danger to health and safety in the work.
- .9 Contaminated Waste: Material identified under Site Conditions, including fallen material, settled dust, other debris and materials or equipment deemed to be contaminated by the Abatement Consultant.
- .10 Curtained Doorway: Doorway consisting of two (2) overlapping flaps of rip-proof polyethylene arranged to permit ingress and egress from one room to another while permitting minimal air movement between rooms.
- .11 DOP Test: A testing method used to determine the integrity of the Negative Pressure unit or vacuum using a Dispersed Oil Particulate (DOP) or Poly Alpha Olefin (PAO) HEPA filter leak test. This test is to be conducted on site where units are to be installed. Refer to the Environmental Abatement Council of Ontario (EACO) DOP/PAO Testing Guideline 2013 or ANSI/ASME N510-2007.
- .12 Fitting: Individual segments or pieces of a mechanical service line which may include but is not limited to the hangers, tees, elbows, joints, valves, unions, etc.
- .13 Friable Material: Material that when dry can be crumbled, pulverized or powdered by hand pressure and includes such material that is crumbled, pulverized or powdered.
- .14 HEPA Filter: High Efficiency Particulate Aerosol filter that is at least 99.97 percent efficient in collecting a 0.3 micrometre aerosol.
- .15 Milestone Inspection: Inspection of the Abatement Work Area at a defined point in the abatement operation.
- .16 Negative Pressure: A reduced pressure within the Abatement Work Area (> 0.02 inches of water column) established by extracting air directly from Abatement Work Area and discharging it to exterior of building.
- .17 Non-Friable Material: Material that when dry cannot be crumbled, pulverized or powdered by hand pressure.
- .18 Occupied Area: Any area of the building or adjoining space outside the Abatement Work Area.
- .19 Personnel: All Contractor's employees, sub-contractors employees, supervisors.
- .20 PCM: Phase Contrast Microscopy.

- .21 **Remove:** Remove means remove and dispose of (as applicable type of waste) unless followed by other instruction (e.g. remove and turn over to the City of Winnipeg).

1.6 Regulations and Guidelines

- .1 Comply with Federal, Provincial, and local requirements, provided that in any case of conflict among those requirements or with these Specifications, the more stringent requirements shall apply. Work shall be performed under regulations in effect at the time work is performed.
- .2 Where regulations are not present, follow accepted industry standards and applicable Guideline documents.
- .3 Regulations and Guidelines include but are not limited to the following:
 - .1 Workplace Safety and Health Act W210.
 - .2 Workplace Safety and Health Regulation M.R. 217/2006
 - .3 Safe Work Manitoba Guide for Asbestos Management
 - .4 The Dangerous Goods Handling and Transportation Act C.C.S.M c. D12.
 - .5 Hazardous Waste Regulation, M.R. 195/2015.
 - .6 Dangerous Goods Handling and Transportation Regulation, M.R. 55/2003.
 - .7 Transportation of Dangerous Goods Regulation (SOR 219/2019-101).

1.7 Quality Assurance

- .1 Removal and handling of hazardous materials is to be performed by persons trained in the methods, procedures and industry practices for Abatement.
- .2 Ensure work proceeds to schedule, meeting all requirements of this Specification.
- .3 Complete work so that at no time airborne dust, visible debris, or water runoff contaminate areas outside the Abatement Work Area.
- .4 Any contamination of surrounding area (indicated by visual inspection or air monitoring) shall necessitate the clean-up of affected area, and in the same manner applicable to an Abatement Work Area at no cost to the City of Winnipeg.
- .5 All work of this Section involving electrical, mechanical, carpentry, glazing, etc., shall be performed by licensed persons experienced and qualified for the work required.

1.8 Supervision

- .1 Provide on site for each work shift, a Shift Superintendent(s), who has authority regarding all aspects related to manpower, equipment and production.

- .2 Supervisory personnel must hold a recognized certificate proving attendance at an asbestos removal training course (3 day minimum duration) and have performed supervisory functions on at least five (5) other asbestos abatement projects of similar size and complexity.
- .3 At all times during work, the Shift Superintendent(s) must be on site. Failure to comply with this requirement will result in a stoppage of all work, at no cost to the City of Winnipeg.
- .4 Replace supervisory personnel, with approved replacements, within three (3) working days of a written request from the City of Winnipeg. The City of Winnipeg reserves the right to request replacement of supervisory personnel without explanation.
- .5 Do not replace supervisory personnel without written approval from the City of Winnipeg.

1.9 Notification

- .1 Not later than 5 days before commencing asbestos abatement work on this project, notify the local office of the Manitoba Workplace Safety and Health Division..
- .2 Notify Sanitary Landfill site as per local requirements.
- .3 Inform all trades on site of the presence and location of hazardous materials identified in the Contract documents.
- .4 Notify the City of Winnipeg or City of Winnipeg’s Representative, if suspected asbestos-containing materials not identified in the contract documents are discovered during the course of the work. Stop work in these areas immediately.

1.10 Submittals

- .1 Submit prior to starting work:
 - .1 Provincial Workers’ Compensation Board Clearance Certificate.
 - .2 Insurance certificates.
 - .3 Copy of Company Health and Safety Policy and applicable programs.
 - .4 Provincial Regulator Notice of Project form.
 - .5 Copy of Certificate of Approval for disposal of hazardous materials waste and location of landfill.
 - .6 Pre-removal damage survey of the Abatement Work Area(s), waste transport routes, and bin storage areas.
- .2 Submit the following information regarding personnel prior to starting work:
 - .1 Resumes of the supervisory personnel.

- .2 Proof in the form of a certificate that supervisory personnel have attended a training course on asbestos (3 day minimum duration).
- .3 Written statement that personnel have had instruction on hazards of exposure to hazardous materials identified within this scope, the use of respirator, protective clothing, worker and waste decontamination procedures, and all aspects of work procedures and protective measures.
- .4 Proof of training for the following site specific hazards or conditions identified:
 - .1 Working at Heights
- .5 Written statement that personnel have had instruction on hazards of exposure to hazardous materials identified within this scope, the use of respirator, protective clothing, worker and waste decontamination procedures, and all aspects of work procedures and protective measures.
- .6 WHMIS training certificates for all personnel.
- .7 Certificate proving that each worker on site has been fit tested for the respirator appropriate for the work being performed.
- .8 Proof, satisfactory to the Consultant, that all persons involved in the transport and disposal hazardous materials have been trained in accordance with the requirements of Federal and Provincial Transportation of Dangerous Good Acts and Regulations.
- .3 Submit the following information regarding HEPA filtered devices prior to construction of enclosure or asbestos abatement:
 - .1 Performance data on HEPA filtered vacuums including DOP tests no more than 3 months old.
 - .2 Performance data on negative air units including DOP tests which must be no more than 3 months old if the unit is vented outdoors or which must be performed on site immediately prior to initial usage and when HEPA filters are changed if the unit is vented indoors.
 - .3 DOP tests to be performed by an independent testing company.
 - .1 DOP testing company is required to submit a detailed technical report of testing protocol, including Introduction, Methodology, Results, Conclusions, and Recommendations, including results of the Air-Aerosol Mixing Uniformity test as per ASME N510-1989 (1995).
 - .2 DOP testing company must also provide calibration certificates from an independent calibration firm or from the manufacturer of the testing equipment for both the aerosol photometer and the pressure gauge on the aerosol generator dated within 1 calendar year from the on-site testing date.

- .3 DOP testing company must also provide the National Sanitation Foundation (NSF) certification name and number of the on-site technician performing the testing.
- .4 Proof of calibration of DOP testing equipment.
- .4 Submit the following prior to isolating the work area:
 - .1 Safety Data Sheets for chemicals or material used in the course of the Abatement Project.
- .5 Submit the following upon completion of the work.
 - .1 Manifests, waybills, bills of lading etc. as applicable for each type of waste.

1.11 Insurance

- .1 Maintain a Commercial General Liability Policy with an insurance company acceptable to Pinchin Ltd. and City of Winnipeg. The intent of this policy is to hold Pinchin Ltd. and City of Winnipeg harmless as it relates to claims for Bodily Injury or Property Damage or both, relating to the contract. Commercial General Liability insurance shall be provided on an “occurrence” basis to cover injury or damage (whether detected or not during the policy period) which happens during the policy period.
- .2 Maintain an Automobile or Fleet Policy, and Non-owned Automobile Policy with an insurance company acceptable to Pinchin Ltd. and the City of Winnipeg. The intent of these policies is to hold Pinchin Ltd. and the City of Winnipeg harmless as it relates to claims for Bodily Injury or Property Damage or both, relating to the contract.
- .3 Maintain a Pollution Liability Policy (or asbestos liability policy or specific coverage under the CGL for asbestos abatement) with an insurance company acceptable to Pinchin Ltd. and the City of Winnipeg. The intent of this policy is to hold Pinchin Ltd. and the City of Winnipeg harmless as it relates to claims for Bodily Injury or Property Damage or both, relating to the contract. Pollution Liability shall be provided on an “occurrence” basis to cover injury or damage (whether detected or not during the policy period) which happens during the policy period. Without limiting the generality of the foregoing, the policy shall insure the operations of abatement and shall not contain any environmental and/or health hazard exclusions relating to remediation operations.
- .4 Forward all certificates to Pinchin Ltd. and the City of Winnipeg before work is commenced, showing Pinchin Ltd. and the City of Winnipeg as additional insured as their interest may appear.
- .5 Pinchin Ltd. and the City of Winnipeg may request a certified true copy of the policies.
- .6 The limits will not be less than:
 - .1 Commercial General Liability \$5,000,000.00

.2	Automobile	\$2,000,000.00
.3	Pollution Policy	\$5,000,000.00

1.12 Inspection

- .1 From commencement of work until completion of clean-up operations, the Abatement Consultant is empowered by the City of Winnipeg to inspect for compliance with the requirements of governing authorities, adherence to specified procedures and materials, and to inspect for final cleanliness and completion.
- .2 The Abatement Consultant is empowered by the City of Winnipeg to order a shutdown of work when leakage of asbestos from the controlled work area has occurred or is likely to occur.
- .3 Any deviation from the requirements of the Specifications or governing authorities that is not approved in writing may result in a stoppage of work, at no cost to the City of Winnipeg.
- .4 Additional labour or materials expended by the Subcontractor to rectify unsatisfactory conditions and to provide performance to the level specified shall be at no additional cost to the City of Winnipeg.
- .5 Inspection and air monitoring performed as a result of Subcontractor's failure to perform satisfactorily regarding quality, safety, or schedule, shall be back-charged to the Subcontractor.
- .6 Facilitate inspection and provide access as necessary. Make good work disturbed by inspection and testing at no cost to the City of Winnipeg.
- .7 Refer to the Sections identified in Related Work for specified milestone inspections which are to take place at defined points throughout the abatement operation specific to each phase or work area.
- .8 Provide 24 hours written notice to the Abatement Consultant of any request for scheduling of milestone inspections or transportation of waste through Occupied Areas.
- .9 The following Milestone Inspections will take place, at the City of Winnipeg's cost:
 - .1 Milestone Inspection - Clean Site Preparation
 - .1 Inspection of preparations and set-up prior to contaminated work in the Abatement Work Area.
 - .2 Milestone Inspection – Bulk Removal Inspection
 - .1 Inspection during asbestos removal, monitoring removal methods, site deficiencies, performing occupied air monitoring, etc.
 - .3 Milestone Inspection - Visual Clearance
 - .1 Inspection of Abatement Work Area after completion of all abatement, but prior to application of lock-down agents or dismantling of enclosure.

- .4 Milestone Inspection – Clearance Sampling
 - .1 Air monitoring performed following removal of asbestos and application of slow drying sealer to ensure fibre levels inside the enclosure(s) are within the acceptable limits.
- .10 Refer to the Sections identified in Related Work for specified milestone inspections which are to take place at defined points throughout the abatement operation specific to each phase or work area.
- .11 Do not proceed with next phase of work until written approval of each milestone is received from the Abatement Consultant.

1.13 Air Monitoring - Asbestos

- .1 Air monitoring will be performed using Phase Contrast Microscopy (PCM) following the National Institute for Occupational Safety and Health Method 7400.
- .2 Co-operate in the collection of air samples, including providing workers to wear sample pumps for up to full-shift periods. Subcontractor will be responsible for the cost of testing equipment repairs or resampling resulting from the actions of the Subcontractor's forces.
- .3 Results of PCM samples of 0.05 fibres per cubic centimeter of air (fibre/cc) or greater, outside an Abatement Work Area, or from within the Abatement Work Area during or following Glove Bag Work, will indicate asbestos contamination of these areas. Respond as follows:
 - .1 Suspend work within the adjoining Abatement Work Area until written authorization to resume work has been received from the Abatement Consultant.
 - .2 Isolate and clean area in the same manner applicable to the Abatement Work Area.
 - .3 Maintain work area isolation, and repeat clean-up operations until visual inspection and air monitoring results are at a level equal to that specified.
 - .4 At the discretion of the Abatement Consultant provide additional negative air units at locations specified in response to elevated fibre levels being detected in the Clean Change Room or Occupied Areas.
- .4 Results of PCM samples at or greater than 0.01 fibres per cubic centimeter of air (fibre/cc), collected within the Abatement Work Area enclosure after the site has passed a visual inspection, and an acceptable coat of lock-down agent has been applied, will indicate asbestos contamination of these areas. Respond as follows:
 - .1 Maintain work area isolation and re-clean entire work area. Then apply another acceptable coat of lock-down agent to exposed surfaces throughout the work area.

- .2 Repeat above measures until visually inspected and air monitoring results are at a level equal to that specified.
- .5 When results exceed 50% of maximum use concentration for the respirator being used within the work area respond as follows:
 - .1 Immediately stop work within the Abatement Work Area.
 - .2 Instruct workers to exit the Abatement Work Area via the Worker Decontamination Facility while observing specified personnel exiting procedures.
 - .3 Subcontractor's forces shall not re-enter the Abatement Work Area for a period of 8 hours or until authorized by the Abatement Consultant.
 - .4 Upon re-entry to the Abatement Work Area, mist the air, any fallen debris or exposed surfaces with amended water using an airless sprayer.
- .6 Additional labour or materials expended by the Subcontractor to rectify unsatisfactory conditions and to provide performance to the level specified shall be at no additional cost to the City of Winnipeg.
- .7 Cost of additional inspection and sampling performed as a result of elevated fibre levels in areas outside the Abatement Work Area or from within the work area following completion of work, will be back-charged to the Subcontractor.

1.14 Worker Protection

- .1 Instruct workers before allowing entry to the Abatement Work Area. Instruction shall include training in use of respirators, dress, showering, entry and exiting from an Abatement Work Area, and all other aspects of work procedures and protective measures.
- .2 Workers shall not eat, drink, chew gum or tobacco, or smoke in the Abatement Work Area.
- .3 Workers shall be fully protected at all times when possibility of disturbance of hazardous materials exists.
- .4 Provide soap, towels and facilities for washing of hands and face, which shall be used by all personnel when leaving the Abatement Work Area.
- .5 Respiratory Protection
 - .1 Refer to each particular Section of the Specification for specified type of respiratory equipment specific to each phase or work area.
 - .2 Respirators shall be:
 - .1 Certified by the National Institute of Occupational Safety and Health (NIOSH) or other testing agency acceptable to the Provincial regulator.

- .2 Fitted so that there is an effective seal between the respirator and the worker's face. Ensure that no person required to enter an Abatement Work Area has facial hair which affects the seal between respirator and face.
 - .3 Assigned to a worker for their exclusive use.
 - .4 Maintained in accordance with manufacturer's specifications.
 - .5 Cleaned, disinfected and inspected by a competent person after use on each shift, or more often if required.
 - .6 Repaired or have damaged or deteriorated parts replaced.
 - .7 Stored in a clean and sanitary location.
 - .8 Provided with new filters as necessary, according to manufacturer's instructions.
 - .9 Worn by personnel who have been fit checked by qualitative or quantitative fit-testing.
 - .10 Instruction on proper use of respirators must be provided by a competent person.
- .3 Provide protective clothing, to all personnel which:
 - .1 Is made of a material that does not readily retain nor permit penetration of asbestos fibres.
 - .2 Consists of head covering and full body covering that fits snugly at the ankles, wrists and neck.
 - .3 Once coveralls are worn, treat and dispose of as contaminated waste.
 - .4 Is replaced or repaired if torn or ripped.
 - .4 Use hard hats, safety footwear and other protective equipment and apparel required by applicable construction safety regulations.

1.15 Visitor Protection

- .1 Provide clean protective clothing and equipment to Authorized Visitors.
- .2 Instruct Authorized Visitors in the use of protective clothing and Abatement Work Area entry and exit procedures.
- .3 Authorized visitors are required to be fit tested on respirators, prior to entering Abatement Work Area.

1.16 Signage

- .1 Asbestos Abatement Signs: Post signs at access points to the Abatement Work Area, stating at minimum, the following:
 - .1 There is an asbestos dust hazard.
 - .2 Access to the work area is restricted to persons wearing protective clothing and equipment.

- .2 Bins and Asbestos Waste Containers: Post signs on both sides of every asbestos waste container. Signs must display thereon in large, easily legible letters that contrast in colour with the background the word “CAUTION” in letters not less than ten centimetres in height and the words:
 - .1 CONTAINS ASBESTOS FIBRES.
 - .2 Avoid Creating Dust and Spillage.
 - .3 Asbestos May be Harmful To Your Health.
 - .4 Wear Approved Protective Equipment.
- .3 Place placards in accordance with Transportation of Dangerous Goods Act.

1.17 Differential Pressure Monitoring

- .1 Provide and install differential pressure monitors as specified in each section.
- .2 Replace damaged or non-functional equipment at the request of the Abatement Consultant.
- .3 Record at minimum twice daily, and when damage to the enclosure is identified and repaired, the following information:
 - .1 Name of inspector.
 - .2 Date and time.
 - .3 Pressure reading.
 - .4 Repairs completed, if applicable.
- .4 Maintain specified differential pressure.
- .5 Stop contaminated work and take corrective action if pressure differential drops below the specified level. Notify the Abatement Consultant immediately.

1.18 Waste and Material Handling

- .1 Waste bins must be placed on grade or in receiving.
- .2 All bins for hazardous materials must be covered and locked when waste transfer is not being performed.
- .3 Ensure redundant non-ACM, rubble, debris, etc. removed during contaminated work are treated, packaged, transported and disposed of as appropriate waste.
- .4 Clean, wash and apply Post Removal Sealant to metal waste prior to removal from Abatement Work Area. Recycle metals.
- .5 Clean, wash and apply Post Removal Sealant to non-porous materials prior to disposal as clean waste. Obtain prior written approval from the Abatement Consultant for each individual type of material.

- .6 Clean and wash equipment prior to removal from Abatement Work Area if removed prior to completion.
- .7 Place all equipment, tools and unused materials that cannot be cleaned in Abatement Waste Containers.
- .8 As work progresses, and at regular intervals, transport the sealed and labelled waste containers from the Abatement Work Area to waste bin.
- .9 Place items in bins according to waste classification. Place asbestos waste, metals, non-asbestos waste, etc. in separate bins.
- .10 Removal of waste containers and decontaminated tools and materials from the Abatement Work Area shall be performed as follows:
 - .1 Remove any visible contamination from the surface of non-porous or cleanable waste being removed from the Abatement Work Area. If the item can be cleaned, remove it from the site as clean waste.
 - .2 Place waste or item in Waste Container and seal closed.
 - .3 Wet wipe outside of Waste Container.
 - .4 Within Decontamination Facility, or at the perimeter of the Abatement Work Area, place in second Waste Container. Seal closed.
 - .5 Remove waste containers and transport to appropriate bin.
- .11 Transport waste and materials via the predetermined routes and exits. Arrange waste transfer route with City of Winnipeg. Use a closed, covered cart to transport through Occupied Areas.
- .12 Use Low Risk Procedures while transporting asbestos waste through facility.
- .13 Provide workers transporting waste with means to access full personal protective equipment and all tools required to properly clean up spilled material in the case of a rupture of a Waste Container.
- .14 Pick-up and drop off of garbage bin shall be at pre-approved times, and must not interfere with the City of Winnipeg operations.
- .15 Transport hazardous waste to landfill in accordance with provincial requirements.
- .16 Cooperate with inspectors from the provincial regulator and immediately carry out instructions for remedial work at dump to maintain environment, at no additional cost to the City of Winnipeg.

1.19 Re-establishment of Objects and Systems

- .1 Re-establish electrical, communication, HVAC and other services previously disconnected or otherwise isolated to accommodate work by this Section.

- .2 Make good at completion of work, all damage not identified in pre-removal survey.

PART 2 PRODUCTS AND FACILITIES

2.1 Materials and Equipment

- .1 Refer to the Sections identified in Related Work for specified materials, equipment or facilities specific to each phase or work area.
- .2 Materials and equipment must be in good condition and free of debris and fibrous materials. Disposable items must be of new materials only.
- .3 Airless Sprayer: AC powered pressure washer that allows wetting agent to mix with water, uses no air or compressed air, and has a nozzle to regulate power and pressure.
- .4 Amended Water: Water with wetting agent added for purpose of reducing surface tension to allow thorough wetting of materials.
- .5 Asbestos Waste Container: A container acceptable to disposal site, and the provincial regulator comprised of the following:
 - .1 Dust tight.
 - .2 Suitable for the type of waste.
 - .3 Impervious to asbestos.
 - .4 Identified as asbestos waste.
- .6 Differential Pressure Monitor: a high precision instrument for measuring and controlling pressure differences in the low range, between the Abatement Work Area and Occupied Area. Calibrate regularly to manufacturer's instructions.
- .7 Discharge Ducting: Polyethylene Tubing. Reinforced with wire. Diameter to equal negative pressure machine discharge. Not to be longer than required, or so long that negative pressure is compromised.
- .8 Ground Fault Panel: Electrical panel as follows:
 - .1 Ground fault circuit interrupters of sufficient capacity to power temporary electrical equipment and lights in Asbestos Work Area.
 - .2 Interrupters to have a 5 mA ground fault protection.
 - .3 Necessary accessories including main switch disconnect, ground fault interrupter lights, test switch to ensure unit is working, and reset switch.
 - .4 Openings sealed to prevent moisture or dust penetration.
 - .5 Inspected by the Electrical Safety Authority.

- .6 Panel uses CSA approved parts and been constructed, inspected and installed by a licensed electrician.
- .7 Provide one Ground Fault Panel for each 5,000 square feet (500 square metres) of Abatement Work Area.
- .9 HEPA Filtered Negative Pressure Machine: Portable air handling system which extracts air directly from the Abatement Work Area and discharges the air to the exterior of the building. Equipped as follows:
 - .1 Prefilter and HEPA filter. Air must pass HEPA filter before discharge.
 - .2 Pressure differential gauge to monitor filter loading.
 - .3 Auto shut off and warning system for HEPA filter failure.
 - .4 Separate hold down clamps to retain HEPA filter in place during change of prefilter.
- .10 HEPA Vacuum: Vacuum with necessary fittings, tools and attachments. Discharged air must pass through a HEPA filter.
- .11 Hose: Leak-proof, minimum busting strength of 500 PSI or greater if required, abrasion resistant covering, reinforcing, and machined-brass couplings. Maintained and tested. Hose to be temperature resistant if it is to carry domestic hot water.
- .12 OSB: Oriented Strand Board.
- .13 Polyethylene Sheeting: 6 mil (0.15 mm) minimum thickness unless otherwise specified, in sheet size to minimize joints.: 6 mil (0.15 mm) minimum thickness unless otherwise specified, in sheet size to minimize joints.
- .14 Post Removal Sealant (or Lockdown): Sealant that when applied to surfaces serves the function of trapping residual asbestos fibres or other dust. Product must have flame spread and smoke development ratings both less than 50. Product shall leave no stain when dry. Post Removal Sealant shall be compatible with replacement insulation or fireproofing where required and capable of withstanding service temperature of substrate. Apply to manufacturer's instructions.
- .15 Protective Clothing: Disposable coveralls complete with head covering and full body covering that fits snugly at the ankles, wrists and neck.
- .16 Rip-Proof Polyethylene Sheeting: 8 mil (0.20 mm) fabric made up from 5 mil (0.13 mm) weave and two (2) layers of 1.5 mil (0.05 mm) poly laminate or approved equal. In sheet size to minimize on-site seams and overlaps.
- .17 Shower Hose: Water lines for supply of hot & cold water to shower facilities to be rated for use at 200 PSI (1380 kPa) or twice the working pressure whichever is greater. Supply lines to be continuous and free of fittings, joints or couplings.

- .18 Sprayer: Garden type portable manual sprayer or water hose with spray attachment if suitable.
- .19 Tape: Duct tape or tape suitable for sealing polyethylene to surfaces under both dry and wet conditions in the presence of Amended Water.
- .20 Wetting Agent: Non-sudzing surfactant added to water to reduce surface tension and increase wetting ability.

PART 3 EXECUTION

- .1 Refer to the Sections identified in Related Work for specified procedures for work area preparation, maintenance, site dismantlement, application of lock-down agent and all other procedures for the safe handling, removal and clean-up of hazardous materials specific to each phase or work area.

END OF SECTION

PART 1 GENERAL

1.1 General and Related Work

- .1 Read this Section in conjunction with all drawings and all other Sections so as to comply with the requirements of Division 1 and the General Conditions of the Contract.
- .2 Requirements specified elsewhere:
 - .1 Section 02 81 00 Hazardous Materials – General Provisions

1.2 Outline of Work

- .1 Refer to Section 02 81 00 Hazardous Materials – General Provisions for the Outline of Work.
- .2 Isolate the Abatement Work Area from adjoining spaces through the installation of temporary barriers and partitions as specified herein.
- .3 The intent of this Section is to provide safe work practices and procedures to govern the handling, removal, clean-up and disposal of asbestos-containing materials following Type 1 (Low Risk) procedures, and Pinchin and the City of Winnipeg’s specific requirements.

1.3 Instruction and Training

- .1 Provide instruction and training to all workers including the following:
 - .1 Hazards of asbestos.
 - .2 Use, care and disposal of protective equipment (including but not limited to respirators and filters) and clothing that would be used and worn during abatement work, including:
 - .1 Limitations of equipment.
 - .2 Inspection and maintenance of equipment.
 - .3 Proper fitting of equipment.
 - .4 Disinfecting and cleaning of equipment.
 - .3 Personal hygiene to be observed when performing the work.
 - .4 Measures and procedures prescribed in the regulation and decontamination of the worker.
- .2 Instruction and training must be provided by a competent person.

1.4 Personal Protection

- .1 Protect all personnel at all times when possibility of disturbance of ACM exists.
 - .1 Provide non-powered half-face respirators with P100 high efficiency (HEPA) cartridge filters when requested by personnel.
 - .2 When requested by personnel, provide protective clothing.

1.5 Inspections

- .1 Refer to Part 1.12 Inspections in Section 02 81 00 – General Provisions.
- .2 The following Milestone Inspections are to be scheduled:
 - .1 Milestone Inspection - Visual Clearance
 - .2 Milestone Inspection – Clearance Sampling

PART 2 PRODUCTS AND FACILITIES

- .1 Refer to Section 02 81 00.

PART 3 EXECUTION

3.1 Site Preparation

- .1 Moving of equipment, tools, supplies, and stored materials that can be performed without disturbing ACM will be performed by others.
- .2 Remove visible dust and friable material from all surfaces in the work area including those to be worked on, using HEPA Vacuums or wet wiping.
- .3 Install polyethylene drop sheets below areas of work except at locations where asbestos flooring is removed.
- .4 Install signage in clearly visible locations and in sufficient numbers to adequately warn of an asbestos dust hazard.
- .5 Shut down HVAC systems serving the Abatement Work Area.
 - .1 Install polyethylene sheeting over openings in ducts and diffusers and seal.
 - .2 HVAC to remaining areas of building must not be disrupted during work of this section.
 - .3 System shall remain inoperative until completion of work, unless ducts can be effectively capped.
 - .4 Perform work at scheduled times after shutting down HVAC systems affecting the Abatement Work Area.
- .6 Provide power from ground fault interrupt circuits.
- .7 Provide amended water for wetting ACM, and adequate method of wetting (garden sprayers, airless sprayers, etc.).
- .8 Do not commence contaminated work until authorized by the Abatement Consultant.

3.2 Maintenance of Abatement Work Area

- .1 Inspect polyethylene sheeting and ensure it is effectively sealed and taped. Repair damage and remedy defects immediately.
- .2 Inspect electrical panels and ensure locks and tags are on panels prior to entering the Abatement Work Area.
- .3 Maintain Abatement Work Area in tidy condition.
- .4 Remove any standing water on polyethylene/floor at the end of every shift.

3.3 Asbestos Removal - General

- .1 Do not use powered tools or non-hand held tools.
- .2 Do not use compressed air to clean or remove dust or debris.
- .3 Do not break, cut, drill, abrade, grind, sand or vibrate ACM if it cannot be wetted. Type 2 (Moderate Risk) procedures would be required if the material cannot be wetted due to hazard or damage.
- .4 Wet ACM prior to work and keep ACM wet throughout the removal process.
- .5 Frequently and at regular intervals during the work, clean up dust and waste using HEPA vacuums and/or wet sweeping or mopping.

- .6 Frequently and at regular intervals, place all waste in asbestos waste containers.
- .7 Immediately upon completion of work, clean area with HEPA vacuum and/or wet sweeping or mopping.

3.4 Asbestos Removal - Vinyl Asbestos Tile

- .1 Wedge a heavy duty scraper in seam of two adjoining tiles and gradually force edge of one tile up and away from floor. Do not break off pieces of tile, but continue to force balance of tile up.
- .2 Place tile, without breaking into smaller pieces, into Asbestos Waste Container.
- .3 Force scraper through tightly adhered areas by striking scraper handle with a hammer.
- .4 Heat tile thoroughly with a hot air gun until heat penetrates through tile and softens adhesive in areas where scraper will not remove tile.
- .5 Scrape up adhesive remaining on floor with a hand scraper until only a thin smooth film remains.
- .6 Use a hot air gun where deposits are heavy or difficult to scrape.
- .7 Deposit scrapings into asbestos waste disposal bag.
- .8 HEPA vacuum floor on completion of work in area.

3.5 Asbestos Removal – Asphalt Plank Flooring

- .1 Wet all material to be disturbed.
- .2 Remove sections of asphalt Plank Flooring.
- .3 Use only non-powered hand-held tools to remove ACM.
- .4 Place directly into asbestos waste container.
- .5 HEPA vacuum floor on completion of work.

3.6 Asbestos Removal – Asbestos Transite Board

- .1 Wet all material to be disturbed.
- .2 Undo fasteners if necessary to remove material.
- .3 Break material only if unavoidable, and wet material if broken during work.
- .4 Use only non-powered hand-held tools to remove ACM.
- .5 Scrape to remove material adhered to substrate.
- .6 Place removed ACM directly into an asbestos waste container.

3.7 Abatement Work Area Dismantling

- .1 Do not commence site dismantlement until authorized by the Asbestos Abatement Consultant.
- .2 Schedule and obtain written approval of Milestone Inspection – Clearance Sampling before proceeding.
- .3 Wash or HEPA vacuum equipment and tools used in contaminated Abatement Work Area to remove all asbestos contamination, or place in Asbestos Waste Containers prior to being removed from Abatement Work Area.

- .4 Place tools and equipment used in contaminated work site but not cleaned in polyethylene bags prior to removal from Abatement Work Area.
- .5 Clean polyethylene sheeting and drop sheets with HEPA vacuum or wet cleaning methods at completion of work.
- .6 Wet drop sheets and polyethylene sheeting.
- .7 Carefully roll polyethylene sheeting and drop sheets toward the centre. As polyethylene is rolled away, immediately remove visible debris beneath with a HEPA vacuum.
- .8 Remove remaining polyethylene sheeting and tape.
- .9 Place polyethylene sheeting, drop sheets, tape, disposal clothing and other contaminated waste in asbestos waste containers, wet wipe and place in second asbestos waste container.

3.8 Waste and Material Handling

- .1 Refer to Section 02 81 00.

END OF SECTION

PART 1 GENERAL

1.1 General and Related Work

- .1 Read this Section in conjunction with all drawings and all other Sections so as to comply with the requirements of Division 1 and the General Conditions of the Contract.
- .2 Requirements specified elsewhere:
 - .1 Section 02 81 00 Hazardous Materials – General Provisions

1.2 Outline of Work

- .1 Refer to Section 02 81 00 Hazardous Materials – General Provisions for the Outline of Work.
- .2 Install Hoarding Walls between Abatement Work Area boundaries.
 - .1 Install Type A Hoarding Walls.
- .3 Using Type 3 (High Risk) procedures of this section, remove and dispose of the following:
 - .1 Drywall with asbestos-containing joint compound.
 - .2 Asbestos-containing pipe insulation where present within an established Type 3 containment.
 - .3 Asbestos-containing vermiculite.

1.3 Personal Protection

- .1 Protect all personnel at all times when possibility of disturbance of ACM exists.
- .2 Provide the following respiratory protection to all personnel:
 - .1 Full Face Air Purifying Respirators with P100 high efficiency (HEPA) cartridge filters during projects when performing wet abatement asbestos-containing or contaminated materials specified in this section.
 - .2 Non-powered half-face respirators with P100 high efficiency (HEPA) cartridge filters for dismantling of Type 3 [High Risk] enclosures, using Type 2 [Moderate Risk] Procedures.
- .3 Provide protective clothing, to all personnel entering the Abatement Work Area.
- .4 Wear hard hats, safety shoes and other personal protective equipment required by applicable construction safety regulations.

1.4 Differential Pressure Monitoring

- .1 Install differential pressure monitor at a location chosen by the Abatement Consultant.
- .2 Co-operate with the Abatement Consultant in collection of pressure monitoring data.
- .3 Maintain specified differential pressure at monitoring location. Negative air pressure is to be -0.02 inches of water, relative to the area outside the enclosed area.

1.5 Inspections

- .1 Refer to Part 1.12 Inspections in Section 02 81 00 – General Provisions.
- .2 The following Milestone Inspections are to be scheduled:
 - .1 Milestone Inspection - Clean Site Preparation

- .2 Milestone Inspection – Bulk Removal Inspection
- .3 Milestone Inspection - Visual Clearance
- .4 Milestone Inspection – Clearance Sampling

PART 2 PRODUCTS AND FACILITIES

2.1 Materials and Equipment

- .1 Refer to Section 02 81 00.

2.2 Hoarding Walls

- .1 Type A Hoarding Wall: 38 mm x 89 mm wood or metal studs at 400 mm o/c with continuous sill and top plate, covered with one layer of rip-proof polyethylene sheeting on each side of wall.

2.3 Decontamination Facilities

- .1 Workers' Decontamination Facility: A decontamination facility comprised of three linked rooms, Contaminated Change Room, a Shower Room, and a Clean Change Room.
 - .1 Rooms, Occupied Areas and Abatement Work Areas, shall be separated by curtained doorways at each door.
 - .2 Contaminated Change Room: Room between Shower Room and Abatement Work Area.
 - .1 Locate on contaminated side of Shower Room.
 - .2 Install asbestos waste container for asbestos contaminated protective clothing.
 - .3 Install storage facilities for any personal protective equipment to be reused in Abatement Work Area including boots, hard hats, etc., but excluding respirators.
 - .4 Install hooks and shelves as required for personal protective equipment.
 - .5 Minimum size of generally 2 m x 2 m. Increase size accordingly to accommodate number of workers.
 - .3 Shower Room: Room between Clean Change Room and Contaminated Change Room.
 - .1 Install one walk through shower unit for every six workers.
 - .2 Install constant supply of hot and cold water, controllable at each shower. Water supply must be sufficient to provide water at a minimum temperature of 40 degrees Celsius (maximum 50 degrees) in a volume required for all workers to properly decontaminate.
 - .1 Install individual hot and cold shut-off valves on water supply located on clean side of Shower Room. Connect shower to these valves.
 - .2 Install individual controls inside the shower to regulate water flow and temperature.
 - .3 Install rigid piping or Shower Hose with watertight connections for supply and drains.
 - .4 Install a sealed drip pan under and around the showers, 150 mm deep.
 - .5 Install sump pumps, sufficient for volume of waste shower water from showers and drip pan. Direct waste shower water to sanitary drains.
 - .6 Install ground fault protected power switch on clean side of shower for sump pumps, or timed for shut off.
 - .7 Provide adequate quantity of soap, shampoo, clean towels

- .8 Install an Asbestos Waste Container for disposal of used respirator filters, on the contaminated side of the Shower Room.
- .4 Clean Change Room: A room between the Shower Room and Occupied Areas.
 - .1 Install hooks and shelves on clean side of shower in clean Change Room for storage of respirators.
 - .2 Install lockers or hangers for workers' street clothes and personal belongings.
 - .3 Provide ground fault protected power supply to hot water tanks, sump pump, battery chargers.
 - .4 Install a fire extinguisher, mount to wall.
 - .5 Minimum size of generally 2m x 2m. Increase size accordingly to accommodate number of workers.
- .5 Waste and Equipment Decontamination Facility: Waste and Equipment Decontamination Facility comprised of three linked rooms: a Container Cleaning Room, a Holding Room and a Transfer Room.
 - .1 Purpose of Waste and Equipment Decontamination Facility is to provide a means to decontaminate asbestos waste containers, scaffolding, vacuums, and other tools and equipment and materials required in the Abatement Work Area.
 - .2 Rooms, Occupied Areas and Abatement Work Areas, shall be separated by curtained doorways at each door.
- .6 Container Cleaning Room: Room between Abatement Work Area and Holding Room of sufficient size to allow proper washing of equipment and waste containers or double bagging of asbestos waste. All wash water shall be treated as asbestos contaminated waste.
- .7 Holding Room: Room between Container Cleaning Room and Transfer Room, of sufficient size to accommodate at least two asbestos waste containers and two workers double bagging waste, or for largest item of equipment used.
 - .1 Install a fire extinguisher mounted to wall.
- .8 Transfer Room: Room between Holding Room and Occupied Area, acting as an air lock for the transfer of waste.
- .9 Construction of Decontamination Facilities
 - .1 Install floor protection as follows:
 - .1 Install one layer of rip-proof polyethylene sheeting over two layers of 6 mil polyethylene sheeting beneath entire decontamination facility.
 - .2 Turn 600 mm of polyethylene up the sides of the decontamination facility and overlap with the polyethylene sheeting covering the walls.
 - .2 Install walls as follows:
 - .1 Around all rooms, between all rooms, at entrance to Abatement Work Area and at entrance to Occupied Area.
 - .2 Install 38 x 89 mm wood framing at 610 mm o/c with continuous top and sill plates.
 - .3 Install one layer rip-proof polyethylene sheeting on interior walls of Decontamination Facility.

- .4 Install one layer rip-proof polyethylene sheeting both sides on interior dividing walls of Decontamination Facility.
- .5 Install one layer rip-proof polyethylene sheeting over one layer of 6 mil polyethylene sheeting on walls exposed to the Abatement Work Area.
- .6 Install one layer rip-proof polyethylene sheeting over one layer of 6 mil polyethylene sheeting on walls exposed to the Occupied Area.
- .3 Install roof as follows:
 - .1 Install joists. Size of joists is to be determined by clear span. Consult Provincial Building Code. For clear spans up to 2850 mm use SPF Select 38 x 140 mm wood joist at 400 mm o/c with continuous 38 x 140 mm wood headers, and install strapping beneath joists.
 - .2 At the Contaminated Change Room and where roof is exposed to the Abatement Work Area, install 19 mm plywood or OSB over joists. Caulk and tape joints and install one layer rip-proof polyethylene sheeting over 2 layers of 6 mil polyethylene sheeting.
 - .3 Where roof is not exposed to the Abatement Work Area, install one layer rip-proof polyethylene sheeting over joists.
 - .4 Turn 600 mm of polyethylene down the sides over polyethylene on the perimeter walls.
 - .5 At underside of joists in all rooms, install one layer of polyethylene sheeting.
 - .6 Minimum interior clear height 2000 mm to underside of joist.
- .10 Curtained Doorways
 - .1 Construct as follows:
 - .1 Install two flap doors, full width and height of door opening at all doors between chambers, facilities and Abatement Work Area.
 - .2 Construct each flap door of two layers of polyethylene sheeting with all edges reinforced with tape. Use wood strapping to securely fasten flap doors to head and alternate jambs.
 - .3 Install weights attached to bottom edge of each door flap.
 - .4 Provide direction arrows on flaps to indicate opening.

PART 3 EXECUTION

3.1 Clean Site Preparation

- .1 Moving of equipment, tools, supplies, and stored materials that can be performed without disturbing ACM will be performed by others.
- .2 Remove visible dust and friable material from all surfaces in the work area including those to be worked on, using HEPA Vacuums or wet wiping using Type 2 (Moderate Risk) Procedures.
- .3 Remove surface mounted fixtures specified to be reused or turned over to the City of Winnipeg.
- .4 Install Hoarding Walls between Abatement Work Area and Occupied Area.
- .5 Install separate Worker and Waste Decontamination facilities.

- .6 Install one layer of rip-proof polyethylene sheeting over two layers of 6 mil polyethylene sheeting so as to protect all equipment and finishes in the Abatement Work Area that may be damaged. Items to remain include but are not limited to:
 - .1 Millwork.
 - .2 Doors.
 - .3 Bulkheads.
 - .4 Toilet Partitions.
 - .5 Plumbing fixtures.
 - .6 Electrical Equipment.
 - .7 Mechanical Equipment.
- .7 Seal openings (excepting electrical trenches) in floor using tape, caulking, polyethylene, etc. Openings in floor are to be sealed independently prior to installation of polyethylene sheeting on floor. Include floors of duct and service shafts.
- .8 Seal openings in walls below ceiling level using polyethylene, tape, caulking, etc. including but not limited to windows, doors, vents, diffusers, etc.
- .9 Seal openings in ceiling, using polyethylene, tape, caulking, etc. including diffusers, grills, etc.
- .10 Install one layer of rip-proof polyethylene sheeting over two layers of 6 mil polyethylene sheeting, on floor surfaces in Abatement Work Area.
 - .1 Install additional layers of rip-proof polyethylene and/or plywood to protect carpeted floor surfaces.
 - .2 Extend floor protection a minimum of 300 mm up all vertical surfaces in the Abatement Work Area.
- .11 On walls within and forming the perimeter of the Abatement Work Area install two layers of 6 mil polyethylene sheeting.
 - .1 At junction of floor and wall surface overlap floor polyethylene with wall polyethylene by a minimum of 300 mm at each layer. One layer of wall polyethylene must always overlap the top layer of floor polyethylene.
- .12 Establish negative pressure in Abatement Work Areas as follows:
 - .1 Discharge HEPA filtered negative pressure machines as follows:
 - .1 To building exterior.
 - .1 Remove existing glazing where necessary and replace with a 19 mm plywood panel.
 - .2 Install panel securely on the exterior side of the window frame and make weather-tight with caulking.
 - .3 For each negative pressure unit, provide a 300 mm diameter, duct opening through panel.
 - .4 Cover duct opening with wire screen and/or chicken wire or extruded metal screen to prevent insect and animal entry.
 - .5 Direct discharge away from building access points or fresh air intakes.
 - .6 Reinstall glazing to match existing upon completion of work.

- .2 Use metal reinforced polyethylene discharge ducting in locations where the ducting must be protected from damage or collapse.
- .3 Install and make airtight all negative air discharge ducting.
- .4 Discharge ducting is not to be longer than required, and to be straight, so that the length of the ducting does not reduce the flow from negative pressure machines.
- .5 Install in-line booster fans along the length of discharge ducting wherever site conditions require negative air unit discharge to be directed over distances greater than 12 m (40 ft.). Position booster fans so as to avoid any disruption to operations in Occupied areas.
- .2 Leak test in place using DOP method, negative pressure units which discharge directly into Occupied Areas.
- .13 Provide one specified ground fault electrical panel for each 300 square metres of Asbestos Work Area. All electrical apparatus including temporary heating equipment shall be supplied from a ground fault system. Ensure safe installation of electrical lines and equipment by skilled tradesmen.
- .14 Install temporary lighting in all work areas at levels that will provide for a safe and efficient use of the work area.
- .15 Isolate, at panel, and disconnect existing power supply to Abatement Work Area. Power supply to remaining areas of building must not be disrupted during work of this section.
 - .1 Lock-out/tag-out power at electrical panels.
 - .2 Mark/tag any items within or passing through the Abatement Work Area that are to remain live including but not limited to cable, conduit, wire, fixtures, equipment panels, etc.
- .16 Shut down HVAC systems serving the Abatement Work Area.
- .17 Perform clean demolition of non-asbestos materials as specified.
- .18 Install signage in clearly visible locations and in sufficient numbers to adequately warn of an asbestos dust hazard.
- .19 Notify Abatement consultant Milestone Inspection - Clean Site Preparation. Obtain written approval for this Milestone Inspection before proceeding.

3.2 Maintenance Of Contaminated Abatement Work Area

- .1 Inspect Abatement Work Area perimeter Hoarding Walls and Upper Perimeter Seals at the beginning and end of each working period and once on each day work does not take place. Inspection must be performed by competent person.
- .2 Inspect HEPA filtered negative pressure machines including discharge ducting at the beginning and end of each working period. Inspection must be performed by competent person.
- .3 Perform Differential Pressure Monitoring on a frequent basis and record pressure at start and end of shift at a minimum.
- .4 Inspect polyethylene sheeting and ensure it is effectively sealed and taped. Repair damage and remedy defects immediately.
- .5 Inspect electrical panels and ensure locks and tags are on panels prior to entering the Abatement Work Area.

- .6 Maintain Abatement Work Area in tidy condition.
- .7 Remove waste and debris frequently.
- .8 Remove standing water on polyethylene/floor at the end of every shift.
- .9 Turn off water supply to hoses and reduce pressure in hose, prior to leaving the Abatement Work Area at end of shift.
- .10 Turn off water supply to showers, at the end of every shift.
- .11 Ensure shower pans are pumped out at the end of every use and shift.

3.3 Wet Removal

- .1 Do not use compressed air to clean or remove dust or debris.
- .2 Remove and dispose of remaining non-asbestos items before, during or after wet removal.
- .3 Spray drywall with asbestos-containing joint compound with Amended Water using airless spray equipment prior to removal. Saturate ACM to prevent release of airborne fibres during removal. The use of pressure spraying equipment of any type to remove asbestos-containing materials is not permitted.
- .4 Remove asbestos-containing drywall, clean substrate.
 - .1 Fully saturated ACM may be placed directly into waste containers or may be allowed to fall to floor.
- .5 Spray asbestos-containing pipe insulations with Amended Water using airless spray equipment.
- .6 Remove pipe insulations to be removed and clean substrate. Maintain exposed surfaces of insulation or lagging in a wet condition.
 - .1 Full saturation of insulation will not be required if material is immediately bagged and not allowed to fall to floor.
- .7 Demolish block walls that have asbestos-containing vermiculite. Ensure that load bearing walls are structurally supported during demolition with shoring etc. Spray debris generated during demolition with Amended Water using airless spray equipment. Place waste into waste containers. Large sections of block wall can be cleaned and disposed of as non-hazardous waste.
- .8 Remove obstructions as required to remove the ACM.
 - .1 Notify Abatement Consultant if item is not specified to be removed and inhibits removal of ACM.
 - .2 Do not demolish any existing walls etc. that form the perimeter of the Abatement Work Area without prior written permission from Abatement Consultant.
- .9 All dislodged ACM shall be maintained in wet state until placed in asbestos waste containers for disposal.
- .10 As work progresses, and at regular intervals, place waste in asbestos waste containers and remove from the Abatement Work Area.

- .11 After completion of gross asbestos removal work, perform the following:
 - .1 Wet clean surfaces from which ACM has been removed with stiff bristle brushes, vacuums, wet-sponges etc. to remove all visible residue and asbestos-containing materials.
 - .2 Wet clean surfaces which ACM has fallen on using stiff bristle brushes, vacuums, wet-sponges etc. to remove all visible residue and asbestos-containing materials
 - .3 Wet clean other surfaces in the Abatement Work Area, including the decontamination facilities, scaffolding, equipment, polyethylene sheeting on floor and walls surfaces etc., ducts and similar items not covered with polyethylene sheeting.
 - .4 Remove wash water as contaminated waste.
 - .5 Remove waste.
 - .6 Level of cleanliness must be acceptable to Abatement Consultant.
 - .7 Remove and dispose of the pre-filters from all negative air units as asbestos-contaminated waste.
- .12 Notify Abatement Consultant to the need for Milestone Inspection - Visual Clearance.

3.4 Waste and Material Handling

- .1 Waste bins must be placed on grade or in receiving.
- .2 All bins must be covered and locked when waste transfer is not being performed.
- .3 Ensure redundant non-ACM, rubble, debris, etc. which was not cleaned and which was removed during contaminated work are treated, packaged, transported and disposed of as asbestos waste.
- .4 Clean, wash and apply Post Removal Sealant to metal waste prior to removal from Abatement Work Area.
 - .1 Recycle metals or dispose of metals as clean waste.
- .5 Clean, wash and apply Post Removal Sealant to non-porous materials prior to disposal as clean waste.
 - .1 Obtain prior written approval from the Abatement Consultant for each individual type of material.
- .6 Clean and wash equipment prior to removal from Abatement Work Area if removed prior to completion.
- .7 Place all equipment, tools and unused materials that cannot be cleaned in Asbestos Waste Containers.
- .8 As work progresses, and at regular intervals, transport the sealed and labelled asbestos waste containers from the Abatement Work Area to waste bin.
- .9 Place items in bins according to waste classification. Place asbestos waste, metals, non-asbestos waste, etc. in separate bins.

- .10 Removal of waste containers and decontaminated equipment and materials from the Abatement Work Area shall be performed using the Waste and Equipment Decontamination Facility as follows:
 - .1 Prior to entering the Waste and Equipment Decontamination Facility Container Cleaning Room, the first worker (fully protected inside the Abatement Work Area) shall remove any visible contamination from the surface of the item or waste container being removed from the Abatement Work Area.
 - .2 The first worker then carries the item into the Container Cleaning Room and wet sponges the item prior to passing the item through the curtained doorway to a second worker in the Holding Room. (The second worker shall be fully protected with respirator and disposable clothing and may only leave the decontamination facility via the Abatement Work Area.)
 - .3 The second worker in the Holding Room double bags or wraps and seals the item. Without entering the Transfer Room, the second worker passes the item through the curtained doorway into the Transfer Room.
 - .4 A third worker enters the Transfer Room from the clean area. (The third worker must never enter the Holding Room.) The third worker removes the item from the Transfer Room and transports it to the disposal bin.
- .11 Dispose of asbestos-contaminated waste that could tear a 6 mil (0.15 mm) polyethylene bag in sealed rigid Asbestos Waste Container.
- .12 Transport waste and materials via the predetermined routes and exits. Arrange waste transfer route with the City of Winnipeg. Use a closed, covered cart to transport through Occupied Areas.
- .13 Provide workers transporting waste with means to access full personal protective equipment and all tools required to properly clean up spilled ACM in the case of a rupture of an Asbestos Waste Container.
- .14 Bin loading area and waste routes shall be kept clean at all times. Use Type 2 asbestos abatement procedures if appropriate or requested by the City of Winnipeg's Representative.
- .15 Pick-up and drop off of garbage bin shall be at pre-approved times, and must not interfere with the City of Winnipeg's operations.
- .16 Transport asbestos contaminated waste to landfill licensed by Manitoba Conservation and Climate.
- .17 Co-operate with inspectors from the provincial regulator and immediately carry out instructions for remedial work at dump to maintain environment, at no additional cost to the City of Winnipeg.

3.5 Application Of Post Removal Sealant

- .1 Wet Removal
 - .1 Obtain Abatement Consultant's written permission to proceed.
 - .2 Apply one coat of Post Removal Sealant with an airless sprayer, in accordance with Manufacturer's Instructions, to cover all surfaces on all items in the Abatement Work Area, including but not limited to polyethylene, ACM substrate, structural steel, and surfaces scheduled for demolition.
 - .3 Notify Abatement Consultant to the need for Milestone Inspection – Clearance Sampling.

3.6 Air Clearance Monitoring

- .1 Site must be dry prior to Air Clearance Monitoring.
- .2 The number of Air Clearance Monitoring samples will be as follows:
 - .1 One sample for every 250 square metres of enclosure volume, minimum of one.
- .3 Restrict access to Abatement Work Area and operate negative air units for a 12 hour period prior to Milestone Inspection – Clearance Sampling.
- .4 The HEPA filtered negative pressure machines shall be in operation during clearance air monitoring.
- .5 PCM samples will be collected as per Air Monitoring Section.

3.7 Abatement Work Area Dismantling

- .1 Continue to restrict access by other trades to the Asbestos Work Area.
- .2 Maintain hoardings, decontamination facilities and negative air unit(s) fully functional during teardown and removal of asbestos contaminated polyethylene, tape, etc.
- .3 Use Type 2 (Moderate Risk) worker precautions during dismantling.
- .4 Operate negative air units during dismantling.
- .5 Phase the removal of polyethylene, tape, polyurethane foam, caulking and enclosures from the Asbestos Work Area so as to maintain perimeter isolation as long as possible.
- .6 Polyethylene, tape, cleaning material, etc. to be treated as asbestos waste.
- .7 Wash remaining equipment and tools used in contaminated Abatement Work Area to remove all asbestos contamination, or place in Asbestos Waste Containers prior to being removed from Abatement Work Area.
- .8 Clean Abatement Work Area, Equipment and Access area, washing/Showering Room.
- .9 Remove upper seals, and seals over tops of walls, on deck, at columns, etc. within the Abatement Work Area.
- .10 Remove top layer of polyethylene sheeting from surfaces protected by two or more layers of polyethylene sheeting. Remove outer layer as follows:
 - .1 Remove asbestos contaminated Polyethylene by carefully rolling away from walls to centre of Abatement Work Area.
 - .2 Cut the lower layer of polyethylene sheeting to expose the baseboards, window sills, cabinets, shelves and other horizontal surfaces that may be contaminated by fallen ACM.
 - .3 Remove visible fibres or residue found during removal of polyethylene using a HEPA vacuum.
 - .4 Remove polyethylene protection and hoarding walls where hoarding walls separate occupied areas from work area. Hoarding walls to remain are identified on asbestos demolition drawings.
- .11 Remove top layer of polyethylene on walls, finishes, and equipment.
- .12 Remove remaining polyethylene sheeting.
- .13 Remove water hoses and shut off at source.
- .14 Remove Signs, Hoarding Walls, Decontamination Facilities.

- .15 Seal vacuum hoses and fittings, flexible ductwork and all tools used in contaminated work site in 6 mil polyethylene bags prior to removal from Work Area.
- .16 Remove temporary lights.
- .17 Remove negative air unit prefilters. Dispose of as asbestos contaminated waste.
- .18 Remove HEPA filtered negative pressure machines and discharge ducting.
- .19 Immediately upon shutting down negative air units, seal air inlet grill and exhaust vent with polyethylene and tape.
- .20 Notify Abatement Consultant to the need for Milestone Inspection - Dismantling Inspection.

3.8 Re-Establishment of Items

- .1 Upon completion of work:
 - .1 Remove and disconnect Ground fault Panel, tags and locks from electrical panels and re-energize equipment and items.
 - .2 Remove negative air discharge panel and reinstall glazing to match existing.
 - .3 Clean, mop and vacuum Abatement Work Area and area beneath Decontamination Facilities.
 - .4 Enable building air handling systems.
- .2 Notify Abatement Consultant to the need for Milestone Inspection – Re-establishment Inspection.

END OF SECTION

PART 1 GENERAL

1.1 General and Related Work

- .1 Read this Section in conjunction with all drawings and all other Sections so as to comply with the requirements of Division 1 and the General Conditions of the Contract.
- .2 Requirements specified elsewhere:
 - .1 Section 02 81 00 Hazardous Materials – General Provisions

1.2 Outline of Work

- .1 Refer to Section 02 81 00 Hazardous Materials – General Provisions for the Outline of Work.
- .2 Isolate the Abatement Work Area from adjoining spaces through the installation of temporary barriers and partitions as specified herein.
- .3 The intent of this Section is to provide safe work practices and procedures to govern the handling, removal, clean-up and disposal of asbestos-containing materials following Glove Bag procedures, and Pinchin and the City of Winnipeg’s specific requirements.
- .4 De-activate steam and condensate, and hot water heating pipe systems prior to work.

1.3 Instruction and Training

- .1 Provide instruction and training to all workers including the following:
 - .1 Hazards of asbestos.
 - .2 Use, care and disposal of protective equipment (including but not limited to respirators and filters) and clothing that would be used and worn during abatement work, including:
 - .1 Limitations of equipment.
 - .2 Inspection and maintenance of equipment.
 - .3 Proper fitting of equipment.
 - .4 Disinfecting and cleaning of equipment.
 - .3 Personal hygiene to be observed when performing the work.
 - .4 The measures and procedures prescribed by this section and decontamination of the worker.
 - .5 Instruction and training must be provided by a competent person.

1.4 Personal Protection

- .1 Protect all personnel at all times when possibility of disturbance of ACM exists.
- .2 Provide the following minimum respiratory protection to all personnel:
 - .1 Non-powered half-face respirators with P100 high efficiency (HEPA) cartridge filters.
- .3 Provide protective clothing, to all personnel entering the Abatement Work Area.
- .4 Wear hard hats, safety shoes and other personal protective equipment required by applicable construction safety regulations.

1.5 Inspections

- .1 Refer to Part 1.12 Inspections in Section 02 81 00 – General Provisions.
- .2 The following Milestone Inspections are to be scheduled:
 - .1 Milestone Inspection - Clean Site Preparation
 - .2 Milestone Inspection – Bulk Removal Inspection
 - .3 Milestone Inspection - Visual Clearance
 - .4 Milestone Inspection – Clearance Sampling

PART 2 PRODUCTS AND FACILITIES

2.1 Materials and Equipment

- .1 Refer to Section 02 81 00.
- .2 Glove Bag: Prefabricated bag which provides a completely sealed envelope surrounding a given section of piping to permit the removal of asbestos-containing insulation while maintaining the integrity of the bag and preventing the spread of airborne asbestos fibres. The glove bag shall be equipped with,
 - .1 sleeves and gloves that are permanently sealed to the body of the bag to allow the worker to access and deal with the insulation and maintain a sealed enclosure throughout the work period,
 - .2 valves or openings to allow insertion of a vacuum hose and the nozzle of a water sprayer while maintaining the seal to the pipe, duct or similar structure,
 - .3 a tool pouch with a drain,
 - .4 a seamless bottom and a means of sealing off the lower portion of the bag, and
- .3 Securing Straps: For some types of Glove Bag, reusable nylon straps at least 25mm wide with metal tightening buckle for sealing ends of bags around pipe and/or insulation.

PART 3 EXECUTION

3.1 Site Preparation - General

- .1 Moving of equipment, tools, supplies, and stored materials that can be performed without disturbing ACM will be performed by others.
- .1 Shut down HVAC systems serving the Abatement Work Area.
 - .1 Install polyethylene sheeting over openings in ducts and at diffusers and seal.
 - .2 HVAC to remaining areas of building must not be disrupted during work of this section.
 - .3 System shall remain inoperative until completion of work, unless ducts can be effectively capped.
 - .4 Perform work at scheduled times after shutting down HVAC systems affecting the Abatement Work Area.
- .2 Install caution tape around work area where existing walls are not present.
- .3 Install Signage in clearly visible locations and in sufficient numbers to adequately warn of an asbestos dust hazard.
- .4 Remove visible dust and friable material from all surfaces in the work area including those to be worked on, using HEPA Vacuums or wet wiping.

- .5 Cover walls, floors, finishes, millwork, equipment and furnishings below the pipe to be worked on in the Abatement Work Area with polyethylene sheets before disturbing ACM. Drop sheets shall extend a minimum of 1,800 mm from pipe.
- .6 Use existing lighting or install temporary lighting to a level that will provide for safe and efficient use of work area - minimum 550 LUX.
- .7 Provide Amended Water for wetting ACM, in garden sprayers. Provide one garden sprayer for each worker.
- .8 Do not use compressed air to clean or remove dust or debris when completing work of this section.
- .9 Place HEPA Vacuum in Abatement Work Area for each worker.
- .10 Place required tools to complete the abatement within the Abatement Work Area.
- .11 Install Signage in clearly visible locations and in sufficient numbers to adequately warn of an asbestos dust hazard.
- .12 Schedule and obtain written approval of Milestone Inspection - Clean Site Preparation before proceeding.

3.2 Maintenance of Abatement Work Area

- .1 Maintain Abatement Work Area in tidy condition.

3.3 Glove Bag Removal

- .1 Do not use Glove Bags on hot pipes that may damage Glove Bag. Refer to manufacturers limitations.
- .2 Prior to use of Glove Bag on damaged or unjacketed insulation:
 - .1 Spray any areas of damaged insulation jacketing with mist of Amended Water.
 - .2 Tape over damaged insulation to provide temporary repair.
 - .3 Mist areas of insulation with no jacketing and wrap with polyethylene sheeting and seal with tape.
- .3 Place any tools necessary to remove insulation in tool pouch built into Glove Bag.
- .4 Inspect the Glove Bag for damage and defects immediately before it is attached to the pipe or duct.
 - .1 If damage or defects are observed, dispose of Glove Bag.
- .5 Install Glove Bag as per manufacturer's instructions.
- .6 Remove metal jacketing or banding carefully. Do not damage the Glove Bag.
- .7 Remove insulation from pipe as per manufacturer's directions.
 - .1 Volume and weight of insulation must not exceed capacity of the Glove Bag or supports.
 - .2 Arrange insulation in the Glove Bag to maximize use of the Glove Bag.
- .8 Only single use glove bags are permitted.

- .9 At regular intervals during its use, if damage or defects are observed during the use of the Glove Bag, which cannot be readily repaired with tape and not affect the integrity or strength of the glove bag.
 - .1 Discontinue use of Glove Bag.
 - .2 Wash inner surface of Glove Bag.
 - .3 Wet insulation.
 - .4 Pull an Asbestos Waste Container over Glove Bag before removing from pipe.
 - .5 Remove Glove Bag and Asbestos Waste Container, seal with tape.
 - .6 Place in a second Asbestos Waste Container and seal with tape.
 - .7 Clean immediate area with a HEPA Vacuum prior to resuming work.
- .10 Glove bags may not be moved along pipe for use on adjacent sections of insulation:
- .11 To remove bag after completion of insulation removal operation:
 - .1 Wash inner surface of Glove Bag.
 - .2 Wash and place all tools in one hand (glove), pull hand out inverted, twist to create a separate pouch, tape inverted hand at two separate locations 25 mm apart so as to seal pouch.
 - .1 Remove inverted hand and tools by cutting between the two tape seals.
 - .2 Place inverted hand pouch and tools into the next clean Glove Bag to be used or into a water bucket, open pouch underwater and clean tools.
 - .3 Wet surface of insulation in lower section of bag and any exposed end of asbestos insulation remaining on pipe with Amended Water.
 - .4 Insert nozzle of HEPA filtered vacuum cleaner into bag through valve and evacuate air from bag.
 - .5 Seal valve cover on valve Glove Bags.
 - .6 Seal closure strip if equipped with one. Twist bag at tapered point and secure with tape.
 - .7 Pull an Asbestos Waste Container over Glove Bag before removing from pipe.
 - .1 Cut upper portion of single-use Glove Bag.
 - .2 Seal Asbestos Waste Container with tape.
 - .8 Ensure pipe is clean of all residue after removal of Glove Bag. If necessary, after removal of each section of asbestos, vacuum all surfaces of pipe, using HEPA vacuum or wipe with wet cloth.
- .12 Seal all surfaces of freshly-exposed pipe with Post Removal Sealer.
- .13 Cover exposed ends of any remaining asbestos insulation with canvas and lagging using Type 2 or Moderate Risk Procedures.

3.4 Clean-Up and Dismantling

- .1 Remove equipment and tools.
- .2 Remove temporary lighting if used.
- .3 Remove polyethylene seals from HVAC systems.

- .4 Place polyethylene sheeting, drop sheets, seals, tape, clothing and other contaminated waste in asbestos waste containers, wet wipe and place in second asbestos waste container.
- .5 Clean Abatement Work Area with HEPA vacuums or wet wiping/mopping.
- .6 Seal openings in HEPA vacuums.
- .7 Proceed with the dismantlement of all barricades, etc. following receipt of authorization to proceed from the Asbestos Abatement Consultant.
- .8 Schedule and obtain written approval of Milestone Inspection – Clearance Sampling before proceeding with the removal of all barricades, etc..
- .9 Remove barricades, fencing, caution tape, signs, etc.

3.5 Waste and Material Handling

- .1 Refer to Section 02 81 00.

3.6 Re-Establishment of Items

- .1 Upon completion of work:
 - .1 Enable building air handling systems.
 - .2 Clean and vacuum Abatement Work Area.

END OF SECTION

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 International)
 - .1 CSA-A23.1-09/A23.2-09, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
 - .2 CSA O121-2008, Douglas Fir Plywood.
 - .3 CSA O151-09, Canadian Softwood Plywood.
 - .4 CSA O153-M1980(R2008), Poplar Plywood.
 - .5 CSA-O325-07, Construction Sheathing.
 - .6 CSA O437 Series-93(R2006), Standards for OSB and Waferboard.
 - .7 CSA-O86-09, Engineering Design in Wood.
 - .8 CSA S269.1-1975(R2003), Falsework for Construction Purposes.
 - .9 CAN/CSA-S269.3-M92(R2008), Concrete Formwork, National Standard of Canada

1.3 MEASUREMENT PROCEDURES

- .1 No measurement will be made under this Section. Include costs in items of work for which concrete formwork and falsework is required.

1.4 SUBMITTALS

- .1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit shop drawings for formwork and falsework.
 - .1 Upon request Submit drawings stamped and signed by professional engineer registered or licensed in Province of Manitoba, Canada.
- .3 Indicate method and schedule of construction, shoring, stripping and re-shoring procedures, materials, arrangement of joints, special architectural exposed finishes, ties, liners, and locations of temporary embedded parts. Comply with CSA S269.1, for falsework drawings. Comply with CAN/CSA-S269.3 for formwork drawings.
- .4 Indicate formwork design data: permissible rate of concrete placement, and temperature of concrete, in forms.

Part 2 Products

2.1 MATERIALS

- .1 Formwork materials:
 - .1 For concrete without special architectural features, use wood and wood product formwork materials to CSA-O121, CAN/CSA-O86, and CSA-O153.
 - .2 For concrete with special architectural features, use formwork materials to CSA-A23.1/A23.2.
- .2 Pan forms: removable steel, or reinforced plastic to match existing profiles and dimensions.
- .3 Tubular column forms: round, internally treated with release material.
 - .1 Spiral pattern may show in hardened concrete, except where column is designated architectural finish, where it shall not show in hardened concrete.
- .4 Form ties:
 - .1 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 diameter in concrete surface.
 - .2 For Architectural concrete, use snap ties complete with plastic cones and light grey concrete plugs.
- .5 Form liner:
 - .1 Plywood: high density overlay.
- .6 Form release agent: non-toxic, biodegradable, low VOC.
- .7 Form stripping agent: colourless mineral oil, non-toxic, biodegradable, low VOC, free of kerosene.
- .8 Falsework materials: to CSA-S269.1.

Part 3 Execution

3.1 FABRICATION AND ERECTION

- .1 Fabricate and erect falsework in accordance with CSA S269.1.
- .2 Refer to drawings for concrete members requiring architectural exposed finishes.
- .3 Do not place shores and mud sills on frozen ground.
- .4 Provide site drainage to prevent washout of soil supporting mud sills and shores.
- .5 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.
- .6 Align form joints and make watertight. Keep form joints to minimum.

- .7 Locate horizontal form joints for exposed columns 2400 mm above finished floor elevation.
- .8 Use 25 mm chamfer strips on external corners and/or 25 mm fillets at interior corners, joints, unless specified otherwise.
- .9 Form chases, slots, openings, drips, recesses, expansion and control joints as indicated.
- .10 Construct forms for architectural concrete, and place ties as indicated and as directed. Joint pattern not necessarily based on using standard size panels or maximum permissible spacing of ties.
- .11 Build in anchors, sleeves, and other inserts required to accommodate Work specified in other sections. Ensure that anchors and inserts will not protrude beyond surfaces designated to receive applied finishes, including painting.
- .12 Line forms for following surfaces:
 - .1 Surfaces designated as architectural finish.
 - .2 Secure lining taut to formwork to prevent folds.
 - .3 Pull down lining over edges of formwork panels.
 - .4 Ensure lining is new and not reused material.
 - .5 Ensure lining is dry and free of oil when concrete is poured.
 - .6 Application of form release agents on formwork surface is prohibited where drainage lining is used.
 - .7 If concrete surfaces require cleaning after form removal, use only pressurized water stream so as not to alter concrete's smooth finish.
 - .8 Cost of textile lining is included in price of concrete for corresponding portion of Work.
- .13 Clean formwork in accordance with CSA-A23.1/A23.2, before placing concrete.

3.2 REMOVAL AND RESHORING

- .1 Notify Contract Administrator 24 hours in advance prior to removing formwork.
- .2 Do not remove forms and bracing until concrete has gained sufficient strength to carry its own weight, construction loads, design loads that are liable to be imposed upon it. Verify strength of concrete by compressive test results.
- .3 Leave formwork in place for following minimum periods of time after placing concrete:

LOCATION	TEMPERATURE IN °C		
	21-35	15-21	10-15
Walls	2 days	3 days	4 days
Grade Beams	2 days	3 days	4 days
Side Forms	2 days	3 days	4 days
Slabs *	7 days	7 days	14 days
Beams *	7 days	7 days	14 days
Structural Shoring *	7 days	7 days	14 days

* formwork below/supporting these elements shall remain in place for the minimums stated above and then replaced with shoring posts until concrete is 28 days old. Formwork can be removed and replaced with shoring posts earlier, if concrete test cylinders show a strength of 75% of the required 28 day strength.

- .4 Reshore structural members where required due to design requirements or construction conditions and as required to permit progressive construction.
- .5 Remove formwork progressively and in accordance with Building and Safety Code requirements and so that no shock loads or unbalanced loads are imposed on structure.
- .6 Loosen forms carefully. Do not wedge pry bars, hammers, or tools against concrete surfaces.
- .7 Store removed forms, for exposed concrete, so surfaces in contact with fresh concrete will not be damaged. Marked or scored forms will be rejected.
- .8 Re-use formwork subject to requirements of CAN/CSA-A23.1.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 03 10 00 – Concrete Forms.
- .2 Section 03 30 00 – Cast-in-Place Concrete.

1.2 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CSA-A23.1-09/A23.2-09, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
 - .2 CAN/CSA-G30.18-09, Billet-Steel Bars for Concrete Reinforcement, A National Standard of Canada.
 - .3 CSA-G40.20/G40.21-04(R2009), General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
 - .4 CAN/CSA-G164-M92(R2003)(withdrawn), Hot Dip Galvanizing of Irregularly Shaped Articles, A National Standard of Canada.
 - .5 CSA W186-M1990(R2007), Welding of Reinforcing Bars in Reinforced Concrete Construction.
- .2 American Society for Testing and Materials International (ASTM)
 - .1 ASTM A82-07, Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.
 - .2 ASTM A185/A185M-07, Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete.
 - .3 ASTM A775/A775M-07b, Standard Specification for Epoxy-Coated Reinforcing Steel Bars.
- .3 Reinforcing Steel Institute of Canada (RSIC)
 - .1 RSIC-2004, Reinforcing Steel Manual of Standard Practice.

1.3 MEASUREMENT PROCEDURES

- .1 Reinforcing steel will be measured in kilograms of steel incorporated into work, computed from theoretical unit mass specified in CAN/CSA G30.18 for lengths and sizes of bars as indicated.
- .2 No measurement will be made under this Section.
 - .1 Include reinforcement costs in items of concrete work in Section 03 30 00 - Cast-In-Place Concrete.

1.4 SUBMITTALS

- .1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.
 - .2 Prepare reinforcement drawings in accordance with RSIC Manual of Standard Practice.
-

- .3 Submit shop drawings including placing of reinforcement and indicate:
 - .1 Bar bending details.
 - .2 Lists.
 - .3 Quantities of reinforcement.
 - .4 Sizes, spacings, locations of reinforcement and mechanical splices if approved by Contract Administrator, with identifying code marks to permit correct placement without reference to structural drawings.
 - .5 Indicate sizes, spacings and locations of chairs, spacers and hangers.
- .4 Detail lap lengths and bar development lengths to CSA-A23.3, unless otherwise indicated.
 - .1 Provide class B tension lap splices unless otherwise indicated.

Part 2 Products

2.1 MATERIALS

- .1 Substitute different size bars only if permitted in writing by Contract Administrator.
- .2 Reinforcing steel: All reinforcing steel to be CAN/CSA-G30.18M grade 400R deformed bars except column ties and beam stirrups which shall be grade 400W.
- .3 Cold drawn annealed steel wire ties: to ASTM A82.
- .4 Welded steel wire fabric: to ASTM A185/A185M. Provide in flat sheets only.
- .5 Epoxy Coating of non-prestressed reinforcement: to ASTM A775/A775M.
- .6 Galvanizing of non-prestressed reinforcement: to CAN/CSA-G164, minimum zinc coating 610 g/m².
- .7 Chairs, bolsters, bar supports, spacers: to CSA-A23.1/A23.2.
- .8 Mechanical splices: subject to approval of Contract Administrator.
- .9 Plain round bars: to CSA-G40.20/G40.21.

2.2 FABRICATION

- .1 Fabricate reinforcing steel in accordance with CSA-A23.1/A23.2 and Reinforcing Steel Manual of Standard Practice by the Reinforcing Steel Institute of Canada.
 - .2 All reinforcing is to be detailed in accordance with the latest edition of the Reinforcing Steel Institute of Canada - Manual of Standard Practice, except otherwise noted
 - .3 Obtain Contract Administrator's approval for locations of reinforcement splices other than those shown on placing drawings.
 - .4 Upon approval of Contract Administrator, weld reinforcement in accordance with CSA W186.
-

- .5 Ship bundles of bar reinforcement, clearly identified in accordance with bar bending details and lists.

- .1 Ship epoxy coated bars in accordance with ASTM A775A/A775M.

2.3 SOURCE QUALITY CONTROL

- .1 Upon request, provide Contract Administrator with certified copy of mill test report of reinforcing steel, showing physical and chemical analysis.
- .2 Upon request inform Contract Administrator 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 Contract Administrator.
- .2 When field bending is authorized, bend without heat, applying slow and steady pressure.
- .3 Replace bars, which develop cracks or splits.

3.2 PLACING REINFORCEMENT

- .1 Place reinforcing steel as indicated on placing drawings and in accordance with CSA-A23.1/A23.2.
- .2 Use plain round bars as slip dowels in concrete where noted on the drawings.
 - .1 Paint portion of dowel intended to move within hardened concrete with one coat of asphalt paint.
 - .2 When paint is dry, apply thick even film of mineral lubricating grease.
- .3 Prior to placing concrete, obtain Contract Administrator's approval of reinforcing material and placement.
- .4 Ensure cover to reinforcement is maintained during concrete pour.
- .5 Protect epoxy coated portions of bars with covering during transportation and handling.

3.3 DOWELING PROCEDURES

- .1 For bars that are indicated as being dowelled in, drill in and epoxy grout bars as follows:
 - .1 10M bars, 200 mm
 - .2 15M bars, 250 mm
 - .3 20M bars, 350 mm
 - .4 25M bars, 400 mm
 - .2 Use only approved adhesive to manufacturer's instructions. Acceptable product:
-

- .1 Hilti HIT HY-200 MAX/HIT-ICE by Hilti Canada.
- .3 Clean hole thoroughly prior to application of epoxy. Use injection or caulking gun to ensure that the epoxy fills the bottom of the hole prior to embedment of bar.

3.4 FIELD TOUCH-UP

- .1 Touch up damaged and cut ends of epoxy coated reinforcing steel with compatible finish to provide continuous coating.

END OF SECTION

1.1 RELATED SECTIONS

- .1 Section 03 10 00 – Concrete Forms.
- .2 Section 03 20 00 – Concrete Reinforcing.

1.2 REFERENCES

- .1 American Society for Testing and Materials International (ASTM)
 - .1 ASTM C260/C250M-10a, Standard Specification for Air-Entraining Admixtures for Concrete.
 - .2 ASTM C309-11, Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
 - .3 ASTM C330/C330M-14, Standard Specification for Lightweight Aggregates for Structural Concrete.
 - .4 ASTM C494/C494M-13, Standard Specification for Chemical Admixtures for Concrete.
 - .5 ASTM C1017/C1017M-13, Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete.
 - .6 ASTM D412-06a(2013), Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers-Tension.
 - .7 ASTM D624-00(2012), Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomer.
 - .8 ASTM D1751-04(2013)e1, Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
 - .9 ASTM D1752-04a(2013), Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction.
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-37.2-M88, Emulsified Asphalt, Mineral Colloid-Type, Unfilled, for Dampproofing and Waterproofing and for Roof Coatings.
 - .2 CAN/CGSB-51.34-M86(R1988), Vapour Barrier, Polyethylene Sheet for Use in Building Construction.
- .3 Canadian Standards Association (CSA International)
 - .1 CSA-A23.1/A23.2-14, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
 - .2 CSA A283-06(R2011), Qualification Code for Concrete Testing Laboratories.
 - .3 CAN/CSA-A3000-13, Cementitious Materials.
- .4 International Concrete Repair Institute (ICRI)
 - .1 ICRI Guideline No. 310.2R-2013, Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, Polymer Overlays, and Concrete Repair.

1.3 SUBMITTALS

- .1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Certificates:
 - .1 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. Certification letter to be sealed by an engineer registered in the Province of Manitoba.
 - .2 Provide certification that plant, equipment, and materials to be used in concrete comply with requirements of CSA-A23.1. Certification letter to be sealed by an engineer registered in the Province of Manitoba.
- .3 Concrete pours: submit accurate records of poured concrete items indicating date and location of pour, quality, air temperature and test samples taken as described in PART 3 - FIELD QUALITY CONTROL.
- .4 Concrete hauling time: submit for review by Contract Administrator deviations exceeding maximum allowable time of 120 minutes for concrete to be delivered to site of Work and discharged after batching.

1.4 QUALITY ASSURANCE

- .1 Quality Assurance: in accordance with Section 01 45 00 - Quality Control.
- .2 Submit to Contract Administrator, minimum 4 weeks prior to starting concrete work, valid and recognized certificate from plant delivering concrete.
 - .1 When plant does not hold valid certification, provide test data and certification by qualified independent inspection and testing laboratory that materials used in concrete mixture will meet specified requirements.
- .3 Minimum 4 weeks prior to starting concrete work, submit proposed quality control procedures for review by Contract Administrator on following items:
 - .1 Falsework erection.
 - .2 Hot weather concrete.
 - .3 Cold weather concrete.
 - .4 Curing.
 - .5 Finishes.
 - .6 Formwork removal.
 - .7 Joints.
- .4 Quality Control Plan: submit written report, as described in PART 3 - VERIFICATION, to Contract Administrator verifying compliance that concrete in place meets performance requirements of concrete as established in PART 2 - PRODUCTS.

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 Contract Administrator and concrete producer as described in CSA A23.1/A23.2.
- .2 Deviations to be submitted for review by Contract Administrator.
- .2 Concrete delivery: ensure continuous concrete delivery from plant meets CSA A23.1/A23.2.

Part 2 Products

2.1 MATERIALS

- .1 The concrete constituents shall comply with the following standards:
 - .1 Cement: to CAN/CSA-A3001.
 - .2 Blended hydraulic cement: to CAN/CSA-A3001.
 - .3 Supplementary cementing materials to CAN/CSA-A3001.
 - .4 Water: to CSA-A23.1.
 - .5 Aggregates: to CAN/CSA-A23.1/A23.2.
 - .6 Admixtures:
 - .1 Air entraining admixture: to ASTM C260.
 - .2 Chemical admixture: to ASTM C494 and ASTM C1017. Contract Administrator to approve accelerating or set retarding admixtures during cold and hot weather placing.

2.2 ACCESSORIES

- .1 Evaporation retardant: Acceptable Product:
 - .1 MasterKure ER 50, formerly (Confilm) by BASF Building Systems at a minimum application rate of 4.9 m²/L.
- .2 Cure and sealing compound: to ASTM C309, Type 1. Acceptable product(s):
 - .1 Florseal WB by Sika Canada Inc. at a minimum application rate of 4.9 m²/L.
 - .2 MasterKure CC, formerly (Kure-N-Seal) by BASF Building Systems at a minimum application rate of 4.9 m²/L.
- .3 Vapour Barrier: 10 mil polyethylene film to CAN/CGSB-51.34 unless otherwise noted on Drawings.
- .4 Grout: Portland Cement based non-shrink, non-metallic composition and shall meet the following requirements:
 - .1 The grout shall not exhibit bleeding or segregation at pumpable consistency.
 - .2 Compressive Strength: 25 MPa @ 1 day.
 - .3 Bond Strength (ASTM C882) 13 MPa @ 28 days.
 - .4 Positive expansion confirmed by ASTM C827.
 - .5 The grout shall not produce a vapour barrier.
 - .6 Acceptable products are one of the following only
 - .1 Sika Grout 212 by Sika Canada Inc.

- .2 Sternson M-Bed Standard by Sternson Construction Products.
- .5 Non premixed dry pack grout: composition of non metallic aggregate Type GU cement with sufficient water for mixture to retain its shape when made into ball by hand and capable of developing compressive strength of 25 MPa at 28 days.
- .6 Post-Tensioning ducts: to CSA-A23.1/A23.2.
- .7 Premoulded joint fillers:
 - .1 Bituminous impregnated fiber board: to ASTM D1751.
 - .2 Sponge rubber: to ASTM D1752, Type I, firm grade.

Part 3 Execution

3.1 PREPARATION

- .1 Obtain Contract Administrator's approval before placing concrete.
 - .1 Provide minimum 48 hours notice prior to placing of 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 Ensure reinforcement and inserts are not disturbed during concrete placement.
- .5 Prior to placing of concrete obtain Contract Administrator's approval of proposed method for protection of concrete during placing and curing in adverse weather.
- .6 Protect previous Work from staining.
- .7 Clean and remove stains prior to application for concrete finishes.
- .8 Maintain accurate records of poured concrete items to indicate date, location of pour, quality, air temperature and test samples taken.
- .9 In locations where new concrete is dowelled to existing work, drill holes in existing concrete.
 - .1 Place steel dowels 66zof deformed steel reinforcing bars and pack solidly with chemical grout to anchor and hold dowels in positions as indicated.
- .10 Do not place load upon new concrete until authorized by Contract Administrator.

3.2 CONSTRUCTION

- .1 Do cast-in-place concrete work in accordance with CSA-A23.1/A23.2.
- .2 Sleeves and inserts:

- .1 Do not permit penetrations, sleeves, ducts, pipes or other openings to pass through joists, beams, column capitals or columns, except where indicated or approved by Contract Administrator.
 - .2 Where approved by Contract Administrator, set sleeves, ties, pipe hangers and other inserts and openings as indicated or specified elsewhere.
 - .3 Sleeves and openings greater than 100 x 100 mm not indicated, must be reviewed by Contract Administrator.
 - .4 Do not eliminate or displace reinforcement to accommodate hardware. If inserts cannot be located as specified, obtain approval of modifications from Contract Administrator before placing of concrete.
 - .5 Check locations and sizes of sleeves and openings shown on drawings.
 - .6 Set special inserts for strength testing as indicated and as required by non-destructive method of testing concrete.
- .3 Anchor bolts:
- .1 Set anchor bolts to templates under supervision of appropriate trade prior to placing concrete.
 - .2 With approval of Contract Administrator, grout anchor bolts in preformed holes or holes drilled after concrete has set. Formed holes to be minimum 100 mm diameter. Drilled holes to manufacturers' recommendations.
 - .3 Protect anchor bolt holes from water accumulations, snow and ice build-ups.
 - .4 Set bolts and fill holes with chemical grout.
 - .5 Locate anchor bolts used in connection with expansion shoes, rollers and rockers with due regard to ambient temperature at time of erection.
- .4 Drainage holes and weep holes:
- .1 Form weep holes and drainage holes in accordance with Section 03 10 00 - Concrete Forming and Accessories. If wood forms are used, remove them after concrete has set.
 - .2 Install weep hole tubes and drains as indicated.
- .5 Grout under base plates using procedures in accordance with manufacturer's recommendations which result in 100% contact over grouted area.
- .6 Finishing:
- .1 Finish concrete in accordance with CSA-A23.1/A23.2.
 - .2 Use curing methods compatible with applied finish on concrete surfaces.
- .7 Curing:
- .1 Cure and protect concrete in accordance with requirements CSA A23.1.
 - .2 Unless noted otherwise the curing regime shall be consistent with the Class of Exposure. See General Notes on structural drawing for Class of Exposure.
- .8 Waterstops:
- .1 Install waterstops to provide continuous water seal.
 - .2 Do not distort or pierce waterstop in way as to hamper performance.
 - .3 Do not displace reinforcement when installing waterstops.

- .4 Use equipment to manufacturer's requirements to field splice waterstops.
- .5 Tie waterstops rigidly in place.
- .6 Use only straight heat sealed butt joints in field.
- .7 Use factory welded corners and intersections unless otherwise approved by Contract Administrator.
- .9 Joint fillers:
 - .1 Furnish filler for each joint in single piece for depth and width required for joint, unless otherwise authorized by Contract Administrator.
 - .2 When more than one piece is required for joint, fasten abutting ends and hold securely to shape by stapling or other positive fastening.
 - .3 Locate and form construction joints as indicated.
 - .4 Install joint filler.
 - .5 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.

3.3 FIELD QUALITY CONTROL

- .1 Inspection and testing of concrete and concrete materials will be carried out by testing laboratory designated by Contract Administrator for review in accordance with CSA-A23.1/A23.2.
 - .1 Ensure testing laboratory is certified in accordance with CSA A283.
- .2 Frequency and Number of Tests:
 - .1 Concrete Tests:
 - .1 Not less than one strength test per 50 cubic metres of concrete placed and not less than one test for each class of concrete placed on any one day.
 - .2 Air measurements will be completed on each of the initial 3 loads of concrete per day of casting to ensure satisfactory control of the air content is established. If adequate control of air content is not established within the first 3 loads of concrete or if a test falls outside the specified limits, the testing frequency shall revert to one test per load until satisfactory control is re-established. Costs for additional testing will be the responsibility of the concrete supplier.
 - .3 Contract Administrator may take additional test cylinders during cold weather concreting. Cure cylinders on job site under same conditions as concrete which they represent.
 - .4 Non-Destructive Methods for Testing Concrete: in accordance with CSA-A23.1/A23.2.
 - .5 Inspection or testing by Contract Administrator will not augment or replace Contractor quality control nor relieve Contractor of his contractual responsibility.

3.4 DEFECTIVE CONCRETE

- .1 Defective concrete: cracking, spalling, scaling and concrete not conforming to required lines, details, dimensions, tolerances, or specified requirements.

- .2 Repair or replacement of defective concrete will be determined by the Contract Administrator, based on the specifications and the above guidelines.
- .3 Do not patch, fill, touch-up, repair or replace exposed concrete except upon express direction of Contract Administrator for each individual use.
- .4 Modify or replace concrete not conforming to lines, detail and elevations indicated on drawings.
- .5 Repair or replace concrete not properly placed, resulting in excessive honeycombing and other defects in critical areas of stress.
- .6 Notify Contract Administrator of proposed methods of repairing or replacing defective concrete. Methods of repairing or replacing defective concrete shall be acceptable to the Contract Administrator.

END OF SECTION

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 ASTM International (ASTM)
 - .1 ASTM C309-03, Liquid Membrane-Forming Compounds for Curing Concrete.
 - .2 C418 – Standard Test Method for Abrasion Resistance of Concrete by Sandblasting
 - .3 C1028 - Standard Test Method for Determining the Static Coefficient of Friction of Ceramic Tile and Other Like Surfaces by the Horizontal Dynamometer Pull-Meter Method.
 - .4 C1353 – Standard Test Method for Abrasion Resistance of Dimension Stone Subjected to Foot Traffic Using a Rotary Platform, Double-Head Abraser.
 - .5 D1308 - Standard Test Method for Effect of Household Chemicals on Clear and Pigmented Organic Finishes.
 - .6 D4541 - Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers.
 - .7 E96/96M Method B (Water Method) - Standard Test Methods for Water Vapor Transmission of Materials.
 - .8 G154 - Standard Practice for Operating Fluorescent Ultraviolet (UV) Lamp Apparatus for Exposure of Nonmetallic Materials.
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-25.20-95 , Surface Sealer for Floors.
- .3 CSA Group (CSA)
 - .1 CAN/CSA-A23.1-14 /A23.2-14 , Concrete Materials and Methods of Concrete Construction//Methods of Test for Concrete.
- .4 American National Standard Institute / National Floor Safety Institute:
 - .1 ANSI B101.1-Test Method for Measuring Wet SCOF of Common Hard-Surface Floor Materials.
 - .2 ANSI B101.3-Test Method for Measuring Wet DCOF of Common Hard-Surface Floor Materials.

1.3 Action and informational submittals

- .1 Submit submittals in accordance with Section 01 33 00- Submittal Procedures.
- .2 Product Data:

- .1 Provide manufacturer's printed product literature and data sheets for concrete finishes and include product characteristics, performance criteria, physical size, finish and limitations.
- .2 Include application instructions for concrete floor treatments.
- .3 Certificates by manufacturer stating that installer is listed applicator of special concrete finishes, and has completed the necessary training programs.
- .4 Floor Protection Plan.
- .5 Closeout Submittals: Submit the following:
 - .1 Maintenance instructions: Operation and maintenance instructions for installed concrete flooring products in accordance with Division 1 Closeout Submittals Section. Include methods for maintaining final finish gloss and cleanliness of concrete slab surface.

1.4 Quality assurance

- .1 Quality Assurance: in accordance with Section 01 45 00- Quality Control.
- .2 Installer Qualifications:
 - .1 Applicator to be familiar with the specified requirements and the methods needed for proper performance of work of this section. Applicator must have availability of proper equipment to perform work within scope of this project on a timely basis. Applicator should have successfully performed a minimum of 5 projects of similar scope and complexity.
- .3 Minimum 4 weeks prior to starting concrete finishing work, provide proposed quality control procedures for review by Contract Administrator on following items:
 - .1 Hardening.
 - .2 Sealing.
 - .3 Curing.
 - .4 Finishes.
- .4 Mock-up: On site, prior to the first application of the densifier.
 - .1 Require attendance of parties directly affecting work of this Section, including the Contractor, Contract Administrator, applicator, and City of Winnipeg's Representative.
 - .2 Notify the above parties one week in advance of date and time when mock-up will be completed.
 - .3 Demonstrate the materials, equipment and application methods to be used for work specified herein in pre-approved location approximately 50 sq. ft. in area or as directed by Contract Administrator.
 - .1 Mock-up to be reviewed to ensure that a matte gloss level with slip resistance is provided.
 - .4 Retain approved mock-up during construction as a standard for judging the completed Work. Areas may remain as part of the completed work.

1.5 Site conditions

- .1 Environmental limitations:

- .1 Comply with manufacturer's written instructions for substrate temperature and moisture content, ambient temperature and humidity, ventilation, and other conditions affecting performance and finishing requirements.
- .2 Close areas to traffic during floor application and after application for time period recommended in writing by manufacturer.
- .3 Protect the completed slab to prevent damage by the other trades during floor completion.
- .4 Temperature Limitations:
 - .1 Apply when surface and air temperature are between 40 degrees F (4 degrees C) and above 100 degrees F (38 degrees C) unless otherwise indicated by manufacturer's written instructions.
 - .2 Apply when surface and air temperatures are expected to remain above 40 degrees F (4 degrees C) for a minimum of 8 hours after application, unless otherwise indicated by manufacturer's written instructions.
- .5 Apply when air conditions are calm to minimize surface treatment contacting surface not intended to be finished.
- .6 Do not apply to frozen substrate. Allow adequate time for substrate to thaw, if freezing conditions exist before application.
- .7 Apply a minimum of 24 hours after rain event. Suspend application when rain is anticipated for a period of 8 hours after application, unless otherwise indicated by manufacturer's written instructions.
- .8 Temporary Lighting: Minimum 200 W light source, placed 8 feet (2.5 meters) above horizontal concrete surface for each 425 square feet (40 square meters) of concrete being finished.
- .9 Temporary Heat: Ambient temperature of 50 degrees F (10 degrees C) minimum.
- .10 Ventilation: Provide ventilation during coating evaporation stage in confined or enclosed areas in accordance with manufacturer's instructions.

1.6 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, address.
- .3 Store concrete hardener/densifier in environment recommended on published manufacturer's product data sheets.
 - .1 Store containers upright in a cool, dry, well-ventilated place, out of the sun with temperature between 40 and 100 degrees F (4 and 38 degrees C).
 - .2 Protect from freezing.
 - .3 Store away from other chemicals and potential sources of contamination.
 - .4 Keep lights, fire, sparks and heat away from containers.
 - .5 Do not drop containers or slide across sharp objects.
 - .6 Do not stack pallets more than three high.
 - .7 Keep containers tightly closed when not in use.

Part 2 Products

2.1 Standard of Acceptance

- .1 Medium grind floor with “Salt and Pepper” finish

2.2 Materials

- .1 Pre-Densifier Concrete Cleaner: Cleaner to remove dirt, oil, grease, and other stains from existing slab surface.
 - .1 Product: Consolideck Cleaner/Degreaser manufactured by PROSOCO, Inc., www.prosoco.com.
 - .1 Or approved equal.
- .2 Penetrating Concrete Hardener/Densifier: Blended silicate hardener/densifier.
 - .1 Product: Consolideck Blended Densifier, manufactured by PROSOCO, Inc., www.prosoco.com.
 - .1 Or approved equal.
 - .2 Subject to compliance with the following minimum performance requirements:
 - .1 Comply with national, state and district AIM VOC regulations and contain 50 g/L or less.
 - .2 Microabrasion Resistance: Greater than 30 percent improvement over the untreated samples when tested in accordance with ASTM C418.
 - .3 Abrasion Resistance: Greater than 40 percent improvement over untreated samples when tested in accordance with ASTM C1353.
 - .4 Achieve ‘High Traction Range’ readings when tested in accordance with ANSI B101.1 and ANSI B101.3.
 - .5 Coefficient of Friction: Greater than 0.60 dry, Greater than 0.60 wet when tested in accordance with ASTM C1028.
 - .6 Adhesion: Greater than 10 percent increase in pull-off strength when compared to an untreated sample when tested in accordance with ASTM D4541.
 - .7 Water Vapor Transmission: 99 percent retained when compared to untreated samples when tested in accordance with ASTM E96/96M Method B (Water Method).
- .3 Protective Coating: to provide stain resistance
 - .1 Product: Consolideck Polish Guard, manufactured by Prosoco, Inc., www.prosoco.com.
 - .1 Or approved equal.
 - .2 Technical Data:
 - .1 Form: White Milky Liquid
 - .2 Specific Gravity: 1.01
 - .3 pH: 8.4
 - .4 Wt/Gal: 8.5 lbs
 - .5 Active Content: 15%

- .6 Total Solids: 15%
- .7 VOC Content: 100 g/L maximum
- .8 Flash Point: >93 degrees celcius
- .9 Freeze Point: 0 degrees celcius

2.3 Equipment

- .1 Auto Scrubber Machine: For cleaning operations.
- .2 Burnishing Machine and Diamond Impregnated Burnishing Pads to produce specified results.
 - .1 Burnishing Machine: High speed burnisher, generating pad speeds of 1,500 RPM or higher, as recommended by diamond impregnated burnishing system
 - .2 Diamond Impregnated Burnishing Pads:
 - .1 Resin Diamond Pad Grit Sizes: 800, 1500 or 3000 grit.

2.4 Concrete Maintenance Supplies

- .1 Concrete Maintenance Cleaner: Lithium silicate concentrated maintenance cleaner to keep maintain concrete surface sheen and remove dirt and soils.
 - .1 Consolideck LSKlean ULTRA 15 or 30 (confirm with Contract Administrator), pre-measured 4 oz packs, manufactured by PROSOCO, Inc., www.prosoco.com
- .2 Floor Maintenance Pads:
 - .1 White floor maintenance pads.
- .3 Spill Clean-up Kit: Provide critical cleaning items to remove spills from concrete floors. Spill Clean-up Kit should include the following:
 - .1 One quart of Consolideck Cleaner Degreaser, one quart of Consolideck Oil and Grease Remover, two pound Spill Guard Neutralizer Absorbent, one package of multi absorbent shop towels, one small plastic scraper and one box of general purpose vinyl gloves.

2.5 Concrete Flooring Accessories

- .1 Tactile Indicator Studs (Interior Concrete Floors):
 - .1 Material: 316 Grade Stainless Steel or Black Anodized Aluminum
 - .2 Testing:
 - .1 ASTM C1028 (static coefficient of friction) =1.01 dry, 0.836 wet.
 - .2 ASTM B117-03 (fog or salt spray 200hrs), no change.
 - .3 ASTM HS20-44 (load test 10400lb).
 - .3 Size:
 - .1 ±23mm in outside diameter, ±10mm top diameter, ±5mm high
 - .4 Geometry compliance:
 - .1 Dome size must be ADA compliant and meets CSA Specification
 - .5 Layout:

- .1 Spacing 60mm O.C. Roughly 25 pcs per sq ft is required. Refer to drawings.
- .2 Care should be taken to ensure spacing does not cause conflict with floor grout lines, etc.
- .6 Installation:
 - .1 Follow manufacturer's installation guidelines. Drill hole in the substrate appropriately sized for stem to fit. Clean hole of debris. Ensure the hole is deep enough to embed stem for the entire length. Apply appropriate amount of epoxy, Devcon 2ton Clear or equivalent to each hole. Insert indicator flush to surface. Clean off any extra and let cure.
- .7 Standard of Acceptance:
 - .1 UAS-SS2218 or UAS-AL2218B by Urban Access Solutions (or approved equal)
 - .1 Contract Administrator to choose from either colour (stainless steel or aluminum/black) to provide adequate colour contrast with finished concrete flooring.

Part 3 Execution

3.1 Examination

- .1 Examine substrate with installer present for conditions affecting performance of finish. Correct conditions detrimental to timely and proper work. Notify the Contract Administrator of conditions detrimental to the proper and timely completion of the work.
- .2 Do not begin installation until unsatisfactory conditions are resolved. Beginning work constitutes acceptance of site conditions and responsibility for defective installation caused by prior observable conditions.

3.2 Preparation

- .1 Clean dirt, dust, oil, grease and other contaminants that interfere with penetration or performance of specified product from surfaces.
- .2 Remove remnants of curing compound, bond breaker, and construction laitance prior to application of densifier. Remove by cleaning and scrubbing in accordance with manufacturer's instructions.
- .3 Repair, patch and fill cracks, voids, defects and damaged areas in surface as approved by the Contract Administrator. Allow repair materials to cure completely before application of product.
- .4 Scrub floor with pre-densifier floor cleaner to remove latent salts.
- .5 Do not proceed until unsatisfactory conditions have been corrected.

3.3 Application of concrete hardener/densifier

- .1 Cured Steel Troweled Concrete: Apply concrete hardener/densifier to cured steel troweled concrete. Apply according to manufacturer's written instructions and as follows:
 - .1 Remove remnants of bond breakers, curing agents, surface grease and oil and construction debris. Contact manufacturer for recommended cleaner and cleaning method.

- .2 Apply hardener/densifier per manufacturer's recommended application rate to designated finished floor area, with a low pressure sprayer fitted with a 0.5 gpm spray tip.
- .3 Apply sufficient material to wet the surface without producing puddles. Use a clean microfiber pad to spread the hardener/densifier evenly to achieve uniform wetting. Avoid spreading once drying begins. Surface should remain wet for 10 to 15 minutes. Avoid over-application. (Scrubbing is not necessary) Allow treated surface to dry.
- .4 Apply second coat of concrete hardener/densifier, as necessary to product desired finishing results.
- .5 Once thoroughly dry, concrete may be auto-scrubbed or burnished with slab surface refinement system

3.4 Interior concrete slab surface refinement system

- .1 Sequential progression of surface refinement shall be required and limited to no more than double the grit value of the previous diamond grit used after application of the concrete hardener/densifier.
- .2 Overlap adjacent burnishing passes by 25 percent
- .3 Perform each pass perpendicular to the other pass north/south then east/west; multiple passes may be needed.
- .4 Progressively refine surface utilizing approved diamond impregnated burnishing system, to produce Finishing Requirements.

3.5 Polished Concrete Finishing requirements

- .1 Appearance (GR-CONC):
 - .1 Interior exposed finished slab areas must consist of the following:
 - .1 Slab surface must meet the desired sheen (matte finish), as discussed in Pre-Installation meeting and be consistent with approved Mock-up.
 - .2 Slab surface must have a consistent look and exhibit a finish that has no evidence of streaking or burnish marks.
 - .3 White residue or hazy appearance is not acceptable.
 - .4 Exposure of aggregate beyond CPC Class B-Fine Aggregate is not acceptable.
 - .2 Interior exposed finished slab areas (GR-CONC) must consist of the following CPC Appearance Level:
 - .1 Level 2 – Satin (Honed).

3.6 Slab protection

- .1 Protect finished floors to prevent damage including staining, gouges and scratching by construction traffic and activities until possession.
- .2 Do not drag or drop equipment or material across the slab which will scratch or chip it.
- .3 Inspect tires for debris prior to use on slab. Remove embedded items which may cause damage to floor slab.

- .4 Clean up spills on slab immediately. Provide cleaning chemicals and absorptive materials.
- .5 Develop a concrete protection procedure which addresses the following procedures:
 - .1 Communication of protection plan to Subcontractors and vendors.
 - .2 Procedures for cleaning up slab spills, including use of and availability of cleaning chemicals and absorptive materials at Site.
- .6 Provide a clean slab surface using concrete maintenance cleaner within an auto scrubber, equipped with soft nylon brushes, in accordance with manufacturer's published recommendations

3.7 Closeout activities

- .1 Provide and post the laminated methods for maintaining final finish gloss and cleanliness of concrete slab surface.
- .2 Contact PROSOCO, Inc. at 800.255.4255 (or approved equal) to obtain colored poster
- .3 Provide City of Winnipeg with the following concrete floor maintenance supplies:
 - .1 One Spill Clean-Up Kit.

3.8 Cleaning

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

3.9 Schedule

- .1 Refer to finish plans and room finish schedule for locations.
- .2 Ground Concrete (GR-CONC) - Cleaner, Densifier, Polish Guard and Polished finish to CPAA Gloss Level 2 as described above.
- .3 Sealed Concrete (SL-CONC) - Cleaner and Densifier as described above.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 04 05 12 – Masonry Mortar and Grout
- .2 Section 04 05 19 – Masonry Anchorage and Reinforcing
- .3 Section 04 05 23 – Masonry Accessories
- .4 Section 04 21 00 – Clay Unit Masonry
- .5 Section 04 22 00 – Concrete Unit Masonry

1.2 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CSA-A165 Series-04, Standards on Concrete Masonry Units.
 - .2 CSA A179-04, Mortar and Grout for Unit Masonry.
 - .3 CSA-A371-04, Masonry Construction for Buildings.

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, limitations and colours.
- .3 Samples:
 - .1 Provide samples as follows:
 - .1 Two of each type of masonry unit specified, including special shapes, supplemented with specific requirements in Section 04 22 00 – Concrete Unit Masonry.
 - .2 Two cured, coloured samples of mortar, illustrating mortar colour and colour range, supplemented with specific requirements in Section 04 05 12 - Masonry Mortar and Grout.
 - .3 Two of each type of masonry accessory and flashing specified, supplemented by specific requirements in Section 04 05 23 - Masonry Accessories.
 - .4 One of each type of masonry anchorage, reinforcement and connector proposed for use, supplemented by specific requirements in Section 04 05 19 - Masonry Anchorage and Reinforcing.
 - .5 Submit samples for testing to laboratories employing technicians certified / trained in procedures for testing masonry units.
- .4 Informational Submittals
 - .1 Submit manufacturer's installation instructions.
 - .2 Test reports and product certificates.

1.4 QUALITY ASSURANCE

- .1 Test Reports
 - .1 Certified test reports showing compliance with specified performance characteristics and physical properties.
 - .2 Submit laboratory test reports certifying compliance of masonry units and mortar with specification requirements.
- .2 Certificates: Product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.
- .3 Confirm and coordinate submittal requirements with the BECxA.

1.5 QUALITY ASSURANCE

1.6 DELIVERY, STORAGE, AND HANDLING

- .1 Deliver materials in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Deliver materials to job site in dry conditions.
- .3 Storage and Handling Protection:
 - .1 Keep materials dry until use.
 - .2 Store under waterproof cover on pallets or plank platforms held off ground by means of plank or timber skids.

1.7 SITE CONDITIONS

- .1 Ambient Conditions: assemble and erect components when temperatures are above 4 degrees C.
- .2 Weather Requirements: to CSA-A371.
- .3 Cold weather requirements:
 - .1 To CSA-A371 with following requirements.
 - .1 Maintain temperature of mortar between 5 degrees C and 50 degrees C until batch is used or becomes stable.
 - .2 Maintain ambient temperature of masonry work and it's constituent materials between 5 degrees C and 50 degrees C and protect site from windchill.
 - .3 Maintain temperature of masonry above 0 degrees C for minimum of 7 days, after mortar is installed.
 - .4 Preheat unheated wall sections in enclosure for minimum 72 hours above 10 degrees C, before applying mortar.
- .4 Hot weather requirements:
 - .1 Protect freshly laid masonry from drying too rapidly, by means of waterproof, non-staining coverings.
 - .2 Keep masonry dry using waterproof, non-staining coverings that extend over walls and down sides sufficient to protect walls from wind driven

rain, until masonry work is completed and protected by flashings or other permanent construction.

- .3 Spray mortar surface at intervals and keep moist for maximum of three days after installation.
- .5 Confirm and coordinate visual review, mock-up, and pre-installation conference requirements with the BECxA.

Part 2 Products

2.1 MATERIALS

- .1 Masonry materials are specified elsewhere in related Sections

Part 3 Execution

3.1 INSTALLERS

- .1 Experienced and qualified masons to carry out erection, assembly and installation of masonry work.

3.2 MANUFACTURER'S INSTRUCTIONS

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

3.3 EXAMINATION

- .1 Examine conditions, substrates and work to receive work of this Section.
- .2 Examine openings to receive masonry units. Verify opening size, location, and that opening is square and plumb, and ready to receive work of this Section.
- .3 Verification of Conditions:
 - .1 Verify that:
 - .1 Substrate conditions which have been previously installed under other sections or contracts, are acceptable for product installation in accordance with manufacturer's instructions prior to installation of masonry.
 - .2 Field conditions are acceptable and are ready to receive work.
 - .3 Built-in items are in proper location, and ready for roughing into masonry work.
 - .2 Confirm and coordinate visual review requirements with the BECxA.

3.4 PREPARATION

- .1 Surface Preparation: prepare surface in accordance with manufacturer's written recommendations.

- .2 Establish and protect lines, levels, and coursing.
- .3 Protect adjacent materials from damage and disfiguration.
- .4 Provide temporary bracing of masonry work during and after erection until permanent lateral support is in place.

3.5 INSTALLATION

- .1 Do masonry work in accordance with CSA-A371 except where specified otherwise.
- .2 Build masonry plumb, level, and true to line, with vertical joints in alignment, respecting construction tolerances permitted by CSA-A371.
- .3 Layout coursing and bond to achieve correct coursing heights, and continuity of bond above and below openings, with minimum of cutting.

3.6 CONSTRUCTION

- .1 Exposed masonry:
 - .1 Remove chipped, cracked, and otherwise damaged units, in accordance with CSA A-165, in exposed masonry and replace with undamaged units.
- .2 Jointing:
 - .1 Allow joints to set just enough to remove excess water, then tool with round jointer to provide smooth, joints true to line, compressed, uniformly concave joints where concave joints are indicated.
 - .2 Allow joints to set just enough to remove excess water, then rake joints uniformly to 6 mm depth and compress with square tool to provide smooth, compressed, raked joints of uniform depth where raked joints are indicated.
 - .3 Strike flush joints concealed in walls and joints in walls to receive plaster, tile, insulation, or other applied material except paint or similar thin finish coating.
- .3 Cutting:
 - .1 Cut out for electrical switches, outlet boxes, and other recessed or built-in objects.
 - .2 Make cuts straight, clean, and free from uneven edges.
- .4 Building-In:
 - .1 Build in items required to be built into masonry.
 - .2 Prevent displacement of built-in items during construction. Check plumb, location and alignment frequently, as work progresses.
 - .3 Brace door jambs to maintain plumb. Fill spaces between jambs and masonry with mortar.
- .5 Wetting of bricks:
 - .1 Except in cold weather, wet bricks having initial rate of absorption exceeding 1 g/minute/1000 mm²: wet to uniform degree of saturation, 3 to 24 hours before laying, and do not lay until surface dry.

- .2 Wet tops of walls built of bricks qualifying for wetting, when recommencing work on such walls.
- .6 Support of loads:
 - .1 Use 20 MPa concrete to Section 03 30 00 - Cast-in-Place Concrete, where concrete fill is used in lieu of solid units unless noted on drawings.
 - .2 Install building paper below voids to be filled with concrete; keep paper 25 mm back from faces of units.
- .7 Provision for movement:
 - .1 Leave 3 to 6 mm space below shelf angles.
 - .2 Leave 20 mm space between top of non-load bearing walls and partitions and structural elements. Do not use wedges.
 - .3 Built masonry to tie in with stabilizers, with provision for vertical movement.
- .8 Loose steel lintels:
 - .1 Install loose steel lintels. Centre over opening width.
- .9 Control joints:
 - .1 Construct continuous control joints as indicated.
- .10 Expansion joints:
 - .1 Build-in continuous expansion joints as indicated.
- .11 Interface with other work:
 - .1 Cut openings in existing work as indicated.
 - .2 Openings in walls: approved by Contract Administrator.
 - .3 Make good existing work. Use materials to match existing.

3.7 SITE TOLERANCES

- .1 Tolerances in notes to CSA-A371 apply.

3.8 FIELD QUALITY CONTROL

- .1 Inspection and Testing will be carried out by Testing Laboratory designated by Contract Administrator.
- .2 Notify inspection agency minimum of 24 hours in advance of requirement for tests.

3.9 CLEANING

- .1 Perform cleaning after installation to remove construction and accumulated environmental dirt.
- .2 Upon completion of installation and verification of performance of installation, remove surplus materials, rubbish, tools and equipment barriers.

3.10 PROTECTION

- .1 Protect masonry and other work from markings and other damage. Protect completed work from mortar droppings. Use non-staining coverings.
- .2 Temporary Bracing:
 - .1 Provide temporary bracing of masonry work during and after erection until permanent lateral support is in place.
 - .2 Brace masonry walls as necessary to resist wind pressure and lateral forces during construction.
- .3 Moisture Protection:
 - .1 Keep masonry dry using waterproof, nonstaining coverings that extend over walls and down sides sufficient to protect walls from wind driven rain, until completed and protected by flashing or other permanent construction.
 - .2 Cover completed and partially completed work not enclosed or sheltered with waterproof covering at end of each work day. Anchor securely in position.
 - .3 Air Temperature Protection: protect completed masonry as recommended in 1.7 SITE CONDITIONS.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 04 05 00 – Common Work Results for Masonry
- .2 Section 04 05 19 – Masonry Anchorage and Reinforcing
- .3 Section 04 05 23 – Masonry Accessories
- .4 Section 04 21 00 – Clay Unit Masonry
- .5 Section 04 22 00 – Concrete Unit Masonry

1.2 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CAN/CSA-A23.1/A23.2-04, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
 - .2 CAN/CSA A179-04, Mortar and Grout for Unit Masonry.
 - .3 CAN/CSA A371-04, Masonry Construction for Buildings.
 - .4 CAN/CSA-A3000-03, Cementitious Materials Compendium; CAN/CSA-A3002-03, Masonry and Mortar Cement.

1.3 SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 23 – Shop Drawings, Product Data, and Samples.
- .2 Product Data:
 - .1 Provide manufacturer's printed product literature, specifications and datasheets.
- .3 Verification Samples: Provide full colour chart showing manufacturer's full range of mortar and grout colours for selection by Contract Administrator.
- .4 Physical Samples: Provide (1) 300mmx300mm physical sample of selected grout colour applied to thin brick sample board. When approved, sample shall become acceptable standard of colour.
- .5 Informational Submittals:
 - .1 Submit two copies of WHMIS MSDS – Material Safety Data Sheets. Indicate VOC's mortar, grout and admixtures.
 - .2 Submit manufacturer's installation instructions.
 - .3 Product certificates.
 - .4 Test reports.
- .6 Confirm and coordinate submittal requirements with the BECxA.

1.4 QUALITY ASSURANCE

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

- .1 Submit laboratory test reports.
- .2 Certificates: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.
- .3 Confirm and coordinate visual review, mock-up, and pre-installation conference requirements with the BECxA.

Part 2 Products

2.1 MATERIALS

- .1 Use same brands of materials and source of aggregate for entire project.
- .2 Cement:
 - .1 Portland Cement: to CAN/CSA-A3000.
 - .2 Masonry Cement: to CAN/CSA-A3002 and CAN/CSA A179.
 - .3 Mortar Cement: to CAN/CSA-A3002 and CAN/CSA A179.
 - .4 Packaged Dry Combined Materials for mortar: to CAN/CSA A179.
- .3 Aggregate: supplied by one supplier. To CAN/CSA A179.
- .4 Water: clean and potable.
- .5 Lime: To CAN/CSA A179.
- .6 Mortar:
 - .1 To CSA A179.
 - .2 Use aggregate passing 1.18mm sieve where 6mm thick joints are indicated.
 - .3 White mortar: use white Portland cement, and white masonry cement to produce mortar type specified.
 - .4 Colour: ground coloured natural aggregates or metallic oxide pigments, use colouring admixture not exceeding 10% of cement content by mass, or integrally coloured masonry cement, to produce coloured mortar to match approved sample.
 - .5 Non-staining mortar: use non-staining masonry cement for cementitious portion of specified mortar type.
 - .6 Mortar type:
 - .1 Exterior, parapet, and Loadbearing Walls: type S mortar having a minimum strength of 12 MPa at 28 days.
 - .2 Non-Loadbearing Walls: type N mortar having a compressive strength of 5 MPa at 28 days. proportion specifications.
 - .3 Thin set mortar (at thin brick finish):
 - .1 Bond coat of modified mortar.
 - .2 Dry components of modified mortar should be pre-blended prior to adding the latex additive. Apply according to manufacturer's instructions. Most manufacturers recommend a nominal 1/8 in.

(3.2 mm) thickness. For maximum adhesion, complete coverage of the back of thin brick with bond coat mortar is advised. Apply modified mortar over an area no greater than can be covered by thin brick while the mortar remains workable. Use a notched trowel as recommended by the mortar manufacturer to evenly spread the modified mortar to a nominal $\frac{1}{8}$ in. (3.2 mm) thickness. Within 10 minutes of applying the latex-modified mortar on the substrate, completely cover the back of thin brick with modified mortar and embed in substrate mortar coat.

.7 Colour mortars:

- .1 Incorporate colour and admixtures into mixes in accordance with manufacturer's instructions.
- .2 Use clean mixer for coloured mortar.

.8 Pointing Mortar:

- .1 Prehydrate pointing mortar by mixing ingredients dry, then mix again adding just enough water to produce damp unworkable mix that will retain its form when pressed into a ball. Allow to stand for not less than 1 hour nor more than 2 hours then remix with sufficient water to produce mortar of proper consistency for pointing.

.7 Grout:

- .1 To CSA A179.
- .2 Mix grout to semi-fluid consistency.
- .3 Do not use calcium chloride or chloride based admixtures.

2.2 SOURCE QUALITY CONTROL

- .1 Use same brands of materials and source of aggregates for entire project.

Part 3 Execution

3.1 EXAMINATION

- .1 Confirm and coordinate visual review requirements with the BECxA.

3.2 MANUFACTURER'S INSTRUCTIONS

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

3.3 CONSTRUCTION

- .1 Do masonry mortar and grout work in accordance with CAN/CSA A179 except where specified otherwise.

3.4 CLEANING

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

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 04 05 00 – Common Work Results for Masonry
- .2 Section 04 05 12 – Masonry Mortar and Grout
- .3 Section 04 05 23 – Masonry Accessories
- .4 Section 04 21 00 – Clay Unit Masonry
- .5 Section 04 22 00 – Concrete Unit Masonry

1.2 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CAN/CSA-A23.1/A23.2-04, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
 - .2 CAN/CSA A179-04, Mortar and Grout for Unit Masonry.
 - .3 CAN/CSA A370-04, Connectors for Masonry.
 - .4 CAN/CSA A371-04, Masonry Construction for Buildings.
 - .5 CAN/CSA G30.18-M92(R2007), Billet-Steel Bars for Concrete Reinforcement.
 - .6 CSA-S304.1-04, Design of Masonry Structures.
 - .7 CSA W186-M1990(R2007), Welding of Reinforcing Bars in Reinforced Concrete Construction.

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 datasheets.
- .3 Shop Drawings:
 - .1 Shop Drawings shall consist of bar bending details, lists and placing drawings.
 - .2 On placing drawings, indicate sizes, spacing, location, and quantities of reinforcement and connectors.
- .4 Informational Submittals:
 - .1 Provide manufacturer's installation instructions.
- .5 Confirm and coordinate submittal requirements with the BECxA.

1.4 QUALITY ASSURANCE

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

- .3 Confirm and coordinate visual review, mock-up, and pre-installation conference requirements with the BECxA.

Part 2 Products

2.1 MATERIALS

- .1 Bar reinforcement: Steel to CAN/CSA A371 and CAN/CSA G30.18, Grade 400.
- .2 Connectors: to CAN/CSA A370 and CSA-S304.1.
- .3 Corrosion protection:
 - .1 To CSA-S304.1.
 - .2 In contact with brick: all connectors shall be hot-dipped galvanized.
- .4 Masonry ties and connectors:
 - .1 To CSA – A370 and CSA-S304. Adjustable anchors that allow vertical adjustment but resist tension and compression forces perpendicular to place of wall.
 - .2 At steel stud wall framing back up walls:
 - .1 Components:
 - .1 Connector plate: 1.6mm thick by length equal to full width of stud plus thickness of sheathing, insulation and air space; hot dipped galvanized.
 - .2 V-tie: V-shape wire tie, 4.8mm dia by length to provide placement of V-tie legs at centreline of solid unit veneer; hot dipped galvanized.
 - .3 Fasteners for steel studs: corrosion-resistance, self-tapping sheet metal screws, length to penetrate 19mm beyond stud face.
 - .4 Insulating strips: close cell polyethylene foam strips, 3mm thick. Same size as connector plate in contact with stud.
 - .5 Insulation Support: polyethylene, friction fit, used to secure insulation in place.
 - .2 Acceptable Products: Fero Corporation “Slotted Rap-Tie System.”
- .5 Single Wythe Joint Reinforcement: ladder type:
 - .1 Cold drawn steel wire conforming to ASTM A82.
 - .2 Standard Joint Reinforcement consisting of 3.66mm (9ga) longitudinal wires and 3.66mm cross or diagonal wires.
 - .3 Yield Strength is 480MPa.
- .6 Anchors: to CAN/CSA A370.

2.2 FABRICATION

- .1 Fabricate reinforcing in accordance with CAN/CSA-A23.1 and Reinforcing Steel Manual of Standard Practice by the Reinforcing Steel Institute of Canada.
- .2 Fabricate connectors in accordance with CAN/CSA A370.

- .3 Obtain Contract Administrator's approval for locations of reinforcement splices other than shown on placing drawings.
- .4 Upon approval of Contract Administrator, weld reinforcement in accordance with CSA W186.
- .5 Ship reinforcement and connectors, clearly identified in accordance with drawings.

2.3 SOURCE QUALITY CONTROL

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

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 EXAMINATION

- .1 Confirm and coordinate visual review requirements with the BECxA.

3.3 GENERAL

- .1 Supply and install masonry reinforcement in accordance with CSA-A371, CAN/CSA-A23.1 and CSA-S304.1 unless indicated otherwise.
- .2 Prior to placing concrete, obtain Contract Administrator's approval of placement of reinforcement.

3.4 TIES AND CONNECTORS

- .1 Tie masonry veneer to backing in accordance with NBC, CSA-S304.1, CAN/CSA A371 and as indicated.
- .2 Exterior masonry veneer on stud framing backup walls.
 - .1 Spacing: 600mm on centre vertical intervals. 400mm on centre horizontal intervals.
 - .2 Install connector plates on studs with two screw fastener / plate. Ensure screws are tight and secure. Remove and replace stripped or loose fasteners.
 - .3 Coordinate spacing with cavity wall insulation to ensure connector plates are centred on horizontal joints of insulation boards.
 - .4 Install insulating strip between each connector plate and stud face.
 - .5 Install insulation support over each connector plate to hold insulation tight to backup walls.

- .6 Insert wire tie into connector plate and embed into mortar joints of masonry veneer. Ensure wire tie is aligned and level with horizontal joints of masonry veneer.

3.5 LADDER REINFORCING

- .1 Install in accordance with CAN/CSA A370 and CAN/CSA A371.
- .2 Install horizontal joint reinforcement every second course. Every course for stack bond.
- .3 Place masonry joint reinforcement in first horizontal joints above and below openings. Extend minimum 400 mm each side of opening.
- .4 Place joint reinforcement continuous in first joint below top of walls.
- .5 Lap joint reinforcement ends minimum 150 mm.
- .6 Connect stack bonded unit joint corners and intersections with strap anchors 200 mm on centre.

3.6 REINFORCED LINTELS AND BOND BEAMS

- .1 Reinforce masonry beams, masonry lintels and bond beams as indicated.
- .2 Place and grout reinforcement in accordance with CSA-S304.1, CAN/CSA A371, and CAN/CSA A179.
- .3 Support and position reinforcing bars in accordance with CAN/CSA A371.

3.7 GROUTING

- .1 Grout masonry in accordance with CSA-S304.1, CAN/CSA A371 and CAN/CSA A179 and as indicated.

3.8 LATERAL SUPPORT AND ANCHORAGE

- .1 Supply and install lateral support and anchorage in accordance with CSA-S304.1 and as indicated.

3.9 MOVEMENT JOINTS

- .1 Reinforcement will not be continuous across movement joints unless otherwise indicated.

3.10 FIELD BENDING

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

3.11 FIELD TOUCH-UP

- .1 Touch up damaged and cut ends of galvanized reinforcement steel and connectors with compatible finish to provide continuous coating.

3.12 CLEANING

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

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 04 05 00 - Common Work Results for Masonry
- .2 Section 04 05 19 – Masonry Anchorage and Reinforcing
- .3 Section 04 21 00 – Clay Unit Masonry
- .4 Section 04 22 00 – Concrete Unit Masonry

1.2 REFERENCE STANDARDS

- .1 ASTM International (ASTM):
 - .1 [ASTM D2240-15](#), Standard Test Method for Rubber Property - Durometer Hardness
- .2 CSA Group (CSA):
 - .1 [CAN/CSA-A371-14](#), Masonry Construction for Buildings
- .3 International Organization for Standardization (ISO):
 - .1 ISO 14021-2016), Environmental Labels and Declarations - Self Declared Environmental Claims (Type II Environmental Labelling)
- .4 South Coast Air Quality Management District (SCAQMD):
 - .1 SCAQMD Rule 1168-05, Adhesive and Sealant Applications

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for masonry accessories and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
 - .1 Submit drawings stamped and signed by professional engineer registered or licensed in the Province of Manitoba, Canada.
 - .2 Indicate on drawings:
 - .1 Flashing, installation details, sizes, spacing, location and quantities of fasteners.
- .4 Confirm and coordinate submittal requirements with the BECxA.

1.4 QUALITY ASSURANCE

- .1 Certificates: submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.
- .2 Manufacturer's Instructions: submit manufacturer's instructions as follows:
 - .1 Submit installation instructions for brick vents, weeps, vents, screens and flashings not supplied by other Sections.
- .3 Confirm and coordinate visual review, mock-up, and pre-installation conference requirements with the BECxA.

1.5 SITE MEASUREMENTS

- .1 Make site measurements necessary to ensure proper fit of members.

1.6 DELIVERY, STORAGE, AND HANDLING

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

Part 2 Products

2.1 MATERIALS

- .1 Movement joint filler: purpose-made elastomer durometer hardness to [ASTM D2240](#) of size and shape indicated
 - .1 Use low VOC products.
 - .2 Material type: rubber, PVC, closed cell neoprene.

2.2 MOISTURE CONTROL

- .1 Cell vents: polypropylene plastic, honeycomb design.
 - .1 Size: to suit brick dimensions.
- .2 Mortar diverters: shaped and sized to suit cavity spaces.
- .3 Polyester/polyethylene mesh trapezoidal shape to maintain cavity airflow and drainage while suspending mortar droppings at unequal heights.

2.3 FLASHINGS

- .1 Sheet metal: galvanized steel.
 - .1 Thickness: 24 gauge unless noted otherwise on Drawings.
 - .2 Finish: Prefinished – colour to be determined by Contract Administrator.

Part 3 Execution

3.1 EXAMINATION

- .1 Verification of Conditions: verify conditions of substrate previously installed under other Sections or Contracts are acceptable for masonry accessories installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate in presence of Contract Administrator.
 - .2 Inform Contract Administrator of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions remedied and after receipt of written approval to proceed from Contract Administrator.
- .2 Confirm and coordinate visual review requirements with the BECxA.

3.2 INSTALLATION: MATERIALS

- .1 Install continuous movement joint fillers in movement joints at locations indicated on drawings.
- .2 Lap adhesive: apply adhesive to flashing lap joints.
- .3 Mechanical fasteners: install fasteners to suit application and in accordance with manufacturer's written installation instructions.
- .4 Reglets: install reglets at locations indicated on drawings.
- .5 Brick vents: install brick vents at locations indicated on drawings.

3.3 INSTALLATION: MOISTURE CONTROL

- .1 Install weep hole vents in vertical joints immediately over flashings, in exterior wythes of cavity wall and masonry veneer wall construction, at maximum horizontal spacing of 600 mm on centre.
- .2 Mortar diverters: install purpose made diverters in cavities where indicated and as directed, size and shape to suit purpose and function.
- .3 Grout screens: install purpose made screens in cavities where indicated and as directed, size and shape to suit purpose and function.

3.4 INSTALLATION: FLASHINGS

- .1 Build in flashings in masonry in accordance with CAN/CSA A371.

- .1 Install flashings under exterior masonry bearing on foundation walls, slabs, shelf angles, and steel angles over openings, and at base of cavity wall and where cavity is interrupted by horizontal members or supports and as shown on drawings. Install flashings under weep hole courses and as indicated.
- .2 In cavity walls and veneered walls, carry flashings from front edge of exterior masonry, under outer wythe, then up backing not less than 150 mm, and as follows:
 - .1 For gypsum board and glass fibre faced sheathing backing, bond to wall using manufacturer's recommended adhesive.
 - .3 Lap joints 150 mm and seal with adhesive.
- .2 Form flashing (end dams) at lintels, sills and wall ends to prevent water from travelling horizontally past flashing ends.
- .3 Install vertical flashing where outer veneer returns at window or door jambs, to prevent contact of veneer with inner wall.

3.5 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 00 - 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 00 - Cleaning.

END OF SECTION

Part 1 General

1.1 Section includes

- .1 Face Brick
- .2 Thin brick veneer

1.2 Related sections

- .1 Section 04 05 12 - Masonry Mortar and Grout
- .2 Section 04 05 19 - Masonry Anchorage and Reinforcing
- .3 Section 04 05 23 - Masonry Accessories
- .4 Section 07 62 00 - Sheet Metal Flashing and Trim

1.3 References

- .1 ASTM C 216 – Standard Specification for Facing Brick (Solid Masonry Units Made from Clay or Shale)
- .2 ASTM C270 – Standard Specification for Mortar for Unit Masonry
- .3 ASTM C 67 - Standard Test Methods for Sampling and Testing Brick and Structural Clay Tile.
- .4 ASTM C 1088 - Standard Specification for Thin Veneer Brick Units Made from Clay or Shale.

1.4 Submittals

- .1 Submit under provisions of Section 01 30 00 - Administrative Requirements
- .2 Product Data: Manufacturer's catalog data, detail sheets, and specifications.
- .3 Verification Samples: For each product, provide two full-size units representing actual color and texture of products to be installed.
- .4 Confirm and coordinate submittal requirements with the BECxA.

1.5 Quality assurance

- .1 Manufacturer Qualifications: All primary products specified in this section will be supplied by a single manufacturer with a minimum of ten years' experience.
- .2 Installer Qualifications: All products listed in this section are to be installed by a single installer with a minimum of five years demonstrated experience in installing products of the same type and scope as specified.
- .3 Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.
 - .1 Construct sample panel at location indicated or directed, and as follows:
 - .1 Size: 4 feet by 4 feet (1.2 m by 1.2 m).
 - .2 Include all unit types and sizes to be used, and mortar joint treatment.
 - .3 Obtain Contract Administrator's acceptance of sample panel before beginning construction activities of this section.

- .4 Do not remove sample panel until construction activities of this section have been accepted by the Contract Administrator.
- .5 Confirm and coordinate mock-up requirements with the BECxA.
- .4 Confirm and coordinate visual review and pre-installation conference requirements with the BECxA.
- .5 Certificates: Prior to delivery, submit to Contract Administrator certificates attesting compliance with the applicable specifications for grades, types or classes included in these specifications.

1.6 Site conditions

- .1 Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.7 Delivery, storage and handling

- .1 Store products in manufacturer's unopened packaging until ready for installation.
- .2 Deliver products of this section in factory packaging with individual faces protected; keep dry.
- .3 Store and dispose of hazardous materials, and materials contaminated by hazardous materials, in accordance with requirements of local authorities having jurisdiction.
- .4 Store thin brick units in protected area or under cover on level ground; keep dry. Do not double-stack pallets.

1.8 Warranty

- .1 At project closeout, provide to Contract Administrator an executed copy of the manufacturer's standard limited warranty against manufacturing defect, outlining its terms, conditions, and exclusions from coverage.

Part 2 Products

2.1 Manufacturers

- .1 Acceptable Manufacturer (face brick): Endicott Clay Products Co., which is located at:
57120 707th Rd.; Endicott, NE 68350
Tel: 402-729-3315
Email: request info (endicott@endicott.com)
Web: <http://www.endicott.com>
- .2 Acceptable Manufacturer (thin brick): Endicott Thin Brick, LLC., which is located at:
57120 707th Rd.; Endicott, NE 68350
Tel: 402-729-3315
Website: <http://www.endicott.com>
- .3 Requests for substitutions will be considered in accordance with provisions of Section 01 60 00 - Product Requirements.

2.2 Face Brick

- .1 Face Brick: ASTM C 216 Grade: SW Type: FBS.

- .1 Modular Size: 3-5/8 inches (92.1 mm) deep, 2-1/4 inches (57.2 mm) high, 7-5/8 inches (193.7 mm) long.
- .2 Covering: No sands.
- .3 Color: Manganese Ironspot.
- .4 Texture: Smooth
- .5 Edge: Square edge

2.3 Thin Brick

- .1 Thin Brick: ASTM C 1088, Type TBX or TBS, tested in accordance with ASTM C67, as manufactured by Endicott Thin Brick, LLC. And PCI/TCA specifications.
 - .1 Size: 2-1/4" (57.2 mm) high, 7-5/8" (193.7 mm) long, 1/2" (12.7 mm) thick
 - .2 Texture: Smooth
 - .3 Approved Color: Manganese Ironspot
- .2 Trim Units: Matching thin brick.
 - .1 Edge cap A – 3-5/8" bed (92.1 mm), 7-5/8" (193.7 mm) long, 2-1/4" face
- .3 Corners: Matching thin brick
 - .1 BC1-5/848: 1-5/8" (41.275mm) face, 11-5/8" (295.3mm) long, 1/2" (12.7mm) thick

2.4 Mortar (Face Brick)

- .1 Mortar shall conform to ASTM C 270 under the guidelines provided in BIA Technical Notes #8 Series.

Part 3 Execution

3.1 Examination

- .1 Confirm and coordinate visual review requirements with the BECxA.

3.2 Installation

- .1 Install face brick in accordance with Brick Industry Association (BIA) guidelines and industry standards.
- .2 Install thin brick in accordance with BIA Technote 28C or appropriate industry standards. Reference system manufacturer's printed instructions, approved submittals and in proper relationship with adjacent construction.

3.3 Cleaning

- .1 In accordance with 01 74 00 Cleaning.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 04 05 00 – Common Work Results for Masonry
- .2 Section 04 05 12 – Masonry Mortar and Grout
- .3 Section 04 05 19 – Masonry Anchorage and Reinforcing
- .4 Section 04 05 23 – Masonry Accessories.

1.2 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CAN/CSA-A165 Series-2004, CSA Standards on Concrete Masonry Units.
 - .2 CAN/CSA A371-04, Masonry Construction for Buildings.
 - .3 CSA S304.1-04, Design of Masonry Structures.

1.3 SUBMITTALS

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

Product Data: provide product data, including manufacturer's printed data sheets.

1.4 QUALITY ASSURANCE

- .1 Test Reports
 - .1 Certified test reports showing compliance with specified performance characteristics and physical properties.
 - .2 Submit laboratory test reports certifying compliance of masonry units and mortar with specification requirements.
- .2 Certificates: Product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

Part 2 Products

2.1 MATERIALS

- .1 Standard concrete block units: to CAN/CSA-A165 Series (CAN/CSA-A165.1) .
 - .1 Classification: H/15/A/M.
 - .2 Size: Modular – Mason to confirm whether existing block is imperial or metric prior to ordering block.
 - .3 Special shapes: provide square units for exposed corners. Provide purpose-made shapes for lintels, beams and bond beams. Provide additional special shapes as indicated.

2.2 TOLERANCES

- .1 Tolerances for standard concrete unit masonry tolerances in accordance with CAN/CSA A165.1, supplemented as follows:
 - .1 Maximum variation between units within specific job lot not to exceed 2 mm.
 - .2 No parallel edge length, width or height dimension for individual unit to differ by more than 2 mm.
 - .3 Out of square tolerance not to exceed 2 mm.
- .2 Tolerances for architectural concrete masonry units in accordance with CAN/CSA A165.1, supplemented as follows:
 - .1 Maximum variation in length or height between units within specific job lot for specified dimension not to exceed 2 mm.
 - .2 No parallel edge length, width or height dimension for individual unit to differ by more than 2 mm.
 - .3 Out of square tolerance not to exceed 2 mm.
 - .4 Maximum variation in width between units within specific job lot for specified dimension not to exceed 2 mm.

Part 3 Execution

3.1 EXAMINATION

- .1 Verify surfaces and conditions are ready to accept work of this Section.
- .2 Commencing installation means acceptance of existing substrates.

3.2 PREPARATION

- .1 Protect adjacent finished materials from damage due to masonry work.

3.3 INSTALLATION

- .1 Concrete block units:
 - .1 Bond: running unless noted.
 - .2 Coursing height: 200 mm for one block and one joint.
 - .3 Jointing:
 - .1 Concave where exposed or where paint or other finish coating is specified.
 - .2 Raked for specialty concrete masonry units.
 - .3 Flush joints: where concealed in walls and joints in walls to receive plaster, tile, insulation, or other applied material except paint or similar thin finish coating, and to height to suit resilient base where resilient base is applied to painted walls.
 - .4 Extend architectural concrete masonry units to one course above ceilings. Where partitions extend to underside of structure use standard CMU for portion of partitions above ceiling.

- .2 Special Shapes:
 - .1 Install special units to form corners, returns, offsets, reveals and indents without cut ends being exposed and without losing bond or module.
 - .2 Install reinforced concrete block lintels over openings in masonry where steel or reinforced concrete lintels are not indicated.
 - .3 End bearing: not less than 200 mm unless noted on drawings.

3.4 REINFORCEMENT

- .1 Install reinforcing in accordance with Section 04 05 19 - Masonry Anchorage and Reinforcing.

3.5 CONNECTORS

- .1 Install connectors in accordance with Section 04 05 19 - Masonry Anchorage and Reinforcing.

3.6 FLASHING

- .1 Install flashings: in accordance with Section 04 05 23 - Masonry Accessories.

3.7 MORTAR PLACEMENT

- .1 Place mortar in accordance with Section 04 05 12 - Masonry Mortar and Grout.

3.8 CONSTRUCTION

- .1 Cull out masonry units, in accordance with CAN/CSA A165 and reviewed range of colour samples, with chips, cracks, broken corners, excessive colour and texture variation.
- .2 Build in miscellaneous items such as bearing plates, steel angles, bolts, anchors, inserts, sleeves and conduits.
- .3 Build around frames previously set and braced. Fill behind hollow frames within masonry walls with mortar or grout and embed anchors.
- .4 Fit masonry closely against electrical and plumbing outlets so collars, plates and covers overlap and conceal cuts.
- .5 Install movement joints and keep free of mortar where indicated.
- .6 Hollow Units: spread mortar setting bed from outside edge of face shells. Gauge amount of mortar on top and end of unit to create full joints, equivalent to shell thickness. Avoid excess mortar.
- .7 Solid Units: apply mortar over entire vertical and horizontal surfaces. Avoid bridging of airspace between brick veneer and backup wall with mortar.
- .8 Ensure compacted head joints. Use full or face-shell joint as indicated.
- .9 Tamp units firmly into place.

- .10 Do not adjust masonry units after mortar has set. Where resetting of masonry is required, remove, clean and reset units in new mortar.
- .11 After mortar has achieved initial set up, tool joints.
- .12 Do not interrupt bond below or above openings.

3.9 REPAIR/RESTORATION

- .1 Upon completion of masonry, fill holes and cracks, remove loose mortar and repair defective work.

3.10 CLEANING

- .1 Standard Block: Allow mortar droppings on masonry to partially dry then remove by means of trowel, followed by rubbing lightly with small piece of block. Clean wall surface with suitable brush or burlap.
- .2 Unglazed clay masonry: Sample clean inconspicuous area, designated by Contract Administrator. If no harmful effects appear and after mortar has set and cured, protect windows, sills, doors, trim and other work, and clean brick masonry as follows:
 - .1 Remove large particles with wood paddles without damaging surface. Saturate masonry with clean water and flush off loose mortar and dirt.
 - .2 Scrub with solution of 25 mL trisodium phosphate and 25 mL household detergent dissolved in 1L of clean water using stiff fibre brushes, then clean off immediately with clean water using hose. Alternatively, use proprietary compound recommended by brick masonry manufacturer, in accordance with manufacturer's directions.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 05 21 12 – Steel Joists
- .2 Section 05 31 00 – Steel Decking.
- .3 Section 05 41 00 – Structural Metal Lightweight Framing.

1.2 REFERENCES

- .1 ASTM International Inc.
 - .1 ASTM A36/A36M-08, Standard Specification for Carbon Structural Steel.
 - .2 ASTM A193/A193M-08, Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature or High-Pressure Service and Other Special Purpose Applications.
 - .3 ASTM A307-07b, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
 - .4 ASTM A325-07a, Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.
 - .5 ASTM A325M-08, Standard Specification for Structural Bolts, Steel, Heat Treated 830 MPa Minimum Tensile Strength (Metric).
 - .6 ASTM A490M-04ae, Standard Specification for High-Strength Steel Structural Bolts, Classes 10.9 and 10.9.3, for Structural Steel Joints (Metric).
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-85.10-99, Protective Coatings for Metals.
- .3 Canadian Institute of Steel Construction (CISC)/Canadian Paint Manufacturer's Association (CPMA)
 - .1 CISC/CPMA 2-75, Quick-Drying, Primer for Use on Structural Steel.
 - .2 CISC/CPMA 1-73a, Quick-Drying, One-Coat Paint for Use on Structural Steel.
- .4 Canadian Standards Association (CSA International)
 - .1 CSA G40.20/G40.21-04, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
 - .2 CAN/CSA-G164-M92(R2003), Hot Dip Galvanizing of Irregularly Shaped Articles.
 - .3 CAN/CSA-S16-01(R2007), Limit States Design of Steel Structures.
 - .4 CAN/CSA-S136-07, North American Specifications for the Design of Cold Formed Steel Structural Members.
 - .5 CSA W47.1-03, Certification of Companies for Fusion Welding of Steel.
 - .6 CSA W48-06, Filler Metals and Allied Materials for Metal Arc Welding.
 - .7 CSA W55.3-1965(R2003), Resistance Welding Qualification Code for Fabricators of Structural Members Used in Buildings.

- .8 CSA W59-03, Welded Steel Construction (Metal Arc Welding).
- .5 The Society for Protective Coatings (SSPC) and National Association of Corrosion Engineers (NACE) International
 - .1 SSPC SP-2, SP-7.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Shop Drawings:
 - .1 Provide drawings stamped and signed by professional engineer registered or licensed in Province of Manitoba, Canada.
- .3 Erection drawings:
 - .1 Submit erection drawings indicating details and information necessary for assembly and erection purposes including:
 - .1 Description of methods.
 - .2 Sequence of erection.
 - .3 Type of equipment used in erection.
 - .4 Temporary bracings.
- .4 Fabrication drawings:
 - .1 Submit fabrication drawings showing designed assemblies, components and connections are stamped and signed by qualified professional engineer licensed in the Province of Manitoba, Canada.
- .5 Samples :
 - .1 Upon request, prepare sample of typical exposed structural connections in accordance with AISC Specifications of Architecturally exposed structural steel for approval of Contract Administrator. Samples to be judged upon alignment of surfaces, uniform contact between surfaces, smoothness and uniformity of finished welds. When approved, sample units will serve as a standard for workmanship, appearance and material acceptable for entire project.
- .6 Source Quality Control Submittals:
 - .1 Submit 2 copies of mill test reports 4 weeks prior to fabrication of structural steel.
 - .1 Mill test reports to show chemical and physical properties and other details of steel to be incorporated in project.
 - .2 Provide mill test reports certified by metallurgists qualified to practice in Province of Manitoba, Canada.
- .7 Fabricator Reports:
 - .1 Upon request, provide structural steel fabricator's affidavit stating that materials and products used in fabrication conform to applicable material and products standards specified and indicated.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Deliver materials in manufacturer's original, undamaged containers with identification labels intact.

Part 2 Products

2.1 DESIGN REQUIREMENTS

- .1 Design details and connections in accordance with requirements of CAN/CSA-S16 and CAN/CSA-S136 with CSA-S136.1 to resist forces, moments, shears and allow for movements indicated.
- .2 Shear connections:
 - .1 Select framed beam shear connections from an industry accepted publication such as "Handbook of the Canadian Institute of Steel Construction" when connection for shear only (standard connection) is required.
 - .2 Select or design connections to support reaction from maximum uniformly distributed load that can be safely supported by beam in bending, provided no point loads act on beam, when shears are not indicated.
- .3 For composite construction select or design minimum end connection to resist reaction resulting from factored movement resistance as tabulated in the "Handbook of the Canadian Institute of Steel Construction" assuming 100% shear connection with depth of steel deck and/or slab shown on drawings.
- .4 Upon request, Submit sketches and design calculations stamped and signed by qualified professional engineer licensed in Province of Manitoba, Canada for non standard connections.

2.2 MATERIALS

- .1 Structural steel: All rolled or steel structural sections shall be G40.21-350W. All Hollow structural sections to be G40.21-350W class C. All angles, channels and plates shall be G40.21-300W.
- .2 Anchor bolts: to CSA-G40.20/G40.21, Grade 300W.
- .3 Bolts, nuts and washers: to ASTM A307, ASTM A325M, and ASTM A490/A490M as required.
- .4 Welding materials: to CSA W59 and certified by Canadian Welding Bureau.
- .5 Shop paint primer:
 - .1 Steel not receiving finish painting: one coat of CISC/CPMA 1-73A quick drying shop primer

- .2 Steel receiving finish painting: one coat of CISC/CPMA 2-75 quick drying shop primer.
- .6 Hot dip galvanizing: galvanize steel, where indicated, to CAN/CSA-G164, minimum zinc coating of 600 g/m².
- .7 Shear studs: to CSA W59, Appendix H.

2.3 FABRICATION

- .1 Fabricate structural steel in accordance with CAN/CSA-S16, CAN/CSA-S136, and in accordance with reviewed shop drawings.
- .2 Install shear studs in accordance with CSA W59.
- .3 Continuously seal members by continuous welds where indicated. Grind smooth.

2.4 SHOP PAINTING

- .1 Clean, prepare surfaces and shop prime structural steel as follows:
 - .1 Steel not receiving finish painting: One coat of CISC / CPMA 1-73a quick drying shop primer. Steel to be cleaned in conformance with SSPC-SP2.
 - .2 Steel receiving finish painting: One coat of CISC / CPMA 2-75 quick drying shop primer. Steel to be cleaned in conformance with SSPC-SP7.
 - .3 Exterior structural steel: All exterior structural steel shall be hot-dipped galvanized unless noted.
- .2 Clean members, remove loose mill scale, rust, oil, dirt and foreign matter.
- .3 Apply one coat of primer in shop to steel surfaces, except:
 - .1 Surfaces to be encased in concrete.
 - .2 Surfaces to receive field installed stud shear connections.
 - .3 Surfaces and edges to be field welded.
 - .4 Faying surfaces of slip-critical connections.
 - .5 Below grade surfaces in contact with soil.
- .4 Apply paint under cover, on dry surfaces when surface and air temperatures are above 5 degrees C.
- .5 Maintain dry condition and 5 degrees C minimum temperature until paint is thoroughly dry.
- .6 Strip paint from bolts, nuts, sharp edges and corners before prime coat is dry.

Part 3 Execution

3.1 APPLICATION

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

3.2 GENERAL

- .1 Structural steel work: in accordance with CAN/CSA-S16, CAN/CSA-S136.
- .2 Welding: in accordance with CSA W59.
- .3 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.

3.3 CONNECTION TO EXISTING WORK

- .1 Verify dimensions and condition of existing work, report discrepancies and potential problem areas to Contract Administrator for direction before commencing fabrication.

3.4 MARKING

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

3.5 ERECTION

- .1 Erect structural steel, as indicated and in accordance with CAN/CSA-S16, CAN/CSA-S136, and in accordance with reviewed erection drawings.
- .2 Field cutting or altering structural members: to approval of Contract Administrator.
- .3 Clean with mechanical brush and touch up shop primer to bolts, rivets, welds and burned or scratched surfaces at completion of erection.
- .4 Continuously seal members by continuous welds where indicated. Grind smooth.

3.6 FIELD QUALITY CONTROL

- .1 Inspection and testing of materials and workmanship will be carried out by testing laboratory designated by Contract Administrator.
- .2 Provide safe access and working areas for testing on site, as required by testing agency and as authorized by Contract Administrator.
- .3 Submit test reports to Contract Administrator within 2 weeks of completion of inspection.
- .4 City of Winnipeg will pay costs of tests as specified in Section 01 21 00 – Allowances.

- .5 Test shear studs in accordance with CSA W59.

3.7 FIELD PAINTING

- .1 Paint in accordance with Section 09 91 00 - Painting.
 - .1 Touch up damaged surfaces and surfaces without shop coat with primer to SSPC-SP7 except as specified otherwise. Apply in accordance: MPI Architectural Painting Specification Manual.

3.8 CLEANING

- .1 Clean in accordance with Section 01 74 00 – Project Clean-Up.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 05 12 23 – Structural Steel
- .2 Section 05 31 00 - Steel Deck.

1.2 REFERENCES

- .1 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-85.10-99, Protective Coatings for Metals.
- .2 Canadian Institute of Steel Construction (CISC)/Canadian Paint Manufacturer's Association (CPMA)
 - .1 CISC/CPMA 2-75, Quick-Drying, Primer for Use on Structural Steel.
 - .2 CISC/CPMA 1-73a, Quick-Drying, One-Coat Paint for Use on Structural Steel.
- .3 Canadian Standards Association (CSA International)
 - .1 CSA-G40.20/G40.21-98, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
 - .2 CAN/CSA-S16-01, Limit States Design of Steel Structures.
 - .3 CSA-S136-94(R2001), Cold Formed Steel Structural Members.
 - .4 CSA-W47.1-92(R2001), Certification of Companies for Fusion Welding of Steel Structures.
 - .5 CSA-W55.3-1965(R1998), Resistance Welding Qualification Code for Fabricators of Structural Members Used in Buildings.
 - .6 CSA-W59-03, Welded Steel Construction (Metal Arc Welding).

1.3 QUALITY ASSURANCE

- .1 Submit 2 copies of mill test reports at least 4 weeks prior to fabrication of steel joists and accessories. Reports to show:
 - .1 Chemical and physical properties.
 - .2 Other details of steel to be incorporated into work.
 - .3 Certification by qualified metallurgists confirming that tests conform to requirements of CSA G40.20/G40.21
- .2 Upon request, supply affidavit prepared by fabricator of structural steel joists stating that materials and products used in fabrication conform to this specification.

1.4 DESIGN OF STEEL JOISTS AND BRIDGING

- .1 Design steel joists and bridging to carry loads indicated on drawings in accordance with CAN/CSA-S16, CSA-S136.
- .2 Design joists and anchorages for uplift forces as indicated.

- .3 Ensure joists are manufactured to consider load effects due to fabrication, erection and handling.
- .4 Limit floor and roof joist deflection due to specified live load to L/360 and deflection due to specified total load to L/240.
- .5 Upon request, submit 2 copies of calculations and joist design drawings for typical joists for Contract Administrator review at least 4 weeks prior to fabrication and/or delivery.

1.5 SHOP DRAWINGS

- .1 Submit shop details and erection drawings in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit drawings stamped and signed by qualified professional engineer registered in the province Manitoba, Canada.
- .3 Indicate on erection drawings, relevant details such as joist mark, depth, spacing, bridging lines, bearing, anchorage and details.
- .4 Provide particulars, on shop drawings, relative to joist geometry, framed openings, splicing details, bearing and anchorage. Include member size, properties, specified and factored member loads, and stresses under various loadings, deflection and camber.

Part 2 Products

2.1 MATERIALS

- .1 Structural steel: to CSA-G40.20/G40.21 and CSA-S136.
- .2 Welding materials: to CSA-W59.
 - .1 Shop paint primer:
 - .1 Steel not receiving finish painting: one coat of CISC/CPMA 1-73A quick drying shop primer
 - .2 Shear studs: to CSA-W59, Appendix H.

2.2 FABRICATION

- .1 Fabricate steel joists and accessories as indicated in accordance with CAN/CSA-S16.1, CSA-S136, and in accordance with reviewed shop drawings.
- .2 Weld in accordance with CSA-W59.
- .3 Provide top and bottom chord extensions where indicated.
- .4 Provide diagonal and horizontal bridging and anchorages as required.
- .5 Weld studs to top chords for attachment purposes.

- .6 Install shear studs in accordance with CSA-W59.

2.3 SHOP PAINTING

- .1 Clean, prepare surfaces and shop prime structural steel as follows:
 - .1 Steel not receiving finish painting: One coat of CISC / CPMA 1-73a quick drying shop primer. Steel to be cleaned in conformance with SSPC-SP2.
 - .2 Clean members of loose mill scale, rust, oil, dirt and other foreign matter.
 - .3 Apply one coat of primer in shop to steel surfaces, except:
 - .1 Surfaces to be encased in concrete.
 - .2 Surfaces to receive field installed stud shear connections.
 - .3 Surfaces and edges to be field welded.
 - .4 Faying surfaces of slip-critical connections.
 - .5 Below grade surfaces in contact with soil.
 - .4 Apply paint under cover, on dry surfaces when surface and air temperatures are above 5 degrees C.
 - .5 Maintain dry condition and 5 degrees C minimum temperature until paint is thoroughly dry.
 - .6 Strip paint bolts, nuts, sharp edges and corners before prime coat is dry.

Part 3 Execution

3.1 GENERAL

- .1 Structural steel work: in accordance with CAN/CSA-S16, and CSA-S136.
- .2 Welding: in accordance with CSA-W59.
- .3 Companies to be certified under Division 1 or 2.1 of CSA-W47.1 for fusion welding and/or CSA-W55.3 for resistance welding.
- .4 Provide certification that welded joints are qualified by Canadian Welding Bureau.

3.2 CONNECTION TO EXISTING WORK

- .1 Verify dimensions and condition of existing work; report discrepancies and potential problem areas to Contract Administrator for direction before commencing fabrication.

3.3 FIELD QUALITY CONTROL

- .1 Inspection and testing of materials and workmanship will be carried out by testing laboratory designated by Contract Administrator.

- .2 Testing laboratory will inspect representative joists for integrity, accuracy of fabrication and soundness of welds. Contract Administrator will determine extent of and identify all inspections.
- .3 Submit test report to Contract Administrator 2 weeks after completion of inspection.
- .4 Owner will pay costs of tests as specified in Section 01 21 00 – Allowances.
- .5 Test shear studs in accordance with CSA-W59.

3.4 ERECTION

- .1 Erect steel joists and bridging as indicated in accordance with CAN/CSA-S16.1, CSA-S136, and in accordance with reviewed erection drawings.
- .2 Complete installation of all bridging and anchorages before placing construction loads on joists.
- .3 Field cutting or altering joists or bridging that are not shown on shop drawings: to be reviewed by Contract Administrator.
- .4 Clean and touch up shop primer to bolts, welds, burned or scratched surfaces at completion of erection.

3.5 FIELD PAINTING

- .1 Paint in accordance with Section 09 91 00 - Painting.
 - .1 Touch up damaged surfaces and surfaces without shop coat with primer to SSPC-SP7 except as specified otherwise. Apply in accordance: MPI Architectural Painting Specification Manual.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

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

1.2 REFERENCES

- .1 American Society for Testing and Materials International, (ASTM)
 - .1 ASTM A653/A653M-01a, Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - .2 ASTM A792/A792M-01a, Specification for Steel Sheet, 55%Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-1.181-99, Ready-Mixed Organic Zinc-Rich Coating.
- .3 Canadian Standards Association (CSA International)
 - .1 CSA C22.2 No.79-1978(R1999), Cellular Metal and Cellular Concrete Floor Raceways and Fittings.
 - .2 CAN/CSA-S16.1-94(R2000), Limit States Design of Steel Structures.
 - .3 CSA-S136-94(R2001), Cold Formed Steel Structural Members.
 - .4 CSA W47.1-92(R2001), Certification of Companies for Fusion Welding of Steel Structures.
 - .5 CSA W55.3-1965(R1998), Resistance Welding Qualification Code for Fabricators of Structural Members Used in Buildings.
 - .6 CSA W59-03, Welded Steel Construction (Metal Arc Welding).
- .4 Canadian Sheet Steel Building Institute (CSSBI)
 - .1 CSSBI 10M-96, Standard for Steel Roof Deck.
 - .2 CSSBI 12M-96, Standard for Composite Steel Deck.

1.3 DESIGN REQUIREMENTS

- .1 Design steel deck using limit states design in accordance with CSA S136.
- .2 Steel deck and connections to steel framing to carry dead, live and other loads including lateral loads, diaphragm action, composite deck action, and uplift as indicated.
- .3 Deflection under specified live load not to exceed 1/360 of span.

1.4 SHOP DRAWINGS

- .1 Submit shop drawings erection and shoring drawings in accordance with Section 01 33 00 - Submittal Procedures.

- .2 Submit drawings stamped and signed by qualified professional engineer registered or licensed in Province of Manitoba, Canada.
- .3 Submit design calculations if requested by Contract Administrator.
- .4 Indicate deck plan, profile, dimensions, base steel thickness, metallic coating designation, connections to supports and spacings, projections, openings, reinforcement details and accessories.
- .5 Indicate details of temporary shoring of steel deck, such as location, time and duration of placement and removal of shoring for concrete fill decks.

Part 2 Products

2.1 MATERIALS

- .1 Zinc-iron Alloy (ZF) coated steel sheet: to ASTM A653/A653M structural quality Grade 230, with ZF75 coating, for interior surfaces not exposed to weather, unpainted finish, thickness as indicated on structural drawings.
- .2 Decks to be painted: zinc-iron alloy coated decks suitable for finish painting.
- .3 Zinc (Z) coated steel sheet: to ASTM A653/A653M structural quality Grade 230, with ZF75, coating, for exterior surfaces exposed to weather, thickness as indicated on structural drawings.
- .4 Acoustic insulation: fibrous glass 17.5 kg/m³ density profiled to suit deck flutes.
- .5 Closures: as indicated in accordance with manufacturer's recommendations.
- .6 Cover plates, cell closures and flashings: steel sheet with minimum base steel thickness of 0.76 mm. Metallic coating same as deck material.
- .7 Primer: zinc rich, ready mix to CAN/CGSB-1.181.
- .8 Shear studs: to CSA W59.

2.2 TYPES OF DECKING

- .1 Steel roof deck: thickness and profile as per structural drawings, interlocking side laps.
- .2 Acoustic steel roof deck: thickness and profile as per structural drawings, non-cellular, perforated on vertical face of flutes, interlocking side laps. Flat sheet for cellular deck.
- .3 Composite steel floor deck: thickness and profile as per structural drawings, interlocking side laps.

Part 3 Execution

3.1 GENERAL

- .1 Structural steel work: in accordance with CAN/CSA-S136.
- .2 Welding: in accordance with CSA W59, except where specified otherwise.
- .3 Companies to be certified under Division 1 or 2.1 of CSA W47.1 for fusion welding of steel and/or CSA W55.3 for resistance welding.

3.2 ERECTION

- .1 Erect steel deck as indicated and in accordance with CSA S136, and in accordance with reviewed erection drawings.
- .2 Butt ends: to 1.5 to 3 mm gap. Install steel cover plates over gaps wider than 3 mm.
- .3 Lap ends: to 50 mm minimum.
- .4 Weld and test stud shear connectors through steel deck to steel joists/beams below in accordance with CSA W59.
- .5 Immediately after deck is permanently secured in place, touch up metallic coated top surface with compatible primer where burned by welding.
- .6 Prior to concrete placement, steel deck to be free of soil, debris, standing water, loose mill scale and other foreign matter.
- .7 Temporary shoring, if required, to be designed to support construction loads, wet concrete and other construction equipment. Do not remove temporary shoring until concrete attains 75% of its specified 28 day compression strength.
- .8 Place and support reinforcing steel as indicated.

3.3 CLOSURES

- .1 Install closures in accordance with approved details.

3.4 OPENINGS AND AREAS OF CONCENTRATED LOADS

- .1 No reinforcement required for openings cut in deck which are smaller than 150 mm square.
- .2 Frame deck openings with any one dimension between 150 to 300 mm as with minimum L64x64x6.4 each side of opening perpendicular to flutes. Angle shall be welded to at least two flutes on each side of opening.
- .3 Deck supplier shall reinforce openings over 300mm to 450mm across the flutes with suitable reinforcement based on a structural analysis of the loads involved.

- .4 For deck openings with any one dimension greater than 450 mm and for areas of concentrated load, reinforce in accordance with structural framing details, except as otherwise indicated.

3.5 CONNECTIONS

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

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Wind/suction and axial load bearing formed steels stud for exterior wall assembly framing. Framing to include wall z-bar girts and insulation clips as detailed on Drawings for both masonry and exterior steel stud walls.
- .2 Roof loading requirements for design of roof insulation clips.
- .3 All anchorage and components described in this Section to be designed by a registered professional engineer, licensed to practice in Manitoba.

1.2 RELATED SECTIONS

- .1 Section 05 12 23 - Structural Steel for Buildings
- .2 Section 06 10 00 – Rough Carpentry
- .3 Section 07 42 43 – High Pressure Laminate Phenolic Wall System
- .4 Section 07 42 46 –Fibre Reinforced Cementitious Panels
- .5 Section 07 26 00 - Vapour Retarders
- .6 Section 07 61 00 – Sheet Metal Roofing & Wall Panels
- .7 Section 07 62 00 - Sheet Metal Flashing and Trim
- .8 Section 09 21 16 - Gypsum Board Assemblies

1.3 REFERENCES

- .1 AWS D1.3/D1.3M-2008 - Structural Welding Code – Sheet Steel.
- .2 ASTM A307-07b - Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
- .3 ASTM A325M-09 - Structural Bolts, Steel, Heat Treated 830 MPa Minimum Tensile Strength.
- .4 ASTM A653/A653M-09 - Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- .5 ASTM A792/A792M-09a - Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.
- .6 ASTM C954-07 - Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness.
- .7 ASTM C955-09a - Load-Bearing (Transverse and Axial) Steel Studs, Runners (Tracks), and Bracing or Bridging for Screw Application of Gypsum Panel Products and Metal Plaster Bases.
- .8 CAN/CGSB-1.181-99 - Ready-Mixed, Organic Zinc-Rich Coating.
- .9 CAN/CGSB-7.1-98 - Lightweight Steel Wall Framing Components.
- .10 CAN/CSA-S16-09 - Design of Steel Structures.
- .11 CAN/CSA-S136-07 - North American Specification for the Design of Cold-Formed Steel Structural Members.

- .12 CAN/ULC-S101-07 - Standard Methods of Fire Endurance Tests of Building Construction Materials.
- .13 CSA-A370-04 - Connectors for Masonry.
- .14 CSA-A371-04 - Masonry Construction for Buildings.
- .15 CSA-S304.1-04 - Masonry Design for Buildings (Limit States Design).
- .16 CSA-W47.1-09 - Certification of Companies for Fusion Welding of Steel Structures.
- .17 CSA-W55.3-08 - Certification of Companies for Resistance Welding of Steel and Aluminum.
- .18 CSA-W59-03 (R2008) - Welded Steel Construction (Metal Arc Welding).
- .19 CSSBI (Canadian Sheet Steel Building Institute - 51-06 - Lightweight Steel Framing Design Manual, 2nd Edition.
- .20 SSPC (The Society for Protective Coatings) - Steel Structures Painting Manual.
- .21 The Master Painters Institute (MPI) / Architectural Painting Specification Manual - February 2004
 - .1 MPI # 18, Organic Zinc Rich Primer.

1.4 PERFORMANCE REQUIREMENTS

- .1 Maximum Allowable Deflection: 1:600 of span.
- .2 Exterior Wall Assemblies:
 - .1 Design to CSSBI 51, National Building code, CSA-S136.
 - .2 Design to provide for movement of components without damage, failure of joint seals, undue stress on fasteners, or other detrimental effects when subject to seasonal or cyclic day/night temperature ranges.
 - .3 Design assembly to accommodate construction tolerances, deflection of building structural members, and clearances of intended openings.
 - .4 Seismic Loads: Design and size components to withstand seismic loads and sway displacement as calculated in accordance with code applicable at place of the Work.
 - .5 Design stud system and tie back clips supporting masonry veneer, metal siding, HPL siding and panels, and fibre cement panels to requirements of CSA-S304.1 with veneer deflections limited to L/600.
 - .6 Design anchorage of insulation clips to building structure.
- .3 Exterior Metal Roof Assemblies:
 - .1 Snow loads and snow build-up and rain load, expected in this geographical region NBCC climatic data, 50 year probability.
 - .2 Wind loads, positive and negative, expected in this geographical region NBCC climatic data, 50 year probability.
 - .3 Dead load of roof system.
 - .4 If the roof system is to be designed as a shear diaphragm, then the factored shear design loads “Q” and the flexibility factors “F” must be shown on the structural drawings.
 - .5 Design anchorage of insulation clips to building structure.

1.5 ADMINISTRATIVE REQUIREMENTS

- .1 Coordination:
 - .1 Coordinate with other work having a direct bearing on work of this section.

1.6 SUBMITTALS FOR REVIEW

- .1 Section 01 33 00: Submission procedures.
- .2 Product Data: Provide data on standard framing members; describe materials and finish, product criteria, limitations and gauge thickness.

1.7 SUBMITTALS FOR INFORMATION

- .1 Section 01 33 00: Submission procedures. All shop drawings to include Engineer's seal of a Professional Engineer licensed to practice in Manitoba.

1.8 CLOSEOUT SUBMITTALS

- .1 Section 01 78 00: Submission procedures.

1.9 QUALITY ASSURANCE

- .1 Products of This Section: Manufactured to ISO 9000 certification requirements.
- .2 Calculate structural properties of framing members to CSSBI 51, CSA-W47.1, CSA-W55.3, CSA-W59 requirements.
- .3 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three (3) years documented experience.
- .4 Installer Qualifications: Company specializing in performing the work of this section with minimum three (3) years documented experience and approved by the manufacturer.
- .5 Design structural elements under direct supervision of a Professional Structural Engineer experienced in design of this Work and licensed at the place where the Project is located.
- .6 Form, fabricate, install, and connect components to CSSBI 51 - Lightweight Steel Framing Design Manual.

Part 2 Products

2.1 FRAMING MATERIALS

- .1 Framing Materials: Cold-rolled steel conforming to CSA-S136, Grade as specified on Structural Drawings, with metallic coating to ASTM A653/A653M, minimum coating thickness Z180 (G60), unless located outside the exterior membrane, then Z275 (G90).
 - .1 Studs: CAN/CGSB-7.1, ASTM C955, formed to channel shape, punched web, knurled faces.
 - .2 Track: Formed steel; channel shaped; same width as studs, tight fit; solid web.
 - .3 Z-Bar wall girts: adjustable galvanized metal z-bars to be designed to support load imposed by wall cladding systems as detailed on Drawings.
 - .4 Insulation clips: adjustable stainless steel or galvanized metal insulation clips to be designed to support load imposed by wall cladding systems & roof system as detailed on Drawings. Insulation clips to include an insulating pad or plastic

thermal stop at the base to help mitigate thermal bridging. Design of insulation clip anchorage to building structure by supplier.

2.2 ACCESSORIES

- .1 Bracing, Furring, Bridging: Formed sheet steel, thickness determined by performance requirements specified.
- .2 Plates, Gussets, Clips: Formed sheet steel, thickness determined by performance requirements specified.
- .3 Welding Materials: CSA-W59.
- .4 Touch-Up Primer for Galvanized Surfaces: CAN/CGSB-1.181, zinc rich.

2.3 FASTENERS

- .1 Bolts, Nuts and Washers: ASTM A307, ASTM A325M, hot-dip galvanized to minimum requirements of CSSBI.
- .2 Self-drilling, Self-tapping Screws: Steel, hot dip galvanized to minimum requirements of CSSBI.
- .3 Anchorage Devices: Powder actuated, drilled expansion bolts or screws with sleeves; hot-dip galvanized to minimum requirements of CSSBI.
- .4 Design of anchorage of insulation clips to building structure by supplier.

2.4 FABRICATION

- .1 Fabricate assemblies of formed sections to sizes and profiles required.
- .2 Provide cut-outs centred in webs of members to accommodate services and through-the-knockout style bridging.
- .3 Fit, reinforce, and brace framing members to suit design requirements.
- .4 Fit and assemble in largest practical sections for delivery to site, ready for installation.
- .5 Do welding to CSA-S136, CSA-W59 and AWS D1.3, as applicable.

Part 3 Execution

3.1 EXAMINATION

- .1 Verify that building components are ready to receive work.
- .2 Verify that rough-in utilities are in proper location.

3.2 ERECTION OF STUD WORK

- .1 Install components to manufacturer's written instructions.
- .2 Align floor and ceiling tracks; locate to wall layout. Secure in place with fasteners at maximum 600 mm (24 inches) on centre. Coordinate installation of acoustic sealant with floor and ceiling tracks.
- .3 Place studs 400 mm (16 inches) on centre unless noted otherwise on Drawings; not more than 50 mm (2 inches) from abutting walls and at each side of openings. Connect studs to tracks using fastener method.

- .4 Construct corners using minimum three studs. Double stud wall openings, door jambs, and window jambs.
- .5 Erect load bearing studs one piece full length. Splicing of studs is not permitted.
- .6 Erect load bearing studs, brace, and reinforce to develop full strength, to achieve design requirements.
- .7 Coordinate placement of insulation in multiple stud spaces after erection.
- .8 Install intermediate studs above and below openings to align with wall stud spacing.
- .9 Provide deflection allowance in stud track, directly below horizontal building framing at non-load bearing framing. Refer to Drawings for deflection head details.
- .10 Attach solid wood blocking to studs for attachment of fixtures anchored to walls.
- .11 Install framing between studs for attachment of mechanical and electrical items, and to prevent stud rotation.
- .12 Touch-up field welds and damaged galvanized surfaces with primer.

END OF SECTION

Part 1 General

1.1 Related requirements

- .1 06 40 00 Architectural Woodwork
- .2 08 11 00 Metal Doors and Frames
- .3 09 21 16 Gypsum Board Assemblies
- .4 09 91 00 Painting
- .5 Section 32 31 13 - Chain Link Fences and Gates
- .6 Section 32 31 16 - Welded Wire Fences and Gates
- .7 Structural Drawings and Specifications

1.2 Reference standards

- .1 ASTM International (ASTM)
 - .1 ASTM A 53/A 53M-12, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.
 - .2 ASTM A269M-15a, Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.
 - .3 ASTM A307-14, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
- .2 CSA Group (CSA)
 - .1 CSA G40.20-13/G40.21-, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
 - .2 CAN/CSA G164-M92(R2003), Hot Dip Galvanizing of Irregularly Shaped Articles.
 - .3 CSA S16-14, Design of Steel Structures.
 - .4 CSA W48-14, Filler Metals and Allied Materials for Metal Arc Welding (Developed in co-operation with the Canadian Welding Bureau).
 - .5 CSA W59-13, Welded Steel Construction (Metal Arc Welding) Metric
- .3 Environmental Choice Program (ECP)
 - .1 CCD-048-95(2006), Surface Coatings - Recycled Water-borne
- .4 Green Seal Environmental Standards (GS)
 - .1 GS-11-2011, Paints and Coatings
- .5 The Master Painters Institute (MPI)
 - .1 Architectural Painting Specification Manual - current edition
- .6 Underwriters Laboratories (UL)
 - .1 UL 2768-11, Architectural Surface Coatings

1.3 Action and informational submittals

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

- .2 Product Data:
 - .1 Submit two copies of WHMIS SDS in accordance with Section 01 35 29.06 - Health and Safety Requirements.
 - .1 For finishes, coatings, primers, and paints applied on site: indicate VOC concentration in g/L.
- .3 Shop Drawings:
 - .1 Submit drawings stamped and signed by professional engineer registered or licensed in Manitoba, Canada.
 - .2 Indicate materials, core thicknesses, finishes, connections, joints, method of anchorage, number of anchors, supports, reinforcement, details, and accessories.
- .4 Sustainable Design Submittals:
 - .1 LEED Submittals: in accordance with 01 35 20 - LEED Sustainable Requirements.
 - .2 Construction Waste Management: Refer to Section 01 74 19 - Construction Waste Management and Disposal.
 - .3 Material product attribute documentation: Refer to Product Check Sheet as listed in 01 35 20 – LEED Sustainable Requirements to determine applicable type of documentation required for each product.
 - .4 Low-Emitting Materials:
 - .1 Submittals are required for any sealants, adhesives, paints, coatings, composite wood, flooring, wall panels, insulation or ceiling components within the inner most weather proofing barrier.
 - .2 Refer to Product Check Sheet as listed in 01 35 20 – LEED Sustainable Requirements to determine applicable type of documentation required for each product.

1.4 Quality assurance

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

1.5 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 off ground indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Replace defective or damaged materials with new.
- .4 Develop Construction Waste Management Plan related to Work of this Section and in accordance with Section 01 35 20 - LEED Sustainable Requirements.

- .5 Packaging Waste Management: remove for reuse and return of pallets, crates, padding, and packaging materials as specified in Construction Waste Management Plan in accordance with Section 01 35 20 - LEED Sustainable Requirements.

Part 2 Products

2.1 Materials

- .1 Steel sections and plates: to CSA G40.20/G40.21, Grade 350W.
- .2 Steel pipe: to ASTM A53/A53M standard weight, galvanized finish.
- .3 Welding materials: to CSA W59.
- .4 Welding electrodes: to CSA W48 Series
- .5 Bolts and anchor bolts: to ASTM A307
- .6 Stainless steel Sheet: Type 304
- .7 Grout: non-shrink, non-metallic, flowable, 15 MPa at 24 hours.

2.2 Fabrication

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

2.3 Finishes

- .1 Galvanizing: hot dipped galvanizing with zinc coating 600 g/m² to CAN/CSA-G164
- .2 Chromium plating: chrome on steel with plating sequence of 0.00035" (0.009 mm) thickness of copper 0.00039" (0.010 mm) thickness of nickel and 0.00009" (0.0025 mm) thickness of chromium.
- .3 Shop coat primer: to CAN/CGSB 1.40.
- .4 Zinc primer: zinc rich, ready mix to MPI-EXT 5.2C in accordance with chemical component limits and restrictions requirements and VOC limits of GS-11 .

2.4 Isolation coating

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

2.5 Shop painting

- .1 Primer: VOC limit 250 g/L maximum to GS-11.
- .2 Apply one shop coat of primer to metal items, with exception of galvanized or concrete encased items.

- .3 Use primer unadulterated, as prepared by manufacturer. Paint on dry surfaces, free from rust, scale, grease. Paint when temperature minimum 7 degrees C.
- .4 Clean surfaces to be field welded; do not paint.

2.6 Angle lintels

- .1 Steel angles: galvanized, sizes indicated for openings. Refer to structural drawings.
- .2 Weld or bolt back-to-back angles to profiles as indicated.
- .3 Finish: shop painted.
 - .1 Primer: VOC limit 250 g/L maximum to GS-11 when applied onsite.

2.7 HSS Rainwater Leaders

- .1 Size: 100mm D x 150mm W x 4.7mm thick steel tube, minimum 2440mm H
- .2 Weld joint at lower angle and weld 3 steel straps per tube. Fasten straps to wood blocking as shown in details. Anchoring of straps to be designed by professional engineer registered or licensed in the Province of Manitoba, Canada.
- .3 All exposed edges to be rounded for safety.
- .4 Powdercoated finish - colour to match siding.
- .5 Submit drawings stamped and signed by professional engineer registered or licensed in the Province of Manitoba, Canada.

2.8 Steel Pipe Bollards (Exterior)

- .1 Provide steel bollards where scheduled on drawings.
- .2 150mm (6") diameter, galvanized steel pipe. Concrete filled.
- .3 Paint finish - refer to Section 09 91 00.
- .4 Refer to structural for details.

2.9 Slab Bearing Angles

- .1 Provide galvanized steel angles to support concrete slabs, including steel angle spacers, where scheduled
- .2 Refer to Structural Drawings

2.10 Stainless Steel Mop Sink Surrounds

- .1 Provide stainless steel surround at all mop sinks
 - .1 Material: Stainless Steel, 14 Ga., Type 304
 - .2 Size: Refer to Architectural Drawings, 915mm high
 - .3 Edge Finish: All edges are hemmed, ensure no sharp edges

2.11 Stainless Steel Shroud - Washroom Vanity

- .1 Provide Stainless Steel Plumbing Shroud in Multi-Stall Washroom (SS-1)
 - .1 Material: Formed Edge Stainless Steel, 14 Ga., Type 304
 - .2 Size: Refer to Architectural Drawings

- .3 Installation: Angled Wall Brackets with Tamper Proof Spanner Head Security Machine Screws
 - .1 Angled Wall Brackets: Refer to Architectural Details
- .4 Edge Finish: All edges are hemmed, ensure no sharp edges
- .5 Locations: Washroom 104

2.12 Stainless Steel Lawn Edging

- .1 Material: Type 304 Stainless Steel, corrosion and rust resistant
- .2 Installation: 3 installation nails per unit, seamless connection end to end. Ensure no sharp edges are present.
- .3 Size: Height to suit site conditions (adjacent gravel and sod), length to suit site conditions (length of window recess)
- .4 Acceptable material: Vodaland Stainless Steel Border Edging
 - .1 Or approved equal

2.13 Access ladders

- .1 Stringers and Rungs: As indicated on drawings.
- .2 Steel Rungs: 20 mm diameter, welded to stringers at 300 mm on centre.
- .3 Brackets: sizes and shapes as indicated, weld to stringers at 1500 mm on centre, complete with fixing anchors.
- .4 Shop paint ladder after fabrication. Colour to be selected by Contract Administrator from Manufacturer's standard range.
- .5 Submit drawings stamped and signed by professional engineer registered or licensed in Manitoba, Canada.

2.14 Washroom Vanity Support Structure

- .1 Provide concealed vanity support structure as detailed on drawings.

2.15 Serving Counter Support

- .1 Provide heavy-duty centreline counter support bracket at counter in lobby 101 as detailed on drawings.
- .2 Submit drawings stamped and signed by professional engineer registered or licensed in Manitoba, Canada.

2.16 Overhead Door Metal Jamb & Head Plates

- .1 Supply galvanized and painted steel plates, anchored to concrete block walls as detailed on Drawings.
- .2 Submit drawings stamped and signed by professional engineer registered or licensed in Manitoba, Canada.

2.17 Fire Shutter Closure Angles

- .1 Supply steel closure angles, as detailed on Drawings. Finish to match adjacent walls.

- .2 Submit drawings stamped and signed by professional engineer registered or licensed in Manitoba, Canada.

2.18 Roof Deck Opening Cover Plates - Arena

- .1 Supply 3mm thick powdercoated steel plates, as detailed on Drawings.
- .2 Submit drawings stamped and signed by professional engineer registered or licensed in Manitoba, Canada.

2.19 Garbage Enclosure

- .1 Provide steel garbage enclosure as detailed on drawings. Powdercoat finish (black).
- .2 Submit drawings stamped and signed by professional engineer registered or licensed in Manitoba, Canada.

2.20 Roof Mechanical Screen

- .1 Provide steel roof screen structure as detailed on drawings. Powdercoat finish (black).

Part 3 Execution

3.1 Examination

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

3.2 Erection - general

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

- .9 Touch-up galvanized surfaces with zinc rich primer where burned by field welding.
 - .1 Primer: maximum VOC limit 250 g/L GS-11.

3.3 Access ladders

- .1 Install access ladders in locations as indicated.

3.4 Cleaning

- .1 Progress Cleaning: clean in accordance with Section 01 74 00 - 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 00 - Cleaning.
- .3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 35 20 - LEED Sustainable Requirements.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.5 Protection

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

END OF SECTION

Part 1 General

1.1 Related requirements

- .1 Section 06 40 00 – Architectural Woodwork.
- .2 Section 08 11 00 - Metal Doors and Frames
- .3 Section 08 44 13 – Glazed Aluminum Curtain Wall.
- .4 Section 08 11 16 - Aluminum Doors and Frames
- .5 Section 08 51 13 - Aluminum Windows
- .6 Section 09 22 16 – Non-Structural Metal Framing.
- .7 Section 10 28 00 – Toilet and Bath Accessories.
- .8 Structural, Mechanical and Electrical Specifications.

1.2 Reference standards

- .1 CSA Group (CSA)
 - .1 CSA B111-1974(R2003) , Wire Nails, Spikes and Staples.
 - .2 CSA O121-08, Douglas Fir Plywood.
 - .3 CSA O141-05(R2009), Softwood Lumber.
 - .4 CSA O151-09, Canadian Softwood Plywood.
 - .5 CAN/CSA-O325.0-07, Construction Sheathing.
 - .6 CAN/CSA-Z809-08, Sustainable Forest Management.
- .2 National Research Council Canada (NRC)
 - .1 National Building Code of Canada 2015 (NBC).
- .3 Forest Stewardship Council (FSC)
 - .1 FSC-STD-01-001-2004, FSC Principle and Criteria for Forest Stewardship.
- .4 National Lumber Grades Authority (NLGA)
 - .1 Standard Grading Rules for Canadian Lumber 2010.

1.3 Informational submittals

- .1 In accordance with Section 01 33 00: Submission procedures.
- .2 Sustainable Design:
 - .1 In accordance with Section 01 35 20: LEED Sustainable Requirements.
 - .2 Provide required LEED documentation for Product recycled content ,regional materials, and certified wood.
 - .3 Manufacturer's Certificate: Certify that Products meet or exceed specified requirements.

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.
- .4 Pressure Preservative Treated Wood: Marked with certification mark authorized by the Canadian Wood Preservers Bureau (CWPB) indicating producer, preservative type, retention and Use Category (UC).

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 in indoors and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect wood from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.

Part 2 Products

2.1 Lumber materials

- .1 Dimension Lumber: CSA-O141, softwood lumber unless indicated otherwise, S4S, maximum moisture content 19%; graded to NLGA Grading Rules Standard Grading Rules for Lumber. Finger jointed lumber not acceptable.

2.2 Panel materials

- .1 Douglas fir plywood (DFP): to CSA O121, standard construction.
 - .1 Urea-formaldehyde free.
- .2 Canadian softwood plywood (CSP): to CSA O151, standard construction.
 - .1 Urea-formaldehyde free.
- .3 Plywood, OSB and wood based composite panels: to CAN/CSA-O325.
 - .1 Urea-formaldehyde free.

2.3 Preservative treatment

- .1 Wood Preservative:
 - .1 Surface-applied wood preservative: clear, copper naphthenate or 5% pentachlorophenol solution, water repellent preservative.
 - .2 Pentachlorophenol use is restricted to building components that are in ground contact and subject to decay or insect attack only. Where used, pentachlorophenol-treated wood must be covered with two coats of an appropriate sealer.
 - .3 Structures built with wood treated with pentachlorophenol and inorganic arsenicals must not be used for storing food nor should the wood come in contact with drinking water.

2.4 Accessories

- .1 Fasteners: to CAN/CSA-G164:
 - .1 Hot dipped galvanized for high humidity interior, pressure treated wood and exterior applications.
 - .2 Stainless steel fasteners for finished carpentry, where indicated. Refer to Architectural Drawings.
- .2 Nails, spikes and staples: to CSA B111.
- .3 Bolts: 12.5mm diameter unless indicated otherwise, complete with nuts and washers
- .4 Proprietary fasteners: toggle bolts, expansion shields and lag bolts, screws and lead or inorganic fibre plugs, explosive actuated fastening devices, recommended for purpose by manufacturer.

Part 3 Execution

3.1 Examination

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

3.2 Preparation

- .1 Treat surfaces of material with wood preservative, before installation.
- .2 Apply preservative by dipping, or by brush to completely saturate and maintain wet film on surface for minimum 3 minute soak on lumber and 1 minute soak on plywood.
- .3 Re-treat surfaces exposed by cutting, trimming or boring with liberal brush application of preservative before installation.
- .4 Treat material as follows:
 - .1 Wood cants, fascia backing, curbs, nailers, sleepers on roof deck
 - .2 Wood furring and blocking for high humidity areas.

3.3 Installation

- .1 Comply with requirements of National Building Code of Canada (NBC), supplemented by the following paragraphs.
- .2 Install furring and blocking as required to space-out and support casework, cabinets, wall and ceiling finishes, facings, fascia, soffit, siding and other work as required.
- .3 Align and plumb faces of furring and blocking to tolerance of 1:600.
- .4 Install rough bucks, nailers and linings to rough openings as required to provide backing for frames and other work.
- .5 Install wood cants, fascia backing, nailers, curbs and other wood supports as required and secure using galvanized steel fasteners.

- .6 Install wood backing, dressed, tapered and recessed slightly below top surface of roof insulation for roof hopper.
- .7 Install sleepers as indicated.
- .8 Use caution when working with particle board. Use dust collectors and high quality respirator masks.
- .9 Frame, anchor, fasten, tie and brace members to provide necessary strength and rigidity.
- .10 Countersink bolts where necessary to provide clearance for other work.

3.4 Framing

- .1 Set structural members level and plumb, in correct position.
- .2 Make provisions for erection loads, and for sufficient temporary bracing to maintain structure safe, plumb, and in true alignment until completion of erection and installation of permanent bracing.
- .3 Place horizontal members, crown side up.
- .4 Construct load bearing framing and curb members full length without splices.
- .5 Space framing as indicated on Drawings.
- .6 Curb roof openings except where prefabricated curbs are provided. Form corners by alternating lapping side members.
- .7 Coordinate curb installation with installation of decking and support of deck openings, roofing vapour retardant, and parapet construction.

3.5 Sheathing

- .1 Secure sheathing to framing members with ends over firm bearing and staggered.
- .2 Install telephone and electrical panel back boards with plywood sheathing material where required. Size the back board as indicated on Electrical Drawings and specifications.
- .3 Allow preservative to dry prior to erecting members.

3.6 Surface-applied Wood Preservative

- .1 Before installation, treat surfaces of material with wood preservative. Apply preservative after materials have been cut and fit to size.
- .2 Apply preservative by dipping, brush, or spray to completely saturate and maintain a wet film on the surface for a minimum of 3 minutes.
- .3 Re treat surfaces exposed by cutting, trimming, or boring with liberal brush application of preservative before installation.
- .4 Touch-up all material as follows:
 - .1 Wood backing, curbs, nailers, sleepers on roof deck or below grade.
 - .2 Blocking for windows and exterior door frames.

3.7 Site Applied Wood Treatment

- .1 Apply preservative treatment in accordance with manufacturer's written instructions.
- .2 Brush apply two (2) coats of preservative treatment on wood in contact with cementitious materials or roofing and related metal flashings. Treat site-sawn cuts.

3.8 Cleaning

- .1 Progress Cleaning: clean in accordance with Section 01 74 00 - 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 00 - Cleaning.

END OF SECTION

Part 1 General

1.1 Related requirements

- .1 Section 01 33 00 - Submittal Procedures
- .2 Section 01 35 20 - LEED Sustainable Requirements.
- .3 Section 01 35 29.06 - Health and Safety Requirements
- .4 Section 05 55 00 - Metal Fabrications.
- .5 Section 06 61 16 - Solid Surfacing Fabrications
- .6 Section 09 91 00 - Painting

1.2 Reference standards

- .1 American National Standards Institute (ANSI)
 - .1 ANSI/ASME 18.6.1 1981 (R2012) Wood Screws (Inch Series).
 - .2 ANSI/BHMA A156.9-2010, Cabinet Hardware.
 - .3 ANSI/BHMA A156.11-2014, Cabinet Locks.
 - .4 ANSI/BHMA A156.16-2013, Auxiliary Hardware.
 - .5 ANSI/BHMA A156.18-2012, Materials and Finishes.
 - .6 ANSI/BHMA A156.20-2006, Strap and Tee Hinges and Hasps.
 - .7 ANSI A208.1-09, Particleboard.
 - .8 ANSI A208.2-09, Medium Density Fiberboard (MDF) for Interior Applications.
 - .9 ANSI/HPVA HP-1-10, Standard for Hardwood and Decorative Plywood.
- .2 Architectural Woodwork Manufacturers Association of Canada (AWMAC)
 - .1 Architectural Woodwork Standards (AWMAC AWS), 2014.
- .3 ASTM International (ASTM)
 - .1 ASTM A 153/A 153M-16, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
 - .2 ASTM E 1333-14, Standard Test Method for Determining Formaldehyde Concentrations in Air and Emission Rates From Wood Products Using a Large Chamber.
 - .3 ASTM F1667-13 Standard Specification for Driven Fasteners: Nails, Spikes and Staples.
- .4 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-11.3-M87, Hardboard.
 - .2 CAN/CGSB-71.20-M88, Adhesive, Contact, Brushable.
 - .3 CAN/CGSB-71.19-M88, Adhesive, Contact, Sprayable.
- .5 CSA Group (CSA)
 - .1 CSA O112-M Series 1977 (R2006) Standards for Wood Adhesives.
 - .2 CSA O121-08(R2013), Douglas Fir Plywood.

- .3 CSA O141-05 (R2014), Softwood Lumber.
- .4 CSA O151-14, Canadian Softwood Plywood.
- .5 CSA O153-M1980 (R2014), Poplar Plywood.
- .6 CAN/CSA-Z809-08(R2013), Sustainable Forest Management.
- .6 Forest Stewardship Council (FSC)
 - .1 FSC-STD-01-001-2004, FSC Principle and Criteria for Forest Stewardship.
- .7 Green Seal Environmental Standards (GS)
 - .1 GS-11-2015, Paints, Coatings, Stains and Sealers.
 - .2 GS-36-2013, Adhesives for Commercial Use.
- .8 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Safety Data Sheets (SDS).
- .9 National Electrical Manufacturers Association (NEMA)
 - .1 ANSI/NEMA LD-3-05, High-Pressure Decorative Laminates (HPDL).
- .10 South Coast Air Quality Management District (SCAQMD), California State, Regulation XI. Source Specific Standards
 - .1 SCAQMD Rule 1113-A2011, Architectural Coatings.
 - .2 SCAQMD Rule 1168-A2005, Adhesives and Sealants Applications.
- .11 Sustainable Forestry Initiative (SFI)
 - .1 SFI-2015-2019 Standard and Rules.

1.3 Action and informational submittals

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Prepare and submit material list in accordance with AWMAC AWS, cross-referenced to specifications.
 - .2 Include manufacturer's instructions, printed product literature, data sheets and catalogue pages for all materials and products to be incorporated into architectural wood casework and include product characteristics, performance criteria, dimensions and profiles, finish and limitations on use.
 - .3 Submit two copies of WHMIS SDS in accordance with Section 01 35 29.06 - Health and Safety Requirements.
- .3 Hardware List:
 - .1 Submit hardware list cross-referenced to specifications.
 - .2 Include manufacturer's specification sheets indicating name, model, material, function, finish, BHMA designations and other pertinent information.
- .4 Shop Drawings:
 - .1 Prepare and submit shop drawings in accordance with AWMAC AWS and as follows.
 - .2 Submit two sets of shop drawings for initial review in accordance with requirements of Division 01. Revise as directed, submit six copies for final acceptance and distribution.

- .3 Indicate details of construction, profiles, jointing, fastening and other related details.
 - .1 Scales: profiles full size, details half full size.
- .4 Indicate materials, thicknesses, finishes and hardware.
- .5 Indicate locations of service outlets in casework, typical and special installation conditions, and connections, attachments, anchorage and location of exposed fastenings.
- .6 Show location on casework elevations of backing required in supporting structure for attachment of casework.
- .7 Indicate AWMAC AWS quality grade where different from predominant grade specified.
- .8 Include color schedule of all casework items, including all countertop, exposed, and semi-exposed cabinet finishes, finish material manufacturer, pattern, and color.
- .5 Samples:
 - .1 Prepare and submit samples in accordance with AWMAC AWS and as follows.
 - .2 Apply sample finishes to specified substrate or core material minimum 300 x 300 mm. For veneers with transparent finish submit three samples to illustrate range and colour of grain expected.
 - .3 Shop applied coatings:
 - .1 For transparent finish, submit duplicate samples of each species and cut of wood to be used, finished as specified.
 - .2 For opaque finish, submit duplicate samples for each colour selection, finished as specified.
 - .4 Submit duplicate samples of laminated plastic for each specified colour selection.
 - .5 Submit duplicate samples of laminated plastic joints, edging, cutouts and post-formed profiles.
 - .6 Certifications: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
 - .7 Submit statement of experience and qualifications of architectural wood casework fabricator.

1.4 Sustainable design submittals

- .1 Submit in accordance with 01 35 20 - LEED Sustainable Requirements for following characteristics:
 - .1 Recycled Content.
 - .2 Regional Materials.
 - .3 Low-Emitting Materials.
 - .4 Salvaged or recovered lumber.
- .2 Submit manufacturer's Chain-of-Custody Certificate number for CAN/CSA-Z809 or FSC or SFI certified wood.

- .1 Submit manufacturer's FSC Chain-of-Custody Certificate number.
- .3 Submit ASTM E1333 test report for formaldehyde emissions from composite wood products showing compliance with specified limits.
- .4 Submit product data indicating compliance with other specified sustainable design characteristics.

1.5 Quality assurance

- .1 Perform Work of this Section by single architectural wood casework fabricator with minimum 5 years of current architectural casework production experience and having completed minimum one project in the past 5 years with value within 20% of the cost of the work of this Section.
- .2 Maintain a copy of AWMAC / AWS Manual on site.

1.6 Delivery, storage and handling

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Deliver wood casework only when area of work is enclosed, plaster and concrete work is dry, and area is broom clean and site environmental conditions are acceptable for installation.
- .3 Protect millwork against dampness and damage during and after delivery.
- .4 Store millwork in ventilated areas, protected from extreme changes of temperature and humidity, and within range recommended by AWMAC AWS for location of project.
- .5 Store materials indoors in clean, dry, well-ventilated area.
- .6 Protect architectural woodwork and hardware from nicks, scratches, and blemishes.
- .7 Replace defective or damaged materials with new.
- .8 Waste Management: for packaging and materials, in accordance with 01 74 19 - Waste Management and Disposal.

Part 2 Products

2.1 Sustainability characteristics

- .1 Lumber, plywood and composite wood products to be CAN/CSA-Z809 or FSC or SFI certified
- .2 Composite wood products: formaldehyde emissions within the following limits when tested in accordance with ASTM E1333.
 - .1 Hardwood plywood with veneer core (HWPW-VC): 0.05 ppm.
 - .2 Hardwood plywood with composite core (HWPW-CC): 0.05 ppm.
 - .3 Particleboard (PB): 0.09 ppm.
 - .4 Medium density fibreboard (MDF): 0.11 ppm.
 - .5 Thin (less than 8 mm) medium density fibreboard (tMDF): 0.13 ppm.
- .3 Recycled content:
 - .1 Composite wood products: in accordance with Section 01 35 20 - LEED Requirements.

- .2 Fibreboard must contain less than 10% roundwood by weight, using weighted average over three month period at manufacturing locations.
- .4 Adhesives: VOC limit 50 g/L maximum to GS-36.
- .5 Coatings
 - .1 Wood Preservatives: VOC limit 350 g/L
 - .2 Wood Coatings: VOC limit 275 g/L
 - .3 Paints: VOC limit 50 g/L

2.2 Quality grade

- .1 Provide all materials and perform all fabrication in accordance with AWMAC AWS Custom Grade and as follows, except where specified otherwise:
 - .1 Economy Grade: storage rooms, janitor's closets, mechanical rooms and utility areas.
 - .2 Premium Grade: Reception Area, Meeting Rooms, Private Offices, Open Office, Lunchroom, and Multi-Purpose Rooms.
- .2 In case of conflict between Contract Documents and AWMAC AWS grade requirements, Contract Documents govern.

2.3 Lumber

- .1 Softwood and Hardwood Lumber: Sound lumber to specified AWMAC AWS quality grade requirements, kiln-dried to moisture content recommended by AWMAC AWS for location of the Work
- .2 Machine stress-rated lumber is acceptable for all purposes.
- .3 Face framing, pulls, trims, molding, edge-banding, stiles and rails: as specified.

2.4 Panel materials

- .1 Interior mat-formed wood particleboard: to ANSI/NPA A208.1, industrial grade M-2 or M-3, medium density (640-800 kg/m³), thickness 19 mm unless indicated otherwise.
 - .1 Use moisture resistant grade 2-M-2 or 2-M-3 for countertops and splash-backs to receive plumbing fixtures.
- .2 MDF (medium density fibreboard) core: to ANSI A208.2, density 769 kg/m³, Grade Standard, 19 mm thick unless indicated otherwise
 - .1 Use moisture resistant MR grade for countertops and splash-backs to receive plumbing fixtures.
- .3 Douglas fir plywood (DFP): to CSA O121, standard construction
- .4 Hardwood plywood: to ANSI/HPVA HP-1.
- .5 Canadian softwood plywood (CSP): to CSA O151, standard construction
- .6 Poplar plywood (PP): to CSA O153, standard construction
- .7 Hardboard: To CAN/CGSB-11.3

2.5 Wood Wall Panels (WP-1)

- .1 To NLGA Standard Grading Rules for Canadian Lumber

- .1 Material: G1S veneer core plywood, 13mm (1/2") thick, all edges sanded smooth
- .2 Grade: Premium
- .3 Species: Douglas Fir
- .4 Dimensions: As shown on Architectural Drawings
- .5 Fasteners: Type 304 stainless steel pan-head screws, size to suit.
 - .1 Pre-drill all fastener locations in shop, and sand smooth
 - .2 Align all pre-drilled fastener locations as per Architectural Drawings
- .6 Transparent Finish:
 - .1 AWI/AWMAC Finish System: Polyurethane, protective varnish.
 - .2 Stain: Clear - submit sample for review
 - .3 Wash Coat for Stained Finish: Apply wash-coat sealer to woodwork made from closed-grain wood before staining and finishing.
 - .4 Filled Finish for Open-Grain Woods: Apply paste wood filler to open-grain woods and wipe off excess. Tint filler to match wood finish.
 - .1 Apply wash-coat sealer after staining and before filling.
 - .5 Sheen: Satin finish, 20-35 gloss units measured on 60-degree gloss meter per ASTM D 523.

2.6 Laminated plastic materials

- .1 Laminated plastic for flatwork: to NEMA LD3
 - .1 High pressure decorative laminated (HPDL) plastic (PL-1).
 - .1 Type: Millwork
 - .2 Horizontal Surfaces: To suit application.
 - .3 Vertical Surfaces: To suit application.
 - .4 Colour: Mouse 928-58
 - .5 Pattern: Solid Colour
 - .6 Finish: Matte
 - .7 Edge: 3 mm PVC edge banding to match
 - .8 Manufacturer: Formica Brand Laminate
 - .2 High pressure decorative laminated (HPDL) plastic (PL-2).
 - .1 Type: Millwork
 - .2 Horizontal Surfaces: To suit application.
 - .3 Vertical Surfaces: To suit application.
 - .4 Colour: Marigold Fields SY9250
 - .5 Pattern: Solid Colour
 - .6 Finish: Textured
 - .7 Edge: 3 mm PVC edge banding to match
 - .8 Manufacturer: Nevamar
 - .3 High pressure decorative laminated (HPDL) plastic (PL-3).

- .1 Type: Millwork
- .2 Horizontal Surfaces: To suit application.
- .3 Vertical Surfaces: To suit application.
- .4 Colour: Inukshuk Carbon P346RM
- .5 Finish: Refined Matte (RM)
- .6 Edge: 3 mm PVC edge banding to match
- .7 Manufacturer: Arborite
- .4 Thermofused Melamine: to NEMA LD3Grade LPDL (ML-1).
 - .1 High wear resistant thermofused melamine: equal or exceed 400 cycles (Minimum standard for HPL abrasion test).
 - .2 Type: Millwork Cabinet Interior
 - .3 Horizontal Surfaces: To suit application.
 - .4 Vertical Surfaces: To suit application.
 - .5 Colour: Froth of Sea L080 (C)
 - .6 Pattern: Solid Colour
 - .7 Manufacturer: Tafisa
- .5 Edge finishing for doors, drawer fronts, shelves and false fronts:
 - .1 HPDL to match face.
 - .2 PVC: solid colour to match face, 3 mm thick.

2.7 Casework fabrication - general

- .1 Fabricate casework of specified core and surface finish materials to specified AWMAC AWS quality grade
 - .1 Construction type: frameless.
 - .2 Door-cabinet interface: Refer to elevations and details.
- .2 Set nails and countersink screws apply wood filler to indentations, sand smooth and leave ready to receive finish.
- .3 Shop install cabinet hardware for doors, shelves and drawers. Recess shelf standards unless noted otherwise.
- .4 Shelving to cabinetwork to be adjustable unless otherwise noted.
- .5 Provide cutouts for plumbing fixtures, inserts, appliances, outlet boxes and other fixtures.
- .6 Shop assemble work for delivery to site in size easily handled and to ensure passage through building openings.
- .7 Obtain governing dimensions before fabricating items which are to accommodate or abut appliances, equipment and other materials.

2.8 Laminated plastic casework fabrication

- .1 Do laminated plastic fabrication in compliance with NEMA LD3, Annex A and specified AWMAC AWS quality grade
- .2 Ensure adjacent parts of continuous laminate work match in colour and pattern.

- .3 Veneer laminated plastic to core material in accordance with adhesive manufacturer's instructions. Ensure core and laminate profiles coincide to provide continuous support and bond over entire surface. Use continuous lengths up to 3000 mm. Keep joints 600 mm from sink cutouts.
- .4 Form shaped profiles and bends as indicated, using post-forming grade laminate to laminate manufacturer's instructions.
- .5 Use straight self-edging laminate strip for flatwork to cover exposed edge of core material. Chamfer exposed edges uniformly at approximately 20 degrees. Do not mitre laminate edges.
- .6 Apply laminate backing sheet to reverse side of core of plastic laminate work.
- .7 Drawer Construction:
 - .1 Sides:
 - .1 Custom grade: LPDL (melamine) or HPDL on MDF, thickness 12 mm.
 - .2 Premium grade: 7-ply veneer core with HPDL faces.
 - .2 Bottoms: MDF with melamine surfaces, thickness 19 mm.
 - .3 Joinery: Meeting requirements of AWMAC for Grade specified.
 - .4 Drawer bottoms fully housed into sides and sub front and mechanically fastened to back or plowed into back

2.9 Shop applied finish coatings

- .1 Finish system: AWMAC AWS system Premium Grade, match grade of products to be finished.
- .2 Apply finish system component materials in accordance with manufacturer's instructions.

2.10 Cabinet hardware

- .1 Cabinet hardware: to AWMAC AWS quality grade specified and to ANSI/BHMA A156.9, designated by letter B and numeral identifiers as listed below
- .2 Finish:
 - .1 Exposed hardware:
 - .1 Contrasting colour to cabinets (to meet WADS)
 - .2 Semi-exposed hardware: Manufacturer's standard finish.
- .3 Casework door hinges: Blum, Semi-concealed, with soft-closure, mounting, 3-way adjustment 120°, lifetime warranty
 - .1 Doors 800-1500 mm high: Provide (3) hinges
 - .2 Doors 1500-2000 mm high: Provide (4) hinges
- .4 Pulls: Refer to Elevations for location of each pulls.
 - .1 Richelieu Modern Metal Pull 873, Brushed Nickel, 202mm Length
- .5 Drawer slides:
 - .1 Slide type: side mounted drawer slides, type heavy-duty, kitchen 100lbs capacity. Soft close.
 - .2 Extension and capacity: full extension meeting requirements of AWMAC AWS for type and size of drawer

- .3 File drawer slides: full extension.
- .6 Adjustable Shelving Standards:
 - .1 Recessed Standards: Richelieu, U-Shape Steel Pilaster with shelf clips in zinc finish, 2552G18
 - .2 Metal Shelf Pins: Richelieu, standard metal shelf pin, 6 mm diameter, 80kg load capacity per shelf, black finish, CP22898990
 - .3 Heavy Duty Centerline Support: Richelieu, Kolossus Floating Counter Bracket, 68122290, with black powder coated finish, 300lbs (136kg) per bracket (or approved equal)
- .7 Cabinet bumpers:
 - .1 Install nylon or polyurethane bumpers at all upper cabinets.

2.11 Cabinet locks

- .1 Provide locks as shown on elevations.
- .2 Cabinet locks: to ANSI/BHMA A156.11, designated by letter E and numeral identifiers as listed below
 - .1 Door or drawer locks: half mortised into back of door or drawer.
- .3 Keying: Each room keyed alike.
 - .1 Provide 3 keys per lock.
 - .2 Provide 3 master keys.
 - .3 Stamp keying code numbers on keys and cylinders.
- .4 Finish: Provide black finish for all locks

2.12 Accessories

- .1 Wood screws: stainless steel, type and size to suit application.
- .2 Nails and staples: to CSA B111 and ASTM F1667
- .3 Splines: wood.
- .4 Sealant: in accordance with 07 92 00 - Joint Sealants.

2.13 Laminated plastic countertops

- .1 Laminated plastic (PL-3) for flatwork: to NEMA LD3
 - .1 Type: general purpose.
 - .2 Size: 1.0 mm thick.
 - .3 Colour: Inukshuk Carbon P346 RM
 - .4 Pattern: To be selected from Manufacturer's standard range of finishes.
 - .5 Finish: Matte.
 - .6 Manufacturer: Arboreta
 - .7 Front Edge: 3mm PVC edge to match laminate
 - .8 Back splashes: Print Area to have plastic laminate backsplash, refer to elevations
 - .9 Location: Print Area countertops

- .2 Core material: MDF.

2.14 Solid Surface Countertops

- .1 Large Format Porcelain Countertop (SSC-1):
 - .1 Manufacturer: Silestone
 - .2 Thickness: 12 mm
 - .3 Colour: FFROM 03 Suede
 - .4 Finish: Matte
 - .5 Backsplash: Provide a 13 mm high backsplash
 - .6 Sink: Undermount
 - .7 Adhesives: 100% silicone sealant
 - .8 Installation: Fabricate components to greatest extent practical to sizes and shapes indicated, in accordance with approved shop drawings and Manufacturer's printed instructions and technical bulletin.
 - .1 Form joints between components using Manufacturer's standard joint adhesive and reinforce as required.
 - .2 Provide factory cutouts for plumbing fittings as indicated on the drawings. Rout and finish component edges with clean, sharp returns. Smooth out all edges.
 - .9 Location: Canteen 103
- .2 Solid Surface (SSC-2):
 - .1 Manufacturer: Corian
 - .2 Thickness: 19 mm
 - .3 Colour: Glacier White
 - .4 Finish: Matte
 - .5 Backsplash: Provide a 85 mm high backsplash
 - .6 Adhesives: 100% silicone sealant
 - .7 Installation: Fabricate components to greatest extent practical to sizes and shapes indicated, in accordance with approved shop drawings and Manufacturer's printed instructions and technical bulletin.
 - .1 Form joints between components using Manufacturer's standard joint adhesive and reinforce as required.
 - .2 Provide factory cutouts for plumbing fittings as indicated on the drawings. Rout and finish component edges with clean, sharp returns. Smooth out all edges.
 - .8 Location: Washrooms 104
- .3 Solid Surface (SSC-3):
 - .1 Manufacturer: Corian
 - .2 Thickness: 19 mm
 - .3 Colour: Carbon Concrete
 - .4 Finish: Matte

- .5 Adhesives: 100% silicone sealant
- .6 Installation: Fabricate components to greatest extent practical to sizes and shapes indicated, in accordance with approved shop drawings and Manufacturer's printed instructions and technical bulletin.
 - .1 Form joints between components using Manufacturer's standard joint adhesive and reinforce as required.
 - .2 Provide factory cutouts for plumbing fittings as indicated on the drawings. Rout and finish component edges with clean, sharp returns. Smooth out all edges.
- .7 Location: UTR 107

Part 3 Execution

3.1 Examination

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

3.2 Installation

- .1 Install architectural wood casework in accordance with AWMAC AWSgrade for respective items
- .2 In case of conflict between Contract Documents and AWMAC AWSgrade requirements, Contract Documents govern.
- .3 Install prefinished millwork at locations shown on drawings.
 - .1 Position accurately, level, plumb straight.
- .4 Fasten and anchor millwork securely.
 - .1 Supply and install heavy duty fixture attachments for wall mounted cabinets.
- .5 Countersink mechanical fasteners at exposed and semi-exposed surfaces, excluding installation attachment screws and screws securing cabinets end to end.
- .6 Use draw bolts in countertop joints.
- .7 Scribe and cut as required to fit abutting walls and to fit properly into recesses and to accommodate piping, columns, fixtures, outlets or other projecting, intersecting or penetrating objects.
- .8 At junction of plastic laminate counter back splash and adjacent wall finish, apply small bead of sealant in accordance with Section 07 92 00 - Joint Sealants.
- .9 Apply moisture barrier between wood framing members and masonry or cementitious construction.

- .10 Fit hardware accurately and securely in accordance with manufacturer's written instructions.
- .11 Make cutouts for inset equipment and fixtures using templates provided.

3.3 Cleaning

- .1 Progress Cleaning: clean in accordance with Section 01 74 00 - 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 00 - Cleaning.
 - .1 Clean all inside and outside surfaces of millwork.
 - .2 Remove excess glue, pencil and ink marks from surfaces.
- .3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 19 - Construction Waste Management and Disposal.

3.4 Protection

- .1 Protect millwork from damage until final inspection.
- .2 Protect installed products and components from damage during construction.
- .3 Repair damage to adjacent materials caused by architectural woodwork installation.

END OF SECTION

Part 1 General

1.1 Related sections

- .1 Section 06 40 00 - Architectural Woodwork
- .2 Section 07 92 00 - Joint Sealants
- .3 Section 09 30 13 - Ceramic Tiling
- .4 Division 22 – Plumbing

1.2 References

- .1 ANSI/NPA A208.2-09, Medium Density Fiberboard (MDF) For Interior Applications
- .2 ASTM C920-14a, Standard Specification for Elastomeric Joint Sealants
- .3 ASTM D638-10, Standard Test Method for Tensile Properties of Plastics
- .4 ASTM D785-08, Standard Test Method for Rockwell Hardness of Plastics and Electrical Insulating Materials
- .5 ASTM D790-10, Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials
- .6 ASTM D5420-10, Standard Test Method for Impact Resistance of Flat, Rigid Plastic Specimen by Means of a Striker Impacted by a Falling Weight (Gardner Impact)
- .7 ASTM E84-14, Standard Test Method for Surface Burning Characteristics of Building Materials
- .8 ASTM E228-11, Standard Test Method for Linear Thermal Expansion of Solid Materials with a Push-Rod Dilatometer
- .9 ASTM G21-13 , Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi
- .10 ASTM G22-76(96), Standard Practice for Determining Resistance of Plastics to Bacteria
- .11 ASTM G155-13, Standard Practice for Operating Xenon Arc Light Apparatus for Exposure of Non-Metallic Materials
- .12 CSA B45.5-11/IAPMO Z124-2011, Plastic Plumbing Fixtures
- .13 CSA O115-M82, Hardwood and Decorative Plywood
- .14 NFPA 255-06, Standard Method of Test of Surface Burning Characteristics of Building Materials
- .15 NSF/ANSI 51-07, Equipment Materials
- .16 SCAQMD Rule 1168, Adhesive & Sealant Applications (amended January 2005)
- .17 CAN/ULC-S102-07, Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies
- .18 UL 723, Standard for Test for Surface Burning Characteristics of Building Materials
- .19 UL Environment / GREENGUARD – UL 2818, Standard for Chemical Emissions for Building Materials, Finishes and Furnishings, Section 7.1

- .20 UL Environment / GREENGUARD - UL 2818, Gold Standard for Chemical Emissions for Building Materials, Finishes and Furnishings, Section 7.1 and 7.2
- .21 UL 2824, GREENGUARD Certification Program, Method for Measuring Microbial Resistance from Various Sources Using Static Environmental Chambers

1.3 Definitions

- .1 Solid Surface: Non-porous, homogeneous material maintaining the same composition throughout the part with a composition of acrylic polymer, aluminum trihydrate filler and pigment.

1.4 Action and Informational Submittals

- .1 Submit in accordance with Section 01 33 00- Submittal Procedures.
- .2 Product data:
 - .1 Detailed specification of construction and fabrication.
 - .2 Indicate Product description including solid surface sheets, sinks, bowls and illustrating full range of standard colours, fabrication information and compliance with specified performance requirements. Submit Product data with resistance to list of chemicals.
 - .3 Manufacturer's installation instructions.
 - .4 Manufacturer's detailed recommendations for handling, storage, installation, protection, and maintenance.
- .3 Shop Drawings:
 - .1 Indicate plans, sections, dimensions, component sizes, profiles, edge details, thermosetting requirements, fabrication details, attachment provisions, sizes of furring, blocking, including concealed blocking and coordination requirements with adjacent work.
 - .2 Show locations and sizes of cutouts and holes for plumbing fixtures, faucets, soap dispensers, waste receptacles and other items installed in solid surface.
 - .3 Indicate materials, colours, patterns and finishes.
 - .4 Indicate location and layout of each type of fabrication and accessory.
- .4 Samples:
 - .1 Submit minimum 150 mm x 150 mm (6" x 6") samples. Cut sample and seam together for representation of inconspicuous seam.
 - .2 Indicate full range of colour and pattern variation.
 - .3 Approved samples will be retained as standard of acceptance for work.

1.5 Close out submittals

- .1 Provide closeout submittals in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Provide manufacturer's care and maintenance information, including repair and maintenance instruction, for incorporation in operation and maintenance manual.
- .3 Provide one (1) commercial care and maintenance kit with instructions. Review maintenance procedures and warranty details with City of Winnipeg upon completion.

1.6 Quality assurance

- .1 Fabricator Qualifications: certified by solid surface manufacturer.
- .2 Installer Qualifications:
 - .1 Firm experienced in installation or application of systems similar in complexity to those required for project, including specific requirements indicated.
 - .2 Work to be executed by competent installers with minimum 5 years' experience in the application of Products, systems and assemblies specified and with approval and training of the Product manufacturers
- .3 Source Limitations: obtain materials and products from single source.

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 in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Maintain indoor temperature and humidity within range recommended by the AWMAC Quality Standards for location of the project.
 - .3 Store and protect laminate, adhesive, and core materials from nicks, scratches, and blemishes.
 - .4 Replace defective or damaged materials with new.

1.8 Warranty

- .1 Manufacturer Warranty: Provide manufacturer's standard warranty for material only for period of 10 years against defects and/or deficiencies in accordance with General Conditions of the Contract. Promptly correct any defects or deficiencies which become apparent within warranty period, to satisfaction of Contract Administrator and at no expense to City of Winnipeg.

Part 2 Products

2.1 Manufacturers

- .1 Basis of Design: Silestone XM Earthic by Consentino (SS1)
- .2 Basis of Design: Corian by DuPont; www.corian.com (SS2 & SS3)
- .3 Or approved equal.

2.2 Performance criteria (SS1)

- .1 Waterproof (water absorption) EN 14617-1: $W4 \leq 0.05$
- .2 Resistance to breaking (flexural strength) EN 14617-2: $F4 \geq 40.0$
- .3 Slipperiness EN 14231: PTV 10 wet, PTV 40 dry
- .4 Tactility / visibility (description): NPD

- .5 Thermal conductivity EN 10456: 1.3 W/m · K
- .6 Adherence for cementitious adhesives EN 1348: 3.50 N/mm²
- .7 Resistance to abrasion EN 14617-4: A3 ≤ 33mm
- .8 Resistance to impact EN 14617-9: 151cm
- .9 Flexural properties white ceramic materials ASTM C674: 10.986 psi
- .10 Flexural strength ASTM C880: 7.57 Dry conditions, 11.815 Wet conditions
- .11 Resistance to abrasion ASTM C1353: 111.8
- .12 Resistance to staining ASTM C1378-04: Not affected
- .13 Lineal thermal expansion ISO 10545-8: 3.48 · 10⁻⁵
- .14 Dynamic coefficient of friction ANSI A326.3: 0.46
- .15 Fire reaction EN 13501-1: B

2.3 Performance criteria (SS2 & SS3)

- .1 Tensile Strength (ASTM D638): 6000 psi min
- .2 Tensile Modulus (ASTM D638): 1.5 x 10⁶ psi min
- .3 Tensile Elongation (ASTM D638): 0.4% min.
- .4 Flexural Strength (ASTM D790): 10000 psi min
- .5 Flexural Modulus (ASTM D790): 1.2 x 10⁶ psi min
- .6 Hardness (ASTM D785): >85-Rockwell "M" scale min.
- .7 Thermal Expansion (ASTM E228): 3.90 x 10⁻⁵ in./in./°C (2.2 x 10⁻⁵ in./in./°F)
- .8 Fungi and Bacteria (ASTM G21 & G22): Does not support microbial growth
- .9 Microbial Resistance (UL 2824): Highly resistant to mould growth
- .10 Ball Impact (NEMA LD 3, Method 3.8):
 - .1 No fracture - 1/2 lb. Ball:
 - .1 1/4" slab - 36" drop
 - .2 1/2" slab - 144" drop
- .11 Weatherability (ASTM G155): ΔE*94<5 in 1,000 hrs
- .12 Flammability (ASTM E84, NFPA 255 & UL 723):
 - .1 Flame Spread: <25 (1/4" slab), <25 (1/2" slab)
 - .2 Smoke Developed: <25 (1/4" slab), <25 (1/2" slab)
 - .3 Class: A (1/4" slab), A (1/2" slab)

2.4 Solid Surfacing Materials

- .1 Non-porous, homogeneous material maintaining the same composition throughout the part with a composition of acrylic polymer, aluminum trihydrate filler and pigment; not coated, laminated or of composite construction; meeting following criteria:
 - .1 Flammability: Flame Spread Index: 0 and Smoke Development Index: 5 when tested to CAN/ULC-S102.
- .2 Ensure material has minimum physical and performance properties specified under "Performance/Design Criteria".

- .3 Ensure superficial damage to a depth of 0.25 mm (0.010") is repairable by sanding and polishing.

2.5 Components

- .1 Washroom Countertops with Integral Bowls:
 - .1 Moulded countertop of 20mm thick solid surfacing material 610 mm (24") wide, complete with integrally molded bowls of 100% acrylic solid surface material; edge details and backsplash as indicated on Drawings.
 - .1 Washroom Countertop Product: (SSC-2) Glacier White
 - .2 Integral Bowls: (SSC-2) Glacier White, 8254 Lavatory (Accessible Collection)
 - .2 Canteen Countertops:
 - .1 Moulded countertop of 20mm thick solid surfacing material 635 mm wide, with integrally molded mini cove in surface material as indicated on Drawings.
 - .1 Canteen Countertop Product: (SSC-1) FFROM 03 Suede
 - .3 UTR Bench:
 - .1 Moulded change bench of 20mm thick solid surfacing material 810mm wide, complete with 152mm face and eased front edge as indicated on Drawings.
 - .1 Change Bench Countertop Product: (SSC-3) Carbon Concrete

2.6 Accessories

- .1 Joint adhesive: manufacturer's standard adhesive to create inconspicuous, nonporous joints, with a chemical bond (WA8215).
- .2 Sealant: mildew-resistant, clear silicone sealant, as specified in Section 07 92 00.
- .3 Sink/bowl mounting hardware: bowl clips, brass inserts and fasteners for attachment of under mount sinks/bowls, of type recommended by manufacturer.

2.7 Fabrication

- .1 Fabricate components in shop to greatest extent practical to sizes and shapes indicated, in accordance with approved Shop Drawings and solid surface manufacturer requirements.
- .2 Form joints between components to create inconspicuous seams, using manufacturer's standard joint adhesive. Provide factory cutouts for plumbing fittings and bath accessories as indicated on Drawings
- .3 Where indicated, thermoform corners and edges or other objects to shapes and sizes indicated on Drawings, prior to seaming and joining. Cut components larger than finished dimensions and sand edges to remove nicks and scratches. Heat entire component uniformly prior to forming.
- .4 Ensure no blistering, whitening and cracking of components during forming.
- .5 Fabricate backsplashes from solid surfacing material with optional radius cove where counter and backsplashes meet as indicated on Drawings.
- .6 Fabricate joints between components using manufacturer's standard joint adhesive. Ensure joints are inconspicuous in appearance and without voids. Attach 50 mm (2") wide reinforcing strip of solid surface material under each joint.

- .7 Provide holes and cutouts for plumbing, bath accessories, and other components as indicated on drawings.
- .8 Rout and finish component edges to a smooth, uniform finish. Rout cutouts and sand edges smooth. Repair or reject defective or inaccurate work.
- .9 Thermoforming:
 - .1 Comply with forming data from manufacturer.
 - .2 Construct matching molds to form components shape.
 - .3 Form pieces to shape prior to seaming and joining.
 - .4 Cut pieces larger than finished dimensions, sand edges, remove nicks and scratches.
 - .5 Heat entire component uniformly between 280°–325°F during forming. Prevent blistering, whitening or cracking of material during forming.
- .10 Fabrication Tolerances:
 - .1 Variation in Component Size: ± 3 mm ($\pm 1/8$ ").
 - .2 Location of Openings: ± 3 mm ($\pm 1/8$ ") from indicated location.
- .11 Finish: surfaces to have a uniform Matte finish, with a 60° gloss rating of 5 – 20.

Part 3 Execution

3.1 Examination

- .1 Examine substrates and conditions, with fabricator present for compliance with requirements for installation tolerances and other conditions affecting performance of work. Proceed with installation only after unsatisfactory conditions have been corrected.
- .2 Verify actual site dimensions and location of adjacent materials prior to commencing work.
- .3 Examine cabinets upon which counter tops are to be installed. Verify cabinets are level to within 3 mm in 3 m (1/8" in 10' - 0").
- .4 Notify Contract Administrator in writing of any conditions which would be detrimental to installation.
- .5 Commencement of work implies acceptance of previously completed work.

3.2 Preparation

- .1 Precondition solid surfacing materials in accordance with manufacturer's printed installation instructions.

3.3 Installation

- .1 Install components plumb, level, rigid, scribed to adjacent finishes in accordance with reviewed Shop Drawings and Product installation details.
- .2 Fabricate field joints using manufacturer's recommended adhesive, with joints being inconspicuous in finished work. Exposed joints/seams are not permitted. Keep components and hands clean when making joints. Reinforce field joints as specified herein. Cut and finish component edges with clean, sharp returns.
- .3 Route radii and contours to template. Anchor securely to base component or other supports. Align adjacent components and form seams to comply with manufacturer's

written recommendations using adhesive in colour to match work. Carefully dress joints smooth, remove surface scratches and clean entire surface.

- .4 Install countertops with no more than 3 mm (1/8") sag, bow or other variation from a straight line. Attach tops securely to base unit or support brackets in accordance with manufacturer's instructions.
- .5 Adhere undermount/submount/bevel mount sinks/bowls to countertops using manufacturer's recommended adhesive and mounting hardware.
- .6 Adhere topmount sinks/bowls to countertops using manufacturer recommended adhesives and colour-coordinated silicone sealant. Secure seam mount bowls and sinks to counter tops using colour-coordinated joint adhesive.
- .7 Seal between wall and components with joint sealant as specified herein and in Section 07 92 00, as applicable.
- .8 Provide backsplashes and endsplashes as indicated on Drawings. Adhere to countertops using a standard colour-coordinated silicone sealant. Adhere applied sidesplashes to countertops using a standard colour-coordinated silicone sealant. Provide coved backsplashes and sidesplashes at walls and adjacent millwork. Fabricate radius cove at intersection of counters with backsplashes to dimensions shown on reviewed Shop Drawings. Adhere to countertops using manufacturer's standard colour-coordinated joint adhesive.
- .9 Keep components and hands clean during installation. Remove adhesives, sealants and other stains. Ensure components are clean on date of Substantial Performance of the Work.
- .10 Coordinate connections of plumbing fixtures with Division 22 - Mechanical. Make plumbing connections to sinks in accordance with Division 22 Mechanical.

3.4 Repair

- .1 Repair minor imperfections and cracked seams and replace areas of severely damaged surfaces in accordance with manufacturer's "Technical Bulletins".

3.5 Field quality control

- .1 Non-Conforming Work: Replace damaged work which cannot be satisfactorily repaired, restored or cleaned, to satisfaction of Contract Administrator at no cost to City of Winnipeg.

3.6 Cleaning

- .1 Remove excess adhesive and sealant from visible surfaces.
- .2 Clean surfaces in accordance with manufacturer's "Care and Maintenance Instructions".

3.7 Protection

- .1 Provide protective coverings to prevent physical damage or staining following installation for duration of Project.
- .2 Protect Protect surfaces from damage until date of Substantial Performance of the Work.
- .3 Repair or replace damaged components that cannot be repaired to Contract Administrator's satisfaction.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 This section includes all labour and materials required to complete mock-up installation including component review and testing and quality control/quality assurance testing on thermal and moisture protection systems.

1.2 RELATED SECTIONS

- .1 Section 04 05 00 – Common Work Results for Masonry
- .2 Section 04 05 13 – Masonry Mortar and Grout
- .3 Section 04 05 19 – Masonry Anchorage and Reinforcing
- .4 Section 04 05 23 – Masonry Accessories
- .5 Section 07 11 13 – Bituminous Dampproofing
- .6 Section 07 21 13 – Board and Semi Rigid Insulation
- .7 Section 07 21 29.03 - Sprayed Insulation - Polyurethane Foam
- .8 Section 07 26 00 – Vapour Retarders
- .9 Section 07 27 00.01 – Air Barriers - Descriptive or Proprietary
- .10 Section 07 42 43 – High Pressure Laminate Phenolic Wall System
- .11 Section 07 42 46 –Fibre Reinforced Cementitious Panels
- .12 Section 07 52 00 – Modified Bituminous Membrane Roofing
- .13 Section 07 61 00 – Sheet Metal Roofing and Wall Panels
- .14 Section 07 62 00 – Sheet Metal Flashing and Trim
- .15 Section 07 92 00 – Joint Sealants

1.3 MEASUREMENT AND PAYMENT

- .1 No measurement will be made under this section.
- .2 Building Envelope Testing; by Building Envelope Commissioning Authority, on behalf of the City.
- .3 Co-ordinate visual review and testing frequency and locations with Building Envelope Commissioning Authority to facilitate review of multiple distinct building envelope elements and components during the same visit.
- .4 Costs incurred for additional testing for items not meeting the specifications including costs for transportation and for required modifications to be the responsibility of the Contractor.

1.4 REFERENCES

- .1 American Society for Testing and Materials (ASTM):

- .1 ASTM C1521-19(2020) Standard Practice for Evaluating Adhesion of Installed Weatherproofing Sealant Joints.
- .2 ASTM D4541-17 Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers.
- .3 ASTM D7954-22a Standard Practice for Moisture Surveying of Roofing and Waterproofing Systems Using Nondestructive Electrical Impedance Scanners.
- .4 ASTM E1186-17 Standard Practices for Air Leakage Site Detection in Building Envelopes and Air Barrier Systems.

1.5 PRE-INSTALLATION CONFERENCE

- .1 Pre-Installation Conference in accordance with Section 01 31 19 Project Meetings.
- .2 Convene pre-installation conference minimum five (5) working days prior to beginning site installation of mock-up.
- .3 Establish date, time and location of conference and notify parties concerned minimum five (5) working days before conference.
- .4 Contractor, Contract Administrator, Commissioning Authority, Building Envelope Commissioning Authority, and installers involved in work to be in attendance.
- .5 Agenda for conference:
 - .1 Verify project requirements, design, and intent of design.
 - .2 Review installation and substrate conditions.
 - .3 Co-ordinate with subtrades.
 - .4 Review manufacturer's installation instructions and warranty requirements.
 - .5 Review compatibility of materials.

1.6 SUBMITTALS

- .1 Submittals in accordance with Section 01 33 00 Submittal Procedures.
- .2 Submit test results from testing agency for each specified test maximum one week following completion of testing.
- .3 The manufacturer for each component of the building envelope, including but not necessarily limited to all thermal and moisture protection components, shall provide written verification that the proposed material and systems will meet or exceed the requirements of the Contract Documents.
- .4 Product Data
 - .1 Provide product data for:
 - .1 Section 04 05 13 – Masonry Mortaring and Grouting
 - .2 Section 04 05 19 – Masonry Anchorage and Reinforcing
 - .3 Section 04 05 23 – Masonry Accessories
 - .4 Section 04 21 00 - Clay Unit Masonry
 - .5 Section 07 11 13 – Bituminous Dampproofing
 - .6 Section 07 21 13 – Board and Semi Rigid Insulation

- .7 Section 07 21 29.03 - Sprayed Insulation - Polyurethane Foam
 - .8 Section 07 26 00 – Vapour Retarders
 - .9 Section 07 27 00.01 – Air Barriers - Descriptive or Proprietary
 - .10 Section 07 42 43 – High Pressure Laminate Phenolic Wall System
 - .11 Section 07 42 46 –Fibre Reinforced Cementitious Panels
 - .12 Section 07 52 00 – Modified Bituminous Membrane Roofing
 - .13 Section 07 61 00 – Sheet Metal Roofing and Wall Panels
 - .14 Section 07 62 00 – Sheet Metal Flashing and Trim
 - .15 Section 07 92 00 – Joint Sealants
- .5 Shop Drawings
- .1 Provide shop drawings for:
 - .1 Section 04 05 00 – Common Work Results for Masonry
 - .2 Section 04 05 19 – Masonry Anchorage and Reinforcing
 - .3 Section 04 05 23 – Masonry Accessories
 - .4 Section 07 42 43 – High Pressure Laminate Phenolic Wall System
 - .5 Section 07 42 46 –Fibre Reinforced Cementitious Panels
 - .6 Section 07 52 00 – Modified Bituminous Membrane Roofing
 - .7 Section 07 61 00 – Sheet Metal Roofing and Wall Panels
 - .8 Section 07 62 00 – Sheet Metal Flashing and Trim

1.7 QUALITY ASSURANCE

- .1 Notify the Contract Administrator, Commissioning Authority, Building Envelope Commissioning Authority, and the Testing Agency in writing of the construction and testing schedule prior to the start of work.
 - .1 On-site testing and reporting of the Contractor’s work shall be carried out by the by the Building Envelope Commissioning Authority.
- .2 Field review/Testing frequency:
 - .1 On-Site Mock-Up Review and/or testing of thermal and moisture protection components:
 - .2 Review the mock-ups at completion milestones. Unless otherwise noted, mock-ups to be the first installation of the thermal and moisture protection components.
 - .3 Provide a minimum seventy-two (72) hours' notice for thermal and moisture protection components to be reviewed by Building Envelope Commissioning Authority.
- .3 On-Site Quality Assurance Review and/or Testing
 - .1 Visual review and testing of the installed thermal and moisture protection components may be periodically completed at the discretion of the Building Envelope Commissioning Authority.
 - .2 Provide a minimum seventy-two (72) hours' notice for thermal and moisture protection components to be reviewed by Building Envelope Commissioning Authority.

Part 2 Products

2.1 NOT USED

Part 3 Execution

3.1 MASONRY

- .1 Provide mock-ups of masonry at locations identified by the Building Envelope Commissioning Authority prior to full system installation.
- .2 Visual review:
 - .1 Visual reviews shall be performed by the Building Envelope Commissioning Authority to determine general conformance with requirements of the Contract Documents.
 - .2 Frequency of visual reviews:
 - .1 Once during Mock-up.
 - .2 Randomly during remainder of installation at the discretion of the Building Envelope Commissioning Authority.

3.2 BITUMINOUS DAMPPROOFING

- .1 Provide a mock-up of the bituminous dampproofing at a location identified by the Building Envelope Commissioning Authority prior to full system installation.
- .2 Visual review:
 - .1 Visual reviews shall be performed by the Building Envelope Commissioning Authority to determine general conformance with requirements of the Contract Documents.
- .3 Frequency of visual reviews:
 - .1 Once during Mock-up.
 - .2 Randomly during remainder of installation at the discretion of the Building Envelope Commissioning Authority.

3.3 BOARD AND SEMI RIGID INSULATION

- .1 Provide mock-ups of board and semi rigid insulation at locations identified by the Building Envelope Commissioning Authority prior to full system installation. Mock-ups to be provided for each type of thermal insulation.
- .2 Visual review:
 - .1 Visual reviews shall be performed by the Building Envelope Commissioning Authority to determine general conformance with requirements of the Contract Documents.
- .3 Frequency of visual reviews:
 - .1 Once during Mock-up.
 - .2 Randomly during remainder of installation at the discretion of the Building Envelope Commissioning Authority.

3.4 SPRAYED INSULATION – POLYURETHANE FOAM

- .1 Provide mock-ups of sprayed insulation at locations identified by the Building Envelope Commissioning Authority prior to full system installation. Mock-ups to be provided for each type of thermal insulation.
- .2 Visual review:
 - .1 Visual reviews shall be performed by the Building Envelope Commissioning Authority to determine general conformance with requirements of the Contract Documents.
- .3 Frequency of visual reviews:
 - .1 Once during Mock-up.
 - .2 Randomly during remainder of installation at the discretion of the Building Envelope Commissioning Authority.

3.5 VAPOUR RETARDERS

- .1 Provide mock-ups of the vapour retarders at locations identified by the Building Envelope Commissioning Authority prior to full system installation.
- .2 Visual review:
 - .1 Visual reviews shall be performed by the Building Envelope Commissioning Authority to determine general conformance with requirements of the Contract Documents.
 - .2 Frequency of visual reviews:
 - .1 Once during Mock-up.
 - .2 Randomly during remainder of installation at the discretion of the Building Envelope Commissioning Authority.

3.6 AIR BARRIERS

- .1 Provide mock-ups of the air barriers at locations identified by the Building Envelope Commissioning Authority prior to full system installation. Mock-ups to be provided for each combination of membrane and substrate.
- .2 Visual review:
 - .1 Visual reviews shall be performed by the Building Envelope Commissioning Authority to determine general conformance with requirements of the Contract Documents.
 - .2 Frequency of visual reviews:
 - .1 Once during Mock-up.
 - .2 Randomly during remainder of installation at the discretion of the Building Envelope Commissioning Authority.
- .3 Adhesion testing (Applies to Self-Adhered, Air and Vapour Barrier Membranes Only):
 - .1 Adhesion testing shall be completed by the Building Envelope Commissioning Authority in accordance with ASTM D4541, using a 2.25” diameter disk.
 - .2 Standard of acceptance shall be the mean minus one standard deviation calculated from the mock-up and compared to manufacturer’s requirements, but not less than 15 psi. In the event of a deficit, the manufacturer shall be consulted for direction.

- .3 Pull tests shall be completed in sets of five per each substrate type, at the discretion of the Building Envelope Commissioning Authority.
- .4 Frequency of testing:
 - .1 Once during Mock-up.
 - .2 Randomly during remainder of installation at the discretion of the Building Envelope Commissioning Authority.
- .4 Air- leakage testing (Applies to Self-Adhered, Air and Vapour Barrier Membranes Only):
 - .1 Air leakage testing shall be completed by the Building Envelope Commissioning Authority at membrane seams and overlaps and at the cladding support system anchorage penetrations in accordance with ASTM E1186.
 - .2 Standard of acceptance is no observable air leakage.
 - .3 Frequency of testing:
 - .1 Once during Mock-up.
 - .2 Randomly during remainder of installation at the discretion of the Building Envelope Commissioning Authority.

3.7 HIGH PRESSURE LAMINATE PHENOLIC WALL SYSTEM

- .1 Provide a mock-up of the aluminum composite wall panels at a location identified by the Building Envelope Commissioning Authority prior to full system installation.
- .2 Visual review:
 - .1 Visual reviews shall be performed by the Building Envelope Commissioning Authority to determine general conformance with requirements of the Contract Documents.
 - .2 Frequency of visual reviews:
 - .1 Once during Mock-up.
 - .2 Randomly during remainder of installation at the discretion of the Building Envelope Commissioning Authority.

3.8 FIBRE REINFORCED CEMENTITIOUS PANELS

- .1 Provide a mock-up of fibre reinforced cementitious panels at a location identified by the Building Envelope Commissioning Authority prior to full system installation.
- .2 Visual review:
 - .1 Visual reviews shall be performed by the Building Envelope Commissioning Authority to determine general conformance with requirements of the Contract Documents.
 - .2 Frequency of visual reviews:
 - .1 Once during Mock-up.
 - .2 Randomly during remainder of installation at the discretion of the Building Envelope Commissioning Authority.

3.9 MODIFIED BITUMINOUS MEMBRANE ROOFING

- .1 Provide a mock-up of the modified bituminous membrane roofing at a location identified by the Building Envelope Commissioning Authority prior to full system installation.

- .2 Visual review:
 - .1 Visual reviews shall be performed by the Building Envelope Commissioning Authority to determine general conformance with requirements of the Contract Documents.
 - .2 Frequency of visual reviews:
 - .1 Once during Mock-up.
 - .2 Randomly during remainder of installation at the discretion of the Building Envelope Commissioning Authority.
- .3 Air-leakage testing:
 - .1 Air leakage testing shall be completed by the Building Envelope Commissioning Authority at vapour barrier membrane seams and overlaps and at penetrations in accordance with ASTM E1186.
 - .2 Standard of acceptance is no observable air leakage at the penetrations.
 - .3 Frequency of testing:
 - .1 Once during Mock-up.
 - .2 Randomly during remainder of installation at the discretion of the Building Envelope Commissioning Authority.
- .4 Electrical Impedance Scanning:
 - .1 Electrical impedance scanning shall be completed by the Building Envelope Commissioning Authority in accordance with ASTM D7954.
 - .2 Frequency of testing:
 - .1 Once upon Substantial Performance of the Work.

3.10 SHEET METAL ROOFING AND WALL PANELS

- .1 Provide a mock-up of the sheet metal roofing and wall panels at a location identified by the Building Envelope Commissioning Authority prior to full system installation.
- .2 Visual review:
 - .1 Visual reviews shall be performed by the Building Envelope Commissioning Authority to determine general conformance with requirements of the Contract Documents.
 - .2 Frequency of visual reviews:
 - .1 Once during Mock-up.
 - .2 Randomly during remainder of installation at the discretion of the Building Envelope Commissioning Authority.

3.11 SHEET METAL FLASHING AND TRIM

- .1 Provide a mock-up of the sheet metal flashing and trim at a location identified by the Building Envelope Commissioning Authority prior to full system installation.
- .2 Visual review:
 - .1 Visual reviews shall be performed by the Building Envelope Commissioning Authority to determine general conformance with requirements of the Contract Documents.
 - .2 Frequency of visual reviews:

- .1 Once during Mock-up.
- .2 Randomly during remainder of installation at the discretion of the Building Envelope Commissioning Authority.

3.12 JOINT SEALANTS

- .1 Provide a mock-up of the joint sealants at a location identified by the Building Envelope Commissioning Authority prior to full system installation.
- .2 Visual review:
 - .1 Visual reviews shall be performed by the Building Envelope Commissioning Authority to determine general conformance with requirements of the Contract Documents.
 - .2 Frequency of visual reviews:
 - .1 Once during Mock-up.
 - .2 Randomly during remainder of installation at the discretion of the Building Envelope Commissioning Authority.
- .3 Adhesion testing:
 - .1 Adhesion testing on fully cured joints shall be completed by the Building Envelope Commissioning Authority in accordance with ASTM C1521, Destructive Procedure Method A.
 - .2 Adhesion testing on fully cured joints at dissimilar substrates shall be completed by the Building Envelope Commissioning Authority in accordance with ASTM C1521, Flap Procedure.
 - .3 Standard of acceptance shall be in accordance with manufacturer's published data and as follows:
 - .1 Silicone Sealants:
 - .1 Sealant should tear cohesively within itself or elongate the 1" gauge length the extent specified in the product manufacturer's technical literature before releasing from either substrate adhesively.
 - .2 Urethane Sealants:
 - .1 Sealant should tear cohesively within itself without bond loss.
 - .4 At this time, the joint will be reviewed for complete fill. The joint should not have voids, and joint dimensions should match those shown on the drawings.
 - .5 Frequency of testing:
 - .1 Once during Mock-up.
 - .2 Randomly during remainder of installation at the discretion of the Building Envelope Commissioning Authority.

3.13 THERMOGRAPHIC SCAN

- .1 Thermographic scan shall be completed by the Building Envelope Commissioning Authority in general accordance with ASTM E1186 prior to Substantial Performance.
 - .1 Minimum temperature differential shall be 20°C, or as otherwise directed by the Contract Administrator.

.2 Building shall be under positive pressurization to 50 Pa, or as otherwise directed by the Contract Administrator.

.2 Contractor to co-ordinate, supervise, assist, and provide access for thermographic scan including coordination with the City for mechanical system pressurization during the test.

3.14 ANALYSIS AND CORRECTIVE PROCEDURES

.1 Repair all damages from testing.

.2 Remediate non-conforming work identified during visual reviews and testing.

.3 Do not cover any remediated work until reviewed by the Building Envelope Commissioning Authority, or until the Building Envelope Commissioning Authority has reviewed proof of remediation.

.4 Re-testing of remediated work shall be at the discretion of the Building Envelope Commissioning Authority.

.5 Costs for repairs, remediation of non-conforming work, and re-testing are the responsibility of the Contractor. No additional costs to be submitted to the City for repairs or testing.

3.15 REPORTING

.1 Prepare reports in accordance with the specified test methods.

.2 Reports to include modifications and repairs made to the test specimen.

.3 Submit reports within 5 working days following field observations and testing.

END OF SECTION

Part 1 General

1.1 Related requirements

- .1 Section 07 21 13 Board and Semi-Rigid Insulation.
- .2 Section 07 26 00 Vapour retarders

1.2 Reference standards

- .1 ASTM International (ASTM):
 - .1 ASTM D1227/D1227M-13(2019)e1, Standard Specification for Emulsified Asphalt Used as a Protective Coating for Roofing
 - .2 ASTM D4479/D4479M-07, Standard Specification for Asphalt Roof Coatings - Asbestos-Free
 - .3 ASTM D4586/D4586M-07, Standard Specification for Asphalt Roof Cement, Asbestos-Free
- .2 Canadian General Standards Board (CGSB):
 - .1 CAN/CGSB-37.2-M88, Emulsified Asphalt, Mineral-Colloid Type, Unfilled, for Dampproofing and Waterproofing and for Roof Coatings
 - .2 CAN/CGSB-37.3-M89, Application of Emulsified Asphalts for Dampproofing or Waterproofing
 - .3 CAN/CGSB-37.5-M89, Cutback Asphalt Plastic Cement
 - .4 CGSB 37-GP-6Ma-83, Asphalt, Cutback, Unfilled, for Dampproofing
 - .5 CGSB 37-GP-9Ma-83, Primer, Asphalt, Unfilled, for Asphalt Roofing, Dampproofing and Waterproofing
 - .6 CGSB 37-GP-11M-76, Application of Cutback Asphalt Plastic Cement
 - .7 CGSB 37-GP-12Ma-84, Application of Unfilled Cutback Asphalt for Dampproofing
 - .8 CGSB 37-GP-15M-76, Application of Asphalt Primer for Asphalt Roofing, Dampproofing and Waterproofing.
 - .9 CAN/CGSB-37.16-M89, Filled, Cutback, Asphalt for Dampproofing and Waterproofing
 - .10 CAN/CGSB-37.28-M89, Reinforced Mineral Colloid Type, Emulsified Asphalt for Roof Coatings and for Waterproofing
 - .11 CGSB 37-GP-36M-76, Application of Filled Cutback Asphalts for Dampproofing and Waterproofing
 - .12 CGSB 37-GP-37M-77, Application of Hot Asphalt for Dampproofing or Waterproofing
- .3 CSA Group (CSA):
 - .1 CAN/CSA-A123.4-04, Asphalt for Construction of Built-Up Roof Coverings and Waterproofing Systems
- .4 National Research Council Canada (NRC)/Institute for Research in Construction (IRC):

- .1 Canadian Construction Materials Centre (CCMC)
- .5 South Coast Air Quality Management District (SCAQMD), California State:
 - .1 SCAQMD Rule 1113-2016, Architectural Coatings
- .6 Health Canada:
 - .1 Workplace Hazardous Materials Information System (WHMIS)
 - .2 Safety Data Sheets (SDS)

1.3 Action and informational submittals

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, product literature and data sheets for bituminous dampproofing and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Submit WHMIS SDS.
- .3 Manufacturer's Instructions: provide to indicate special handling criteria, installation sequence, cleaning procedures.
- .4 Sustainable Design Submittals:
 - .1 LEED Canada submittals: in accordance with Section 01 35 20 - LEED Sustainable Requirements.
 - .2 Construction Waste Management: Refer to Section 01 74 19 - Construction/Demolition Waste Management and Disposal.
 - .3 Material product attribute documentation: Refer to Product Check Sheet as listed in 01 35 20 – LEED Sustainable Requirements to determine applicable type of documentation required for each product.
 - .4 Low-Emitting Materials:
 - .1 Submittals are required for any sealants, adhesives, paints, coatings, composite wood, flooring, wall panels, insulation or ceiling components within the inner most weather proofing barrier.
 - .2 Refer to Product Check Sheet as listed in 01 35 20 – LEED Sustainable Requirements to determine applicable type of documentation required for each product.
- .5 Confirm and coordinate submittal requirements with the BECxA.

1.4 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:
 - .1 Store materials in original container, indoors in a clean dry well-ventilated area location, and in accordance with manufacturer's recommendations.
 - .2 Store and protect dampproofing materials from freezing and solvents.
 - .3 Replace defective or damaged materials with new.

- .4 Develop Construction Waste Management Plan related to Work of this Section and in accordance with Section 01 35 20 - LEED Requirements.
- .5 Packaging Waste Management: Perform in accordance with Section 01 74 19 - Waste Management Disposal

1.5 Site conditions

- .1 Ambient Conditions: temperature, relative humidity, moisture content.
 - .1 Apply dampproofing materials only when surfaces and ambient temperatures are within manufacturers' prescribed limits.
 - .2 Do not proceed with Work when wind chill effect would tend to set bitumen before proper curing takes place.
 - .3 Maintain air temperature and substrate temperature at dampproofing installation area above 5 degrees C for 24 hours before, during and 24 hours after installation.
 - .4 Do not apply dampproofing in wet weather.
- .2 Safety: comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of asphalt, sealing compounds, primers and caulking materials.

1.6 Quality Assurance

- .1 Confirm and coordinate visual review, mock-up, and pre-installation conference requirements with the BECxA.

Part 2 Products

2.1 Asphaltic Materials

- .1 Asphalt:
 - .1 For application and curing at temperatures above 5 degrees C: to CAN/CSA-A123.4 ASTM 449, Type 1.
 - .1 Solvent-based asphalt mastics: Cold-applied, asbestos-free, non-fibered asphalt compounds for exterior concrete surfaces below grade.
 - .2 Sealing mastic: ASTM D4586, asbestos-free asphalt cement for trowel application.
 - .3 Asphalt primer: to CGSB 37-GP-9Ma, ASTM D41 Type 1, compatible with substrate.

2.2 Accessories

- .1 Protection Board: Rigid insulation specified in Section 07 21 13- Board and Semi-Rigid Insulation.

Part 3 Execution

3.1 Examination

- .1 Verification of Conditions: verify that conditions of substrate previously installed are acceptable for bituminous dampproofing application installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate in presence of Contract Administrator.

- .2 Inform Contract Administrator of unacceptable conditions immediately upon discovery.
- .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Contract Administrator.
- .2 Confirm and coordinate visual review requirements with the BECxA.

3.2 Workmanship

- .1 Keep hot asphalt:
 - .1 Below its flash point.
 - .2 At or below its final blowing temperature.
 - .3 Within its equiviscous temperature range at place of application.

3.3 Preparation

- .1 Before applying dampproofing:
 - .1 Seal exterior joints between foundation walls and footings, joints between concrete floor slab and foundation and around penetrations through dampproofing with sealing compound.
 - .2 Protect adjacent surfaces not designated to receive dampproofing.
 - .3 Clean and prepare surfaces to receive dampproofing to manufacturer’s written instructions.
 - .4 Do not apply dampproofing to surfaces unacceptable to manufacturer.

3.4 Application

- .1 Dampproofing in accordance with CAN/CGSB-37.3.
- .2 Seal work in accordance with CGSB 37-GP-11M.
- .3 Prime surface in accordance with CGSB 37-GP-15M.
 - .1 Apply primer to CGSB primer standard.
- .4 Apply dampproofing in accordance with applicable CGSB application standard.
 - .1

Material	Application	
CAN/CGSB-37.2	use	CAN/CGSB-37.3
CGSB 37-GP-6Ma	use	CGSB 37-GP-12M
CAN/CGSB-37.1	use	CGSB 6 37-GP-36M
CAN/CGSB-37.2	use	CAN/CGSB-37.3 8
CSA A123.4	use	CGSB 37-GP-37M

- .5 Apply bitumen dampproofing with mop, roller, or by spray application in accordance with manufacturer’s instructions best suited for site application.

- .6 Apply bitumen continuous and uniform, at a rate of 1.5 L/sq.m. (3.6 gal/100 sq ft.), to provide a minimum thickness of 3 mm (1/8").
- .7 Seal items projecting through dampproofing with mastic. Seal watertight.

3.5 Schedule

- .1 Apply continuous, uniform coating to entire exterior faces of foundation walls from 2" (50 mm) below finished grade level to and including tops of foundation wall footings.
- .2 Apply continuous, uniform coating to exterior side of foundation walls enclosing rooms below finished grade. Include exterior portion of interior walls where floors in adjacent rooms are at different elevations.
- .3 Apply two additional coats of dampproofing to vertical corners and construction joints for a minimum width of 230 mm on each side, and all around and for 9" (230 mm) along pipes passing through walls.

3.6 Cleaning

- .1 Progress Cleaning: clean in accordance with Section 01 74 00 - Cleaning.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 - Cleaning upon completion.
- .3 Clean adjacent materials of spills, splatter, and accidentally applied dampproofing.
- .4 Waste Management: in accordance with Section 01 74 19 - Waste Management and Disposal.

3.7 Protection

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by dampproofing application.
- .3 Protect dampproofing from excessive UV exposure. Cover with backfill or other temporary means within 2 days.

END OF SECTION

Part 1 General

1.1 Related requirements

- .1 Section 07 11 13 Bituminous dampproofing.
- .2 Section 07 26 00 Vapour retarders
- .3 Section 07 42 46 Fibre Reinforced Cementitious Panels
- .4 Section 07 52 00 Modified Bituminous Membrane Roofing

1.2 Definitions

- .1 Thermal Resistance: Means long-term thermal resistance (LTTR) in accordance with CAN/ULC-S770 or ASTM C1303/C1303M.

1.3 Reference standards

- .1 ASTM International (ASTM):
 - .1 ASTM A653/A653M-20 Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc Iron Alloy Coated (Galvannealed) by the Hot Dip Process
 - .2 ASTM A792/A792M-21a, Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process
 - .3 ASTM C208-12(2017)e2, Standard Specification for Cellulosic Fiber Insulating Board
 - .4 ASTM C578-19 Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation
 - .5 ASTM C591-21, Standard Specification for Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation
 - .6 ASTM C612-14, Standard Specification for Mineral Fibre Block and Board Thermal Insulation
 - .7 ASTM C726-17, Standard Specification for Mineral Fiber Roof Insulation Board
 - .8 ASTM C728-17a, Standard Specification for Perlite Thermal Insulation Board
 - .9 ASTM C1126-19, Standard Specification for Faced or Unfaced Rigid Cellular Phenolic Thermal Insulation
 - .10 ASTM C1289-21, Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board
 - .11 ASTM C1303/C1303M-19, Standard Test Method for Predicting Long-Term Thermal Resistance of Closed-Cell Foam Insulation
 - .12 ASTM D1621-16, Standard Test Method for Compressive Properties of Rigid Cellular Plastics
 - .13 ASTM D2842-19, Standard Test Method for Water Absorption of Rigid Cellular Plastics
 - .14 ASTM E84-21a Standard Test Method for Surface Burning Characteristics of Building Materials

- .15 ASTM E96/E96M-21, Standard Test Methods for Water Vapour Transmission of Materials.
- .2 Canadian General Standards Board (CGSB):
 - .1 CGSB 71-GP-24M-AMEND-77, Adhesive, Flexible, for Bonding Cellular polystyrene Insulation
- .3 Health Canada/Workplace Hazardous Materials Information System (WHMIS):
 - .1 Safety Data Sheets (SDS)
- .4 Underwriters Laboratories of Canada (ULC):
 - .1 CAN/ULC-S102-10, Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies
 - .2 CAN/ULC-S114-05, Standard Method of Test for Determination of Non-Combustibility in Building Materials
 - .3 CAN/ULC-S604:2016, Standard for Factory-Built Type A Chimneys
 - .4 CAN/ULC-701.1:2017, Standard for Thermal Insulation, Polystyrene Boards
 - .5 CAN/ULC-S702-14, Standard for Mineral Fibre Insulation for Buildings
 - .6 CAN/ULC-S704-11, Standard for Thermal Insulation Polyurethane and Polyisocyanurate, Boards, Faced
 - .7 CAN/ULC S770-15, Standard Test Method for Determination of Long-term Thermal Resistance of Closed-Cell Thermal Insulating Foams

1.4 Administrative requirements

- .1 Coordination: Coordinate work of other Subcontractors adjacent and penetrating board insulation which must be completed before or after insulation work.

1.5 Action and informational submittals

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's product literature, and data sheets for each type of board insulation. Include product characteristics, performance criteria, physical sizes, and limitations.
 - .2 Submit WHMIS SDS
- .3 Samples: When requested, submit sample 12" x 12" (300 x 300) mm x full board thickness of each type of board insulation.
- .4 Certificates: When requested, submit manufacturer's product certificates certifying materials comply with specified performance characteristics and criteria and physical requirements.
- .5 Test Reports: Submit certified test reports showing compliance with specified performance characteristics and physical properties.
- .6 Manufacturer's Instructions: Submit manufacturer's installation instructions.
- .7 Sustainable Design Submittals:
 - .1 LEED Canada submittals: in accordance with Section 01 35 20 - LEED Sustainable Requirements.

- .2 Construction Waste Management: Refer to Section 01 74 19 - Construction/Demolition Waste Management and Disposal.
- .3 Material product attribute documentation: Refer to Product Check Sheet as listed in 01 35 20 – LEED Sustainable Requirements to determine applicable type of documentation required for each product.
- .4 Low-Emitting Materials:
 - .1 Submittals are required for any sealants, adhesives, paints, coatings, composite wood, flooring, wall panels, insulation or ceiling components within the inner most weather proofing barrier.
 - .2 Refer to Product Check Sheet as listed in 01 35 20 – LEED Sustainable Requirements to determine applicable type of documentation required for each product.
- .8 Confirm and coordinate submittal requirements with the BECxA.

1.6 Delivery, storage, and handling

- .1 Perform in accordance with Section 01 61 00 - Common Product Requirements.
 - .1 Deliver board insulation marked with its thermal resistance value, associated reference standard number, Type, and Class. Packaged in accordance with the associated reference standard.
 - .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .2 Storage and Handling Requirements:
 - .1 Store materials indoors and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect specified materials from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.
- .3 Develop Construction Waste Management Plan related to Work of this Section and in accordance with Section 01 35 20 - LEED Requirements.
- .4 Packaging Waste Management: Perform in accordance with Section 01 74 19 - Waste Management and Disposal

1.7 Quality Assurance

- .1 Confirm and coordinate visual review, mock-up, and pre-installation conference requirements with the BECxA.

Part 2 Products

2.1 Insulation Materials

- .1 Extruded polystyrene (XPS) (below grade): To CAN/ULC-701, refer to drawings and schedule for locations.
 - .1 Type: 4, closed-cell.
 - .2 Thermal Resistance @ 24°C: RSI-0.88 (R-5.0) per inch.
 - .3 Compressive strength: 25 psi, min.
 - .4 Flexural Strength: 50 psi, min.

- .5 Water Absorption: 0.1% by volume, max.
- .6 Water Vapor Permeance: 1.5 perm, max.
- .7 Board thickness: As indicated on Drawings.
- .8 Facing: Unfaced
- .9 Board Edges: Square
- .10 Flame/Smoke Properties: to CAN/ULC-S102.
- .11 Product: Styrofoam SM, manufactured by Dupont or approved equal.
- .12 Insulation Protection: Refer to Section 07 42 46 - Fiber Reinforced Cementitious Panels
- .13 Ensure insulation meets VOC emissions evaluation as per 01 35 20 LEED Sustainable Requirements.
- .2 Extruded polystyrene (XPS) Insulation (sloped metal roof): To CAN/ULC-S701
 - .1 Type: 4, closed-cell.
 - .2 Thermal Resistance @ 24°C: RSI-0.88 (R-5.0) per inch.
 - .3 Compressive Strength: 16 psi, min.
 - .4 Flexural Strength: 35 psi, min.
 - .5 Water Absorption: 0.9% by volume, max.
 - .6 Water Vapor Permeance: 1.5 perm, max.
 - .7 Board Thickness: As indicated on Drawings.
 - .8 Edges: Square
 - .9 Flame/Smoke Properties: to CAN/ULC-S102.
 - .10 Ensure insulation meets VOC emissions evaluation as per 01 35 20 LEED Sustainable Requirements.
 - .11 Acceptable Manufacturer:
 - .1 Styrofoam Deckmate, manufactured by Dupont or approved equal.
- .3 Semi-rigid Mineral Fibre Insulation Board (exterior walls, outboard): CAN/ULC-S702 Type 1 ASTM C612 Type 1VB, non-combustible, water repellent, semi-rigid board, with the following characteristics:
 - .1 Board Density: 64 kg/cu m (4.0 lb/cu ft).
 - .2 Thermal Resistance: RSI value/25.4 mm at 24 ° C: 0.76 m2K/W to ASTM C518.
 - .3 Thickness: As shown on Drawings.
 - .4 Facing: Unfaced.
 - .5 Board Edges: Square.
 - .6 Flame/Smoke Properties: In accordance with CAN/ULC-S102.
 - .1 Flame spread: 0.
 - .2 Smoke developed: 0
 - .7 Standard of Acceptance:
 - .1 Cavityrock DD (Dual Density) manufactured by Rockwool or approved equal

- .4 Semi-rigid Mineral Fibre Batt Insulation (parapet walls, existing garage): CAN/ULC-S702 Type 1 ASTM C612 Type 1VB, non-combustible, water repellent, semi-rigid board, with the following characteristics:
 - .1 Board Density: 32 kg/cu m (2.0 lb/cu ft).
 - .2 Thermal Resistance: RSI value/25.4 mm at 24 ° C: 0.70 m2K/W to ASTM C518.
 - .3 Thickness: As shown on Drawings.
 - .4 Facing: Unfaced.
 - .5 Edges: Square.
 - .6 Flame/Smoke Properties: In accordance with CAN/ULC-S102.
 - .1 Flame spread: 0.
 - .2 Smoke developed: 0
 - .7 Standard of Acceptance:
 - .1 ComfortBatt; manufactured by Rockwool or approved equal
- .5 Acoustical Sound Insulation (interior walls): Semi-rigid, non-combustible mineral fibre batt insulation, type 1 compliant.
 - .1 Flame/Smoke Properties: In accordance with CAN/ULC-S102.
 - .2 Acoustical Performance: NRC 0.7
 - .3 Thickness: As shown on Drawings.
 - .4 Standard of Acceptance:
 - .1 Rockwool AFB or approved equal
- .6 Roof Insulation (flat roof areas):
 - .1 Refer to Section 07 52 00 - Modified Bituminous Membrane Roofing

2.2 Adhesive

- .1 Adhesive (for polystyrene): to CGSB 71-GP-24M.
 - .1 Adhesive Type 1: Type recommended by insulation manufacturer for application.

2.3 Accessories

- .1 Joint Tape: Polyethylene self-adhering type, mesh reinforced, 50 mm (2 inch) wide.
- .2 Insulation Fasteners:
 - .1 As recommended by the manufacturer.
 - .2 Insulation Clips: Impale type, perforated 50 x 50 mm cold rolled carbon steel 0.8 mm thick, adhesive back, spindle of 2.5 mm diameter annealed steel, length to suit insulation thickness, minimum 25 mm diameter self-locking washers.
 - .3 Mechanical Fasteners: Impact-resistant plastic fastener system specifically designed for installation of insulation boards, minimum 38 mm diameter, shaft length to suit insulation thickness and hot dipped galvanized fastener to suit substrate.

Part 3 Execution

3.1 Examination

- .1 Verify that substrate, adjacent materials, and insulation boards are dry and ready to receive insulation and adhesive.
- .2 Verify substrate surface is flat, free of honeycomb, fins, irregularities and materials or substances that may impede adhesive bond.
- .3 Verification of Conditions: Verify that conditions of substrate previously installed are clean, dry, smooth, and acceptable for application of board insulation in accordance with manufacturer's instructions.
 - .1 Visually inspect substrate.
 - .2 Inform Contract Administrator of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied.
- .4 Confirm and coordinate visual review requirements with the BECxA.

3.2 Installation - general

- .1 Install insulation to maintain continuity of thermal protection to building elements and spaces.
- .2 Fit insulation tight around penetrating electrical boxes, plumbing piping heating pipes, and ducts, around exterior doors and windows and other protrusions.
- .3 Keep plastic insulation minimum 3" (75 mm) from heat emitting devices such as recessed light fixtures, and minimum 2" (50 mm) from sidewalls of ULC-604 type A chimneys and CSA B149.1 and CSA B149.2 type B and L vents.
- .4 Cut and trim insulation neatly to fit spaces. Butt joints tightly.
- .5 In multi-layered applications, offset vertical and horizontal joints.
- .6 Use only insulation boards free from chipped or broken edges.
- .7 Use largest possible boards to reduce number of joints.
- .8 In multiple layer applications offset both vertical and horizontal joints
- .9 Do not enclose, cover, or perform backfilling of insulation until it has been reviewed and accepted by Contract Administrator.

3.3 Rigid Insulation Installation - Sloped Roof

- .1 Apply adhesive to substrate in accordance with manufacturer's recommendations.
- .2 Imbed insulation boards into vapour barrier type adhesive, applied as specified, prior to skinning of adhesive.
- .3 Leave insulation board joints unbonded over line of expansion and control joints. Bond a continuous 150 mm wide, 0.15 mm modified bituminous membrane over expansion and control joints using compatible adhesive and primer before application of insulation.
- .4 Install boards on foundation wall and grade beam perimeter, as best suited to maintain thermal continuity.
 - .1 Place boards in a method to maximize contact bedding.
 - .2 Stagger side / end joints.

- .3 Butt edges and ends tight to adjacent board and to protrusions.
- .5 Cut and fit insulation tight to protrusions or interruptions to the insulation plane.

3.4 Rigid Insulation Installation - foundation perimeter

- .1 Install rigid insulation on concrete foundation walls and concrete grade beams using H40 Hilti gun X-1E 6 –50min D152 washer/ fastener spaced 600mm (24”) vertically and horizontally or with purpose made multi-clinch metal strip c/w Gripcon® nail. Set metal strip flush into cut rigid insulation at 600mm (24”) spacing.
- .2 Install boards on foundation wall and grade beam perimeter, as best suited to maintain thermal continuity.
 - .1 Place boards in a method to maximize contact bedding.
 - .2 Stagger side/ end joints
 - .3 Butt edges and ends tight to adjacent board and to protrusions.
- .3 Cut and fit insulation tight to protrusions or interruptions to the insulation plane.

3.5 Installation - exterior walls

- .1 Install insulation in accordance with manufacturer’s written recommendations.
- .2 Insulation boards are to be pressurefitted between supporting clips, girts, and rails.
- .3 Install insulation fasteners and impaling clips as recommended by the manufacturer to provide permanent support for the insulation.
- .4 Place boards in a method to maximize contact bedding. Stagger end joints. Butt edges and ends tight to adjacent board and to protrusions.
- .5 Cut and fit insulation tight to protrusions or interruptions to the insulation plane.

3.6 Installation - cavity wall insulation (parapets)

- .1 Install mineral fibre batt insulation in wall cavities where scheduled.
- .2 Install insulation in accordance with manufacturer’s written recommendations.

3.7 Installation - flat roofing insulation

- .1 Refer to Section 07 52 00 Modified Bituminous Membrane Roofing.

3.8 Cleaning

- .1 Progress Cleaning: Perform in accordance with Section 01 74 00 - Cleaning.
- .2 Final Cleaning: Perform in accordance with Section 01 74 00 - Cleaning upon completion.
- .3 Waste Management: Perform in accordance with Section 01 74 19 - Waste Management and Disposal

END OF SECTION

Part 1 General

1.1 Related requirements

- .1 Section 07 21 13- Board & Semi-Rigid Insulation
- .2 Section 07 26 00 Vapour Retarders
- .3 Section 07 52 00 - Modified Bituminous Membrane Roofing
- .4 Section 08 11 00 Metal Doors and Frames
- .5 Section 08 11 16 Aluminum Doors and Frames
- .6 Section 08 44 13 Glazed Aluminum Curtain Walls
- .7 Section 08 51 13 Aluminum Windows

1.2 Reference standards

- .1 Canadian Urethane Foam Contractors Association Inc. (CUFCA)
- .2 ASTM International (ASTM):
 - .1 ASTM C411-19, Standard Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation
 - .2 ASTM C518-17, Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus
 - .3 ASTM C1029-20, Standard Specification for Spray-Applied Rigid Cellular Polyurethane Thermal Insulation
 - .4 ASTM C1338-19, Standard Test Method for Determining Fungi Resistance of Insulation Materials and Facings
 - .5 ASTM D1621-16, Standard Test Method for Compressive Properties Of Rigid Cellular Plastics
 - .6 ASTM D1622-20, Standard Test Method for Apparent Density of Rigid Cellular Plastics
 - .7 ASTM D1623-17, Standard Test Method for Tensile and Tensile Adhesion Properties of Rigid Cellular Plastics
 - .8 ASTM D2126-20, Standard Test Method for Response of Rigid Cellular Plastics to Thermal and Humid Aging
 - .9 ASTM D2369-20, Standard Test Method for Volatile Content of Coatings
 - .10 ASTM D2842-19, Standard Test Method for Water Absorption of Rigid Cellular Plastics
 - .11 ASTM D6226-21, Standard Test Method for Open Cell Content of Rigid Cellular Plastics
 - .12 ASTM E96/E96M-16, Standard Test Methods for Water Vapor Transmission of Materials
- .3 Green Seal Environmental Standards (GS):
 - .1 Standard GC-03-97, Anti-Corrosive Paints

- .2 Standard GS-11-2013, Paints and Coatings
- .4 South Coast Air Quality Management District (SCAQMD), California State:
 - .1 SCAQMD Rule 1113-2016, Architectural Coatings
- .5 ULC Standards (ULC):
 - .1 CAN/ULC S10114, Standard Methods of Fire Endurance Tests of Building Construction and Materials
 - .2 ULC 102, Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies
 - .3 CAN/ULC-S127-14, Standard Corner Wall Method of Test for Flammability Characteristics on Non-Melting Foam Plastic Building Materials
 - .4 ULC-705.1-15, Standard for Thermal Insulation - Spray Applied Rigid Polyurethane Foam, Medium Density, Material Specification. Includes Amendment 1.2
 - .5 ULC-705.2-05, Standard for Thermal Insulation - Spray Applied Rigid Polyurethane Foam, Medium Density, Application
 - .6 ULC 718-13, Standard for Site Quality Assurance Program for Spray Polyurethane Foam
 - .7 CAN/ULC S77015, Standard Test Method for Determination of Long-Term Thermal Resistance of Closed-Cell Thermal Insulating Foams

1.3 Action and informational submittals

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for polyurethane foam sprayed insulation and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Test Reports:
 - .1 Submit certified test reports for insulation from approved independent testing laboratories, indicating compliance with specifications for specified performance characteristics and physical properties.
 - .2 Submit test reports in accordance with CAN/ULC-S101 for fire endurance and CAN/ULC-S102 for surface burning characteristics.
- .4 Manufacturer's Instructions:
 - .1 Submit manufacturer's installation instructions and special handling criteria, installation sequence, and cleaning procedures.
- .5 Submit WHMIS Safety Data Sheet (SDS).
- .6 Sustainable Design Submittals:
 - .1 LEED Canada submittals: in accordance with Section 01 35 20 - LEED Sustainable Requirements.
 - .2 Construction Waste Management: Refer to Section 01 74 19 - Construction/Demolition Waste Management and Disposal.

- .3 Material product attribute documentation: Refer to Product Check Sheet as listed in 01 35 20 – LEED Sustainable Requirements to determine applicable type of documentation required for each product.
- .4 Low-Emitting Materials:
 - .1 Submittals are required for any sealants, adhesives, paints, coatings, composite wood, flooring, wall panels, insulation or ceiling components within the inner most weather proofing barrier.
 - .2 Refer to Product Check Sheet as listed in 01 35 20 – LEED Sustainable Requirements to determine applicable type of documentation required for each product.
- .7 Confirm and coordinate submittal requirements with the BECxA.

1.4 Quality assurance

- .1 Applicators to conform to manufacturer's Quality Assurance Program.
- .2 Qualifications:
 - .1 Installer: person specializing in sprayed insulation installations approved by manufacturer with minimum three (3) years documented experience.
 - .2 Manufacturer: company with minimum three (3) years experience in production of material used for work required for this project, with sufficient production capacity to produce and deliver required units without causing delay in work.
- .3 Confirm and coordinate visual review, mock-up, and pre-installation conference requirements with the BECxA.

1.5 Health and safety

- .1 Comply with requirements of Workplace Hazardous Materials Information System regarding use, handling, storage and disposal of insulation materials.
- .2 Protect workers in accordance with CAN/ULC-S705.2 and manufacturer's recommendations.
- .3 Ensure that workers wear gloves, supplied fresh air system, dust masks, long sleeved clothing, eye protection and protective clothing when applying foam insulation.
- .4 Ensure that workers do not eat, drink or smoke while applying foam insulation.

1.6 Delivery, storage, and handling

- .1 Perform in accordance with Section 01 61 00 - Common Product Requirements.
 - .1 Delivery and Acceptance Requirements: Deliver materials to site in original factory packaging, with manufacturer's labels.
- .2 Storage and Handling Requirements:
 - .1 Store materials off ground, indoors, and in clean, dry, well-ventilated area.
 - .2 Protect insulation materials from exposure to moisture.
 - .3 Replace wet or damaged materials with new.

1.7 Waste management

- .1 Conduct Waste Management Plan as specified in Section 01 74 19- Waste Management and Disposal.
- .2 Separate and recycle waste packaging materials in accordance with Waste Management Plan and Waste Reduction Plan.
- .3 Dispose of waste products at appropriate recycling facilities. Collect and separate paper and plastic material in appropriate on-site storage containers.
- .4 Dispose of waste foam daily and decontaminate empty drums in accordance with foam manufacturer's instructions. Divert metal drums to metal recycling facility.

1.8 Site conditions

- .1 Ventilate area in accordance with Section 01 51 00 - Temporary Utilities.
- .2 Ventilate area to receive insulation by introducing fresh air and exhausting air continuously during and 24hour after application to maintain non-toxic, unpolluted, safe working conditions.
- .3 Provide temporary enclosures to prevent spray and noxious vapours from contaminating air beyond application area.
- .4 Protect adjacent surfaces and equipment from damage by overspray and fall-out.
- .5 Apply insulation only when surfaces and ambient temperatures are within manufacturers' prescribed limits.

Part 2 Products

2.1 Materials

- .1 Insulation: spray polyurethane foam insulation/air barrier (at locations indicated on drawings including but not limited to roof assembly and at exterior wall crevices requiring a thermal seal and at junctons of dissimilar wall and roof materials to achieve a thermal and air seal): to CAN/ULC-S705.1.
 - .1 Type: Closed cell, medium density, spray applied.
 - .2 Thermal Resistance: R-30 min.
 - .3 Acceptable Materials:
 - .1 BASF - WALLTITE ECO.
 - .2 CertainTeed - CertaSpray Closed Cell Foam.
 - .3 Approved Equals
- .2 Primers: in accordance with manufacturer's recommendations for surface conditions.
 - .1 Maximum VOC limit 100g/L.

2.2 Equipment

- .1 Spray equipment: In accordance with ULC-705.2 and the equipment manufacturer's recommendations for specific type of application
- .2 Provide a separate proportioner unit for each spray gun.

Part 3 Execution

3.1 Examination

- .1 Verify that conditions of existing substrate are acceptable for sprayed insulation application in accordance with manufacturer's instructions.
 - .1 Ensure surfaces are free of snow, ice, frost, grease and other deleterious materials.
 - .2 Measure moisture content and temperature of substrate and surface suitability in accordance with ULC-705.2. Measurements below ULC-705.2 requirements are not acceptable.
 - .3 Inform Contract Administrator of unacceptable conditions immediately upon discovery.
 - .4 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Contract Administrator.
- .2 Confirm and coordinate visual review requirements with the BECxA.

3.2 Preparation

- .1 Protection of In-Place Conditions:
 - .1 Mask and cover adjacent areas to protect from over spray.
 - .2 Ensure any required foam stop or back up material are in place to prevent over spray and achieve complete seal.
 - .3 Seal off existing ventilation equipment. Install temporary ducting and fans to ensure exhaust fumes. Provide for make-up air.
 - .4 Erect barriers, isolate area and post warning signs to advise non-protected personnel to avoid the spray area.
- .2 Surface Preparation:
 - .1 Clean all surfaces free of oil, grease, dust and debris. Ensure surfaces are clean, dry and properly fastened to ensure adhesion of the foam to the substrate.
 - .2 Ensure that all work by other Subcontractors that may penetrate through the insulation is in place and complete.

3.3 Application

- .1 Apply primer to surfaces where recommended by manufacturer. Apply primer in accordance with manufacturer's instructions.
- .2 Spray apply insulation to maintain continuity of thermal protection to building elements and spaces.
- .3 Spray apply insulation to primed surfaces in accordance with ULC-705.2
- .4 Use primer where recommended by manufacturer.
- .5 Spray apply insulation to final thickness as indicated on Drawings. Apply in consecutive passes to thicknesses as recommended by manufacturer.
- .6 Spray insulation to seal perimeter of electrical boxes, pipes, ducts, frames and other objects into or passing through insulation.

- .7 Keep insulation away from heat emitting devices such as recessed light fixtures, chimneys and furnace vents. Maintain minimum distances as recommended by manufacturer's instructions.
- .8 Finished surface of foam insulation to be free of voids and imbedded foreign objects.
- .9 Remove masking materials and over spray from adjacent areas immediately after foam surface has hardened. Ensure cleaning methods do not damage work performed under other sections.
- .10 Trim, as required, any excess thickness that would interfere with the application of cladding system by other Subcontractors.
- .11 Do not enclose insulation until it has been reviewed and is acceptable to Contract Administrator.

3.4 Site quality control

- .1 Provide Manufacturer's Site Services consisting of product use recommendations and regular site visits to inspect product installation to ensure compliance with manufacturer's instructions.

3.5 Cleaning

- .1 Perform cleaning in accordance with Section 01 74 00 - Cleaning.
- .2 Upon completion of insulation work, remove surplus materials, rubbish, tools and equipment.
 - .1 Remove insulation material spilled and oversprayed during installation and leave work area clean.

3.6 Protection

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

END OF SECTION

Part 1 General

1.1 Section includes

- .1 Sheet and sealant materials for controlling vapour diffusion.

1.2 Related requirements

- .1 Section 03 30 00 – Cast-in-Place Concrete
- .2 Section 07 11 13 - Bituminous Dampproofing
- .3 Section 07 21 13 – Board & Semi-Rigid Insulation
- .4 Section 07 21 29.03 – Sprayed Insulation - Polyurethane Foam
- .5 Section 07 52 00 – Modified Bituminous Membrane Roofing
- .6 Section 07 92 00 - Joint Sealants
- .7 Section 08 11 00 - Metal Doors and Frames
- .8 Section 08 44 13 - Glazed Aluminum Curtain Walls
- .9 Section 08 51 13 - Aluminum Windows

1.3 Definitions

- .1 Vapour Retarder: A material or assembly of materials that resists water vapour diffusion through it.

1.4 Reference standards

- .1 ASTM International (ASTM):
 - .1 ASTM E84-21, Standard Test Method for Surface Burning Characteristics of Building Materials
 - .2 ASTM E96/E96M-16, Standard Test Methods for Water Vapor Transmission of Materials
 - .3 ASTM E154/E154M-08a(2019), Standard Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover
 - .4 ASTM E1643-18a, Standard Practice for Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs
 - .5 ASTM E1745-17, Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill Under Concrete Slabs
 - .6 ASTM E1993/E1993M-98(2020), Standard Specification for Bituminous Water Vapor Retarders Used in Contact with Soil or Granular Fill Under Concrete Slabs
 - .7 ASTM C920-08 - Elastomeric Joint Sealants.
 - .8 ASTM C1311-10 - Solvent Release Sealants
- .2 Canadian General Standards Board (CGSB):

- .1 CAN/CGSB-51.33-M89, Vapour Barrier Sheet, Excluding Polyethylene, for Use in Building Construction
 - .2 CAN/CGSB-51.34-M86, Vapour Barrier, Polyethylene Sheet, for Use in Building Construction
 - .3 CGSB-19-GP-14M-1984 - Sealing Compound, One Component, Butyl-Polyisobutylene Polymer Base, Solvent Curing.
 - .4 CAN/CGSB-19.13-M87 - Sealing Compound, One-component, Elastomeric, Chemical Curing.
 - .5 CAN/CGSB-51.34-M86 - Vapour Barrier, Polyethylene Sheet, for Use in Building Construction.
- .3 SWRI (Sealant, Waterproofing and Restoration Institute) - Sealant and Caulking Guide Specification.

1.5 System Description

- .1 Materials and installation methods to provide continuity of vapour retarder:
 - .1 In conjunction with materials described in Section 07 21 13 and 07 21 29.03.
 - .2 To seal gaps between enclosure components and opening frames.

1.6 Performance Requirements

- .1 Vapour Permeability (Perm): Maximum water vapour permeance of 57.4 ng/(Pa•s•m²) (1.0 perm) measured to CAN/CGSB-51.34, CAN/CGSB-51.33, ASTM E96/E96M.

1.7 Administrative requirements

- .1 Coordination: Coordinate with other work having a direct bearing on work of this section.
- .2 Sequencing:
 - .1 Sequence Work to permit installation of materials in conjunction with other retardant materials and seals , and air barrier assemblies.
 - .2 Do not install vapour retarder until items penetrating it are in place.

1.8 Action and informational submittals

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Installation Data: Manufacturer's special installation requirements, including preparation and installation requirements, techniques.
- .3 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for vapour retarders and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Submit one electronic copy of WHMIS SDS in accordance with Section 01 35 29.06 - Health and Safety Requirements and 01 35 43 - Environmental Procedures.
- .4 Certificates:
 - .1 Submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

- .5 Closeout Submittals: Submit in accordance with Section 01 78 00: Closeout Submittals.
- .6 Sustainable Design Submittals:
 - .1 LEED submittals: in accordance with Section 01 35 20 - LEED Requirements.
 - .2 Construction Waste Management: Refer to Section 01 74 19 - Construction/Demolition Waste Management and Disposal.
 - .3 Material product attribute documentation: Refer to Product Check Sheet as listed in 01 35 20 – LEED Sustainable Requirements to determine applicable type of documentation required for each product.
 - .4 Low-Emitting Materials:
 - .1 Submittals are required for any sealants, adhesives, paints, coatings, composite wood, flooring, wall panels, insulation or ceiling components within the inner most weather proofing barrier.
 - .2 Refer to Product Check Sheet as listed in 01 35 20 – LEED Sustainable Requirements to determine applicable type of documentation required for each product.
- .7 Confirm and coordinate submittal requirements with the BECxA.

1.9 Quality assurance

- .1 Confirm and coordinate visual review, testing requirements, and pre-installation conference requirements with the BECxA.
- .2 Mock-Ups:
 - .1 Submit mock-ups in accordance with Section 01 45 00 - Quality Control.
 - .2 Construct mock-up of sheet vapour barrier installation including one lap joint, one inside corner and at one electrical box. Mock-up may be part of finished work.
 - .3 Mock-up will be used to judge quality of work, substrate preparation, and material application.
 - .4 Locate where directed.
 - .5 Contract Administrator will require minimum 72 hours to review the mock-up.
 - .6 When accepted, mock-up will demonstrate minimum standard of quality required for this work. Approved mock-up may remain as part of finished work.
 - .7 Confirm and coordinate mock-up requirements with the BECxA.

1.10 Delivery, storage, and handling

- .1 Deliver, store and handle materials in accordance with Section 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 off ground indoors and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect specified materials from nicks, scratches, and blemishes.

- .3 Replace defective or damaged materials with new.
- .4 Develop Construction Waste Management Plan related to Work of this Section and in accordance with Section 01 35 20 - LEED Requirements.
- .5 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding, as specified in Construction Waste Management Plan in accordance with Section 01 74 19 - Waste Management and Disposal.

Part 2 Products

2.1 Sheet vapour barrier

- .1 Polyethylene film: to CAN/CGSB-51.34, 0.15 mm (6 mil) thick.
- .2 Sheet Retarder (for Exterior Walls): Self-adhesive rubberized asphalt bonded to sheet polyethylene, regular temperature, nominal total thickness of 1.5 mm.
 - .1 Product: Blue Skin SA, manufactured by Henry (use appropriate grade depending on outdoor air temperatures at time of installation)
- .3 Sheet Retarder (for Flat Roof Assembly): refer to Section 07 52 00.
- .4 Sheet Retarder (for Sloped Metal Roof Assembly):
 - .1 Self-adhesive Air/Vapour Barrier: composed of bitumen modified with thermoplastic polymers and high-density polyethylene film. The self-adhesive underface is covered with a silicone release sheet. Water vapour permeability: 0.92 ng/Pa.s.m² (0.016 Perm)
 - .1 Acceptable material:
 - .1 Sopravap'r by Soprema
- .5 Foam-In-Place Seal expansion, spray-applied polyurethane foam insulation. Refer to Section – 07 21 29.03.
- .6 Underslab Plastic Sheet Vapour Retarder: High density, puncture resistant polyolefin resin sheet in accordance with ASTM E1745 and CAN/CGSB-51.34, and as follows:
 - .1 Thickness: 15 mm
 - .2 Vapour Permeance: Nominal = .01 Perms maximum
 - .3 Tensile Strength and Puncture Resistance: ASTM E1745 Class A minimum
 - .4 Acceptable Material:
 - .1 W.R. Meadows Perminator 15 Mil
 - .2 Permalon Griffolyn 15 Mil Green
 - .3 Stego Wrap 15 mil Class A
 - .4 or approved equal.

2.2 Fluid-applied vapour barrier

- .1 Single-component, water-based, water-resistive air barrier designed to provide a vapor impermeable air and water barrier when applied on above-grade wall assemblies, having the following typical properties:
 - .1 Basis of Design: Air-Bloc 16MR Fluid Applied Air and Vapor Barrier
 - .2 Colour: Grey

- .3 Solids Content:
 - .1 Weight: 69%
 - .2 Volume: 60%
- .4 Minimum Application Temperature: +20 °F (-6 °C)
- .5 Service Temperature: -40 °F to +180 °F (-40 °C to +82 °C)
- .6 Water Vapor Permeance (ASTM E96):
 - .1 Method A: 0.03 perms
- .7 Air Permeance:
 - .1 Material (ASTM E2178): 0.0013 L/s.m.2
 - .2 Air Leakage – Assembly (ASTM E2357): Pass
- .8 Elongation (ASTM D412): 270%
- .9 Tensile Strength (ASTM D412): 100 psi
- .10 Nail Sealability (AAMA 711/ASTM D1970 modified): Pass
- .11 Water Absorption (ASTM D570): 4.6%
- .12 Surface Burning Characteristics (ASTM E84):
 - .1 Flame Spread Index: 20, Class A
 - .2 Smoke developed: 85, Class A
- .13 Fire Testing (NFPA 285): Complies in various assemblies
- .14 VOC Content, max (EPA Method 24): <50 g/L Method 24
- .15 Declaration Status: LBC Red List Free

2.3 Flexible Silicone Vapour Barrier Membrane

- .1 Pre-engineered silicone sheet with single or double rib - used as a transition assembly between adjacent vapour barrier materials. Comprised of a flat single or double ribbed silicone extrusion of varying widths, adhered with sealant to ensure a durable connection and positive seal. The opposite edge of the ribbed silicone extrusion will span unsupported onto the wall system, which is adhered with sealant. This connection will provide a long-term durable flexible connection between the two components.
 - .1 Comprised of the following components:
 - .1 Silicone Rubber Sheet (SRS): Extruded, 40 durometer, ribbed translucent silicone sheet.
 - .2 Silicone Transition Profiles: Three dimensional injected molded profiles should be used where appropriate.
 - .2 Basis of design: Proglaze ETA (Engineered Transition Assembly) by Tremco

2.4 Sealants

- .1 Sealant: Asbestos-free non hardening sealant, compatible with vapour retarder materials, recommended by vapour retarder manufacturer. Refer to Section 07 92 00- Joint Sealants and 01 35 20 LEED Sustainable Requirements.
 - .1 Exterior wall vapour barrier: 925 BES Sealant, Air-Bloc 21 or Air-Bloc 21FR by Henry.

- .2 Fluid-applied vapour barrier: 925 BES Sealant or Air-Bloc LF by Henry (sealant for cracks in masonry and concrete).
- .3 Silicone vapour barrier sealant: Spectrem 1 Silicone Sealant by Tremco.
 - .1 Complies with ASTM C920, single-component, neutral-curing silicone; Class 100/50, Grade NS, Use O.
- .2 Cleaner: Non-corrosive type; recommended by sealant manufacturer; compatible with adjacent materials.

2.5 Adhesives and Primers

- .1 Adhesives: Compatible with sheet barrier and substrate, permanently non-curing.
 - .1 Exterior wall vapour barrier: Blueskin Adhesive, Blueskin LVC Adhesive or Aquatac™ Primer by Henry.
 - .2 Sloped metal roof vapour barrier: Elastocol Stick or Elastocol Stick Zero by Soprema.

2.6 Accessories

- .1 Thinner and Cleaner for Butyl Sheet: As recommended by sheet material manufacturer.
- .2 Fasteners: Provide non-corrosive metal screws, nails, plastic clips and other fasteners as recommended by vapour retarder manufacturer required for complete installation of Work.
- .3 Termination/Retention Bar: Provide termination or retention bar for attachment of vapour barrier to concrete grade beam as recommended by manufacturer.
- .4 Joint sealing tape: High density, air resistant pressure sensitive adhesive tape, type recommended by vapour barrier manufacturer, 2" (50 mm) wide for lap joints and perimeter seals, 1" (25 mm) wide elsewhere.
- .5 Staples: minimum 1/4" (6 mm) leg.
- .6 Substrate Crack Filler:
 - .1 Sealant or closed cell foam backer rod, as recommended by vapour barrier manufacturer.
- .7 Through Wall Membranes: Manufacturer's recommended reinforced self adhesive, compatible with vapour membrane and that will not become plastic and extrude onto finished surfaces when exposed to high wall temperatures.
- .8 Moulded box vapour barrier: factory-moulded polyethylene box for use with recessed electric switch and outlet device boxes.

Part 3 Execution

3.1 Examination

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for vapour retarder installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate in presence of Contract Administrator.
 - .2 Inform Contract Administrator of unacceptable conditions immediately upon discovery.

- .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Contract Administrator.
- .2 Confirm and coordinate visual review requirements with the BECxA.

3.2 Preparation

- .1 Remove loose or foreign matter which might impair adhesion.
- .2 Clean and prime substrate surfaces to receive adhesive/ sealants in accordance with manufacturers' written instructions.

3.3 Installation - sheet vapour barrier (exterior walls)

- .1 Install materials to manufacturer's written instructions.
- .2 Apply sealant within recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges or where compatibility with adjacent materials may be in doubt.
- .3 Ensure services are installed and inspected before installation of retarder.
- .4 All surfaces to receive vapour barrier must be clean of oil, dust and excess mortar. Strike masonry joints flush. Concrete surfaces must be smooth and without large voids, spalled areas or sharp protrusions. Concrete must be cured a minimum of 14 days and must be dry before vapour barrier is applied. Where curing compounds are used, they must be clear resin based, without oil, wax or pigments.
- .5 All surfaces to receive vapour barrier require an application of adhesive or primer and allowed to dry to a tacky film before vapour barrier is applied. Coated surfaces not covered by membrane during the working day must be recoated.
- .6 Position vapour barrier for alignment and remove release film and press firmly in place. Roll membrane, including seams, with a countertop roller to ensure full contact once in place. Membrane must be rolled after application to ensure adhesion to substrate and laps. Vapour barrier must be lapped a minimum of 2" (50 mm) on both sides and end laps. When using with brick ties, position, press in place and cut for ties or projections. Seal around any openings and at leading edge at the end of the workday with sealant. Detail work must be carefully carried out to ensure continuous air tightness of the membrane. Mechanical attachment to be made to all window and doorframes, or a properly designed sealant joint be provided.
- .7 Membrane applied to the underside of the substrate and extending more than 6 inches (152 mm) onto inverted surfaces requires requires mechanical fastening through treated wood or galvanized metal strapping, or have insulation mechanically fastened. Fastening must take place immediately after installation of the membrane. Space strapping on 18" (457 mm) centers, running perpendicular to the side laps.
- .8 Insulation Application: The use of mechanical fasteners through vapour barrier along changes in plane, such as inside corners, may be required by some insulation manufacturers. Consult insulation manufacturer prior to installation of insulation.
 - .1 Insulation Clips: Insulation clips should be mechanically fastened through the membrane into the substrate with a self- tapping screw. Apply number of insulation clips as recommended by the insulation manufacturer.
 - .2 Insulation Adhesive: Adhesive (Air-Bloc® 21, Air-Bloc® 21FR, or approved equal) should be applied to insulation boards in a serpentine pattern to restrict

movement of air behind the insulation. Alternatively, a full coat notched trowel application may be applied to the back of the board. Press insulation firmly in place.

- .9 Exterior Surface Openings:
 - .1 Cut sheet vapour retarder to form openings and ensure material is lapped and sealed to frame.
- .10 Perimeter Seals:
 - .1 Seal perimeter of sheet vapour barrier as follows:
 - .1 Apply continuous bead of sealant to substrate at perimeter of sheets.
 - .2 Lap sheet over sealant and press into sealant bead.
 - .3 Ensure that no gaps exist in sealant bead. Smooth out folds and ripples occurring in sheet over sealant.
- .11 Electrical Boxes:
 - .1 Seal electrical switch and outlet device boxes that penetrate vapour barrier as follows:
 - .1 Install moulded box vapour barrier. Wrap boxes with film sheet providing minimum 12" (300 mm) perimeter lap flange.
 - .2 Apply sealant to seal edges of flange to main vapour barrier and seal wiring penetrations through box cover.
- .12 Vapour barrier is designed for exposure up to 90 days if necessary to accommodate construction scheduling, but is not designed for permanent exposure to ultraviolet light and should be covered as soon as practical after application. It is not to be used in direct contact with flexible PVC/vinyl membranes or gaskets. Consult the PVC/vinyl window manufacturer for compatibility.
- .13 Use sheets of largest practical size to minimize joints.
- .14 Inspect for continuity. Repair punctures and tears with sealing tape before work is concealed.

3.4 Installation - Sheet Vapour Barrier - Flat Roof Assembly

- .1 In accordance with Section 07 52 00.

3.5 Installation - Sheet Vapour Barrier - Sloped Metal Roof Assembly

- .1 Install materials to manufacturer's written instructions.
- .2 Vapour barrier can be installed on most substrates, such as steel, concrete, plywood, gypsum or cement boards, and asphaltic panels.
- .3 Except for the steel deck, all substrates must be primed with primer. The substrate should be clean and sound, free of loose materials or contaminants, such as water and grease which may compromise the performance of the product.
- .4 Vapour barrier is adhered to substrate by peeling off the silicone release film.
- .5 Side laps must be a minimum of 75 mm (3 in) and end laps must be a minimum of 150 mm (6 in).
- .6 All end laps on steel deck shall be supported by a metal plate 15 cm x 106 cm (6 in x 42 in).

- .7 Once installed, pressure must be applied over the whole surface using a roller to ensure a perfect adhesion.
- .8 Minimum application temperature: - 10 °C (14 °F)
- .9 Vapour barrier may be left in place during construction. When left exposed to precipitation, positive slope and adequate drainage is required. The effects of weathering may vary based upon local climate and project conditions. Cover as soon as possible to limit exposure to UV and construction traffic. Not recommended for use as temporary roof assembly.
- .10 No product can be installed over vapour barrier membrane with hot bitumen.

3.6 Installation - Fluid-applied Vapour Barrier

- .1 Install materials to manufacturer's written instructions.
- .2 Apply sealant within recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges or where compatibility with adjacent materials may be in doubt.
- .3 Ensure services are installed and inspected before installation of retarder.
- .4 All surfaces must be sound, dry, clean and free of frost, oil, grease, dirt, excess mortar or other contaminants. New concrete should be cured for a minimum of 16 hours before vapour barrier is applied. Concrete surfaces should be free of large voids and spalled areas.
- .5 Vapour barrier may be applied by brush, trowel or roller, however, application by conventional air assisted spray equipment in a single or dual-coat application is the preferred method. Apply in continuous, monolithic application without sags, runs or voids, transitioning onto flashing membrane to create a uniform drainage plane and air barrier. Regularly monitor wet mil thickness during application to assure adequate coverage. The preferred method of application is to mark areas off and ensure that the appropriate volume has been sprayed over this area. During spraying, the material should be applied in horizontal strokes ensuring even application of the product, and then applied in vertical strokes, again ensuring even application. In areas where surface is not uniform, i.e., slightly rough with the presence of small indentations and recesses, an added over-spray should be performed. This over-spray should be sufficient to fill the voids, without excessive material application such that slumping or running of the material occurs.
- .6 Coverage rates:
 - .1 Smooth Surfaces: such as exterior gypsum sheathing or formed concrete: 3.7 gal US / 100 ft² (1.5 L/m²) to give a wet film thickness of approximately 60 mils (1.5 mm), and a nominal cured dry film thickness of 36 mils (0.91 mm) , depending on texture and porosity of surface.
 - .2 Rough Surfaces such as CMU: 5.4 gal US / 100 ft² (2.2 L/m²) to give a wet film thickness of approximately 90 mils (2.3 mm), and a nominal cured dry film thickness of 54 mils (1.4 mm), depending on texture and porosity of surface
- .7 Application Equipment:
 - .1 5 Gallon Pail: Suggested Spray Equipment: Graco 7900HD (2.1 GPM and 3300psi) airless sprayer with up to 250' of 3/8" ID hose and a HD Mastic Gun using a .031-.045 XHD tip, or similar equipment.

- .2 55 Gallon Drum: Suggested Spray Equipment: Graco 833HD (4.0 GPM and 4000psi) airless sprayer with up to 250' of 3/8" ID hose and a HD Mastic Gun using a .031-.045 XHD tip, or similar equipment.
- .8 Joint and Crack Treatment:
 - .1 Joints between panels of exterior grade gypsum and plywood should be treated as outlined in the table below. Mortar joints on CMU walls should be struck full and flush with block surface. Cracks in masonry and concrete up to 1/2" (12 mm) wide shall be filled with a trowel application of Sealant and allowed to cure overnight prior to application of the liquid-applied air barrier to the surface, or alternatively, the cracks may be sealed with a strip of air barrier. Transition joints between two dissimilar asphalt compatible materials at beams, columns, window and door frames, etc., should be sealed with strips of air barrier, lapped a minimum of 3" (75 mm) on both substrates. Surfaces to receive air barrier must be prepared per the applicable Technical Data Sheet. For non-asphalt compatible materials, contact a product representative for more information. Dynamic or expansion joint treatment must be in compliance with the project's architectural details and specifications.
 - .2 Sheathing or Substrate Non-Moving Joint Treatment Options (Apply per products' published Technical Data Sheets):
 - .1

Non-Moving Joints	Method #1 Sealant Method	Method #2 Fluid-Applied Method	Method #3 Self-Adhered Sheet Method
Less than 1/4" (6mm)	1. 925 BES Sealant or Air-Bloc LF2. Fill and strike smooth 3. Allow to dry	1. Fill with Air-Bloc 16MR by trowel or spray, extending beyond joint line a minimum of 3" (75 mm) onto face of substrate 2. Fully embed 2" (50 mm) minimum 183 – Repair Fabric Yellow Fiberglass glass fiber reinforcing tape into wet Air-Bloc 16 MR – centered over joint	1. Apply Blueskin Adhesive, Blueskin LVC Adhesive or Aquatac™ Primer 2. Allow to dry 3. Apply self-adhered membrane and roll in place. Select One: Non-permeable option: • Blueskin SA • Blueskin SA LT • Metal Clad
1/4" (6mm) to 1/2" (12mm)	Same as above	Do Not Use	Same as above

- .9 Vapour Barrier is designed for exposure of up to 180 days, but is not designed for permanent exposure to ultraviolet light and should be covered as soon as practical after application. Do not expose the backside of the substrate to moisture or rain. Protect exposed back-up walls against wet weather conditions during and after application of membrane, including wall openings and construction activity above completed air barrier installation.

- .10 Vapour Barrier should not be applied to wet surfaces or when ambient air and substrate temperatures are below or expected to fall below 20°F (-6°C) within 48 hours. The product should not be applied if it is raining, or if the possibility of rain is likely within 16 hours.
- .11 In hot weather or direct sun applications over porous substrates, such as concrete, rapid surface drying can form blisters. A thin 'prime coat' application to substrate, which is allowed to dry, often prevents blister formation in subsequent application. Alternatively, a two coat application vs. single heavy coat – with back rolling of base coat – also aids in prevention of blistering in hot weather. Vapour Barrier is non-resistant to oils, grease or solvents.

3.7 Installation: underslab sheet vapour barrier

- .1 Install vapour barrier in accordance with manufacturer's written instructions and ASTM E1643, and generally as follows:
 - .1 Unroll vapour barrier with the longest dimension parallel to direction of concrete placement.
 - .2 Lap vapour barrier onto face of grade beams.
 - .3 Secure vapour barrier with termination/retention bar as recommended by the manufacturer.
 - .4 Overlap joints in accordance with manufacturer's requirements.
 - .5 Seal penetrations including pipe and conduit risers in accordance with manufacturer's written instructions.
 - .6 Make no additional penetrations except as required for placing of reinforcing steel and permanent utilities.
- .2 Repair damaged areas by cutting patches of vapour barrier membrane; sized to overlap damaged area, and tape all sides using manufacturer's required tape.

3.8 Cleaning

- .1 Progress Cleaning: clean in accordance with Section 01 74 00 - Cleaning.
- .2 Final Cleaning: remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 - Cleaning upon completion.
 - .1 Remove insulation material spilled during installation and leave work area ready for application of wall board.
- .3 Waste Management: perform in accordance with Section 01 74 19 - Waste Management and Disposal.

END OF SECTION

Part 1 General

1.1 Related requirements

- .1 Section 07 92 00 - Joint Sealants

1.2 Reference standards

- .1 Canadian General Standards Board (CGSB):
 - .1 CAN/CGSB-19.13M-M87, Sealing Compound, One Component, Elastomeric Chemical Curing
 - .2 CAN/CGSB-19.24M-M90, Multi-Component, Chemical Curing Sealing Compound
 - .3 CGSB 19-GP-14M-84, Sealing Compound, One Component, Butyl-Polyisobutylene Polymer Base, Solvent Curing
- .2 Sealant and Waterproofer's Institute - Sealant and Caulking Guide Specification.

1.3 Action and informational submittals

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Quality Assurance Submittals: submit following in accordance with Section 01 45 00 - Quality Control.
 - .1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
 - .2 Manufacturer's Instructions: submit manufacturer's installation instructions and special handling criteria, installation sequence, and cleaning procedures.
- .4 Sustainable Design Submittals:
 - .1 LEED submittals: in accordance with 01 35 20 - LEED Sustainable Requirements.
 - .2 Construction Waste Management: Refer to Section 01 74 19 - Waste Management and Disposal.
 - .3 Material product attribute documentation: Refer to Product Check Sheet as listed in 01 35 20 - LEED Sustainable Requirements to determine applicable type of documentation required for each product.
 - .4 Low-Emitting Materials:
 - .1 Submittals are required for any sealants, adhesives, paints, coatings, composite wood, flooring, wall panels, insulation or ceiling components within the inner most weather proofing barrier.

- .2 Refer to Product Check Sheet as listed in 01 35 20 - LEED Sustainable Requirements to determine applicable type of documentation required for each product.
- .5 Confirm and coordinate submittal requirements with the BECxA.

1.4 Quality assurance

- .1 Qualifications:
 - .1 Applicator: company specializing in performing work of this section with minimum 3 years documented experience with installation of air/vapour barrier systems.
 - .1 Completed installation must be approved by the material manufacturer.
 - .2 Single Source Responsibility:
 - .1 Obtain air barrier and auxiliary materials including adhesive/ primer, air barrier, flashings, and sealants from a single Air Barrier Manufacturer regularly engaged in the manufacturing and supply of the specified products.
- .2 Mock-Up:
 - .1 Construct mock-up in accordance with Section 01 43 00 - Quality Assurance.
 - .2 Locate where directed.
 - .3 Mock-up may remain as part of finished work.
 - .4 Contract Administrator will require minimum 72 hours to review the mock-up.
 - .5 Confirm and coordinate mock-up requirements with the BECxA.
- .3 Confirm and coordinate visual review and pre-installation conference requirements with the BECxA.

1.5 Delivery, storage, and handling

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

1.6 Ambient conditions

- .1 Install solvent curing sealants and vapour release adhesive materials in open spaces with ventilation.
- .2 Ventilate enclosed spaces in accordance with Section 01 51 00 - Temporary Utilities.
- .3 Maintain temperature and humidity recommended by materials manufactures before, during and after installation.

1.7 Ambient Conditions

- .1 Install solvent curing sealants and vapour release adhesive materials in open spaces with ventilation.
- .2 Ventilate enclosed spaces in accordance with Section 01 51 00- Temporary Utilities .

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

1.8 Sequencing

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

1.9 Warranty

- .1 Warranty: include coverage of installed sealant and sheet materials which:
 - .1 Fail to achieve air tight and watertight seal.
 - .2 Exhibit loss of adhesion or cohesion.
 - .3 Do not cure.

Part 2 Products

2.1 Sheet materials

- .1 Primary Sheet: Self-adhered vapor permeable, water resistive air barrier consisting of a reinforced, modified polyolefin tri-laminate film surface and patented permeable adhesive technology with split-back poly-release film; having the following typical physical properties:
 - .1 Color: Blue
 - .2 Thickness: 23 mils (0.58 mm)
 - .3 Water Vapor Permeance (ASTM E96): 29 perms
 - .4 Air Leakage of Air Barrier Assemblies (ASTM E2357): Pass
 - .5 Air Permeance (ASTM E2178): Pass
 - .6 Nail Sealability (ASTM D1970): Pass
 - .7 Dry Tensile Strength (ASTM D882):
 - .8 41 lbf /182N MD
 - .9 29 lbf /129N CD
 - .10 Surface Burning Characteristics (ASTM E84):
 - .11 Flame Spread: Class A
 - .12 Smoke Development: Class A
 - .13 Low Application Temperature: 20 degrees F (-7 degrees C)
 - .14 Basis of design: Blueskin VP160 Self-Adhered Water Resistive Air Barrier by Henry
- .2 Vapour Permeable Flashing: Self-adhered water resistive vapor permeable air barrier consisting of a reinforced modified polyolefin tri-laminate film surface and patented adhesive technology with split-back poly-release film; having the following typical physical properties:
 - .1 Color: Blue
 - .2 Thickness: 23 mils (0.58 mm)

- .3 Water Vapor Permeance (ASTM E96): 29 perms
 - .4 Nail Sealability (ASTM D1970): Pass
 - .5 Low Application Temperature: 20 degrees F (-7 degrees C)
 - .6 Basis of design: Blueskin VP160 Self-Adhered Water Resistive Air Barrier manufactured by Henry.
- .3 Through Wall Flashing: self-adhered membrane consisting of an SBS rubberized asphalt compound which is integrally laminated to a tough, yellow cross-laminated polyethylene film. The membrane is specifically designed for use as a thru-wall flashing; having the following typical physical properties:
- .1 Color: Yellow
 - .2 Thickness: 40 mils (1.0 mm)
 - .3 Water vapor permeance: 0.03 perms (1.6 ng/Pa.s.m²), ASTM E96 Method B
 - .4 Elongation: 200% Minimum, ASTM D412 Die C
 - .5 Tensile Strength (membrane): 800psi (55 bar) Minimum, ASTM D412 Die C
 - .6 Tensile Strength (film): 5000psi (344.7 bar) Minimum, ASTM D882
 - .7 Puncture Resistance (membrane): 134lbf (61 kgf), ASTM E154
 - .8 Basis of design: Blueskin TWF Self-Adhered Thru-Wall Flashing Membrane manufactured by Henry.

2.2 Sealants

- .1 Sealants in accordance with Section 07 92 00 - Joint Sealants.
- .2 Building Envelope Sealant:
 - .1 Moisture cure, medium modulus polymer modified sealing compound; having the following typical physical properties:
 - .2 Basis of design: Henry® 925 BES Sealant
 - .3 Color: Varies
 - .4 Elongation: 450 – 550%.

2.3 Adhesives

- .1 Standard VOC adhesive:
 - .1 Synthetic rubber based quick setting adhesive; having the following typical physical properties:
 - .2 Basis of design: Henry® Blueskin® Adhesive
 - .3 Color: Blue
 - .4 Maximum VOC: 450 g/L
 - .5 Drying time (initial set): 30 minutes
 - .6 Low Application Temperature: 10 degrees F (-12 degrees C)

Part 3 Execution

3.1 Manufacturer's instructions

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

3.2 General

- .1 Perform Work in accordance with Sealant and Waterproofer's Institute - Sealant and Caulking Guide Specification requirements for materials and installation.
- .2 Perform Work in accordance with National Air Barrier Association - Professional Contractor Quality Assurance Program and requirements for materials and installation.
- .3 Perform Work in accordance with Canadian Urethane Foam Contractor's Association - Professional Contractor Quality Assurance Program and requirements for materials and installation.

3.3 Examination

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

3.4 Preparation

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

3.5 Installation

- .1 Install materials in accordance with manufacturer's instructions.
- .2 Lap sheet onto roof vapour retarder and seal with adhesive .
 - .1 Caulk to ensure complete air seal.
 - .2 Position lap seal over firm bearing.
- .3 Install sheet seal frames and adjacent wall seal materials with doors and windows.
 - .1 Caulk to ensure complete air seal.

- .2 Position lap seal over firm bearing.
- .4 Apply sealant within recommended application temperature ranges.
 - .1 Consult manufacturer when sealant cannot be applied within these temperature ranges.

3.6 Cleaning

- .1 Proceed in accordance with Section 01 74 00 - Cleaning.
- .2 Remove surplus materials, excess materials, rubbish, tools and equipment on completion and verification of performance of installation.

3.7 Protection of work

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

END OF SECTION

Part 1 General

1.1 Section Includes

- .1 Exterior high pressure laminate cladding, factory fabricated plank panel system, and accessories as required for a drained and back-ventilated rainscreen wall system.
 - .1 Wall panels
 - .2 Horizontal soffits
 - .3 Interior Ceilings
- .2 Exterior solid phenolic cladding panel system and accessories as required for a complete drained and back-ventilated rainscreen system.
 - .1 Wall panels
 - .2 Fascia.

1.2 Related requirements

- .1 Section 05 41 00 – Structural Metal Lightweight Framing
 - .1 Additional sub framing, insulation clips to accommodate exterior insulation is not in the scope of Section 07 42 43.
- .2 Section 06 10 00 - Rough Carpentry
- .3 Section 07 21 13 - Board and Semi Rigid Insulation
 - .1 Exterior insulation is not included in the scope of Section 07 42 43.
- .4 Section 07 26 00 - Vapour Retarders
- .5 Section 07 62 00 - Sheet Metal Flashing and Trim
- .6 Section 07 92 00 – Joint Sealants
- .7 Section 08 44 13 – Glazed Aluminum Curtain Walls
- .8 Section 09 21 16 - Gypsum Board Assemblies
- .9 Section 09 22 16 - Non-Structural Metal Framing

1.3 Reference standards

- .1 ASTM International (ASTM):
 - .1 ASTM B 117 – Standard Practice for Operating Salt Spray (Fog) Apparatus.
 - .2 ASTM D 1929 – Standard Test Method for Ignition Temperature.
 - .3 ASTM D 2244 – Standard Practice for Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates.
 - .4 ASTM D 2247 – Standard Practice for Testing Water Resistance of Coatings in 100% Relative Humidity.
 - .5 ASTM E84-21, Standard Test Method for Surface Burning Characteristics of Building Materials

- .6 ASTM E 119 – Standard Test Method for Fire Rated or Fire Resistive Construction.
- .7 ASTM E 330 – Standard Test Method for Structural Performance of Exterior Windows, Curtain Walls, and Doors Under the Influence of Wind Loads.
- .2 International Organization for Standardization (ISO):
 - .1 ISO 105 A02-93 – Tests for Color Fastness – Part A02: Grey scale for assessing change in color.
 - .2 ISO 178 – Determination of Flexural Properties.
 - .3 ISO 527-2 – Determination of Tensile Properties.
 - .4 ISO 846 – Evaluation of the Action of Organisms.
 - .5 ISO 1183 – Determination of Density of Non Cellular Plastics.
 - .6 ISO 13894-1 – High Pressure Decorative Laminates.
- .3 National Fire Protection Association (NFPA):
 - .1 NFPA 268 - Standard Test Method for Determining Ignitibility of Exterior Wall Assemblies Using a Radiant Heat Energy Source.
 - .2 NFPA 285 - Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components

1.4 Administrative requirements

- .1 Pre-Installation Meetings: convene meeting one week before beginning work of this Section, with Contractor, affected Subcontractors and Contract Administrator in accordance with Section Section 01 31 19 - Project Meetings:
 - .1 Verify project requirements.
 - .2 Review installation and substrate conditions.
 - .3 Coordination with other Subcontractors.
 - .4 Review manufacturer's installation instructions and warranty requirements.
 - .5 Confirm and coordinate pre-installation conference requirements with the BECxA.

1.5 Action and informational submittals

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Manufacturer's data sheets on each product to be used, including:
 - .1 Material Property Datasheet.
 - .2 Storage and handling requirements and recommendations.
 - .3 Installation Manual.
- .3 Shop Drawings:
 - .1 Submit plan, section, elevation and perspective drawings necessary to describe and convey the layout, profiles and product components, including edge conditions, panel joints, fixture location, anchorage, accessories, finish colours.

- .4 Code Compliance:
 - .1 Documents showing product compliance with local building code shall be submitted prior to the bid. These documents shall include, but not be limited to, appropriate Evaluation Reports and/or test reports supporting the use of the product. Alternate materials must be approved by the architect of record prior to the bid date.
- .5 Verification Samples:
 - .1 For each finish product specified, submit duplicate 100x 100mm samples, representative of materials, finishes, and colours.
- .6 Installation Instructions: Manufacturer's written instructions including surface preparation and installation procedures.
- .7 Sustainable Design Submittals: Submit in accordance with Section 01 35 20 - LEED Sustainable Requirements.
 - .1 Construction Waste Management: Refer to Section 01 74 19 - Waste Management and Disposal.
 - .2 Material product attribute documentation: Refer to Product Check Sheet as listed in 01 35 20 - LEED Sustainable Requirements to determine applicable type of documentation required for each product.
- .8 Operation and Maintenance Data: Submit operation, maintenance, and cleaning information for products covered under this section.
- .9 Provide LEED submittals indicating how following requirements will be met.
 - .1 Indoor Environmental Quality Credit EQc4.1 Low-Emitting Materials: Adhesives and Sealants: submit product data ensuring that VOC content in g/L for adhesives and sealants used, is calculated in accordance with SCAQMD Rule 1168.
- .10 Quality assurance submittals: submit following in accordance with Section 01 43 00 - Quality Assurance.
 - .1 Certificates: submit certificates signed by manufacturer certifying that composite wall panels comply with specified performance characteristics and physical properties.
 - .2 Manufacturer's Instructions: submit manufacturer's installation instructions and special handling criteria, installation sequence, and cleaning procedures.
 - .3 Manufacturer's Site Reports: submit to manufacturer's written reports within 3 days of review, verifying compliance of Work, as described in PART 3 - SITE QUALITY CONTROL.
- .11 Confirm and coordinate submittal requirements with the BECxA.

1.6 Quality assurance

- .1 Manufacturer Qualifications: All primary panel products specified in this section will be supplied by a single manufacturer with a minimum of ten years experience.
 - .1 Products covered under the Work listed in this section are to be manufactured in an ISO 9001 certified facility.

- .2 Installer Qualifications: All products listed in this section are to be installed by a single installer trained and approved by the manufacturer or representative.
- .3 Manufacturer's Field Services: Upon City of Winnipeg request, provide manufacturer's field service consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.
- .4 Mock-ups: construct mock-ups in accordance with Section Section 01 45 00 - Quality Control and to requirements supplemented as follows:
 - .1 Provide mock-up for evaluation of surface finishes and workmanship. Do not proceed with remaining work until workmanship, colour, and sheen are approved by the Contract Administrator.
 - .2 Locate where directed.
 - .3 Mock-up may remain as part of the Work.
 - .4 Confirm and coordinate visual review and mock-up requirements with the BECxA.
- .5 Pre-installation Meetings: Conduct pre-installation conference to verify project requirements, substrate conditions, manufacturer's installation instructions and manufacturer's warranty requirements. Confirm and coordinate pre-installation conference requirements with the BECxA.

1.7 Delivery, storage, and handling

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Develop Construction Waste Management Plan related to Work of this Section and in accordance with Section Section 01 74 19 - Construction Waste Management and Disposal.
- .3 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding, and packaging materials as specified in Construction Waste Management Plan in accordance with Section 01 74 19 - Construction Waste Management and Disposal.
- .4 Delivery:
 - .1 During transportation, use stable, flat pallets that are at least the same dimension as the sheets.
 - .2 Materials shall be packaged to minimize or eliminate the possibility of damage during shipping. Items such as wooden sideboards, wooden lid, and spacers or protective sheeting between panels shall be used to protect the panels from surface and/or edge damage.
- .5 Storage:
 - .1 Store products in an enclosed area protected from direct sunlight, moisture and heat. Maintain a consistent temperature and humidity.
 - .2 Store products in manufacturer's unopened packaging until ready for installation.
 - .3 Stack panels using protective dividers to avoid damage to decorative surface.

- .4 For horizontal storage, store sheets on pallets of equal or greater size as the sheets with a protective layer between the pallet and sheet and on top of the uppermost sheet.
- .5 Do not store sheets, or fabricated panels vertically.
- .6 Handling:
 - .1 Remove protective film within 24 hours of the panels being removed from the pallet.
 - .2 When moving sheets, lift evenly to avoid dragging panels across each other and scratching the decorative surface.
 - .3 Remove all labels and stickers immediately after installation.

1.8 Project Conditions

- .1 Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.
- .2 Field Measurements: Verify actual measurements/openings by field measurements performed by the installer prior to release for fabrication. Recorded measurements to be indicated on shop drawings based on field measurements provided by the installer. Coordinate field measurements and fabrication schedule with construction progress to avoid construction delays.

1.9 Warranty

- .1 At project closeout, provide manufacturer's limited ten year warranty covering defects in materials. Warranty only available when material installed by an installation Subcontractor trained and approved by the manufacturer's representative.

Part 2 Products

2.1 Description

- .1 Sustainable Requirements:
 - .1 Materials and products in accordance with Section 01 35 20 - LEED Sustainable Requirements.

2.2 Manufacturers

- .1 Acceptable Manufacturer:
Trespa International B.V.; P.O. Box 110, 6000 AC Weert Wetering 20, 6002 SM Weert
The Netherlands;
www.trespa.com.
- .2 Acceptable Manufacturer's Representative:
Trespa North America, Ltd.; 12267 Crosthwaite Cir., Poway, CA 92064. ASD. Toll Free
Tel: (800) 4-TRESPA. Tel: (858) 679-2090.
Fax: (858) 679-9568.
Email: info.northamerica@trespa.com.
Web: <http://www.trespa.com/na>.

- .3 Acceptable Manufacturer's Distributor (HPL Siding):
Upper Canada Forest Products, 7088 Financial Drive Mississauga, ON Canada L5N 7H5.
Contact: David Lucas
Tel: 416-709-6247.
Email: dlucas@ucfp.com
Web: <https://www.ucfp.com/>
- .4 Requests for substitutions will be considered in accordance with provisions of Section 01 60 00.

2.3 HPL Wall Panels

- .1 Solid Phenolic Wall Panels: Trespa Meteon by Trespa International as represented by Trespa North America, LTD.
 - .1 Material: Solid panel manufactured using a combination of high pressure and temperature to create a flat panel created from thermosetting resins, homogenously reinforced with wood-based fibers and an integrated decorative surface or printed décor.
 - .2 Color on Primary Face: Uni Colours A19.7.1 Charcoal Grey color with black reverse.
 - .3 Color: Uni Colours A19.7.1 Charcoal Grey
 - .4 Finish: Satin sheen.
 - .5 Panel Core: Fire retardant (FR) black core classified as Class A materials when tested per ASTM-E84.
 - .6 Panel Thickness: 5/16 inch (8 mm).
 - .7 Physical Properties:
 - .1 Modulus of Elasticity: 1,300,000 psi (9000 N/mm²) minimum, ISO 178.
 - .2 Tensile Strength: 10,100 psi (70 N/mm²) minimum, ISO 527-2.
 - .3 Flexural Strength: 14,500psi (120 N/mm²) minimum, ISO 178.
 - .4 Thermal Conductivity: 2.1 BTU/inch/ft².hr.°F, EN 12524.
 - .5 Structural Performance (ASTM E330):
 - .1 Panels shall be designed to withstand the Design Wind Load based upon the local building code, but in no case less than 15 pounds per square foot (psf). Wind load testing shall be done in accordance with this standard to obtain the following results:
 - .2 Normal to the plane of the wall, the maximum panel deflection shall not exceed L/175
 - .3 Normal to the plane of the wall between supports, deflection of the aluminum sub-framing members shall not exceed L/175 or 3/4 inch, whichever is less
 - .1 At 1-1/2 times design pressure, permanent deflection of framing members shall not exceed L/100 of span length and components shall not experience failure or gross permanent distortion.

- .2 If system tests are not available, mock ups shall be constructed and tests performed under the direction of an independent third party laboratory which show compliance to the minimum standards listed above.
- .8 Fire Performance:
- .1 Flame Spread: Class A, ASTM E 84.
 - .2 Smoke Development: Less than 450, ASTM E 84.
 - .3 Ignition Temperature: Greater than 650 degree F (350 degree C) above ambient, ASTM D1929.
 - .4 Burning Classification: CC1 or CC2, ASTM D635.
 - .5 When required for compliance with local building codes, the wall cladding assembly shall show no degradation of the rating of Fire Resistant Assemblies, ASTM E119.
 - .6 When required for compliance with local building codes, the wall cladding assembly including cladding and non-cladding elements such as, but not limited to, specific weather resistive barriers and/or exterior insulation materials, shall meet the performance requirements of NFPA 285. Performance shall be determined by actual testing in accordance with NFPA 285 or through an equivalency analysis provided by a recognized fire protection expert.
 - .7 When required for compliance with local building codes, the wall cladding assembly shall not ignite when exposed to a radiant heat energy source, NFPA 268.
- .9 Finish Performance: Electron Beam Cure resin in conformance with the following general requirements:
- .1 Colour: Uni Colours A19.7.1 Charcoal Grey
 - .2 Humidity Resistance: No formation of blisters when subjected to condensing water fog at 100% relative humidity and 100 degree F (38 degree C) for 3000 hours, ASTM D 2247.
 - .3 Salt Spray Resistance: Corrosion creepage from scribe line (1/16 inch (1.6 mm) max.) and minimum blister rating of 8 within the test specimen field, ASTM B117.
 - .4 Weather Exposure: Accelerated - 3000 hours in Atlas Type Weatherometer using cycle of 90 minutes light and 30 minutes diminished light and demineralized water with a maximum color change of 5 Delta E units from the original color according to ASTM D-2244, with the exception of Uni-Colors A12.3.7 / A18.3.5 / A04.1.7, which will not deviate more than 10 Delta E units from original color according ASTM D-2244.
 - .5 Color Stability: The decorative surface comply with, classification, 4 - 5 measured with the grey scale according to ISO 105 A02-93 according to test method EN 438-2:29.
 - .6 Microbial Characteristics: Will not support micro-organic growth (ISO 846).

- .2 Mounting System:
 - .1 TS220 - Concealed fastening over variable depth aluminum sub-framing.
 - .2 TS210 - Concealed fastening over fixed depth aluminum sub-framing.
- .3 Aluminum Sub Structure: Aluminum sub-structure designed to withstand structural loading due to wind load and the dead load of the panel, painted as required to conceal behind the open joinery of the attachment system.
 - .1 Extrusions, including corner closures, joint closures and vent screens, formed members, sheet, and plate shall conform with the recommendations of the manufacturer.
- .4 Extruded Aluminum Trim: Color as specified in the finish schedule.
- .5 Fasteners (Concealed/Exposed): Fasteners shall be non-corrosive and as recommended by panel manufacturer. Exposed fasteners shall be coloured to match panels.

2.4 HPL Siding

- .1 Solid High Pressure Laminate Phenolic Wall Panels: Trespa® PuraNFC® by Trespa International as represented by Trespa North America, LTD.
 - .1 Material: Solid panel manufactured using a combination of high pressure and temperature to create a flat panel created from thermosetting phenolic resins, homogenously reinforced with natural wood-based fibers and an integrated Electron Beam Cured decorative surface or printed décor.
 - .2 Siding System: Trespa® PuraNFC® is a factory fabricated High Pressure Laminate material used in conjunction with siding accessories and components to provide a cladding for a drained and back ventilated rainscreen wall system.
 - .3 Colour: Wood Decors PU08 Romantic Walnut with Brown core
 - .4 Finish: Matte sheen.
 - .5 Flush Siding System.
 - .6 Panel Core: Fire retardant (FR) core.
 - .7 Panel thickness: 5/16 inch (8mm).
 - .8 Physical Properties:
 - .1 Modulus of Elasticity: 1,300,000 psi (9000 N/mm²) minimum, ISO 178.
 - .2 Tensile Strength: 10,100 psi (70 N/mm²) minimum, ISO 527-2.
 - .3 Flexural Strength: 14,500psi (120 N/mm²) minimum, ISO 178.
 - .9 Fire Performance:
 - .1 Flame Spread: Class A, Less than 25, ASTM E 84.
 - .2 Smoke Development: Less than 450, ASTM E 84.
 - .10 Finish Performance: Electron Beam Cured Acrylic Décor in conformance with the following general requirements:
 - .1 Colour: Wood Decors PU08 Romantic Walnut
 - .2 Resistance to Climactic Shock: EN 438-2:19.
 - .3 Resistance to Artificial Weathering: EN 438-2:29.

- .4 Color Stability: The decorative surface comply with, classification, 4 - 5 measured with the grey scale according to ISO 105 A02-93 according to test method EN 438-2:29.
- .5 Resistance to SO₂: DIN 50018.
- .6 Microbial Characteristics: Will not support micro-organic growth (ISO 846).
- .11 Mounting System:
 - .1 Flush Siding System.
- .12 Sub Structure:
 - .1 Sub-structure designed to withstand structural loading due to wind load and the dead load of the panel, finished as required to conceal behind the joinery of the attachment system.
 - .2 Extrusions, battens, including corner closures, joint closures and vent screens, formed members, sheet, and plate shall conform with the recommendations of the manufacturer.
- .13 Fasteners (Concealed/Exposed): Fasteners are non-corrosive. Exposed fasteners shall be coloured to match panels.
- .14 Accessories:
 - .1 Extruded aluminum trim includes outside corners, inside corners, start profiles, j channel, and finish profiles.
 - .2 Provide accessories in siding matched colours.
- .15 Code Compliance Requirement for Siding System
 - .1 High Pressure Laminate Siding System, Pura, complies with ASTM E 136 as a combustible material.
 - .2 High Pressure Laminate Siding System, Pura, complies with CAN/ULC S102.2-18 Standard Method of Test for Surface Burning Characteristics of Flooring, Floor Covering, and Miscellaneous Materials and Assemblies
 - .3 High Pressure Laminate Siding System, Pura, complies with ASTM E 84 Flame Spread Index=0, Smoke Development Index=15.
 - .4 High Pressure Laminate Siding System, Pura, tested to ASTM E 330 for Transverse Loads.

2.5 Fabrication

- .1 HPL Wall Panels:
 - .1 Panels: Solid phenolic impregnated kraft paper wall panels with no voids, air spaces or foamed insulation in the core material. Accessory items in accordance with manufacturer's recommendations and approved submittals
 - .2 Panel Weight: 8 mm (2.4 lb/ft²)
 - .3 Panel Bow: = 2 mm / m (= 0.079 inch/39.38 inches).

- .4 Panel Dimensions: Field fabrication shall be allowed where necessary, but shall be kept to an absolute minimum. All fabrication shall be done under controlled shop conditions when possible.
- .5 Appearance: Panel lines, breaks, and angles shall be sharp, true, and surfaces free from warp and buckle
- .2 HPL Siding:
 - .1 Panels: Solid high pressure laminate phenolic wall panels with no voids, air spaces or foamed insulation in the core material. Accessory items in accordance with manufacturer's recommendations and approved submittals. Panel edges are factory fabricated to be used with the provided hardware system.
 - .2 Panel Weight: 8mm-5/16" (2.4lb/ft²)
 - .3 Panel Dimensions: Field fabrication shall be allowed where necessary, but shall be kept to an absolute minimum.
 - .1 Flush Siding Dimensions = 8mm (5/16") thick, 186mm (7 3/8") tall, 3050mm (10') length
 - .4 Appearance: Panel lines, breaks, and angles shall be sharp, true, and surfaces free from warp and buckle.

2.6 Furring Strapping Battens

- .1 Rainscreen Cavity: Install High Pressure Siding System, Pura, on a drained and ventilated rainscreen cavity with a minimum 3/4" (19mm) air cavity. The furring strapping or battens shall be composed of wood and the selection of cavity trim pieces shall be incorporated into the rainscreen wall design to prevent insect or pests from entry into the cavity.

Part 3 Execution

3.1 Examination

- .1 Do not begin installation until substrates have been properly prepared.
- .2 Surfaces to receive panels shall be even, smooth, dry, and free from defects detrimental to the installation of the panel system. Notify Contractor in writing of conditions detrimental to proper and timely completion of the work.
- .3 Confirm exterior sheathing is plumb and level, with no deflection greater than 1/4 inch (6 mm) in 20 feet (6096 mm).
- .4 If substrate preparation is the responsibility of another installer, notify Contract Administrator of unsatisfactory preparation before proceeding. Do not proceed with installation until unsatisfactory conditions have been corrected.
- .5 Confirm and coordinate visual review requirements with the BECxA.

3.2 Preparation

- .1 Clean surfaces thoroughly prior to installation.
- .2 Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 Installation - HPL Wall Panels

- .1 Install solid phenolic wall panels and sub-frame system in accordance with manufacturer's instructions.
- .2 Install solid phenolic wall panels plumb and level and accurately spaced in accordance with manufacturer's recommendations and approved submittals and drawings.
- .3 Anchor panels and sub-framing securely per engineering recommendations and in accordance with approved shop drawings to allow for necessary movement and structural support.
- .4 Fasten solid phenolic wall panels with fasteners approved for use with supporting substrate.
- .5 Do not install panels or component parts which are observed to be defective or damaged including, but not limited to: warped, bowed, abraded, scratched, and broken members.
- .6 Do not cut or trim component parts during installation in a manner that would damage the finish, decrease the strength, or result in visual imperfection or a failure in performance. Return component parts with require alteration to the shop for re-fabrication or replacement.
- .7 Install corner profiles and trim with fasteners appropriate for use with adjoining construction as indicated on the Contract Drawings and as recommended by manufacturer.

3.4 Installation - HPL Siding

- .1 Install High Pressure Laminate Siding System, Pura, and furring system in accordance with manufacturer's instructions and local building code
- .2 Install High Pressure Laminate Siding System, Pura, plumb and level and accurately spaced in accordance with manufacturer's recommendations and approved submittals and drawings.
- .3 Anchor siding panels and sub-framing securely per engineering recommendations and in accordance with approved shop drawings to allow for necessary movement and structural support.
- .4 Fasten siding panels with fasteners approved for use with supporting substrate.
- .5 Do not install siding panels or component parts which are observed to be defective or damaged including, but not limited to: warped, bowed, abraded, scratched, and broken members.
- .6 Do not cut or trim component system parts during installation in a manner that would damage the finish, decrease the strength, or result in visual imperfection or a failure in performance. Return component system parts with require alteration to the shop for re-fabrication or replacement.
- .7 Install corner profiles and trim with fasteners appropriate for use with adjoining construction as indicated on the Contract Drawings and as recommended by manufacturer.

3.5 Cleaning

- .1 Proceed in accordance with Section 01 74 00 - Cleaning.

- .2 Remove masking or panel protection as soon as possible after installation. Any masking intentionally left in place after panel installation on an elevation, shall become the responsibility of the Contractor to remove.
- .3 Adjust final panel installation so that all joints are true and even throughout the installation. Panels out of plane shall be adjusted with the surrounding panels to minimize any imperfection.
- .4 Repair panels with minor damage. Remove and replace panels damaged beyond repair as a direct result of the panel installation. After installation, panel repair and replacement shall become the responsibility of the Contractor.
- .5 Clean finished surfaces as recommended by panel manufacturer. After installation cleaning, cleaning during construction shall become the responsibility of the Contractor.

END OF SECTION

Part 1 General

1.1 Section includes

- .1 Materials and installation for foundation wall systems comprising fibre reinforced cementitious composite panel.
 - .1 Fiber cement panels, furring strips and accessories engineered for climate.
- .2 Materials and installation for wall, soffit, and fascia systems comprising fibre reinforced cementitious composite panel.
 - .1 Fiber cement panels, trim, furring strips and accessories engineered for climate.

1.2 Related sections

- .1 Section 01 33 00 - Submittal Procedures
- .2 Section 07 11 13 - Bituminous Dampproofing
- .3 Section 06 10 00 - Rough Carpentry
- .4 Section 07 21 13 - Board, and Semi Rigid Insulation
- .5 Section 07 62 00 - Sheet Metal Flashing and Trim

1.3 References

- .1 American Society for Testing and Materials International, (ASTM).
 - .1 ASTM A653/A653M 02a, Standard Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc Iron Alloy Coated (Galvannealed) by the Hot Dip Process.
 - .2 ASTM E96 00e1, Standard Test Methods for Water Vapour Transmission of Materials.
 - .3 ASTM C1186 - Standard Specification for Flat Fiber-Cement Sheets
 - .4 ASTM D3359 - Standard Test Method for Measuring Adhesion by Tape Test, Tool and Tape.
 - .5 ASTM E136 - Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750 degrees C.
- .2 Department of Justice Canada (Jus).
 - .1 Canadian Environmental Protection Act (CEPA), 1999.
- .3 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS)
- .4 National Research Council (NRC)
- .5 Underwriters Laboratories of Canada (ULC):
 - .1 CAN/ULC S701 01, Standard for Thermal Insulation, Polystyrene, Boards and Pipe Covering.
 - .2 CAN/ULC S702 1997, Standard for Thermal Insulation, Mineral Fibre, for Buildings.

- .3 CAN/ULC S704 2001, Standard for Thermal Insulation, Polyurethane and Polyisocyanurate Boards, Faced.
- .4 CAN/ULC S706 02, Standard for Wood Fibre Thermal Insulation for Buildings.

1.4 Design Requirements

- .1 Design composite building panel wall to provide for thermal movement of component materials caused by ambient temperature range of Winnipeg, MB without causing buckling, failure of joint seals, undue stress on fasteners or other detrimental effects.
- .2 Include expansion joints to accommodate movement in wall system and between wall system 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 and applicable Municipal/Territorial 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".
- .5 Design wall system to accommodate specified erection tolerances of structure.
- .6 Maintain following installation tolerances:
 - .1 Maximum variation from plane or location shown on approved shop drawings: 10mm/m of length and up to 20mm/100 m maximum.
 - .2 Maximum offset from true alignment between two adjacent members abutting end to end, in line: 0.75 mm.

1.5 Submittals

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Samples:
 - .1 Submit duplicate 12" x 12" (300 x 300mm) samples of each panel material, finish, and colour.
- .3 Product Data:
 - .1 Submit two copies of manufacturer's literature for the GFRC panels. Including:
 - .1 Preparation instructions and recommendations.
 - .2 Storage and handling requirements and recommendations.
 - .3 Installation methods.
- .4 Shop Drawings:
 - .1 Include details showing thickness and dimensions of various system parts, fastening and anchoring methods, locations of joints, and location and configuration of joints. Show methods of erection, plans of wall panels, sections and details, flashings, sealants, and interfaces with all materials not supplied.
- .5 Confirm and coordinate submittal requirements with the BECx A.

1.6 Mockups

- .1 Refer to Section 01 45 00.

- .1 Provide site mock-up of Fibre Cement Cladding on exterior foundation walls, arena column surrounds, arena fascia, and arena soffits.
- .2 Provide approximate 1200mm wide x actual height of wall, illustrating full boards, trims and fasteners and condition at corner.
- .3 Include insulation, furring channels, and sheet metal trims as part of mock-up.
- .4 Include self adhesive air/vapour barrier.
- .5 Locate where directed by Contract Administrator.
- .6 Approved mock-up may remain as part of the Work if acceptable to Contract Administrator.
- .7 If not accepted, make necessary changes for Contract Administrator to review.
- .8 Confirm and coordinate mock-up requirements with the BECxA.

1.7 Quality assurance

- .1 Comply with requirements of Section 01 45 00- Quality Control.
- .2 Applicator: Company specializing in performing work of this section with minimum five years documented experience with installation of similar systems.
- .3 Certificates: Product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.
- .4 Confirm and coordinate visual review and pre-installation conference requirements with the BECxA.

1.8 Delivery, storage and handling

- .1 Comply with Section 01 61 00 – Common Product Requirements.
- .2 Deliver materials in original, unopened packages bearing brand names and identification of manufacturer. Provide markings to identify components consistent with drawings.
- .3 Exercise care in unloading, storing, and installing panels to prevent damage.
- .4 Store siding on edge or lay flat on a smooth level surface. Protect edges and corners from chipping. Store sheets under cover and keep dry prior to installing.
- .5 Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.9 Project conditions

- .1 Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.10 Manufacturer's Warranty

- .1 Product Warranty: Limited, non-pro-rated product Warranty.
 - .1 Hardie Architectural Panel Siding - for 30 years.
 - .2 Hardie Soffit Panel - for 30 years
 - .3 Finish Warranty: Limited product warranty against manufacturing finish defects.
 - .4 When used for its intended purpose, properly installed and maintained according to James Hardie's published installation instructions, James Hardie's ColorPlus

finish with ColorPlus Technology, for a period of 15 years from the date of purchase: will not peel; will not crack; and will not chip. Finish warranty includes the coverage for labor and material.

- .2 Workmanship Warranty: Application limited warranty for 2 years.

Part 2 Products

2.1 Manufacturers

- .1 Manufacturers approved to bid the work of this division are:
 - .1 James Hardie Building Products
 - .2 Finex
 - .3 Other manufacturers wishing to bid the work of this division shall, if necessary, modify their products to meet this specification, and shall submit to the Contract Administrator for review.

2.2 Materials

- .1 Foundation wall cladding:
 - .1 Finex Multi-purpose Fiber Cement Panels suitable for contact with the ground and complying with ULC S-102/ULC S-114 as manufactured by FINEX Inc.
 - .2 Type: Smooth Finish siding panel to accommodate panels sizes as per architectural drawings. Supply panels in either 1220mm x 1220mm (4' x 4') or 1220mm x 2440mm (4'x8'). Cut to suit installation.
 - .3 Thickness: 13mm (1/2") for vertical applications.
 - .4 Refer to Drawings.
 - .5 Provide Pre-finished Metal flashing at vertical joints as per manufacturers instructions
- .2 Exterior Wall Panels:
 - .1 Hardie Architectural Panel Siding as manufactured by James Hardie Building Products, Inc.
 - .1 Type: Smooth (fine sand) siding panel to accommodate sizes as per architectural drawings. Panels up to 4 feet by 10 feet (1219 mm by 2540 mm) may be required. Thickness: 8mm (5/16").
 - .2 Finishes: Factory primed finish.
 - .1 Colour: factory primed and ready for painting. Painting to be done by Section 09 91 00.
 - .3 Protection: Factory applied finish protection such as plastic laminate that is removed once panels are installed.
 - .4 Accessories: Complete finishing system including trims and pre-packaged touch-up kit provided by fiber cement manufacturer. Provide quantities as recommended by manufacturer. All trims to match colour of panels.
- .3 Exterior Soffit Panels:
 - .1 HardieSoffit Panel as manufactured by James Hardie Building Products, Inc.

- .1 Type: Non-Vented Smooth soffit panels to accommodate panel sizes as per architectural drawings. Thickness: 6mm (1/4").
- .2 Finishes: Factory primed finish.
 - .1 Colour: factory primed and ready for painting. Painting to be done by Section 09 91 00.
- .3 Protection: Factory applied finish protection such as plastic laminate that is removed once panels are installed.
- .4 Accessories: Complete finishing system including trims and pre-packaged touch-up kit provided by fiber cement manufacturer. Provide quantities as recommended by manufacturer. All trims to match colour of panels.
- .4 Fasteners
 - .1 For panel products:
 - .1 Purpose made, colour matched nails fasteners, lengths and sizes to suit application, in accordance to manufacturer's recommendations. Colour matched screw fasteners permitted if allowed by panel manufacturer for installation.

2.3 Accessories (foundation panels)

- .1 Perimeter Insulation Flashings: Coordinate supply of end closures and flashings for perimeter insulation system with Section 07 62 00 - Sheet Metal Flashing and Trim.
- .2 Fasteners:
 - .1 Insulated GRFC Panel (XPS and Mineral Wool): as recommended by the manufacturer.

Part 3 Execution

3.1 Examination

- .1 Do not begin installation until substrates have been properly prepared.
 - .1 Install water-resistive barriers and claddings to dry surfaces.
 - .2 Repair any punctures or tears in the water-resistive barrier prior to the installation of the siding.
 - .3 Protect siding from other trades.
- .2 If framing preparation is the responsibility of another installer, notify Contract Administrator of unsatisfactory preparation before proceeding.
- .3 Verification of Conditions: Verify that conditions of substrate previously installed are clean, dry, smooth, and acceptable for application of GRFC faced insulation in accordance with manufacturer's instructions.
- .4 Inspect substrates in presence of Contract Administrator.
- .5 Inform Contract Administrator of unacceptable conditions immediately upon discovery.

- .6 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Contract Administrator.
- .7 Confirm and coordinate visual review requirements with the BECxA.

3.2 Preparation

- .1 Clean surfaces thoroughly prior to installation.
- .2 Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- .3 Install a water-resistive barrier is required in accordance with local building code requirements if indicated on Drawings.
- .4 The water-resistive barrier must be appropriately installed with penetration and junction flashing in accordance with local building code requirements.

3.3 Installation - Foundation Panels

- .1 Install in strict accordance with manufacturer's installation instructions.
- .2 Install panels 300mm (12") below ground level and fasten every 600mm (24") along the width and height of the panels.
- .3 Drill holes using a bit with a diameter that is 2mm (5/64") larger than the diameter of the screws. Fasteners must penetrate at least 19mm (3/4") into the furring strips.
- .4 Fasteners must be placed 25mm (1") minimum from the edges of the panels. 38mm (1 1/2") is recommended. Do not countersink screw head in 6mm (1/4") panel.
- .5 At corners of panels, place fasteners in an asymmetric position at a minimum of 63mm (2-1/2") from corner and 25mm (1") from the edge.
- .6 Leave a minimum space of 3mm (1/8") between panels for expansion. If a flexible adhesive sealant is used, leave a minimum space of 6mm (1/4"). A bond breaking tape is required to prevent the flexible sealant from adhering under the joint. Sealing of the joints is not required.
- .7 Provide 38mm wide 26 gauge prefinished metal flashing at all exposed panel joints. Colour: grey
- .8 Refer to Drawings for additional details.

3.4 Installation - Fascia and Column Surrounds, Roof Screen

- .1 Refer to Drawings for details.
- .2 Install in strict accordance with manufacturer's installation instructions.
- .3 Maintain clearance between siding and adjacent finished grade.
- .4 Fasten exterior vertical siding into framing with exposed head, purpose made stainless steel screws. Spacing to follow manufacturer's installation instructions.
- .5 Factory Finish Touch Up: Apply touch up paint to cut edges in accordance with manufacturer's printed instructions.
 - .1 Touch-up nicks, scrapes, and nail heads in pre-finished siding using the manufacturer's touch-up kit pen.

- .2 Touch-up of nails shall be performed after application, but before plastic protection wrap is removed to prevent spotting of touch-up finish.
- .3 Use touch-up paint sparingly. If large areas require touch-up, replace the damaged area with new pre-finished siding. Match touch up color to siding color through use of manufacturer's branded touch-up kits.

3.5 Installation - Soffit Panels

- .1 Refer to Drawings for details.
- .2 Install in strict accordance with manufacturer's installation instructions.

3.6 Protection

- .1 Protect installed products until completion of project.
- .2 Repair damage to adjacent materials caused by mineral fibre reinforced panel installation.
- .3 Touch-up, repair or replace damaged products before Substantial Completion.

3.7 Cleaning

- .1 Progress Cleaning: Perform in accordance with Section 01 74 00 - Cleaning.
- .2 Final Cleaning: Perform in accordance with Section 01 74 00 - Cleaning upon completion.
- .3 Waste Management: Perform in accordance with Section 01 74 19 - Waste Management and Disposal

END OF SECTION

Part 1 General

1.1 Section Includes

- .1 Insulation.
- .2 Modified bituminous membrane roofing, and flashings.

1.2 Related requirements

- .1 Section 06 10 00 - Rough Carpentry
- .2 Section 07 26 00 - Vapour Retarders
- .3 Section 07 62 00 - Sheet Metal Flashing and Trim
- .4 Section 07 92 00 - Joint Sealants
- .5 Section 09 21 16 - Non-Structural metal framing

1.3 Reference standards

- .1 American Society for Testing and Materials International Inc:
 - .1 ASTM C726-17, Standard Specification for Mineral Fiber Roof Insulation Board
 - .2 ASTM C728-17a, Standard Specification for Perlite Thermal Insulation Board
 - .3 ASTM C1002-20, Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs
 - .4 ASTM C1177/C1177M-17, Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing
 - .5 ASTM C1396/C1396M-17, Standard Specification for Gypsum Board
 - .6 ASTM D41/D41M-11(2016), Standard Specification for Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing
 - .7 ASTM D312/D312M-16a, Standard Specification for Asphalt Used in Roofing
 - .8 ASTM D448-12(2017), Standard Classification for Sizes of Aggregate for Road and Bridge Construction
 - .9 ASTM D2178/D2178M-15a, Standard Specification for Asphalt Glass Felt Used in Roofing and Waterproofing
 - .10 ASTM D6162/D6162M-16, Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using a Combination of Polyester and Glass Fibre Reinforcements
 - .11 ASTM D6163/D6163M-16, Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using Glass Fibre Reinforcements
 - .12 ASTM D6164/D6164M-16, Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using Polyester Reinforcements

- .13 ASTM D6222/D6222M-16, Standard Specification for Atactic Polypropylene (APP) Modified Bituminous Sheet Materials Using Polyester Reinforcement
- .14 ASTM D6223/D6223M-16, Standard Specification for Atactic Polypropylene (APP) Modified Bituminous Sheet Materials Using a Combination of Polyester and Glass Fiber Reinforcement
- .15 ASTM D6509/D6509M-16, Standard Specification for Atactic Polypropylene (APP) Modified Bituminous Sheet Materials Using Glass Fiber Reinforcement
- .16 ASTM D6622/D6622M-20, Standard Guide for Application of Fully Adhered Hot-Applied Reinforced Waterproofing Systems
- .17 ASTM E96/E96M-16, Standard Test Methods for Water Vapor Transmission of Materials
- .18 ASTM E2707-15, Standard Test Method for Determining Fire Penetration of Exterior Wall Assemblies Using a Direct Flame Impingement Exposure
- .19 ASTM E2886/E2886M-20, Standard Test Method for Evaluating the Ability of Exterior Vents to Resist the Entry of Embers and Direct Flame Impingement
- .2 Canadian General Standards Board (CGSB):
 - .1 CGSB 37-GP-9Ma-83, Primer, Asphalt, Unfilled, for Asphalt Roofing, Dampproofing and Waterproofing
 - .2 CGSB 37-GP-56M-80b(A1985), Membrane, Modified, Bituminous, Prefabricated, and Reinforced for Roofing
 - .3 CAN/CGSB-51.33-M89, Vapour Barrier Sheet, Excluding Polyethylene, for Use in Building Construction
- .3 Canadian Roofing Contractors Association (CRCA):
 - .1 CRCA Roofing Specifications Manual- Current Version
- .4 CSA Group (CSA):
 - .1 CSA-A123.3-05, Asphalt Saturated Organic Roofing Felt (Reaffirmed 2010)
 - .2 CAN/CSA-A123.4-04, Asphalt for Constructing Built-Up Roof Coverings and Waterproofing Systems, Includes Update No. 1 (2006)
 - .3 CSA A123.21-20, Standard Test Method for the Dynamic Wind Uplift Resistance of Mechanically Attached Membrane-Roofing Systems
 - .4 CSA A231.1:19/A231.2:19, Precast Concrete Paving Slabs/Precast Concrete Pavers, Includes Update No. 1 (2020).
 - .5 CAN/CSA O80 SERIES-15, Wood Preservation, Includes Update No. 1 (2017) and Update No. 2 (2019).
 - .6 CSA O121-17, Douglas Fir Plywood
 - .7 CSA O151-17, Canadian Softwood Plywood
- .5 Factory Mutual (FM Global):
 - .1 FM Approvals - Roofing Products
 - .2 FM Approval Standard #4470, Approval Standard for Singly-Ply, Polymer-Modified Bitumen Sheet, Built-Up Roof (BUR) and Liquid Applied for use in Class 1 and Non-combustible Roof Deck Construction
 - .3 FM Global Property Loss Prevention Data Sheets 1-29

- .4 FM Global Property Loss Prevention Data Sheets 1-49
- .6 Health Canada / Workplace Hazardous Materials Information System (WHMIS):
 - .1 Safety Data Sheets (SDS)
- .7 Underwriters Laboratories' of Canada (ULC):
 - .1 ULC 102, Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies. (ULC S102)
 - .2 ULC 107, Methods of Fire Tests of Roof Coverings. (CAN/ULC S107 10)
 - .3 ULC 701.1, Standard for Thermal Insulation, Polystyrene, Boards
 - .4 ULC 702.2, Mineral Fibre Thermal Insulation for Buildings, Part 2: Application Guidelines. (ULC S702.2-15)
 - .5 ULC 704, Standard for Thermal Insulation, Polyurethane and Polyisocyanurate Boards, Faced. (CAN/ULC-S704-11)
 - .6 ULC 770, Standard Test Method for Determination of Long-term Thermal Resistance of Closed-Cell Thermal Insulating Foams CAN/ULC-S770-(15)
 - .7 CAN/ULC-S107-10, Methods of Fire Tests of Roof Coverings

1.4 System Description

- .1 Assembly of components include two (2) ply membrane system, heat-welded, with granulated surface, and insulation.

1.5 Administrative requirements

- .1 Coordination:
 - .1 Coordinate with other work having a direct bearing on work of this section.
 - .2 Coordinate the work with the installation of associated metal flashings, as the work of this section proceeds.
- .2 Convene pre-installation meeting oneweek before beginning waterproofing Work, with roofing Subcontractor's representative and Contract Administrator in accordance with Section 01 32 16.19 - Construction Progress Schedule - Bar (GANTT) Chart to:
 - .1 Verify project requirements.
 - .2 Review installation and substrate conditions.
 - .3 Review manufacturer's installation instructions and warranty requirements.
 - .4 Safety.
 - .5 Set-up.

1.6 Action and informational submittals

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Provide two copies of most recent technical roofing components data sheets describing materials' physical properties and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Provide one electronic copy of WHMIS SDS in accordance with Section 01 35 29.06 - Health and Safety Requirements , and indicate VOC content for:

- .1 Primers.
- .2 Asphalt.
- .3 Sealers.
- .4 Filter fabric.
- .3 Provide shop drawings:
 - .1 Indicate fasteners, flashing, control joints, tapered insulation details.
 - .2 Provide layout for tapered insulation.
 - .3 Shop drawings to be sealed by an engineer registered in the Province of Manitoba.
- .4 Samples: submit two (2) samples of 12" (305 mm) long pieces of roof insulation.
- .5 Manufacturer's Certificate: certify that products meet or exceed specified requirements.
- .6 Test and Evaluation Reports: submit laboratory test reports certifying compliance of bitumens and membrane with specification requirements.
- .7 Manufacturer's Installation Instructions: indicate special precautions required for seaming the membrane.
- .8 Reports: indicate procedures followed, ambient temperatures and wind velocity during application, and wind velocity during application.
- .9 Sustainable Design Submittals:
 - .1 LEED Canada Submittals: in accordance with Section 01 35 20 - LEED Requirements.
 - .2 Construction Waste Management: Refer to Section 01 74 19 - Construction/Demolition Waste Management and Disposal.
 - .3 Material product attribute documentation: Refer to Product Check Sheet as listed in 01 35 20 – LEED Sustainable Requirements to determine applicable type of documentation required for each product.
 - .4 Low-Emitting Materials:
 - .1 Submittals are required for any sealants, adhesives, paints, coatings, composite wood, flooring, wall panels, insulation or ceiling components within the inner most weather proofing barrier.
 - .2 Refer to Product Check Sheet as listed in 01 35 20 – LEED Sustainable Requirements to determine applicable type of documentation required for each product.
- .10 Confirm and coordinate submittal requirements with the BECxA.

1.7 Quality assurance

- .1 Perform work to CRCA Roofing Specifications Manual and manufacturer's written instructions.
- .2 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three (3) years documented experience.
- .3 Installer qualifications: company or person specializing in application of modified bituminous roofing systems with 5 years documented experience approved by manufacturer.

- .4 Confirm and coordinate visual review and pre-installation conference requirements with the BECxA.
- .5 The FM Global Hot Work Permit System shall be used to manage all hot work.
- .6 Sustainability Standards Certification:
 - .1 Mock-ups:
 - .1 Construct mock-up of roof membrane assembly and associated components and accessories to Section 01 43 00 - Quality Assurance.
 - .2 Mock-up size: 10' x 10' (3 x 3 m).
 - .3 Locate mock-up where designated by Contract Administrator.
 - .4 Confirm and coordinate mock-up requirements with the BECxA.

1.8 Regulatory Requirements

- .1 Conform to applicable code for roof assembly fire hazard requirements.
- .2 CAN/ULC-S107: Class A Fire Hazard Classification.

1.9 Delivery, storage, and handling

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions and Section 01 61 00 - Common Product Requirements.
- .2 Storage and Handling Requirements:
 - .1 Safety: comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of asphalt, sealing compounds, primers and caulking materials.
 - .2 Provide and maintain dry, off-ground weatherproof storage.
 - .3 Store rolls of felt and membrane in upright position. Store membrane rolls with salvage edge up.
 - .4 Remove only in quantities required for same day use.
 - .5 Place plywood runways over completed Work to enable movement of material and other traffic.
 - .6 Store sealants at +5 degrees C minimum.
 - .7 Store insulation protected from daylight and weather and deleterious materials.
- .3 Packaging Waste Management: remove for reuse and return by manufacturer of pallets crates padding and packaging materials in accordance with Section 01 74 19 - Construction Waste Management and Disposal.
 - .1 Collect and separate plastic, paper packaging and corrugated cardboard in accordance with Waste Management Plan.
 - .2 Fold up metal banding, flatten and place in designated area for recycling.

1.10 Site conditions

- .1 Do not apply roofing membrane during inclement weather. Consult manufacture for temperatures requirements prior to membrane application.
- .2 Do not apply roofing membrane to damp or frozen deck surface.

- .3 Do not expose materials vulnerable to water or sun damage in quantities greater than can be weatherproofed during same day.

1.11 Warranty

- .1 **Manufacturer's Warranty:** Provide ten (15) year manufacturer's written warranty to include coverage for failure to meet specified requirements, including damage to building resulting from failure to prevent penetration of water. Warranty period shall be measured from the date of substantial performance.
- .2 **Installer's Warranty:** Provide extended warranty against failure of roofing system due to poor workmanship for a period of five (5) years from date of substantial performance.

Part 2 Products

2.1 Performance criteria

- .1 Compatibility between components of roofing system is essential. Provide written declaration to Contract Administrator stating that materials and components, as assembled in system, meet this requirement.
- .2 Roofing System: to CSA A123.21 for wind uplift resistance.

2.2 Vapour Barriers

- .1 **Self-adhesive Air/Vapour Barrier:** composed of bitumen modified with thermoplastic polymers and high-density polyethylene film. The self-adhesive underface is covered with a silicone release sheet. Water vapour permeability: 0.92 ng/Pa.s.m² (0.016 Perm)
 - .1 Acceptable material:
 - .1 Sopravap'r by Soprema
- .2 **Flexible Transition Air/Vapour Barrier:** waterproofing membrane specifically designed for waterproofing expansion joints where the maximum multidirectional movement is 20 mm (¾ in). Manufactured by combining a polyester fabric with SBS-modified bitumen. The underface is covered with a thermofusible plastic film. The top face has an aluminium foil adhered to the centre of the membrane and is covered by a protective silicone paper to be removed during application. This product is applied only by heatwelding.
 - .1 Acceptable material:
 - .1 Soprajoint by Soprema
- .3 **Fluid Applied Roof Vapour Barrier:** one-component polyurethane / bitumen resin applied with a trowel, a brush or a roller in two (2) layers or in three (3) layers when POLYFLEECE reinforcement is required. Each layer must have a minimum wet film thickness of 0.8 mm (30 mil). Transitions, changes in plan and junctions between two supports, must be reinforced with POLYFLEECE reinforcement. Minimum application temperature: 5 °C (41 °F).
 - .1 Acceptable material:
 - .1 ALSAN Flashing by Soprema

2.3 Polyisocyanurate Insulation

- .1 Non-Sloped Insulation (bottom layers): To CAN/ULC-S704, closed-cell polyisocyanurate foam core integrally laminated between two heavy coated-glass facers, 100mm (4") thickness, RSI as indicated.
 - .1 Acceptable material:
 - .1 Sopra-Iso Plus by Soprema.
- .2 Sloped insulation (top layer): To CAN/ULC-S704, closed-cell polyisocyanurate foam core integrally laminated between between two heavy coated-glass facers. Thickness to suit roof backslopes/saddles/drains as indicated on Drawings.
 - .1 Acceptable material:
 - .1 Sopra-Iso Plus Tapered by Soprema

2.4 Roof Membranes

- .1 Base Sheet Membrane: SBS modified bitumen and glass mat reinforcement, nominal thickness 2.5 mm (98 mils).
 - .1 Application: fully adhered.
 - .2 Top surface: sanded.
 - .3 Underside: discontinuous self adhesive strips, covered with a release protection film.
 - .4 Acceptable material:
 - .1 Colvent Base 840 by Soprema
- .2 Base Sheet Flashing: SBS modified bitumen and composite reinforcement, nominal thickness 3mm, (118 mils). Suitable grade dependent on outdoor temperature.
 - .1 Application: self adhered
 - .2 Top surface: sanded.
 - .3 Underside: self-adhesive.
 - .4 Acceptable material:
 - .1 Sopraply Stick Duo by Soprema
- .3 Cap Sheet Membrane: SBS modified bitumen and composite reinforcement, nominal thickness 3.8mm (150 mils).
 - .1 Application: self adhered
 - .2 Top surface: coloured granulars.
 - .3 Top surface colour: Light Grey (Contract Administrator has the option to select from Manufacturer's full range).
 - .4 Underside: self adhesive underface covered with a split-back silicone release film.
 - .5 Acceptable material:
 - .1 Sopraply Stick Traffic Cap by Soprema
- .4 Cap Sheet Walkway: SBS modified bitumen and composite reinforcement, nominal thickness 3.5mm (138 mils).
 - .1 Application: thermofusible

- .2 Top surface: coloured granulars.
- .3 Top surface colour: Black (Contract Administrator has the option to select from Manufacturer's full range).
- .4 Underside: thermofusible plastic film.
- .5 Acceptable material:
 - .1 Sopraply Traffic Cap by Soprema
- .5 Cover Strip
 - .1 Membrane strip of 330 mm (13 in) made of SBS modified bitumen with a composite reinforcement. The surface is sanded and the self-adhesive underface is covered by a release protection film and the surface is sanded. The strip ensures water-tightness in the end laps.
 - .1 Acceptable material:
 - .1 Sopralap Stick by Soprema.
- .6 Adhesives
 - .1 Low rise, two component polyurethane adhesive.
 - .1 Acceptable material:
 - .1 Duotack by Soprema.
 - .2 Low VOC, 100% solid, odourless polyether based cold-applied adhesive for SBS modified polymer membrane.
 - .1 Acceptable material:
 - .1 Colply EF Flashing Cement by Soprema.
- .7 Membrane Primer
 - .1 This is to be the primer recommended by the membrane manufacturer being used (for self adhering stripping)
- .8 Pitch Box Filler
 - .1 Sopramastic Block System by Soprema, or approved equal.
- .9 Plumbing Vent Flashing
 - .1 These shall be Insulated Stack Jack Flashings (with metal cap not neoprene seal) SJ-20 as manufactured by Thaler.
- .10 Metal Flashing
 - .1 Flashing shall be a minimum of 22 gauge in thickness, unless shown otherwise on Drawings. Metal is to be prefinished and is to be chosen from the standard in stock range of Stelco 8,000 series of colors or approved equal. Colour to match exterior wall cladding where visible.
- .11 Fasteners
 - .1 Covering to steel deck: No. 12 flat head, self tapping, Type A or AB, cadmium plated screws. Recommend FM Approved screw and plate assemblies.
 - .2 Insulation to deck: Duotack Adhesive, as recommended by insulation manufacturer.

2.5 Thermal Barrier (Deck covering)

- .1 Fire Rated Gypsum Board: to ASTM C1177 , 5/8" (16mm thick).
 - .1 Acceptable Material: DensDeck by Georgia Pacific.

2.6 Accessories

- .1 Roof hatch:
 - .1 Basis-of-Design Manufacturer:
 - .1 The BILCO Company
P.O. Box 1203, New Haven, CT 06505
1-800-366-6530
Fax: 1-203-535-1582
Web: www.BILCO.com.
 - .2 Basis-of-Design Product: Type E Roof Hatc
 - .3 Furnish and install where indicated on plans metal roof hatch Type E, size width: 36" (914mm) x length: 36" (914mm). Length denotes hinge side. The roof hatch shall be single leaf. The roof hatch shall be pre-assembled from the manufacturer.
 - .4 Performance characteristics:
 - .1 Cover shall be reinforced to support a minimum live load of 40 psf (195kg/m²) with a maximum deflection of 1/150th of the span or 20 psf (97 kg/m²) wind uplift.
 - .2 Operation of the cover shall be smooth and easy with controlled operation throughout the entire arc of opening and closing.
 - .3 Operation of the cover shall not be affected by temperature.
 - .4 Entire hatch shall be weather tight with fully welded corner joints on cover and curb.
 - .5 Cover: Shall be 14 gauge (1.9mm) galvanized steel with a 3" (76mm) beaded flange with formed reinforcing members. Cover shall have a heavy extruded EPDM rubber gasket that is bonded to the cover interior to assure a continuous seal when compressed to the top surface of the curb.
 - .6 Cover insulation: Shall be fiberglass of 1" (25mm) thickness, fully covered and protected by a metal liner : 22 gauge (.8mm) galvanized steel.
 - .7 Curb: Shall be 12" (305mm) in height and of: 14 gauge (1.9mm) galvanized steel. The curb shall be formed with a 3-1/2" (89mm) flange with 7/16" (11.1mm) holes provided for securing to the roof deck. The curb shall be equipped with an integral metal capflashing of the same gauge and material as the curb, fully welded at the corners, that features the Bil-Clip® flashing system, including stamped tabs, 6" (153mm) on center, to be bent inward to hold single ply roofing membrane securely in place.
 - .8 Curb insulation: Shall be rigid, high-density fiberboard of 1" (25mm) thickness on outside of curb.
 - .9 Lifting mechanisms: Manufacturer shall provide compression spring operators enclosed in telescopic tubes to provide, smooth, easy, and controlled cover operation throughout the entire arc of opening and closing. The upper tube shall be the outer tube to prevent accumulation of moisture, grit, and debris inside the

lower tube assembly. The lower tube shall interlock with a flanged support shoe through bolted to the curb assembly.

- .10 Hardware:
 - .1 Heavy pintle hinges shall be provided
 - .2 Cover shall be equipped with a spring latch with interior and exterior turn handles
 - .3 Roof hatch shall be equipped with interior and exterior padlock hasps.
 - .4 The latch strike shall be a stamped component bolted to the curb assembly.
 - .5 Cover shall automatically lock in the open position with a rigid hold open arm equipped with a 1" (25mm) diameter red vinyl grip handle to permit easy release for closing.
 - .6 All hardware shall be zinc plated and chromate sealed.
 - .7 Cover hardware shall be bolted into heavy gauge channel reinforcing welded to the underside of the cover and concealed within the insulation space.
- .11 Finishes: Factory finish shall be alkyd based red oxide primed steel.

Part 3 Execution

3.1 Quality of work

- .1 Do examination, preparation and roofing Work in accordance with CRCA Roofing Specification Manual, particularly for fire safety precautions, and to FM Design No. 428396-403321-0 .
- .2 Do priming in accordance with manufacturers written recommendations.
- .3 The interface of the walls and roof assemblies will be fitted with durable rigid sheet metal / plywood material providing connection point for continuity of air barrier.
- .4 Assembly, component and material connections will be made in consideration of appropriate design loads, with reversible mechanical attachments.

3.2 Examination of roof decks

- .1 Verification of Conditions:
 - .1 Inspect deck conditions including parapets, construction joints, roof drains, plumbing vents and ventilation outlets to determine readiness to proceed.
- .2 Evaluation and Assessment:
 - .1 Before beginning of work ensure:
 - .1 Decks are firm, straight, smooth, dry, free of snow, ice or frost, and swept clean of dust and debris. Do not use calcium or salt for ice or snow removal.
 - .2 Roof curbs, nailers, equipment supports, vents and other roof penetrations are properly secured and prepared to receive new roofing materials.

- .3 Roof drains have been installed at proper elevations relative to finished roof surface.
- .4 Roof drains and scuppers have been installed at proper elevations relative to finished roof surface.
- .5 Plywood and lumber nailer plates have been installed to deck, walls and parapets as indicated.
- .3 Do not install roofing materials during rain or snowfall.
- .4 Confirm and coordinate visual review requirements with the BECxA.

3.3 Protection of in-place conditions

- .1 Cover walls, walks, sloped roofs and adjacent work where materials hoisted or used.
- .2 Use warning signs and barriers. Maintain in good order until completion of Work.
- .3 Clean off drips and smears of bituminous material immediately.
- .4 Dispose of rain water off roof and away from face of building until roof drains or hoppers installed and connected.
- .5 Protect roof from traffic and damage. Comply with precautions deemed necessary by Contract Administrator.
- .6 At end of each day's work or when stoppage occurs due to inclement weather, provide protection for completed Work and materials out of storage.
- .7 Metal connectors and decking will be treated with rust proofing or galvanization.

3.4 Preparation of Steel Deck (Channel Type)

- .1 Install sound absorbing insulation in flutes of acoustical steel roof deck in accordance with deck manufacturer's instructions.
- .2 Steel decking will be treated with rust proofing or galvanization.

3.5 Deck Sheathing

- .1 Mechanically fasten to steel deck Glass Mat Gypsum Board with screws to steel deck's upper rib surfaces, spaced 400 mm on centre each way.
- .2 Place with long axis of each sheet transverse to steel deck ribs, with end joints staggered and fully supported on ribs.

3.6 Priming Deck

- .1 Apply deck primer to roofing substrate at the rate recommended by manufacturer.

3.7 Vapour Retarder

- .1 Adhere vapour retarder using solvent based adhesive as per manufacturer's instructions.

3.8 (Exposed) Conventional Membrane Roofing (CMR) Application

- .1 Insulation: fully adhered, adhesive application:
 - .1 Adhere insulation by using specified adhesive in continuous strips spaced as required by CSA A123.21 testing report.

- .2 Install tapered insulation panels in conformance with manufacturer's instructions and recommendations.
- .3 All boards must be in perfect connection, without any significant variances in level, and must be completely adhered to the surface.
- .4 All vertical joints between flat boards and sloped modules and the rows of insulation boards will be staggered.
- .5 Install only as much insulation as can be covered in the same day.
- .2 Tapered insulation application:
 - .1 Adhere insulation by using specified adhesive in continuous strips spaced as required by CSA A123.21 testing report.
 - .2 Install tapered insulation panels in conformance with manufacturer's instructions and recommendations.
 - .3 All boards must be in perfect connection, without any significant variances in level, and must be completely adhered to the surface.
 - .4 All vertical joints between flat boards and sloped modules and the rows of insulation boards will be staggered.
 - .5 Install only as much insulation as can be covered in the same day.
- .3 Base sheet application:
 - .1 Unroll base sheet onto primed substrate, taking care to align the edge of the first selvedge with drain centre (parallel to roof edge).
 - .2 Remove the silicone release film to adhere the membrane to the substrate. Remove the protective film from the side lap strip.
 - .3 Apply even pressure on the whole membrane surface with a heavy membrane roller to ensure good adherence and waterproofing of overlaps.
 - .4 Each selvedge will overlap the previous one along lines provided for this purpose, and will overlap by 25 mm (1 in) at the ends. Because of the nature of this system, for this type of base sheet, joints can be aligned (no offset) to facilitate the installation of the reinforcing strip.
 - .5 Adhere the first 60 mm (2.5 in) of the self-adhesive side laps using a membrane roller, then weld the last 40 mm (1.5 in) using an electric hot air welder.
 - .6 Seal end laps with a 330-mm (13-in) wide protection strip centered on the joint, pre-primed with an appropriate primer.
 - .7 Avoid the formation of wrinkles, swellings or fishmouths.
- .4 Cap sheet application:
 - .1 Apply self-adhesive membrane primer to the area to be covered.
 - .2 Unroll the cap sheet membrane on the base sheet, taking care to align the edge of the first selvedge with the edge of the roof.
 - .3 Cut off corners at end laps at areas to be covered by the next roll.
 - .4 Each selvedge will overlap the previous one laterally along lines provided for this purpose, and will overlap by 150 mm (6 in) at the ends. Space end laps a minimum of 300 mm (12 in).

- .5 Remove the silicone release film, pressing down the membrane using a membrane roller to ensure good adhesion.
- .6 Adhere the first part of the self-adhesive side laps using a membrane roller, then weld the last part using an electric hot air welder.
- .7 Apply adhesive for the first 100 to 125 mm (4 to 5 in) of the end laps using a 4.8 mm (3/16 in) or a 6.0 mm (1/4 in) notched trowel.
- .8 Complete the application by welding the last 25 to 50 mm (1 to 2 in) of the overlap to the field surface, using an electric hot-air welder and a membrane roller.
- .9 Apply pressure on the whole surface with a membrane roller to ensure complete and uniform adherence.
- .10 Repeat these steps to install the other membranes.
- .11 Avoid the formation of wrinkles, swellings or fishmouths.
- .5 Reinforced gussets:
 - .1 Install reinforcing gussets at all inside and outside corners.
 - .2 Heat-weld the gussets in place after installing base sheet membrane.
- .6 Self-Adhesive Base Sheet on Flashings and Parapets:
 - .1 Before applying membranes, always burn the plastic film from the section to be covered if there is an overlap (inside and outside corners and field surface). For sanded base sheet membranes, apply primer for self-adhesive membrane on the area to be covered at the foot of the parapets.
 - .2 Apply base sheet flashing only after primer coat is dry.
 - .3 Install base sheet by 1m (3.25 ft) wide strips
 - .4 Each selvedge will overlap the previous one along lines provided for this purpose, and by 150 mm (6 in) at the ends. Membranes for flashings must be spaced at least 100 mm (4 in) with respect to the cap sheet membranes on the field surface, to avoid areas of excessive membrane thickness.
 - .5 Cut off corners at end laps of areas to be covered by the next roll.
 - .6 Position the pre-cut membrane. Remove 150 mm (6 in) of the silicone release film to hold the membrane in place at the top of the parapet.
 - .7 Then, gradually peel off the remaining silicone release film, pressing down on the membrane with an aluminum applicator to ensure good adhesion. Use the aluminum applicator to ensure a perfect transition between the flashing and the field surface. Smooth the entire membrane surface with a membrane roller for full adhesion.
 - .8 Install a reinforcing gusset at all inside and outside corners.
 - .9 Always seal overlaps at the end of the workday.
 - .10 Avoid the formation of wrinkles, swellings or fishmouths.
- .7 Self Adhesive Cap Sheet on Flashings and Parapets:
 - .1 This cap sheet must be installed in one-metre-wide strips (3.25 ft).
 - .2 Each selvedge will overlap the previous one laterally along lines provided for this purpose, and will overlap by 150 mm (6 in) the field surface. Cap sheet

membranes for flashings must be spaced at least 100 mm (4 in) with respect to the cap sheet membranes on the field surface, to avoid areas of excessive membrane thickness.

- .3 Cut off corners at end laps of areas to be covered by the next roll.
 - .4 Use a chalk line to draw a straight line on the field surface 150 mm (6 in) from the flashings and parapets.
 - .5 Apply a coat of self-adhesive membrane primer on the field surface and allow to dry.
 - .6 Position the pre-cut membrane. Remove 150 mm (6 in) of the silicone release film to hold the membrane in place at the top of the flashing.
 - .7 Then, gradually peel off the remaining silicone release film, pressing down on the membrane with an aluminum applicator to ensure good adhesion. Use the aluminum applicator to ensure a perfect transition between the flashing and the field surface. Smooth the entire membrane surface with a membrane roller for full adhesion.
 - .8 Adhere the first part of the self-adhesive side laps using a membrane roller, then weld the last part with an electric hot air welder.
 - .9 Apply adhesive for the first 100 to 125 mm (4 to 5 in) of the end lap using a 4.8 mm (3/16 in) or a 6.0 mm (1/4 in) notched trowel.
 - .10 Complete the application by welding the last 25 to 50 mm (1 to 2 in) of the overlap to the field surface, using an electric hot-air welder and a membrane roller.
 - .11 Apply pressure on the whole surface with a membrane roller to ensure complete and uniform adherence
- .8 Roof Penetrations:
- .1 Install roof drain pans, vent stack covers and other roof penetration flashings and seal to membrane in accordance with manufacturer's recommendations and details.

3.9 Walkways

- .1 Install walkway membrane in accordance with manufacturer's instructions as indicated.
 - .1 Apply primer to cap sheet membrane and torch apply, ensuring selvage edge is removed.

3.10 Field quality control

- .1 Inspections:
 - .1 Inspection and testing of roofing application will be carried out by testing laboratory designated by Contract Administrator.
 - .2 Costs of tests will be paid under cash allowance.
- .2 Confirm and Coordinate visual review and testing requirements with the BECxA.

3.11 Cleaning

- .1 Remove bituminous markings from finished surfaces.

- .2 Consult manufacturer of surfaces for cleaning advice and complying with their documented instructions in areas where finished surfaces are soiled caused by work of this section.
- .3 Repair or replace defaced or disfigured finishes caused by work of this section.
- .4 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 19 - Construction Waste Management and Disposal and 01 35 21 - LEED Requirements.
 - .1 Place materials defined as hazardous or toxic in designated containers.
 - .2 Clearly label location of salvaged material's storage areas and provide barriers and security devices.
 - .3 Ensure emptied containers are sealed and stored safely.
 - .4 Do not dispose of unused adhesive, sealant and asphalt materials into sewer system, streams, lakes, onto ground or in other location where it will pose health or environmental hazard.
 - .5 Dispose of unused adhesive material at official hazardous material collections site approved by Contract Administrator.
 - .6 Dispose of unused sealant material at official hazardous material collections site approved by Contract Administrator.
 - .7 Dispose of unused asphalt material at official hazardous material collections site approved by Contract Administrator.
 - .8 Divert unused gypsum materials from landfill to recycling facility as reviewed by Contract Administrator.

3.12 Protection of Finished Work

- .1 Protect building surfaces against damage from roofing work.
- .2 Where traffic must continue over finished roof membrane, protect surfaces.
- .3 During roofing work, exposed surfaces of finished walls shall be protected with tarps in order to prevent damage. Contractor shall assume full responsibility for any damage.

END OF SECTION

Part 1 General

1.1 Related requirements

- .1 Section 05 41 00 – Structural Metal Lightweight Framing
- .2 Section 05 50 00 - Metal Fabrications
- .3 Section 07 21 13 – Board and Semi-Rigid Insulation
- .4 Section 07 62 00 - Sheet Metal Flashing and Trim
- .5 Section 07 92 00 - Joint Sealants
- .6 Section 09 22 16 - Non-Structural Metal Framing

1.2 Scope of Work

- .1 Supply and install standing seam metal roofing and snow guards as specified herein. Support systems for roofing and snow guards to be designed by a registered professional engineer, licensed to practice in Manitoba.
- .2 Supply and install semi-rigid insulation and clip supports to sloped roof and exterior walls. Clip support systems to be designed by a registered professional engineer, licensed to practice in Manitoba.
 - .1 Refer to Section 05 41 00 for requirements of both metal roof panel and exterior wall metal panel support systems to be designed by a registered professional engineer, licensed to practice in Manitoba.
- .3 Supply and install rainware including gutters and downspouts for metal roof. Support systems for gutters and downspouts to be designed by a registered professional engineer, licensed to practice in Manitoba.
- .4 Supply and install corrugated metal panels on vertical walls as indicated on the drawings.
- .5 Fabricate metal closures and membrane waterproofing to all roof mounted mechanical equipment and roof vents to make watertight.
- .6 Refer to Section 07 62 00 for requirements of flashing and trim. Flashing and trim support systems to be designed by a registered professional engineer, licensed to practice in Manitoba.

1.3 Reference standards

- .1 Aluminum Association (AA):
 - .1 DAF-45-R03, Designation System for Aluminum Finishes - 9th Edition
 - .2 ASM-35-October 2000, Specifications for Aluminum Sheet Metal Work in Building Construction, Section 5
- .2 ASTM International (ASTM):
 - .1 ASTM A167-99(2009), Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
 - .2 ASTM A240/A240M-20a, Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications

- .3 ASTM A480/A480M-20a, Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip
- .4 ASTM A653/A653M-20, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
- .5 ASTM A755/A755M-18, Standard Specification for Steel Sheet, Metallic Coated by the Hot-Dip Process and Prepainted by the Coil-Coating Process for Exterior Exposed Building Products
- .6 ASTM A792/A792M-10 (2015), Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot Dip Process
- .7 ASTM B32-20, Standard Specification for Solder Metal
- .8 ASTM B370-12 (2019), Standard Specification for Copper Sheet and Strip for Building Construction
- .9 ASTM C303-21, Standard Test Method for Dimensions and Density of Preformed Block and Board-Type Thermal Insulation
- .10 ASTM D523-14(2018), Standard Test Method for Specular Gloss
- .11 ASTM D822/D822M-13(2018), 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-M89, Cutback Asphalt Plastic Cement
 - .2 CAN/CGSB-37.29-M89, Rubber-Asphalt Sealing Compound
 - .3 CAN/CGSB-51.32-M77, Sheathing, Membrane, Breather Type
 - .4 CAN/CGSB-93.1-M85, Sheet Aluminum Alloy, Prefinished, Residential
- .4 CSA Group (CSA):
 - .1 CSA A123.3-05, Asphalt Saturated Organic Roofing Felt
 - .2 CSA S136-16, North American Specification for the Design of Cold Formed Steel Structural Members
- .5 Department of Justice Canada (Jus):
 - .1 Canadian Environmental Protection Act (CEPA), 1999
- .6 Health Canada/Workplace Hazardous Materials Information System (WHMIS):
 - .1 Safety Data Sheets (SDS)
- .7 National Building Code of Canada 2010 (NBC)
- .8 National Research Council Canada (NRC)/Institute for Research in Construction (IRC) - Canadian Construction Materials Centre (CCMC):
 - .1 CCMC-2002, Registry of Product Evaluations
- .9 Transport Canada (TC):
 - .1 Transportation of Dangerous Goods Act (TDGA), 1992
- .10 ULC Standards (ULC):
 - .1 ULC 102, Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies. (ULC S102)
 - .2 ULC 114, Standard Method of Test for Determination of Non-Combustibility in Building Materials

1.4 Action and informational submittals

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for sheet metal wall panels and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Submit product data sheets for insulation. Include:
 - .1 Product characteristics.
 - .2 Performance criteria.
 - .3 Limitations.
 - .3 Proof of manufacturer's CCMC listing and listing number.
 - .4 Submit one electronic copy of WHMIS SDS in accordance with Section 01 35 29.06 - Health and Safety Requirements.
- .3 Shop Drawings:
 - .1 Submit drawings stamped and signed by professional engineer registered or licensed in the Province of Manitoba, Canada.
 - .2 Indicate arrangements of sheets and joints, types and locations of fasteners and special shapes and relationship of panels to structural frame.
- .4 Samples:
 - .1 Submit duplicate 12" x 12" (300mm x 300mm) samples of each sheet metal material.
- .5 Sustainable Design Submittals:
 - .1 LEED Canada submittals: in accordance with Section 01 35 20 - LEED Requirements.
 - .2 Construction Waste Management: Refer to Section 01 74 19 - Construction/Demolition Waste Management and Disposal.
 - .3 Material product attribute documentation: Refer to Product Check Sheet as listed in 01 35 20 – LEED Sustainable Requirements to determine applicable type of documentation required for each product.
 - .4 Low-Emitting Materials:
 - .1 Submittals are required for any sealants, adhesives, paints, coatings, composite wood, flooring, wall panels, insulation or ceiling components within the inner most weather proofing barrier.
 - .2 Refer to Product Check Sheet as listed in 01 35 20 – LEED Sustainable Requirements to determine applicable type of documentation required for each product.
- .6 Confirm and coordinate submittal requirements with the BECxA.

1.5 Quality assurance

- .1 Installer Qualifications: Engage experienced installer with a minimum of 5 years experience who has completed systems similar in material, design, and extent to that indicated for Project and with record of successful performance.

- .2 Obtain each type of metal wall panel system through one source from a single manufacturer.
- .3 Mock-ups:
 - .1 Submit mock-ups in accordance with Section 01 45 00 - Quality Control.
 - .2 Provide a 1200mm wide, full height section of exterior metal wall panel, including mitre joint at roof eave. Locate at outside corner of building and include all trims, flashings and closures.
 - .3 Mock-up will be used:
 - .1 To judge workmanship, substrate preparation, operation of equipment and material application.
 - .4 Locate where directed by Contract Administrator.
 - .5 Allow 72 hours for inspection of mock-up by Contract Administrator before proceeding with sheet metal flashing work.
 - .6 When accepted, mock-up will demonstrate minimum standard of quality required for this Work.
 - .7 Confirm and coordinate mock-up requirements with the BECxA.
- .4 Confirm and coordinate visual review and pre-installation conference requirements with the BECxA.

1.6 Design Requirements

- .1 Design roof system to resist:
 - .1 Snow loads and snow build-up and rain load, expected in this geographical region NBCC climatic data, 50 year probability.
 - .2 Wind loads, positive and negative, expected in this geographical region NBCC climatic data, 50 year probability.
 - .3 Dead load of roof system.
 - .4 If the roof system is to be designed as a shear diaphragm, then the factored shear design loads "Q" and the flexibility factors "F" must be shown on the structural drawings.
- .2 Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, overstressing of components, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime sky heat loss.

1.7 Delivery, Storage, and Handling

- .1 Deliver, store, and handle materials in accordance with Section 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 off ground indoors and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect sheet metal wall panel from nicks, scratches, and blemishes.

- .3 Replace defective or damaged materials with new.
- .4 Develop Construction Waste Management Plan related to Work of this Section and in accordance with Section 01 35 20 - LEED Sustainable Requirements.
- .5 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding, and packaging materials as specified in Construction Waste Management Plan in accordance with Section Section 01 74 19 - Construction Waste Management and Disposal.

1.8 Warranty

- .1 Manufacturers Warranty for Finishes: Twenty (20) years from date of Substantial Performance.

Part 2 Products

2.1 Prefinished steel sheet

- .1 Prefinished steel with factory applied polyvinylidene fluoride.
 - .1 Use for arena wall panels, and all related flashing, and caps and rainware.
 - .2 Class F1S.
 - .3 Steel conforms to ASTM A653.
 - .4 Section properties are in accordance with CSA-S136-07
 - .5 Colour: selected by Contract Administrator from manufacturer's full range.
 - .6 Specular gloss: 30 units +/-5 to ASTM D523.
 - .7 Coating thickness: 22 micrometres minimum.
 - .8 Resistance to accelerated weathering for chalk rating of 8, colour fade maximum 5 units and erosion rate maximum 20% to ASTM D822 as follows:
 - .1 Outdoor exposure period 2500 hours minimum.
 - .2 Humidity resistance exposure period 5000 hours minimum.
 - .9 Gauge: 22 gauge.
 - .10 Panel width: $\pm 26 \frac{1}{2}$ " (878mm)
 - .11 Panel Height: 8'-0" (2440mm) typical height. Refer to drawings.
 - .12 Fastening: Exposed fastening as per manufacturer's instructions.
 - .13 Corrugation depth: 7/8"
 - .14 Location: Refer to drawings.
 - .15 Acceptable Materials:
 - .1 Agway Metals inc. - 7/8" Corrugated.
 - .2 Viewest Building Products - 7/8" Corrugated.
 - .3 Westman Steel - 7/8" Corrugated.
 - .4 Or approved equal.
- .2 Prefinished galvanized steel sheet with factory applied polyvinylidene fluoride based on Kynar 500® resin, (PVF2), formulated by a Pennwalt licensed manufacturer's approved applicator.

- .1 Steel sheet: to be 22ga. 0.76mm thickness, grade C, G-90, hot dipped galvanized, as per ASTM A446.
- .2 Colour: selected by Contract Administrator from manufacturer's full range.
- .3 Coating: coating system shall provide minimum 1.1 mil dry film thickness, consisting of primer and minimum 0.75 mil dry film colour coat.
- .4 Seaming Style: 180 degree "I" Style.
- .5 Use for arena roof panels, and all related flashing, and caps and rainware.
 - .1 Standard of Acceptance:
 - .1 Standing Seam Roof, Type AR-38 by Agway Metals (or approved equal).

2.2 Insulation

- .1 Insulation: as specified in Section 07 21 13.

2.3 Concealed Clips & Fasteners (standing seam roofing)

- .1 Thermally responsive clips to be fabricated from a minimum of 0.61 mm (0.018") steel, with minimum Z275 galvanized coating designed to accommodate expansion and contraction of the roof sheet. Design of clips to be by Manufacturer.
- .2 Roof Fasteners: As specified by Manufacturer, to resist wind uplift and sliding snow forces.

2.4 Weather Resistant Barrier (standing seam roofing)

- .1 To be applied over tongue and groove exterior plywood and roof z-bars in accordance with manufacturer's recommendations. Refer to Drawings.
 - .1 Standard of Acceptance:
 - .1 Titanium UDL 30 synthetic roofing underlayment

2.5 Snow Guard (standing seam roofing)

- .1 Supply and install purpose made, pre-finished metal snow guard, engineered to support sliding snow loads. Colour of metal to match roof panels.
- .2 Standard of acceptance: Colorgard Metal Roof Snow Retention System by S-5 or approved equal.

2.6 Gutter Guard (standing seam roofing)

- .1 Supply and install purpose-made aluminum gutter guard, size to suit gutters. Colour to match roof panels.
- .2 Standard of acceptance: All-Aluminum Gutter Guard by Gutterglove or approved equal.

2.7 Accessories

- .1 Provide components required for complete metal wall system assembly including trim, copings, corner units, flashings, sealants, gaskets, fillers, closure strips, and similar items; match material and finish of metal wall panel system.
- .2 Isolation coating: alkali resistant bituminous paint.
- .3 Plastic cement: to CAN/CGSB-37.5.

- .4 Sealant: Asbestos free sealant, compatible with systems materials, recommended by system manufacturer. Refer to Section 07 92 00 - Joint Sealants.
- .5 Rubber-asphalt sealing compound: to CAN/CGSB-37.29.
- .6 Cleats: of same material, and temper as sheet metal: 2" (50mm) minimum wide.
 - .1 Thickness same as sheet metal being secured.
- .7 Fasteners: as recommended by manufacturer.
 - .1 Exposed fasteners acceptable at corrugated metal siding.
 - .2 Concealed fasteners at standing seam roofing.
- .8 Washers: of same material as sheet metal, 1 mm thick with rubber packings.
- .9 Solder: to ASTM B32.
- .10 Flux: rosin, cut muriatic acid, or commercial preparation suitable for materials to be soldered.
- .11 Touch-up paint: as recommended by sheet metal roofing manufacturer.
- .12 Flashing, Roof Curbs, Gutters and Downspouts, and Trim: Prefinished flashing materials to match roofing materials in accordance with Section 07 62 00 - Sheet Metal Flashing and Trim.

2.8 Fabrication

- .1 Fabricate aluminum sheet metal in accordance with AA ASM-35.
- .2 Form individual pieces in maximum lengths possible. 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.

Part 3 Execution

3.1 Examination

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for sheet metal installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate.
 - .2 Inform Contract Administrator of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Contract Administrator.
 - .4 Confirm and coordinate visual review requirements with the BECxA.

3.2 Installation

- .1 Architectural Sheet Metal Manual specification shall govern for material and workmanship not otherwise specified herein. The work shall be done by qualified journeymen having a record of experience with similar applications. The quality of the work shall meet or exceed the industry standards for this type of construction. Manufacturer shall provide trained metal craftsmen to supervise performance of installation activities.
- .2 Roof panels: Install exterior prefinished roof panels on panel support clips, using manufacturer's proper construction procedure. Ensure metal roofing sheet side-lap is positively retained by clips, and proper sheet coverage is maintained.
 - .1 Install the seam-cap at all side laps as shown on the approved shop drawings. Add sealant as required.
 - .2 Where indicated on approved shop drawings, secure the end-lap of metal roofing sheets in accordance with the manufacturers specifications and details to provide a weather-tight seal. Exposed fasteners to match colour of the roof sheet.
 - .3 Provide notched and formed closures, sealed against weather penetration, at changes in pitch, and at ridges and eaves, where required.
 - .4 Install all companion flashing and gutters as shown on the shop drawings. Use concealed fasteners when possible. Exposed fasteners to match colour of roof sheet.
 - .5 Flash roof penetrations with material matching roof panels and make watertight.
 - .6 Install rigid insulation in two (2) layers as indicated on Drawings. Tightly butt against support z-bars and ensure no gaps between successive boards. Stagger joints between layers.
- .3 Wall panels: Install metal wall panel system in accordance with manufacturer's written instruction and drawings.
 - .1 Provide hat channels and blocking as required.
 - .2 Provide flashings as required, formed from same materials as the wall panel sheet. Custom fabricated to suit architectural details as required.
 - .3 Install drip flashings and closures laminated such that all exposed faces are prefinished in colour to match wall panels.

3.3 Cleaning

- .1 Remove temporary protective coverings and strippable films, if any, as metal roofing system are installed, unless otherwise indicated in manufacturer's written installation instructions.
- .2 Clean finished surfaces as recommended by metal roofing system manufacturer upon completion of metal roofing system installation; maintain in a clean condition during remainder of construction.
- .3 Repair and touch up with colour matching high grade enamel minor surface damage, only where permitted by the Contract Administrator and only where appearance after touch-up is acceptable to Contract Administrator.
- .4 Replace damaged panels and components that, in opinion of the Contract Administrator, cannot be satisfactorily repaired.

- .5 Progress Cleaning: clean in accordance with Section 01 74 00 - Cleaning.
- .6 Final Cleaning: remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 - Cleaning upon completion.
- .7 Waste Management: perform in accordance with Section 01 74 19 - Construction Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.4 Protection

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

END OF SECTION

Part 1 General

1.1 Related requirements

- .1 Section 04 21 00 - Clay Unit Masonry
- .2 Section 07 11 13 - Bituminous Dampproofing.
- .3 Section 07 42 43 – High Pressure Laminate Phenolic Wall System
- .4 Section 07 42 46 –Fibre Reinforced Cementitious Panels
- .5 Section 07 52 00 - Modified Bituminous Membrane Roofing
- .6 Section 07 92 00 - Joint Sealants
- .7 Mechanical Specifications – Heating, Ventilating, and Air-Conditioning (HVAC).
- .8 Electrical Specifications: Flashing sleeves and collars for electrical items protruding through roof/exterior wall assemblies.

1.2 Reference standards

- .1 American Society for Testing and Materials International (ASTM):
 - .1 ASTM A167- 99(2009), Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip (Withdrawn 2014)
 - .2 ASTM A653/A653M- 20, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - .3 ASTM A 792/A 792M- 10(2015), Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.
 - .4 ASTM B32- 20, Standard Specification for Solder Metal
 - .5 ASTM B209- 14Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
 - .6 ASTM D2178-04 - Asphalt Glass Felt Used in Roofing and Waterproofing.
 - .7 ASTM D226-06 - Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing.
 - .8 ASTM D4586/D4586M- 07(2018), Standard Specification for Asphalt Roof Cement, Asbestos-Free
- .2 Canadian General Standards Board (CGSB):
 - .1 CAN/CGSB-37.29- M89, Rubber-Asphalt Sealing Compound
 - .2 CAN/CGSB-51.32- M77, Sheathing, Membrane, Breather Type
- .3 Canadian Roofing Contractors Association (CRCA):
 - .1 Roofing Specifications Manual Current Edition
- .4 Canadian Sheet Steel Building Institute (CSSBI):
 - .1 CSSBI S8- 2018Quality and Performance Specification for Prefinished Sheet Steel Used for Building Products.
 - .2 CSSBI B17- 2002Barrier Series Prefinished Steel Sheet: Product Performance & Applications.

- .3 CSSBI Sheet Steel Facts #12 2003 Fastener Guide for Sheet Steel Building Products.
- .4 CSSBI Sheet Steel Facts No. 10, Table 1 - MSG Sheet Steel Gauge Numbers and Thicknesses.
- .5 CSA Group (CSA):
 - .1 CSA A123.3- 05(2015), Asphalt Saturated Organic Roofing Felt
 - .2 CSA B111-1974(R2003), Wire Nails, Spikes and Staples
- .6 Green Seal Environmental Standards:
 - .1 Standard GS-03-97, Anti-Corrosive Paints
 - .2 Standard GS-11-15 Paints, Coatings, Stains, and Sealers
 - .3 Standard GS-36-15, Adhesives for Commercial Use
- .7 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Safety Data Sheets (SDS)
- .8 Canadian Roofing Contractor's Association – Roofing Specifications Manual.
- .9 Sheet Metal and Air Conditioning Contractors Association of North America (SMACNA):
 - .1 Architectural Sheet Metal Manual (2012)
 - .2 Residential Sheet Metal Guidelines (2001)
- .10 South Coast Air Quality Management District (SCAQMD), California State
 - .1 SCAQMD Rule #1113- 16, Architectural Coatings
 - .2 SCAQMD Rule #1168- 17, Adhesives and Sealants

1.3 Administrative requirements

- .1 Coordination:
 - .1 Coordinate with other work having a direct bearing on work of this section.

1.4 Action and informational submittals

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's printed product literature including product specifications and technical data sheets for sheet metal flashing fasteners and accessory materials. Include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Submit one electronic copy WHMIS SDS - Safety Data Sheets in accordance with Section 01 35 29.06 - Health and Safety Requirements and 01 35 43 - Environmental Procedures.
- .3 Shop Drawings:
 - .1 Submit drawings stamped and signed by professional engineer registered or licensed in the Province of Manitoba, Canada for all sheet metal fabrications including anchoring and support systems.

- .2 Indicate sheet thickness, flashing dimensions and fastenings. Include anchorage, expansion joints and other provisions for thermal movement.
- .3 Indicate material profile, jointing pattern, jointing details, flashings, terminations, and installation details.
- .4 Submit manufacturer's catalogue cut sheets for manufactured items.
- .4 Samples:
 - .1 Submit duplicate 50 x 50 mm samples of each type of sheet metal material, finishes and colour.
- .5 Closeout submittals:
 - .1 Section 01 78 00: Closeout Submittals.
- .6 Sustainable Design Submittals:
 - .1 LEED Canada submittals: in accordance with Section 01 35 20 - LEED Sustainable Requirements.
 - .2 Construction Waste Management: Refer to Section 01 74 19 - Construction Waste Management and Disposal.
 - .3 Material product attribute documentation: Refer to Product Check Sheet as listed in 01 35 20 – LEED Sustainable Requirements to determine applicable type of documentation required for each product.
 - .4 Low-Emitting Materials:
 - .1 Submittals are required for any sealants, adhesives, paints, coatings, composite wood, flooring, wall panels, insulation or ceiling components within the inner most weather proofing barrier.
 - .2 Refer to Product Check Sheet as listed in 01 35 20 – LEED Sustainable Requirements to determine applicable type of documentation required for each product.
- .7 Confirm and coordinate submittal requirements with the BECxA.

1.5 Quality assurance

- .1 Fabricator Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three (3) years documented experience.
- .2 Installer: Engage an experienced installer having a minimum of three years experience who has completed projects similar in material, design, and extent to that indicated for this Project and with a record of successful in service performance.
- .3 Construct and install roof metal flashings in accordance with CRCA Manual details and in accordance with the CRCA Manual. If requirements conflict, this specification takes precedence over the manual.
- .4 Mock-ups
 - .1 Confirm and coordinate mock-up requirements with the BECxA.
- .5 Confirm and coordinate visual review and pre-installation conference requirements with the BECxA.

1.6 Delivery, storage and handling

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Handle and store flashing materials to prevent creasing, buckling, scratching, or other damage.
- .3 Prevent contact with materials which may cause discolouration or staining.
- .4 Waste Management and Disposal:
 - .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 19 - Construction Waste Management and Disposal.

1.7 Warranty

- .1 The same warranty provisions apply to flashings associated with roofing as to the roofing.
- .2 Provide Warranty for sheet metal flashing and trim to include in maintenance manuals as specified in Section 01 78 00 - Closeout Submittals.

Part 2 Products

2.1 Design Criteria

- .1 Base steel thicknesses of sheet steel:
 - .1 Base metal thicknesses of sheet steel specified herein are based on the Manufacturers Standard Gauge (MSG) system. The minimum thickness shall be the design thickness (nominal base steel thickness) minus the maximum allowable under-tolerance as specified by CSA-S136. Thicknesses (gauge) specified are for uncoated steel.
 - .2 Design thicknesses are in accordance with CSSBI Sheet Steel Facts No. 10, Table 1 - MSG Sheet Steel Gauge Numbers and Thicknesses, summarized as follows:

	Sheet Steel	
Gauge No. (MSG)	SI Metric (mm)	Imperial (inches)
10	3.416	0.1345
12	2.657	0.1046
14	1.897	0.0747
16	1.519	0.0598
18	1.214	0.0478
20	0.912	0.0359
22	0.759	0.0299
24	0.607	0.0239
26	0.455	0.0179
28	0.378	0.0149

2.2 Base sheet metal materials

- .1 Provide sheet metal in base metal thickness specified. Where no thickness specified, provide base sheet metal in thickness recommended in SMACNA Architectural Sheet Metal Manual for type of item being fabricated, but not less than the thickness required by the authority having jurisdiction.
- .2 Pre-Coated Galvanized Steel: ASTM A653/A653M, Z275 (275 g/m²), (G90 (0.90 oz/ft²) zinc coating designation; 22 gauge unless indicated otherwise on Drawings.
- .3 Galvanized Steel: ASTM A653/A653M, Z275 (G90) zinc coating designation; 0.6 mm (24 gauge) unless otherwise indicated on Drawings.

2.3 Accessories

- .1 Fasteners: Same material and finish as flashing metal.
- .2 Primer: Zinc chromate type.
- .3 Protective Backing Paint: Bituminous.
- .4 Sealant: Type specified in Section 07 92 00.
- .5 Bedding Compound: Rubber-asphalt type.

2.4 Fabrication

- .1 Form sections true to shape, accurate in size, square, and free from distortion or defects.

- .2 Fabricate cleats of same material as sheet, minimum 100 mm (4 inches) wide, interlockable with sheet.
- .3 Shop fabricate metal flashing and trim components to the maximum length possible, forming metal work with clear, sharp, straight and uniform bends and rises. Hem exposed edges of flashings 12mm (1/2") to the underside.
- .4 Form flashing components from single full width sheet. Provide shop fabricated mitred corners, joined using closed end pop rivets and joint sealant.
- .5 Fabricate related sheet metal work in accordance with approved shop drawings and applicable standards.
- .6 Provide linear sheet metal items in minimum 3000mm (10') sections except as otherwise noted on Drawings. Form flashing using single pieces for the full width. Provide shop fabricated, mitred and joined corners.

2.5 Rainware

- .1 Downspout: Refer to drawings and Section 05 50 00 - Metal Fabrications.
- .2 Eaves Troughs: Custom fabricated 22 gauge, 6" x 6" (152 x 152 mm) prefinished metal. Provide drop outlets, connectors hangers and brackets as required to suit installation

2.6 Soffit Vents

- .1 Provide soffit vent strips prefinished, aluminum c/w bent louvre venting pattern.
- .2 Standard of Acceptance:
 - .1 Arena Soffit Vents: Air Vent Inc. SV 202 MF, custom painted black (or approved equal).
 - .2 Addition Soffit Vents: Custom profile to integrate into HPL siding.
- .3 Coordinate with work of other sections.
- .4 Fasteners: Secure to solid soffit framing with self-tapping screws, size to suit.
- .5 Refer to drawings for details and locations.

Part 3 Execution

3.1 Manufacturer's instructions

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

3.2 Examination

- .1 Verify roof openings, curbs, pipes, sleeves, ducts, or vents through roof are solidly set, reglets in place, and nailing strips located.
- .2 Verify roofing termination and base flashings are in place, sealed, and secure.

3.3 Preparation

- .1 Confirm and coordinate visual review requirements with the BECx A.
- .2 Install starter and edge strips, and cleats before starting installation.
- .3 Install surface mounted reglets true to lines and levels. Seal top of reglets with sealant.

3.4 Installation

- .1 Install all prefinished metal flashing and trim such that liner face is not exposed to view. Where liner face is exposed, prepaint to match prefinished exposed face, or fabricate 2-ply installation.
- .2 Oil-canning or crimping at fasteners securing metal flashing or trim, will not be acceptable. Contract Administrator to review upon completion.
- .3 Install butt joints and lapped joints at locations acceptable to the Contract Administrator.
- .4 Separate dissimilar metals by painting each metal surface in area of contact with a bituminous coating, by applying rubberized asphalt underlayment to each metal surface, or by other permanent separation as recommended by manufacturers of dissimilar metals.
- .5 Install plumb, straight, and true to adjacent work in continuous lengths without flashings, closures or horizontal laps.
- .6 Install parapet flashing, miscellaneous flashing, and closure caps as per drawings to provide a watertight roof system.
- .7 Seal all metal joints weathertight.

3.5 Site Quality Control

- .1 Section 01 45 00 - Quality Control.

3.6 Scuppers

- .1 Install scuppers as indicated.

3.7 Cleaning

- .1 Proceed in accordance with Section 01 74 00 - Cleaning.
- .2 Remove surplus materials, excess materials, rubbish, tools and equipment on completion and verification of performance of installation.
- .3 Clean exposed metal surfaces, removing substances that might cause corrosion of metal or deterioration of finishes.
- .4 Provide final protection and maintain conditions that ensure sheet metal flashing and trim Work during construction is without damage or deterioration other than natural weathering at the time of Substantial Performance.
- .5 Leave work areas clean, free from grease, finger marks and stains.

3.8 Schedule

- .1 Refer to drawings.
- .2 Colour of all pre-finished metal (interior and exterior) to be selected by Contract Administrator from Standard Architectural Stock Colours.

END OF SECTION

Part 1 General

1.1 Summary

- .1 This Section specifies fire stop and smoke seal systems and materials intended to fill gaps between fire separations, between fire separations and other construction assemblies, or used in or around items which fully or partially penetrate a fire separation, to restrict the spread of fire and smoke thus maintaining the integrity of a fire separation.
- .2 This Section includes fire stopping and smoke seal work for the entire Project including selection, installation and inspection of all required fire stops.

1.2 Related requirements

- .1 Section 07 92 00 Joint Sealants.
- .2 Section 02 81 00 - Hazardous Materials

1.3 Reference standards

- .1 ASTM International (ASTM):
 - .1 ASTM A1008/A1008M- 13 Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable
 - .2 ASTM C719- 14, Standard Test Method for Adhesion and Cohesion of Elastomeric Joint Sealants Under Cyclic Movement (Hockman Cycle)
 - .3 ASTM C920- 14, Standard Specification for Elastomeric Joint Sealants
 - .4 ASTM E84- 21, Standard Test Method for Surface Burning Characteristics of Building Materials
 - .5 ASTM E119- 20, Standard Test Methods for Fire Tests of Building Construction and Materials
 - .6 ASTM E136- 19A, Standard Test Method for Assessing Combustibility of Materials Using a Vertical Tube Furnace at 750 degrees
 - .7 ASTM E595- 15, Standard Test Method for Total Mass Loss and Collected Volatile Condensable Materials from Outgassing in a Vacuum Environment
 - .8 ASTM E814- 13a, Standard Test Method for Fire Tests of Penetration Firestop Systems
 - .9 ASTM E1966 15, Standard Test Method for Fire Resistive Joint Systems
 - .10 ASTM E2032- 09, Standard Guide for Extension of Data From Fire Resistance Tests Conducted in Accordance with ASTM E 119.
 - .11 ASTM E2174- 20A, Standard Practice for On-Site Inspection of Installed Firestops.
 - .12 ASTM E2393- 20A, Standard Practice for On-Site Inspection of Installed Fire Resistive Joint Systems and Perimeter Fire Barriers
- .2 Firestop Contractors International Association (FCIA):

- .1 FCIA Firestop Manual of Practice, 6th Edition 2015
- .3 Factory Mutual Approvals (FM):
 - .1 FM 4990- 2009, Approval Standard for Fire stopping
 - .2 FM 4991- 2013, Approval Standard for Firestop Contractors
- .4 International Accreditation Service (IAS):
 - .1 IAS AC291- 19, Accreditation Criteria for Special Inspection Agencies
- .5 International Firestop Council (IFC)
 - .1 IFC Guidelines for Evaluating Engineering Judgments
 - .2 IFC Guidelines for Evaluating Engineering Judgments - Perimeter Fire Barrier Systems
 - .3 IFC Inspection Guidelines for Penetration Firestop Systems and Fire Resistive Joint Systems in Fire Resistance Rated Construction, 5th Edition
- .6 National Fire Protection Agency (NFPA):
 - .1 NFPA 251- 2006, Standard Methods of Tests of Fire Endurance of Building Construction and Materials
- .7 National Research Council Canada (NRC):
 - .1 National Building Code of Canada (NBC) 2015
 - .2 Best Practice Guide on Fire Stops and Fire Blocks and Their Impact on Sound Transmission 2007
- .8 ULC Standards (ULC):
 - .1 CAN/ULC-S101- 14, Standard Method of Fire Endurance Tests of Building Construction and Materials
 - .2 CAN/ULC-S102- 10, Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies
 - .3 CAN/ULC-S114- 05, Standard Method of Test for Determination of Non-Combustibility in Building Materials
 - .4 CAN/ULC-S115- 11, Standard Method of Fire Tests of Firestop Systems
- .9 Underwriters Laboratories Inc. (UL):
 - .1 UL 1479- 2015, Fire Tests of Penetration Firestops
 - .2 UL Qualified Firestop Contractor Program

1.4 Definitions

- .1 Fire Blocking: materials, components or system installed in a concealed space in the building to restrict the spread of fire and smoke in that concealed space or from that concealed space to an adjacent space.
- .2 Fire Compartment: spaces within a building that are enclosed by exterior walls or separated from other parts of the building by enclosing Fire Separations having a Fire-Resistance Rating.
- .3 Fire-Resistance Rating: time in minutes or hours that a material or assembly of materials will withstand the passage of flame and transmission of heat when exposed to fire, meeting the requirements of CAN/ULC-S101 or as determined by formal testing of material or assembly of materials, meeting requirements of CAN/ULC-S115, or an

interpretation of information derived from formal testing in accordance with requirements of the Building Code and acceptable to the Authority Having Jurisdiction (AHJ).

- .4 Fire Separation: assembly that acts as a barrier against the spread of fire, smoke and noxious gases resulting from combustion as defined by the Building Code and includes the following assemblies having a Fire-Resistance Rating requiring Fire Stopping as follows:
 - .1 Penetration-Type Fire Stop systems located within loadbearing walls and partitions.
 - .2 Penetration-Type Fire Stop systems located within non-loadbearing walls and partitions.
 - .3 Penetration-Type located within floor assemblies.
 - .4 Building Perimeter-Type located between floor assemblies and exterior wall and roof construction.
 - .5 Construction Joint-Type and other assemblies having a Fire-Resistance Rating indicated on Drawings or Schedules.
- .5 Fire Stop: material, component or system, and its means of support, used to protect gaps between fire separations, between fire separations and other construction assemblies, or used in openings where penetrating items wholly or partially penetrate fire separations, to restrict the spread of fire and smoke thus maintaining the fire-resistance continuity of a fire separation.
- .6 Fire Stop System: a specific site erected construction consisting of the assembly, fire stop materials, any penetrating items and their means of support which have met the requirements for an F, FT, FH, FTH and/or L rating when tested in a fire-resistance rated assembly in accordance with CAN/ULC-S115.
 - .1 F-Rating: the amount of time a fire stop system can remain in place without the passage of flame through the opening or the occurrence of flaming on the unexposed face of the fire stop.
 - .2 FT-Rating: a fire stop system with an F-Rating for the required time period which can also resist the transmission of heat through the fire stop during the same period and limit the rise in temperature on the unexposed face and/or penetrating item of the fire stop.
 - .3 FH-Rating: a fire stop system with an F-Rating for the required time period which can also resist the force of a hose stream without developing openings for a prescribed period.
 - .4 FTH-Rating: a fire stop system with an FT-Rating for the required time period which also passes the hose stream test for a prescribed period.
 - .5 L-Rating: largest test sample leakage rate, determined in accordance with the optional air leakage test in CAN/ULC-S115.
- .7 Multi-penetration: two or more service penetrations through an opening in the fire separation.
- .8 Non-rated Fire Separation: fire separation acting as a barrier to the spread of smoke until a response is initiated such as the activation of a fire suppression system.
- .9 Single-penetration: single service penetration through an opening in the fire separation.

- .10 System Design Listing: document providing proof of testing with technical details, specifications and requirements that leads to the application of a specific listed fire stop system.
- .11 Single Component Fire Stop System: fire stop material that has Listed Systems Design and is used individually without use of high temperature insulation or other materials to create fire stop system.
- .12 Multiple Component Fire Stop System: exact group of fire stop materials that are identified within Listed Systems Design to create on site fire stop system.
- .13 Tightly Fitted; (ref: NBC Part 3.1.9.1.1 and 9.10.9.6.1): penetrating items that are cast in place in buildings of noncombustible 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.

1.5 Administrative requirements

- .1 Pre-Installation Meetings:
 - .1 Hold pre-installation meeting one week before beginning Work of this Section, with Contractor, Subcontractor and Contract Administrator in accordance with Section 01 31 19 - Project Meetings to:
 - .1 Verify Project requirements.
 - .2 Review sustainable requirements.
 - .3 Review installation and substrate conditions.
 - .4 Discuss coordination with other Subcontractors.
 - .5 Review system design listings, manufacturer's installation instructions and warranty requirements.
 - .6 Review quantity and location of mock-ups.
 - .2 Hold pre-installation meetings with other trades to review:
 - .1 Installation procedures and precautions.
 - .2 Location, scheduling and sequencing of other work around fire stops that can affect the outcome of the installation.
 - .3 Requirements for annular opening sizes.
 - .4 Requirements and preparations for wall/floor single and multi-penetrations.
 - .5 Requirements for construction and perimeter joints.
 - .6 Mock-up requirements.
 - .3 Submit copies of applicable listed fire stop system details to each trade for opening preparation. Include installation details required for the listed system.
 - .4 Meeting minutes: Contractor to take minutes of pre-installation meetings and distribute to Contract Administrator and each affected trade.
- .2 Sequencing:
 - .1 Proceed with installation only when submittals have been reviewed by Contract Administrator.

- .2 Install fire stops located in floor assemblies before interior partition erections.
- .3 Pipe and duct insulation: Certified fire stop system component.
 - .1 Ensure pipe and duct insulation installation precedes fire stopping.

1.6 Action and informational submittals

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Qualification Statement:
 - .1 Submit Subcontractor qualification statements and certificates demonstrating compliance with the qualification requirements of this Section, as described in PART 1 - QUALITY ASSURANCE, within Ten working days after award of contract and before starting Work.
- .3 Product Data:
 - .1 Submit manufacturer's product data for each type of fire stopping and smoke seal. Submit complete product data for each individual component and include:
 - .1 Product name and product number
 - .2 Product characteristics and performance criteria
 - .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
 - .8 Life expectancy
 - .9 Temperature range for installation
 - .10 Humidity range for installation
 - .11 Sound attenuation STC-Rating
 - .2 Manufacture Product Certification:
 - .1 Submit manufacturer certification certifying products supplied comply with local regulations controlling use of Volatile Organic Compounds (VOC's) and are non-toxic to building occupants.
 - .2 Submit test reports showing compliance to ASTM E595.
 - .3 Submit one copy of WHMIS Safety Data Sheets (SDS) for each individual component in accordance with Section 02 81 00 - Hazardous Materials
 - .4 Submit a comprehensive list of all products and components included in submittal.
- .4 Shop Drawings:
 - .1 Submit shop drawings showing system design listings for Project including proposed materials, reinforcement, anchorage, fastenings and method of installation.
 - .2 Construction details to accurately reflect actual job conditions for each product and assembly.
 - .3 Submit details for materials and prefabricated devices.

- .4 Submit electronic copy of shop drawings and include:
 - .1 Title page, labelled "Fire and Smoke Stop System Listings". Include project name, date and the names of the installation company and the manufacturer of proposed products.
 - .2 List of each proposed listed fire stop system and corresponding service penetration type or joint type in a matrix spreadsheet schedule, indicating floor and wall system, including rating for each.
 - .3 Location of penetrations:
 - .1 Drawings showing the location of each penetration with a unique penetration identification number and associated listing number
 - .2 Schedules listing each penetration with a unique identification number, their associated listing number, organized by floor, wall and ceiling area and indicating each room number.
 - .4 System Design Listings:
 - .1 Submit design listings for each listed fire stop system and each application identified in accordance with CAN/ULC-S115
 - .2 When more than one product is specified for the listed fire stop system or more than one packing/damming material is indicated, identify the item that will be used on this Project.
 - .5 Certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .5 Manufacturer's Instructions: Submit manufacturer's installation instructions and special handling criteria, installation sequence, cleaning procedures.
- .6 Quality Assurance Submittals: Submit the following in accordance with Section 01 45 00 - Quality Control:
 - .1 Test reports in accordance with CAN/ULC-S101, CAN/ULC-S102, and CAN/ULC-S115.
 - .1 Submit certified test reports from approved independent testing laboratories, indicating compliance of applied fire stopping with specifications for specified performance characteristics and physical properties.
 - .2 Document from Engineer of Record showing compliance of alternative fire stopping solution with CAN/ULC-S115 and the EJ guidelines provided by the National Research Council, Best Practice Guide on Fire Stops and Fire Blocks and Their Impact on Sound Transmission.
 - .3 Certificates: Submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
 - .4 Manufacturer's Instructions: Submit manufacturer's installation instructions and special handling criteria, installation sequence, and cleaning procedures.
 - .5 Manufacturer's Site Reports: Submit manufacturer's reports within three days of review, verifying compliance of Work, as described in SITE QUALITY CONTROL in Part 3 of this Section.
- .7 Engineering Judgments(EJ):

- .1 Where there is no specific tested listed fire stop system available from the manufacturer for a particular fire stop configuration, review systems from other manufacturers to obtain a listed fire stop system.
 - .2 Submit an EJ from the system manufacturer if there are no listed systems available from other manufacturers.
 - .3 Prepare and submit an EJ in accordance with best practices established in the following documents:
 - .1 IFC Guidelines for Evaluating Engineering Judgments.
 - .2 IFC Guidelines for Evaluating Engineering Judgments - Perimeter Fire Barrier Systems.
 - .4 For each EJ submitted, include:
 - .1 Project name, number and location.
 - .2 A description of the proposed system with detailed drawing.
 - .3 Installation instructions.
 - .4 Complete descriptions of critical elements for the fire stop configuration.
 - .5 Copies of all referenced system design listings which EJ is based on.
 - .6 EJ issuer name and contact information.
 - .7 Date of issue of EJ with authorization signature of issuer.
 - .5 EJ shall only be issued by fire stop manufacturer's qualified technical personnel or in collaboration with the manufacturer by a knowledgeable registered Professional Engineer, a Fire Protection Engineer or an independent testing agency that provides testing and listing services for fire stop systems similar to the EJ being contemplated.
 - .6 EJ shall be based upon interpolations of previously tested fire stop systems that are either sufficiently similar in nature or clearly bracket the conditions upon which the EJ 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.
 - .7 EJ shall be based upon knowledge of the elements of the construction to be protected and understanding of the probable behaviour of that construction and the recommended fire stop system protecting it were they to be subjected to the adequate standard fire test method for the required fire rating duration.
 - .8 EJ shall be limited to the specific conditions and configurations for which it was created and should be based upon reasonable performance expectations for the recommended fire stop system under those conditions.
 - .9 EJ shall 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 Manufacturer letter stating their opinion, with supporting justification, that the EJ will perform as a fire stop system when subjected to the appropriate standard fire test method for the required fire rating duration.
 - .10 Once the EJ has been reviewed, submit to the AHJ for final approval.
- .8 Sustainable Design Submittals:

- .1 LEED Canada submittals: in accordance with Section 01 35 20 - LEED Sustainable Requirements.
- .2 Construction Waste Management: Refer to Section 01 74 19 - Construction Waste Management and Disposal.
- .3 Material product attribute documentation: Refer to Product Check Sheet as listed in 01 35 20 – LEED Sustainable Requirements to determine applicable type of documentation required for each product.
- .4 Low-Emitting Materials:
 - .1 Submittals are required for any sealants, adhesives, paints, coatings, composite wood, flooring, wall panels, insulation or ceiling components within the inner most weather proofing barrier.
 - .2 Refer to Product Check Sheet as listed in 01 35 20 – LEED Sustainable Requirements to determine applicable type of documentation required for each product.
- .9 Closeout Submittals:
 - .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .10 Operation and Maintenance Data: Submit maintenance data for incorporation into manual, including:
 - .1 WHMIS Safety Data Sheets (SDS),
 - .2 product data and manufacturer's installation and maintenance instructions for each product/system used on this project,
 - .3 approved system design listings and EJs, and
 - .4 matrix schedule listing all system design listings and EJs with a description of their penetration or joint type.
 - .5 Certifications:
 - .1 Provide proof of training for each worker that performed installation on the Project.
 - .2 Provide proof of company installing fire stopping and smoke seals is a Member in Good Standing with FCIA.
 - .3 Certification of company as a ULC Qualified or FM 4991 approved Firestop Contractor, including the Designated Responsible Individual (DRI) certificate.
 - .4 Accreditation of third-party inspection firm.
 - .6 Manufacturer's field reports.
 - .7 Warranty information on fire stop installations.
 - .8 Life expectancy of each product installed as part of Project. For each system, list the installation date of products and the expected expiration date (month/year).
- .11 Record Documentation:
 - .1 As-built Drawings:
 - .1 Submit a marked-up set of Drawings to provide referencing system identifying the location of each fire stop.

- .2 Identify each penetration type fire stop with their penetration identification number.
- .2 Fire Stop Schedules:
 - .1 Submit complete fire stop schedules for floors, walls and ceilings.
 - .2 Indicate all penetration fire stops and joint fire stops through each reference wall, floor and ceiling in the schedules.
 - .3 Cross-reference firestop schedules with as-built drawings and indicate design listing numbers associated to each penetration fire stop and joint fire stop.

1.7 Quality assurance

- .1 Regulatory Requirements: Use materials and methods of determining required thickness of application that have the full acceptance of AHJ and that are tested in accordance with CAN/ULC-S115, and form a part of a ULC or cUL listed system, Engineered Judgement or Equivalent Fire Resistance Rated Assembly.
- .2 Provide systems selection and analysis, installation and inspection of fire stop systems in accordance with the recommended practices detailed in the following guides:
 - .1 FCIA Firestop Manual of Practice (MOP).
- .3 Qualifications:
 - .1 Contractor specializing in selection and installation of fire stops with five years documented experience. Submit a list of five successfully completed projects of similar scale and type.
 - .2 The installers are recognized as a Member in Good Standing with the Firestop Contractors International Association (FCIA). Submit proof of current membership.
 - .3 Training: Workers, including site supervisor, to complete:
 - .1 Manufacturer training on the products/systems installed as part of this Section.
 - .2 Training under the FCIA Firestop Containment Worker Education Program.
 - .4 Certified Firestop Contractor: company certified with one of the following programs:
 - .1 ULC Qualified Firestop Contractor Program. Submit signed copy of certificate.
 - .2 FM 4991 Approved Firestop Contractor. Submit signed copy of FM Approval certificate.
 - .5 Third-Party Inspection Firm: IAS AC291 Accredited inspection agency with inspectors who have passed the ULC Firestop Exam or FM Firestop Exam.
- .4 Mock-ups:
 - .1 Construct mock-up of fire stop systems in accordance with Section 01 45 00 - Quality Control
 - .2 Before beginning construction, provide mock-up of each proposed listed fire stop system for review by Contract Administrator. Mock-up shall include work by

other trades to demonstrate the required finish work, such as steel stud/gypsum board trade framing out multi-penetration openings.

- .3 Install proposed identification labels for each penetration.
- .4 Locations for mock-ups as directed by the Contract Administrator.
- .5 After mock-up completion and adequate curing time for materials, provide a minimum of 48 hours notification to Contract Administrator to conduct review.
- .6 Correct mock-up deficiencies as directed by Contract Administrator. Mock-up may remain as part of finished work.
- .7 Contract Administrator may perform destructive tests to each mock-up to ensure the system meets or exceeds the approved system design listing.

1.8 Delivery, storage and handling

- .1 Packing, shipping, handling and unloading:
 - .1 Perform in accordance with Section 01 61 00 - Common Product Requirements.
 - .2 Deliver materials to the site in undamaged condition and in original unopened containers, marked to indicate brand name, manufacturer, ULC markings, manufacturing date, shelf life expiry date.
- .2 Storage and Protection:
 - .1 Store materials in a well-ventilated, dry indoor location and in accordance with manufacturer's instructions.
 - .2 Coordinate delivery of materials with scheduled installation dates to allow minimum storage time on site.
 - .3 Comply with recommended procedures, precautions and measures described in WHMIS Safety Data Sheets (SDS).
- .3 Waste Management and Disposal:
 - .1 Perform in accordance with Section 01 74 19 - Construction Waste Management and Disposal.

1.9 Ambient conditions

- .1 Ambient Conditions:
 - .1 Install fire stops and smoke seals when ambient and substrate temperatures are within the limits prescribed by the manufacturer and when the substrate is dry and without risk of condensation.
 - .2 Maintain manufacturer's recommended ambient and substrate temperatures for 48 hours before and 72 hours after installation.
- .2 Ventilate fire stops and smoke seals in accordance with manufacturers' instructions by natural means or, where this is inadequate or not available, use forced air circulation.

1.10 Warranty

- .1 Extend 12 month warranty period to 24 months for Work of this Section.
- .2 Manufacturers shall warrant work of this Section against defects and deficiencies in the product material for a period of 24 months. Promptly correct any defects or deficiencies which become apparent within warranty period at no expense.

- .3 Contractor warrants workmanship on materials and installation for a period of 24 months. Promptly correct any defects or deficiencies which become apparent within warranty period at no expense.

Part 2 Products

2.1 Manufacturers

- .1 Provide products from a single manufacturer, to the greatest extent possible, to perform all fire stopping work. Materials of different manufacturers will not be permitted without authorization from Contract Administrator.
- .2 Provide a listed system from an alternative where there is no specific tested listed fire stop system available from the manufacturer for a particular fire stopping application to avoid providing an Engineering Judgment.

2.2 Sustainability characteristics

- .1 Materials and products in accordance with Section 01 35 20 - LEED Sustainable Requirements.

2.3 Performance/design criteria

- .1 Fire stop and smoke seal systems consisting of a material or combination of materials installed to maintain the integrity of the fire-resistance rating of a fire separation in accordance with the requirements of the NBC.
- .2 Performance Requirements: Manufacturer shall design proprietary assemblies to withstand the listed ratings in accordance with the NBC, ULC Standards, and AHJ, and as follows:
 - .1 Non-rated fire separations: Provide L-Rated smoke protection fire stop system for application on both sides of separation.
 - .2 Provide through-penetration fire stop and joint systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of penetrated assembly, such as:
 - .1 Fire-resistance rated loadbearing walls, including partitions, with fire protection rated openings.
 - .2 Fire-resistance rated non-loadbearing walls, including partitions with fire protection rated openings.
 - .3 Fire-resistance rated floor assemblies.
 - .3 "F" Rated Systems: Provide through-penetration fire stop systems with F-ratings indicated, as determined by CAN/ULC-S115 or ASTM E814, and equal to or exceeding the fire-resistance rating of the penetrations created during construction.
 - .4 "T" Rated Systems: Where fire stop systems protect penetrating items from potential contact with adjacent materials, provide through-penetration fire stop systems with T-ratings and F-ratings indicated, as determined by CAN/ULC-S115 or ASTM E814, for the following conditions:
 - .1 Penetrations located outside wall cavities.

- .2 Penetrations located outside fire resistive shaft enclosures.
- .3 Penetrations located in a construction containing fire protection rated openings.
- .4 Penetrating items larger than a 100-mm-diameter nominal pipe or 100 cm² in overall cross-sectional area.
- .5 Fire stopping and Smoke Seal Systems Exposed to View: Provide products that after curing do not deteriorate when exposed to view, traffic, moisture, and physical damage both during and after construction, and as follows:
 - .1 Provide moisture resistant through-penetration fire stop systems for piping penetrations for plumbing and wet pipe sprinkler systems.
 - .2 Provide fire stopping and smoke seal systems capable of supporting anticipated floor loads either by installing floor plates or by other means for floor penetrations with annular spaces exceeding 100 mm in width and exposed to possible loading and traffic.
 - .3 Provide fire stopping and smoke seal systems not requiring removal of insulation for penetrations involving insulated piping.
 - .4 Provide products with flame-spread ratings of less than 25 and smoke-developed ratings of less than 50 for fire stopping, smoke seal, and joint systems exposed to view.
 - .5 Architectural considerations: When fire stop system is exposed to view, consider architectural finish, potential traffic, and exposure to moisture and heat.
- .6 Fire Resistance of Joint Systems: Assembly ratings and movement capabilities shall be as indicated with assembly ratings equal to or exceeding the fire-resistance rating of constructions in which joints are located.
- .3 Acoustic insulation properties as indicated on drawings.
- .4 Dynamic Joints: Where required, design fire stop and smoke seal systems to accommodate a defined amount of movement in structural elements, construction joints and mechanical piping caused by expansion or contraction. Systems should also accommodate movement and sound and vibration control in mechanical installations.
- .5 Insulated Pipes and Ducts: Design and test listed fire stop system with the actual insulation materials penetrating the fire separation, as indicated on the system design listing.
- .6 Use in Wet Areas: water-based products are unacceptable in wet areas or areas that may be subject to occasional water exposure or flooding during and after construction.
- .7 Environment Considerations: Select materials taking into consideration the environment in which they will be used during and after curing, as well as the intended use of the space. Confirm compatibility of the proposed materials/products with fire stop manufacturer for the following situations:
 - .1 Spaces containing sensitive electronic equipment.

2.4 Materials

- .1 Compatibility: Under conditions of service and application, provide fire stopping and smoke seal systems that are compatible with one another, with the substrates forming

openings, and with the items, if any, penetrating the systems, as demonstrated by fire stopping and smoke seal system manufacturer based on testing and site experience, and as follows:

- .1 Asbestos-free materials and systems capable of maintaining an effective barrier against the passage of flame, smoke and water and the transmission of heat in compliance with requirements of CAN-ULC-S115 and not to exceed opening sizes for which they are intended, as indicated on System Design Listing.
- .2 Fire Stop System Rating: To match fire-resistance rating of fire separation as indicated on Drawings and meeting requirements in CAN/ULC-S115.
- .3 Service penetration assemblies and fire stop components: Certified by testing laboratory to CAN/ULC-S115.
- .4 Provide elastomeric seal or non-shrink foam cement mortar for fire and smoke stop systems at openings intended for re-entry, such as cables. Do not use cementitious or rigid seal at such locations.
- .5 Provide elastomeric protection for fire and smoke stop systems at openings around penetrations for pipes, ductwork and other mechanical items requiring sound and vibration control. Do not use a cementitious or rigid seal at such locations. Exemption for fire dampers.
- .6 Provide elastomeric seal for fire and smoke seals behind and around mechanical and electrical boxes within wall, floor, and ceiling assemblies.

2.5 Fill materials

- .1 General:
 - .1 Provide fire stopping and smoke seal systems containing the types of fill materials indicated in SCHEDULE in Part 3 of this Section by reference to the types of materials described in this Article. Fill materials are those referred to in directories of the referenced testing and inspecting agencies as fill, void, or cavity materials.
 - .2 Fire stopping and smoke seal systems shall be tested in accordance with CAN/ULC-S115 and be comprised of asbestos free materials and systems capable of maintaining an effective barrier against flame, smoke and gases. Fire stopping and smoke seal systems not to exceed opening sizes for which they are intended for the ratings as indicated on Drawings.
- .2 Cast-in-Place Fire Stopping and Smoke Seal Devices: Factory assembled devices for use in cast-in-place concrete floors and consisting of an outer metallic sleeve lined with an intumescent strip, a radial extended flange attached to one end of the sleeve for fastening to concrete formwork, and a neoprene gasket.
- .3 Latex Sealants: Single component latex formulations that after curing do not re-emulsify during exposure to moisture.
- .4 Fire Stopping and Smoke Seal Devices: Factory-assembled collars formed from galvanized steel and lined with intumescent material sized to fit specific diameter of penetrating item.
- .5 Cable Penetration Devices:
 - .1 Pre-manufactured intumescent blocks
 - .2 Pre-manufactured sleeves, consisting of an adjustable core

- .3 Pre-manufactured cable management system, consisting of a system of intumescent inserts and adjustable cores
- .6 Intumescent Composite Sheets: Rigid panels consisting of aluminum foil faced elastomeric sheet bonded to galvanized steel sheet.
- .7 Intumescent Putties: Non-hardening dielectric, water resistant putties containing no solvents, inorganic fibres, or silicone compounds.
- .8 Intumescent Spray Foam: Expanding spray-in-place intumescent foam sealant.
- .9 Intumescent Wrap Strips: Single component intumescent elastomeric sheets with aluminum foil on one side.
- .10 Intumescent, Latex Sealant: Single-component, intumescent, latex formulation.
- .11 Job-Mixed Vinyl Compound: Prepackaged vinyl-based powder product for mixing with water at Project site to produce a paintable compound, passing ASTM E136, with flame-spread and smoke-developed ratings of zero per ASTM E84.
- .12 Solvent-Release-Curing Intumescent Sealant: Solvent-release-curing, single-component, synthetic-polymer-based sealant of grade indicated below:
 - .1 Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces. Non-sag formulation for openings in vertical and other surfaces requiring a non-slumping/gunnable sealant, unless indicated fire stop system limits use non-sag grade.
- .13 Mortars: Pre-packaged, dry mixes consisting of a blend of inorganic binders, hydraulic cement, fillers, and lightweight aggregate formulated for mixing with water at Project site to form a non-shrinking, homogeneous mortar.
- .14 Pillows/Bags: Reusable, heat-expanding pillows/bags consisting of glass fibre cloth cases filled with a combination of mineral fibre, water insoluble expansion agents and fire-retardant additives.
- .15 Silicone Foams: Multi-component, silicone based liquid elastomers that, when mixed, expand and cure in-place to produce a flexible, non-shrinking foam.
- .16 Silicone Sealants: Moisture curing, single component, silicone based, neutral curing elastomeric sealants of grade indicated below:
 - .1 Grade for Horizontal Surfaces: Pourable (self-levelling) formulation for openings in floors and other horizontal surfaces.
 - .2 Grade for Vertical Surfaces: Non-sag formulation for openings in vertical and other surfaces.
- .17 Ceramic-Fibre and Mastic Coating: Ceramic fibres in bulk form formulated for use with mastic coating, and ceramic fibre manufacturer's mastic coating.
- .18 Ceramic-Fibre Sealant: Single-component formulation of ceramic fibres and inorganic binders.

2.6 Mixing

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

2.7 Fire-resistive elastomeric joint sealants

- .1 Elastomeric Sealant Standard: Provide manufacturer's standard chemically curing, elastomeric sealants of base polymer that comply with ASTM C920 requirements, including those referenced for Type, Grade, Class, and Uses, and requirements specified in this Section applicable to fire-resistive joint sealants.
- .2 Single-Component, Neutral-Curing Silicone Sealant: Type S; Grade NS; Class 25; exposure-related Use NT, and joint-substrate-related Uses M, G, A, and (as applicable to joint substrates indicated) O.
 - .1 Additional Movement Capability: When tested for adhesion and cohesion under maximum cyclic movement per ASTM C719, provide sealant with the capability to withstand the changes in joint width existing at the time of installation, and remain in compliance with other requirements of ASTM C920.
- .3 Multicomponent, Non-sag, Urethane Sealant: Type M; Grade NS; Class 25; exposure-related Use NT, and joint-substrate-related Uses M, A, and (as applicable to joint substrates indicated) O.
 - .1 Additional Movement Capability: When tested for adhesion and cohesion under maximum cyclic movement per ASTM C719, provide sealant with the capability to withstand the change in joint width existing at the time of installation, and remain in compliance with other requirements of ASTM C920.
- .4 Single-Component, Non-sag, Urethane Sealant: Type S; Grade NS; Class 25; and Uses NT, M, A, and (as applicable to joint substrates indicated) O.

2.8 Fire stop identification

- .1 Identification Labels and Markings: Permanent for the expected service life of the installation.
- .2 Fire Stopped Penetrations:
 - .1 Provide identification labels at each penetration.
 - .2 Identification labels: adhesive plastic stickers, tamper-evident frangible stickers, embossed metal tags or ceramic fiber tags with metal fastening device, used singly or in combination, with the following information:
 - .1 penetration number
 - .2 room number
 - .3 product name and number
 - .4 system design number
 - .5 fire rating required in hours.
 - .6 fire stop Subcontractor's name and phone number
 - .7 installer's name
 - .8 date of installation
 - .9 re-penetrated by: Date, name and phone number of person or company responsible for repenetration of assembly (allow several lines).
 - .3 Indicate on label that fill material around the penetration is a fire stop system and shall not be disturbed except by authorized personnel.
- .3 Fire Separation (Barrier) Markings:

- .1 Provide identification for all vertical fire separations.
- .2 Identification markings: adhesive stickers with lettering at least 75 mm in height with a minimum 10 -mm stroke in contrasting colour.
- .3 Incorporate assembly's fire-resistance rating and the following suggested wording, "FIRE AND/OR SMOKE BARRIER - PROTECT ALL OPENINGS", or other accepted wording.

2.9 Accessories

- .1 Provide components for each fire stopping and smoke seal system needed to install fill materials. Use only components specified by fire stopping and smoke seal system manufacturer and approved by the qualified testing and inspecting agency for fire stopping and smoke seal systems indicated on Drawings.
- .2 Primers: To manufacturer's recommendation for specific material, substrate, and end use.
- .3 Water (if applicable): Potable, clean and free from harmful amounts of deleterious substances.
- .4 Metal Fire Stop: Commercial galvanized steel, to ASTM A1008/A1008M, zinc coating 260 g/m², minimum metal core thickness 0.912 mm.
- .5 Steel Deck Moulded Flute Inserts: One-piece moulded mineral fibre flute inserts, sized for steel deck profiles, for placement at top of fire-rated wall assemblies
- .6 Packing/Damming Materials, Supports and Anchoring Devices: To manufacturer's recommendations, and in accordance with tested assembly being installed as acceptable to AHJ.
- .7 Fire Stop Insulation: Pre-formed, semi-rigid, non-combustible mineral wool, pre-cut in 1220-mm lengths to required depth and width.
- .8 Junction Box/Outlet Sealing Putty: Intumescent putty, pre-formed in pads.
- .9 Sealants: Good adhesion without use of primer, high visibility safety colours.
 - .1 Flame-spread rating: Maximum 25
 - .2 Smoke development classification: Maximum 50
 - .3 For vertical joints: Non-sagging
 - .4 For horizontal joints: Single component, self-levelling

Part 3 Execution

3.1 Manufacturer's Instructions

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

3.2 Examination

- .1 Verify that conditions of substrates previously installed are acceptable for product installation in accordance with manufacturer's instructions and approved system design listings for each condition.
- .2 Verify each opening/annular space to ensure it does not exceed the maximum and minimum dimensions indicated on the approved system design listing.

- .3 Verify that all joints, service penetrating elements and supporting devices/hangers have been properly installed as indicated on approved system design listings. Remove all temporary lines and markings to meet the approved system design listings.
- .4 Verify that proposed fire stop system consists of components that are compatible with each other, with substrates forming the openings, and with items, if any, penetrating the fire stop under conditions of application and service, as demonstrated by the fire stop manufacturer based on testing and site experience.
- .5 Pipe and Duct Insulation: Confirm that proposed fire stop system has been tested with the actual insulation penetrating the fire separation on site, as indicated in the approved system design listing. Maintain insulation around pipes and ducts penetrating the fire separation.
- .6 Ensure no additional items have been installed through opening that does not appear on the approved system design listing.
- .7 Ensure fire stopped areas are accessible for proper application and that conditions are suitable for installation of the fire stop system. Areas to remain accessible for inspection.
- .8 Report in writing to Contract Administrator any defective surfaces or conditions affecting the fire stop system installation immediately and before commencing any installations.
- .9 Proceed only once defected surfaces or conditions have been corrected.
- .10 Proceed with installation only after unacceptable conditions have been remedied.

3.3 Preparation

- .1 Examine sizes and conditions of voids to be filled to establish correct thicknesses and installation of materials.
 - .1 Ensure that substrates and surfaces are clean, dry and frost free.
 - .2 Ensure substrates and surfaces are free of dirt, grease, oil, rust, laitance, release agents, water repellents, and any other substances that may affect proper adhesion.
- .2 Prepare surfaces in contact with fire stop and smoke stop materials to manufacturer's instructions.
- .3 Maintain insulation around pipes and ducts penetrating fire separation without interruption to vapour barrier.
- .4 Mask where necessary to avoid spillage and over coating onto adjoining surfaces; remove stains on adjacent surfaces.
- .5 Protect adjacent work areas and finish surfaces from damage during product installation.
- .6 Prime surfaces as required.
- .7 Ensure multi-penetration openings have been framed and boarded out around annular openings, as indicated in the system design listing before prepping the opening.

3.4 Installation

- .1 Install fire stop and smoke seal materials and components in accordance with manufacturer's certified tested system listing.
- .2 Coordinate with other sub-trades to ensure that all pipes, conduits, cables, and other items, which penetrate fire separations, have been permanently installed before installation of fire stop systems.

- .3 Schedule work to ensure that fire separations and all other construction that conceals penetrations are not erected before installation of fire and smoke seal systems
- .4 Seal holes or voids made by through-penetrations, poke-through termination devices, and un-penetrated openings or joints to ensure that both continuity and integrity of fire separation are maintained.
- .5 Provide temporary forming as required and remove forming only after materials have gained sufficient strength and after initial curing per manufacturer's instructions.
- .6 Tool or trowel exposed surfaces to neat finish.
- .7 Remove excess compound promptly as work progresses and upon completion.
- .8 Protect gaps around recessed components (e.g., panels, electrical boxes, outlets) with sealing putty in accordance with manufacturer's instructions.
- .9 Do not use damaged or expired material.

3.5 Installation - joint fire stops

- .1 For sealant applications, install joint fillers to support fire stop materials during application. Position joint fillers to ensure fire stop material cross-sectional shape and thickness relative to the joint width allows for optimum sealant movement, while developing the required fire-resistance rating.
- .2 Install fire stops using techniques recommended by the manufacturer:
 - .1 Fully wetting joint substrates to optimize adhesion.
 - .2 Completely filling recesses provided for each joint configuration.
 - .3 Tool non-sag fire stop materials immediately after their application and before the time skinning begins. Form smooth, uniform beads of configuration indicated or required to
 - .1 provide required fire-resistance rating,
 - .2 eliminate air pockets, and
 - .3 ensure contact and adhesion with sides of joint.
 - .4 Joint Systems and Perimeter Fire Containment Systems:
 - .1 For systems with dynamic joints, ensure movement capabilities of the installation meet or exceed the movement expectations of the system design listing and manufacturer's installation instructions.

3.6 Installation - through penetration joint sealants

- .1 Install forming/damming materials and other accessories of types required to support fill materials during their application and in the position required to achieve fire ratings of designated through-penetration fire stop systems.
- .2 Install fill materials for through-penetration fire stop systems by techniques recommended by the manufacturer to produce the following results:
 - .1 Completely fill voids and cavities formed by openings, forming materials, accessories, and penetrating items.
 - .2 Apply materials so they contact and adhere to substrates formed by openings and penetrating items.

- .3 For fill materials that will remain exposed after completing Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.
- .3 Remove combustible forming materials and other accessories not indicated as permanent components of fire stop systems.

3.7 Identification

- .1 General:
 - .1 Clean substrate before applying identification.
 - .2 Determine final location of identification on site.
 - .3 Identification is not required on both sides of the fire separation.
 - .4 Refer to Drawings for locations of fire separations and rating required.
- .2 Fire Stopped Penetrations:
 - .1 Install identification label adjacent to each fire stopped wall/floor service penetration. Provide one identification label per single opening or per grouping cluster.
 - .2 Securely apply identification to substrate by providing adequate adhesive
 - .3 Secure tags with metal fasteners or hang with metal chain or wire.
 - .4 Identification shall be completely filled out and installed before requesting substantial performance.
- .3 Fire Separations (Barriers):
 - .1 Position identification at least 4500 mm from end of each wall and at intervals not exceeding 9000 mm along wall/floor joint fire stops.
 - .2 Install markings within ceiling spaces, 600 mm below horizontal fire separation or roof structure unless otherwise indicated on Drawings.
 - .3 Review location of identification with Contract Administrator for occupied areas with exposed ceilings before proceeding.

3.8 Repairs and modifications

- .1 Identify damaged or re-entered seals requiring repair or modification.
- .2 Remove loose or damaged materials. If adding penetrating items, remove sufficient material to insert new elements and to avoid damaging the balance of the seal.
- .3 Ensure sealed surfaces are clean and dry.
- .4 Use only materials that are suitable for repair of original seal, as approved by manufacturer. Do not mix products from different manufacturers.

3.9 Site quality control

- .1 Inspections: Notify Contract Administrator when ready for inspection and before concealing or enclosing fire stop materials and service penetration assemblies.
- .2 Manufacturer's Field Services:
 - .1 Obtain report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Site Reports as described in SUBMITTALS in Part 1 of this Section.

3.10 Inspections

- .1 Third-Party Inspection Firm: Provide the services of a third-party inspection firm to conduct random inspections and direct exploratory review (i.e., destructive testing) during the course of construction and before closing off any concealed areas. Perform inspections and destructive testing in compliance with ASTM E2174 and ASTM E2393.
- .2 Exploratory investigations:
 - .1 The Contract Administrator may request random exploratory investigations of designated fire stopping installation during course of the Work.
 - .2 Allow for three exploratory reviews in total.
 - .3 Cut or open up designated assemblies to allow Contract Administrator's review.
 - .4 Once the investigation is complete and is acceptable to Contract Administrator, replace the fire stop system with new materials that meet specification requirements.
 - .5 If an installation is deemed unacceptable to the Contract Administrator, the Contract Administrator may request additional investigations on similar installations.
 - .6 If additional investigations are found deficient Contract Administrator will determine the degree of remedial measures allowed by Contractor to correct similar installations. Remedial work may include complete removal and replacement of fire stopping at similar installations.
- .3 Upon completion of construction and before requesting substantial performance review, fire stop Subcontractor and manufacturer's representative shall inspect all fire stopping work and prepare a deficiency list. Submit deficiency list to Contract Administrator for review. Repair any deficiencies and re-inspect work to ensure that all deficiencies have been completed.
- .4 Submit formal request for substantial performance review of work once all work is completed, quality control has been performed and all fire stop installations have been inspected and identified with the approved fire stop identification labels.
- .5 Contract Administrator will conduct the substantial performance review in the presence of the fire stop Contractor and the manufacturer's representative.

3.11 Cleaning

- .1 Perform cleaning in accordance with Section 01 74 00 - Cleaning.
- .2 Remove equipment, excess materials and debris and clean adjacent surfaces immediately after application. Use methods and cleaning materials approved by manufacturer.
- .3 Protect fire stops during and after curing period from contact with contaminating substances
- .4 Remove temporary dams after initial set of fire stop and smoke seal materials.

3.12 Schedule

- .1 Fire stop and smoke seal at:

- .1 Penetrations through fire-resistance rated masonry, concrete, and gypsum board partitions and walls.
 - .2 Top of fire-resistance rated masonry and gypsum board partitions.
 - .3 Intersection of fire-resistance rated masonry and gypsum board partitions.
 - .4 Control and sway joints in fire-resistance rated masonry and gypsum board partitions and walls.
 - .5 Penetrations through fire-resistance rated floor slabs, ceilings and roofs.
 - .6 Openings and sleeves installed for future use through fire separations.
 - .7 Around mechanical and electrical assemblies penetrating fire separations.
 - .8 Rigid ducts: greater than 20 square inches (129 square cm): fire stopping to consist of bead of fire stopping material between retaining angle and fire separation and between retaining angle and duct, on each side of fire separation.
- .2 Smoke seals for smoke separations:
- .1 Use elastomeric sealant (fire stop caulking) to provide smoke seals in smoke separations at:
 - .1 Penetrations (pipes, ducts, conduit, wiring and other penetrations).
 - .2 Intersection of smoke separations and adjacent walls, partitions, floors and ceilings.
 - .3 Perimeter seal around door and window frames in separations.
 - .2 Apply sealant on both sides of separation where applicable. Elastomeric sealant does not require a fire stop system rating, but is required to effectively seal smoke separations from passage of smoke in the event of a fire.
- .3 Provide fire stop and L-Rated smoke-resistant fire stop systems at locations shown on drawings.
- .4 Design and provide through-penetration fire stopping and smoke seals as follows:
- .1 Systems with no penetrating items, select one or more of the following fill materials:
 - .1 latex sealant
 - .2 silicone sealant
 - .3 intumescent putty
 - .4 intumescent foam blocks or boards
 - .5 intumescent spray foam
 - .2 Systems for metallic pipes, conduit, or tubing, select one or more of the following fill materials:
 - .1 latex sealant
 - .2 silicone sealant
 - .3 intumescent putty
 - .4 intumescent foam blocks or boards
 - .5 intumescent spray foam
 - .3 Systems for non-metallic pipe, conduit, or tubing, select one or more of the following fill materials:

- .1 latex sealant
- .2 silicone sealant
- .3 intumescent putty
- .4 intumescent foam blocks or boards
- .5 intumescent spray foam
- .4 Re-enterable and cable managed systems for electrical, and data and communications cables:
 - .1 prefabricated fire stop sleeve cp653 (hilti)
 - .2 preformed intumescent blocks cfs-bl (hilti)
 - .3 preformed intumescent blocks (roxtec)
 - .4 prefabricated cable pathways (ez-path)
- .5 Systems for electrical, and data and communications cables, select one or more of the following fill materials:
 - .1 latex sealant
 - .2 silicone sealant
 - .3 intumescent putty
 - .4 silicone foam
 - .5 prefabricated fire stop sleeve cp 653 (hilti)
 - .6 preformed intumescent blocks cfs-bl (hilti)
 - .7 preformed intumescent blocks (roxtec)
 - .8 prefabricated cable pathways (ez-path)
 - .9 intumescent foam blocks or boards
 - .10 intumescent spray foam
- .6 Systems for cable trays, select one or more of the following fill materials:
 - .1 latex sealant
 - .2 intumescent putty
 - .3 silicone foam
 - .4 pillows/bags
 - .5 intumescent foam blocks or boards
- .7 Systems for insulated pipes, select one or more of the following fill materials:
 - .1 latex sealant
 - .2 intumescent putty
 - .3 silicone foam
 - .4 intumescent wrap strips
 - .5 intumescent foam blocks or boards
 - .6 intumescent spray foam
- .8 Systems for miscellaneous electrical penetrations, select one or more of the following fill materials:

- .1 latex sealant
- .2 intumescent putty
- .3 intumescent foam blocks or boards
- .4 intumescent spray foam
- .9 Systems for miscellaneous mechanical penetrations, select one or more of the following fill materials:
 - .1 latex sealant
 - .2 intumescent foam blocks or boards
 - .3 intumescent spray foam
- .10 Systems for groupings of penetrations, select one or more of the following fill materials:
 - .1 latex sealant
 - .2 intumescent wrap strips
 - .3 fire stopping and smoke seal device
 - .4 intumescent composite sheet
 - .5 intumescent foam blocks or boards
 - .6 intumescent spray foam
- .5 Design and provide joint fire stopping and smoke seals as follows for:
 - .1 Floor-to-Floor, Fire-Resistive Joint System: Provide materials to meet the following criteria:
 - .1 assembly rating: as indicated
 - .2 nominal joint width: as indicated
 - .3 movement capabilities: compression and extension
 - .2 Floor-to-Wall, Fire-Resistive Joint System: Provide materials to meet the following criteria:
 - .1 assembly rating: as indicated
 - .2 nominal joint width: as indicated
 - .3 movement capabilities: to be confirmed, compression, extension, or horizontal shear
 - .3 Head-of-Wall, Fire-Resistive Joint System: Provide materials to meet the following criteria:
 - .1 assembly rating: as indicated
 - .2 nominal joint width: as indicated
 - .3 movement capabilities: compression and extension
 - .4 Wall-to-Wall, Fire-Resistive Joint System: Provide materials to meet the following criteria:
 - .1 assembly rating: as indicated
 - .2 nominal joint width: as indicated
 - .3 movement capabilities: compression and extension

- .6 Design and provide perimeter fire containment fire stopping and smoke seals as follows for:
 - .1 Perimeter Fire Containment System: Provide materials to meet the following criteria:
 - .1 integrity rating: as indicated
 - .2 insulation rating: as indicated
 - .3 linear opening width: as indicated

END OF SECTION

Part 1 General

1.1 Related requirements

- .1 Section 07 11 13 - Bituminous Damproofing
- .2 Section 07 26 00 - Vapour Retarders
- .3 Section 07 52 00 - Modified Bituminous Membrane Roofing
- .4 Section 07 61 00 – Sheet Metal Roofing & Wall Panels
- .5 Section 07 62 00 - Sheet Metal Flashing and Trim.
- .6 Section 07 84 00 - Fire Stopping
- .7 Section 08 11 00 – Metal Doors and Frames
- .8 Section 08 44 13 – Glazed Aluminum Curtain Walls
- .9 Section 08 51 13 - Aluminum Windows
- .10 Section 08 80 00 - Glazing
- .11 Section 09 21 16 - Gypsum board Assemblies
- .12 Section 09 22 16 – Non-Structural Metal Stud Framing
- .13 Section 09 30 13 - Ceramic Tiling

1.2 Reference standards

- .1 ASTM International (ASTM):
 - .1 ASTM C834-17, Standard Specification for Latex Sealants
 - .2 ASTM C919-19, Standard Practice for Use of Sealants in Acoustical Applications
 - .3 ASTM C920-18, Standard Specification for Elastomeric Joint Sealants
 - .4 ASTM C1193-16, Standard Guide for Use of Joint Sealants
 - .5 ASTM C1330-18, Standard Specification for Cylindrical Sealant Backing for Use with Cold Liquid-Applied Sealants
 - .6 ASTM C1481-12, Standard Guide for Use of Joint Sealants with Exterior Insulation and Finish Systems (EIFS)
 - .7 ASTM D1056-20, Standard Specification for Flexible Cellular Materials-Sponge or Expanded Rubber
 - .8 ASTM D2240-15e1, Standard Test Methods for Rubber Property, Durometer Hardness
 - .9 ASTM D2628-91, Standard Specification for Preformed Polychloroprene Elastomeric Joint Seals for Concrete Pavements
- .2 Canadian General Standards Board (CGSB) 1330:
 - .1 CGSB 19-GP-5M-1984 , Sealing Compound, One Component, Acrylic Base, Solvent Curing (Issue of 1976 reaffirmed, incorporating Amendment No. 1).
 - .2 CAN/CGSB-19.13-M87 , Sealing Compound, One-component, Elastomeric, Chemical Curing.

- .3 CGSB 19-GP-14M-1984 , Sealing Compound, One Component, Butyl-Polyisobutylene Polymer Base, Solvent Curing (Reaffirmation of April 1976).
- .4 CAN/CGSB-19.17-M90 , One-Component Acrylic Emulsion Base Sealing Compound.
- .5 CAN/CGSB-19.24-M90, Multi-component, Chemical Curing Sealing Compound
- .3 Department of Justice Canada (Jus):
 - .1 Canadian Environmental Protection Act, 1999 (2018) (CEPA)
- .4 General Services Administration (GSA) - Federal Specifications (FS):
 - .1 FS-SS-S-200-E(2)1993, Sealants, Joint, Two-Component, Jet-Blast-Resistant, Cold Applied, for Portland Cement Concrete Pavement
- .5 Health Canada/Workplace Hazardous Materials Information System (WHMIS):
 - .1 Safety Data Sheets (SDS)
 - .2 Sealant, Waterproofing, and Restoration Institute (SWRI): Sealants: The Professionals' Guide 2013
- .6 South Coast Air Quality Management District (SCAQMD), California State, Regulation XI. Source Specific Standards:
 - .1 SCAQMD Rule 1168-A2017, Adhesives and Sealants Applications
- .7 Transport Canada (TC):
 - .1 Transportation of Dangerous Goods Act, 1992 (2019 amended.) (TDGA)
- .8 ULC Standards/ UL Canada (ULC):
 - .1 CAN/ULC 115-2018, Standard Method of Fire Tests of Firestop Systems

1.3 Action and informational submittals

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's product data for each type of primer, backer rod, and sealants and include product characteristics, performance criteria, available colours, compatibility warnings, compliance standards and limitations.
 - .2 Manufacturer's product to describe:
 - .1 Caulking compound.
 - .2 Primers.
 - .3 Sealing compound, each type, including compatibility when different sealants are in contact with each other.
 - .3 Submit one electronic copy of WHMIS SDS.
- .3 Samples:
 - .1 Submit two samples of each type of joint sealant material and colour.
 - .2 Submit two cured samples of exposed sealants of each colour to match adjacent material.
- .4 Manufacturer's Instructions:
 - .1 Submit instructions for each type of product.

- .5 Sustainable Design Submittals:
 - .1 LEED Canada submittals: in accordance with Section 01 35 20 - LEED Sustainable Requirements.
 - .2 Construction Waste Management: Refer to Section 01 74 19 - Construction/Demolition Waste Management and Disposal.
 - .3 Material product attribute documentation: Refer to Product Check Sheet as listed in 01 35 20 – LEED Sustainable Requirements to determine applicable type of documentation required for each product.
 - .4 Low-Emitting Materials:
 - .1 Submittals are required for any sealants, adhesives, paints, coatings, composite wood, flooring, wall panels, insulation or ceiling components within the inner most weather proofing barrier.
 - .2 Refer to Product Check Sheet as listed in 01 35 20 – LEED Sustainable Requirements to determine applicable type of documentation required for each product.
 - .5 Low Emitting Materials: Provide low VOC emitting Products (within the building waterproofing membrane), in compliance with VOC emission limits referenced in SCAQMD Rule 1168 program standards, for the following categories:
 - .6 Interior primers, adhesives, and sealants applied on site.
 - .7 Submit manufacturer's information indicating VOC emission limit in grams per litre (g/L).
 - .6 Confirm and coordinate submittal requirements with the BECxA.

1.4 Closeout submittals

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

1.5 Quality assurance

- .1 Qualifications:
 - .1 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three (3) years documented experience. Obtain each type of joint sealant from a single manufacturer.
 - .2 Applicator Qualifications: Company specializing in performing the work of this section with minimum three (3) years documented experience.
- .2 Compatibility: Ensure sealants are compatible with adjacent materials and are approved by manufacture for use with adjacent materials.
- .3 Perform work to sealant manufacturer's requirements for preparation of surfaces and material installation instructions.
- .4 Mock-Ups:
 - .1 Construct mock up in accordance with Section 01 43 00 - Quality Assurance.

- .2 Before performing sealant work do sample applications of each type of sealant for review.
- .3 Site locations for sample applications shall be designated by Contract Administrator.
- .4 Construct joint sealant mock-ups in assemblies of other Sections with joint sealants, which are referenced in this Section.
- .5 Confirm and coordinate mock-up requirements with the BECxA.
- .5 Comply with requirements of WHMIS regarding use, handling, storage, and disposal of hazardous materials; and regarding labelling and provision of Safety Data Sheets (SDS) acceptable to Health Canada.
- .6 Perform acoustical sealant application work to ASTM C919.
- .7 Perform structural sealant application work to ASTM C1401.
- .8 Confirm and coordinate visual review and pre-installation conference requirements with the BECxA.

1.6 Warranty

- .1 Section 01 78 00: Closeout Submittals.
- .2 Warranty: Include coverage for installed sealants and accessories which fail to achieve air tight seal and water tight seal, exhibit loss of adhesion or cohesion, or do not cure.
- .3 Provide manufacturer's twenty (20) year material warranty for installed silicone sealant.
- .4 Defective work shall include, but not be restricted to joint leakage, cracking, crumbling, melting, running, loss of adhesion, loss of cohesion, or staining of adjoining or adjacent work or surfaces.

1.7 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, with manufacturer's label.
- .3 Storage and Handling Requirements:
 - .1 Store materials off ground in a ventilated dry indoor location and in accordance with manufacturer's recommendations.
 - .2 Store and protect joint sealants from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.
 - .4 Handle and dispose of hazardous materials in accordance with the CEPA, TDGA, Regional and Municipal regulations.
 - .5 Do not dispose of unused sealant material into sewer system, streams, lakes, onto ground or in other location where it will pose health or environmental hazard.

1.8 Site conditions

- .1 Ambient Conditions:
 - .1 Proceed with installation of joint sealants only when:
 - .1 Ambient and substrate temperature conditions are within limits permitted by joint sealant manufacturer or are above 4.4 degrees C.

- .2 Joint substrates are dry.
 - .3 Conform to manufacturer's recommended temperatures, relative humidity, and substrate moisture content for application and curing of sealants including special conditions governing use.
- .2 Joint-Width Conditions:
 - .1 Proceed with installation of joint sealants only where joint widths are more than those allowed by joint sealant manufacturer for applications indicated.
 - .3 Joint-Substrate Conditions:
 - .1 Proceed with installation of joint sealants only after contaminants capable of interfering with adhesion are removed from joint substrates.

Part 2 Products

2.1 Sustainability characteristics

- .1 When low toxicity sealants 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.

2.2 Performance requirements

- .1 Each sealant system shall meet the following requirements for warranty period:
 - .1 Waterproof, flexible, and compatible with substrate under applicable service conditions.
 - .2 Provide a weather-tight seal that does not allow moisture penetration.
 - .3 Shall not de-bond, crack, or craze.
 - .4 Shall not leak.

2.3 Sealant materials

- .1 Sealants and caulking compounds must:
 - .1 meet or exceed all applicable governmental and industrial safety and performance standards; and be manufactured and transported in such a manner that all steps of 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 sulfate.
- .3 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.
- .4 In air handling units and supply air system, use sealants without strong odours, without toxic chemicals, and are mould-resistant. When low toxicity sealants 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.

- .5 Provide primers in accordance with manufacturer recommendation.

2.4 Sealant material designations

- .1 Type 1: Sealant for all locations except where another type is specified in this section. Multi-component, polyepoxide urethane sealant. To meet specified requirements of CGSB Specification CAN2.19-24-M80.

- .1 Acceptable Material:

- .1 Tremco Dymeric 511
 - .2 Sonolastic NP-2
 - .3 Permapol RC-2.
 - .4 Morton Thiokol
 - .5 Sikaflex 2CNS/SL
 - .6 Bostik Chem-Calk 500
 - .7 or approved equal

- .2 Type 2: Sealant for construction joints in lieu of Type 1 where approved by Contract Administrator. One part elastomeric sealants: to meet specified requirements of NSC/CGSB 25-B-N moisture curing hybrid polyurethane.

- .1 Acceptable Material:

- .1 Tremco Dymonic
 - .2 Sonolastic 150
 - .3 Permapol RC-1
 - .4 Morton Thiokol.
 - .5 Sikaflex 1A
 - .6 Bostik Chem-Calk900
 - .7 or equal

- .3 Type 3: Sealant for glass to glass, sloped glazing systems, glass to metal, and metal to metal joints. One part low modulus silicone elastomeric sealant to meet specified requirements of NSC/CGSB Specification CAN2-19.13-M82.

- .1 Acceptable Material:

- .1 Dow Corning 795
 - .2 Tremco Spectrum 2
 - .3 GE Silglaze 2800
 - .4 GE Silpruf 2000
 - .5 or equal

- .4 Type 4: Polyurethane sealant for exterior and interior horizontal traffic joints.

- .1 Acceptable Material:

- .1 Tremco THC-900
 - .2 Permapol RC-2SI
 - .3 Sonolastic SL2
 - .4 Sikaflex 2CSL

- .5 Bostik Chem-Calk 550
- .6 or equal
- .5 Type 5: Use around perimeter of all washroom fixtures (including sinks, tubs, showers, urinals, water closets, basins, vanities, etc.). One part silicone sealant.
 - .1 Acceptable Material:
 - .1 Tremco, Tremsil 200
 - .2 Dow Corning 786
 - .3 GE Sanitary 1702
 - .4 or equal
- .6 Type 6: Use at all perimeter joints and openings in sound rated drywall systems and sealing polyethylene air/vapour barriers. One part acoustical sealant to meet specified requirements of CGSB Specification 19-GP-21M.
 - .1 Acceptable Material:
 - .1 Tremco Tremflex 834
 - .2 Chem-Calk 600
 - .3 Gibson Homans 2210
 - .4 or equal
- .7 Type 7: Sealant for finishing interior construction joints subject to minimal movement, interior perimeters of doors and window frames, and locations not otherwise specified in this section. One part paintable latex.
 - .1 Acceptable Material:
 - .1 Tremco Latex 100
 - .2 Bulldog Acrylic Latex
 - .3 or equal
- .8 Type 8: Sealant for sealing gutters and rainware. One part high quality synthetic rubber blended with a synthetic resin for metal to metal and metal to plastic joints.
 - .1 Acceptable Material:
 - .1 Tremco Gutter Seal
 - .2 or equal
- .9 Type 9: Sealant for masonry joints including control joints, reglets, etc.: Ultra-low modulus, one part silicone joint sealant. 790 or moisture curing hybrid polyurethane 150
 - .1 Acceptable Material:
 - .1 Sonolastic 150
 - .2 or equal

2.5 Expanding Foam Sealants

- .1 Expanding foam sealant - Type 1 (to be used as a primary or secondary seal for vertical or horizontal joints below grade):
 - .1 High-density open cell polyurethane foam, pre-compressed, impregnated with water-based, polymer-modified asphalt. Three part system with foam seal, epoxy adhesive and topcoat (where used as primary seal).

- .2 Acceptable material: Emseal 20H System.
- .2 Expanding foam sealant - Type 2 Primary seal for vertical or horizontal joints above grade concealed in final assembly:
 - .1 High-density open cell polyurethane foam, pre-compressed, impregnated with water-based, polymer-modified asphalt, self-adhesive.
 - .2 Acceptable material: Emseal 25V.
- .3 Expanding foam sealant - Type 3 (Secondary seal for vertical and horizontal joints above grade exposed in final assembly. For joints less than 3/4" (19mm) wide only):
 - .1 High-density open cell polyurethane foam, pre-compressed, impregnated with water-based, stabilized acrylic, self-adhesive.
 - .2 Acceptable material: Emseal Backerseal/Greyflex.
- .4 Expanding foam sealant - Type 4 (Primary seal for vertical and horizontal joints above grade exposed in final assembly. Seal edges with wet sealant. For joints 3/4" (19 mm) or more in width):
 - .1 High-density open cell polyurethane foam, pre-compressed, impregnated with water-based, stabilized acrylic, self-adhesive. Factory applied external colour facing of Dow Corning 790 silicone in colour selected by Contract Administrator.
 - .2 Acceptable material: Emseal Colorseal.

2.6 Multi-Use Sealant Tape (Door Threshold Gaskets)

- .1 Preformed expanding tape seal made of a resilient cellular foam infused with a hydrophobic, modified-acrylic, liquid adhesive sealant which is then compressed to a sealing density level appropriate to the application. Compresses uniformly without overspill to provide a lasting seal.
 - .1 Acceptable material: Emseal MST (Multi-Use Sealant Tape)

2.7 Sealant selection

- .1 Where no specific type of sealant is scheduled, provide one of the sealants indicated in this Section appropriate for its application and consistent with manufacturer's recommendations and the recommendations of SWRI, Sealants: The Professionals' Guide.
- .2 Make sealant selections consistent with manufacturer's recommendations.

2.8 Accessories

- .1 Preformed compressible and non-compressible back-up materials that are non-staining, compatible with joint substrate, sealants, primers, and other joint fillers, and are approved for applications indicated by sealant manufacturer based on site experience and laboratory testing:
 - .1 Rod Type Sealant Backings:
 - .1 ASTM C1330, Type C (closed cell material with a surface skin), Type O (open cell material) or Type B (bi cellular material with a surface skin).

- .2 Provide any of the preceding types, as approved in writing by joint sealant manufacturer for joint application indicated.
- .3 Size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.
- .4 Non adhering to sealant, to maintain two sided adhesion across joint.
- .2 High Density Foam:
 - .1 Extruded closed cell polyvinyl chloride (PVC), extruded polyethylene, closed cell, Shore A hardness 20, tensile strength 140 to 200 kPa, extruded polyolefin foam, 32 kg/m³ density, or neoprene foam backer, size as recommended by manufacturer.
 - .3 Elastomeric Tubing Joint Fillers: Neoprene, butyl, EPDM, or silicone tubing complying with ASTM D1056, non absorbent to water and gas, capable of remaining resilient at temperatures down to 15 deg C. Provide products with low compression set and of size and shape to provide a secondary seal, to control sealant depth and otherwise contribute to optimum sealant performance.
 - .4 Bond Breaker Tape:
 - .1 Polyethylene bond breaker tape or other tape recommended by sealant manufacturer which will not bond to sealant.
- .2 Preformed Sealants:
 - .1 Preformed Silicone Sealant System: Manufacturer's standard system consisting of pre-cured low modulus silicone extrusion, in sizes to fit joint widths indicated, combined with a neutral curing silicone sealant for bonding extrusions to substrates.
 - .2 Preformed Hollow Neoprene Gasket: Manufacturer's standard preformed polychloroprene elastomeric joint seal of the open cell compression type complying with ASTM D2628 and with requirements for size, profile and cross sectional design.
- .3 Bond Breaker: Pressure-sensitive plastic tape that will not bond to sealants.
- .4 Joint Cleaner: Provide a non-corrosive and non-staining type, compatible with joint forming materials and sealant in accordance with sealant manufacturer's recommendations
- .5 Primer: Provide in accordance with sealant manufacturer's recommendations.
- .6 Masking Tape: Non-absorbent type, non-staining, compatible with joint sealant and joint substrates.

2.9 Colours

- .1 Sealant Colours: Match colour of adjacent materials where visible, as selected by Contract Administrator, from manufacturer's standard colour range.

Part 3 Execution

3.1 Examination

- .1 Verification of Conditions: verify that conditions of substrate previously installed are acceptable for joint sealants installation in accordance with manufacturer's instructions.

- .1 Visually inspect substrate.
 - .2 Verify joint surfaces are dry and frost free.
 - .3 Verify substrates are without contaminants capable of interfering with sealant adhesion. Remove contaminants where occurring.
 - .4 Examine joint sizes and conditions to establish acceptable depth to width ratio for installation of backup materials and application of sealants.
 - .5 Verify joint widths are within the limits recommended by joint sealant manufacturer for applications indicated.
 - .6 Inform Contract Administrator of unacceptable conditions immediately upon discovery.
 - .7 Proceed with installation only after unacceptable conditions have been remedied.
- .2 Confirm and coordinate visual review requirements with the BECxA.

3.2 Surface preparation

- .1 Before commencing application of sealants test materials for indications of staining or poor adhesion.
- .2 Clean bonding joint surfaces of harmful contaminants including dust, rust, oil grease, and other matter which may impair adhesion.
- .3 Do not apply sealants to joint substrates 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 Prepare surfaces in accordance with manufacturer's directions.

3.3 Priming

- .1 Mask adjacent surfaces prior to priming and sealing where necessary to prevent staining.
- .2 Prime sides of joints in accordance with sealant manufacturer's instructions immediately applying sealant, except when manufacturer's instructions explicitly state priming is not required.
- .3 Prime all porous material (e.g. wood, masonry, concrete, ceramic or paver tile, etc).

3.4 Backup material

- .1 Provide backer rod as specified, to limit depth of sealant and to act as bond breaker at back of joint.
- .2 Install joint filler to achieve correct joint depth and shape, with approximately 30% compression.
- .3 Apply paper masking tape to back of joint to act as bond break where depth of joint does not permit the use of backer rod.
- .4 Ensure that no joints are formed which are bonded on adjacent sides where there is any possibility of movement.

3.5 Mixing

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

3.6 Expanding Foam Sealants

- .1 Install expanding foam sealants in accordance with manufacturer's instructions.
- .2 Coordinate installation with work of other trades to ensure foam sealants are installed before building joints are covered.
- .3 For expansion joints below grade in foundation walls and grade beams install as primary seal.
- .4 For expansion joints above grade in foundation walls, grade beams, exterior walls install as secondary seal with wet caulking as primary seal.
- .5 Where used as a secondary seal together with field applied wet caulking provide bond breaker tape or backer rod between foam sealant and caulking.
- .6 Size preformed foam sealant to suit joint depth and width allowing for proper compression of the material:
 - .1 Horizontal expansion and control joints below grade: 20%
 - .2 Vertical and horizontal joints in building façade: 25%
 - .3 Watertight joints: 20%
- .7 Use adhesives recommended by manufacturer, suitable for substrate and application.
- .8 Install in longest possible lengths. Keep number of joints to a minimum. Join individual strips by means of scarf joint, cut at approximately 30°.

3.7 Application

- .1 Sealant: Application: Apply sealants to recommendations of ASTM C1193, and in accordance with manufacturer's instructions, and as follows:
 - .1 Apply sealant within recommended temperature ranges. Consult manufacturer when sealant cannot be applied within recommended temperature range.
 - .2 Mask edges of joint where irregular surface or sensitive joint border exists to provide neat joint.
 - .3 For joints where movement is possible, apply backer rod to achieve a joint depth of one half the joint width but not less than 9 mm; for joints larger than 25 mm use a depth of 13 mm
 - .4 Apply sealant in a continuous beads.
 - .5 Apply sealant using gun with proper size nozzle.
 - .6 Fill voids and joints solid.
 - .7 Form sealant surface with a smooth full bead, without from ridges, wrinkles, sags, air pockets, embedded impurities.
 - .8 Tool exposed surfaces before skinning begins to give slightly concave shape.
 - .9 Ensure bead is solid, filling entire space between sides and bedding material, exerting sufficient pressure to obtain maximum bond, by allowing sealant to bulge out in advance of nozzle.
 - .10 Apply sealant within recommended temperature ranges. Consult manufacturer when sealant cannot be applied within recommended temperature range.
 - .11 Seal at all locations where dissimilar material meet.
- .2 Sealant Curing:

- .1 Cure sealants in accordance with sealant manufacturer's instructions.
- .2 Do not cover up sealants until after curing has completed.

3.8 Cleaning

- .1 Progress Cleaning: Clean in accordance with Section 01 74 00 - Cleaning.
 - .1 Clean adjacent surfaces immediately of excess primers and sealants.
 - .2 Remove excess and droppings, using recommended cleaners as work progresses.
 - .3 Remove masking tape after initial set of sealant.
- .2 Final Cleaning: Perform in accordance with Section 01 74 00 - Cleaning upon completion.

3.9 Protection

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

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 This section includes labour and materials required to complete conformance testing and reporting of openings.

1.2 RELATED SECTIONS

- .1 Section 08 11 10 – Metal Doors and Frames
- .2 Section 08 11 16 – Aluminum Doors and Frames
- .3 Section 08 36 16 – Sectional Overhead Doors
- .4 Section 08 44 13 – Glazed Aluminum Curtain Walls
- .5 Section 08 51 13 – Aluminum Windows
- .6 Section 08 80 00 – Glazing

1.3 MEASUREMENT AND PAYMENT

- .1 No measurement will be made under this section.
- .2 Building Envelope Testing; by Building Envelope Commissioning Authority, on behalf of the The City.
- .3 Co-ordinate visual review and testing frequency and locations with Building Envelope Commissioning Authority to facilitate review of multiple distinct building envelope elements and components during the same visit.
- .4 Costs incurred for additional testing for items not meeting the specifications including costs for transportation and for required modifications to be the responsibility of the Contractor.

1.4 REFERENCES

- .1 American Architectural Manufacturer’s Association (AAMA):
 - .1 AAMA 501.1-17 Standard Test Method for Water Penetration of Windows, Curtain Walls, and Doors Using Dynamic Pressure.
 - .2 AAMA 501.2-15 Quality Assurance and Diagnosis Water Leakage Field Check of Installed Storefronts, Curtain Walls, and Sloped Glazing Systems.
- .2 American Society for Testing and Materials (ASTM):
 - .1 ASTM E783-02(2018) Standard Test Method for Field Measurement of Air Leakage Through Installed Exterior Windows and Doors.
 - .2 ASTM E1105-15 Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform or Cyclic Static Air Pressure Difference.
 - .3 ASTM E1186-17 Standard Practices for Air Leakage Site Detection in Building Envelopes and Air Barrier Systems.
- .3 Canadian Standards Association (CSA International):

- .1 AAMA/WDMA/CSA 101/I.S.2/A440-17, NAFS - North American Fenestration Standard/Specification for Windows, Doors, and Skylights.
- .2 CSA A440SI-19 - Canadian Supplement to AAMA/WDMA/CSA 101/I.S.2/A440, NAFS - North American Fenestration Standard/Specification for Windows, Doors, and Skylights.

1.5 PRE-INSTALLATION CONFERENCE

- .1 Pre-work Conference in accordance with General Requirements.
- .2 Convene pre-work conference minimum five (5) working days prior to beginning site installation of mock-up.
- .3 Establish date, time and location of conference and notify parties concerned minimum five (5) working days before conference.
- .4 Construction Manager, Contract Administrator, Commissioning Authority, Building Envelope Commissioning Authority, and installers involved in work to be in attendance.
- .5 Agenda for conference:
 - .1 Verify project requirements, design, and intent of design.
 - .2 Review installation and substrate conditions.
 - .3 Co-ordinate with subtrades.
 - .4 Review manufacturer's installation instructions and warranty requirements.
 - .5 Review compatibility of materials.

1.6 SUBMITTALS

- .1 Submittals in accordance with Section 01 33 00 Submittal Procedures.
- .2 Submit test results from testing agency for each specified test, maximum one week following completion of testing.
- .3 The manufacturer for each component of the building envelope, including but not necessarily limited to all aluminum windows and associated adjacent wall assembly components, shall provide written verification that the proposed material and systems will meet or exceed the requirements of the Contract Documents.
- .4 Product Data
 - .1 Provide product data for:
 - .1 Section 08 11 10 – Metal Doors and Frames
 - .2 Section 08 11 16 – Aluminum Doors and Frames
 - .3 Section 08 36 16 – Sectional Overhead Doors
 - .4 Section 08 44 13 – Glazed Aluminum Curtain Walls
 - .5 Section 08 51 13 – Aluminum Windows
 - .6 Section 08 80 00 – Glazing
- .5 Shop Drawings
 - .1 Provide shop drawings for:
 - .1 Section 08 11 10 – Metal Doors and Frames

- .2 Section 08 11 16 – Aluminum Doors and Frames
- .3 Section 08 36 16 – Sectional Overhead Doors
- .4 Section 08 44 13 – Glazed Aluminum Curtain Walls
- .5 Section 08 51 13 – Aluminum Windows
- .6 Section 08 80 00 – Glazing

.6 Qualification Statements:

- .1 Submit proof of Testing Agency qualifications for review and acceptance:
 - .1 Proof of ISO 17025:2005 accreditation.
 - .2 Minimum five projects completed in last five years demonstrating experience in air leakage testing and water penetration testing of glazed aluminum curtain walls and aluminum windows in accordance with standards specified in this section.

1.7 TESTING AGENCY

- .1 Testing Agency:
 - .1 Third-party accredited testing laboratory.
 - .2 Accredited to ISO 17025:2005, General requirements for the competence of testing and calibration laboratories.

1.8 QUALITY ASSURANCE

- .1 Notify the Contract Administrator, Commissioning Authority, Building Envelope Commissioning Authority, and the Testing Agency in writing of the construction and testing schedule prior to the start of work.
 - .1 On-site testing and reporting of the Contractor's work shall be carried out by the Testing Agency identified by the Building Envelope Commissioning Authority.
 - .1 Provide a minimum seventy-two (72) hours' notice for openings to be reviewed by Building Envelope Commissioning Authority.
- .2 Field review/Testing frequency:
 - .1 On-Site Mock-Up Review and/or testing of openings:
 - .1 Review the mock-ups at completion milestones. Unless otherwise noted, mock-ups to be the first installation of the openings including thermal and moisture protection components.
 - .2 Provide a minimum seventy-two (72) hours' notice for openings to be reviewed by Building Envelope Commissioning Authority.
 - .2 On-Site Quality Assurance Review and/or Testing
 - .1 Visual review and testing of the installed openings including thermal and moisture protection components may be periodically completed at the discretion of the Building Envelope Commissioning Authority.
Provide a minimum seventy-two (72) hours' notice for openings to be reviewed by Building Envelope Commissioning Authority.

Part 2 Products

2.1 NOT USED

Part 3 Execution

3.1 METAL DOORS AND FRAMES

- .1 Provide a mock-up of metal doors and frames at a location identified by the Building Envelope Commissioning Authority prior to full system installation.
- .2 Visual review:
 - .1 Visual reviews shall be performed by the Building Envelope Commissioning Authority to determine general conformance with requirements of the Contract Documents.
 - .1 Once during Mock-up.
 - .2 Randomly during remainder of installation at the discretion of the Building Envelope Commissioning Authority.

3.2 ALUMINUM DOORS AND FRAMES

- .1 Provide a mock-up of aluminum doors and frames at a location identified by the Building Envelope Commissioning Authority prior to full system installation.
- .2 Visual review:
 - .1 Visual reviews shall be performed by the Building Envelope Commissioning Authority to determine general conformance with requirements of the Contract Documents.
 - .1 Once during Mock-up.
 - .2 Randomly during remainder of installation at the discretion of the Building Envelope Commissioning Authority.

3.3 SECTIONAL OVERHEAD DOORS

- .1 Provide a mock-up of sectional overhead doors at a location identified by the Building Envelope Commissioning Authority prior to full system installation.
- .2 Visual review:
 - .1 Visual reviews shall be performed by the Building Envelope Commissioning Authority to determine general conformance with requirements of the Contract Documents.
 - .1 Once during Mock-up.
 - .2 Randomly during remainder of installation at the discretion of the Building Envelope Commissioning Authority.

3.4 GLAZED ALUMINUM CURTAIN WALLS

- .1 Provide a mock-up of glazed aluminum curtain walls at a location identified by the Building Envelope Commissioning Authority prior to full system installation. Mock-up to be at least two (2) bays wide, full-height, and capturing both vertical and horizontal mullions, jambs, head, and sill conditions.
- .2 Visual review:
 - .1 Visual reviews shall be performed by the Building Envelope Commissioning Authority to determine general conformance with requirements of the Contract Documents.
 - .1 Frequency of visual reviews:
 - .1 Once during Mock-up.
 - .2 Randomly during remainder of installation at the discretion of the Building Envelope Commissioning Authority.
- .3 Testing: Mock-Up:
 - .1 Water leakage testing:
 - .1 Provide means for capture and disposal of water generated during the test.
 - .2 Water penetration testing under uniform static air pressure difference:
 - .1 Conduct water penetration testing in accordance with:
 - .1 AAMA 501.2.
 - .2 AAMA/WDMA/CSA 101/I.S.2/A440.
 - .3 CSA A440S1.
 - .3 Conduct water penetration testing as follows:
 - .1 Static pressure.
 - .2 Uniform method.
 - .3 Include the rough opening.
 - .2 Qualitative air leakage testing:
 - .1 Air leakage testing under pressurization or depressurization:
 - .1 Conduct air leakage testing in accordance with:
 - .1 ASTM E1186.
 - .2 AAMA/WDMA/CSA 101/I.S.2/A440.
 - .3 CSA A440S1.
 - .3 Test pressure in accordance with:
 - .1 Section 08 44 13.
 - .4 Frequency of Testing:
 - .1 One (1) during mock-ups.
 - .4 Testing: Functional performance:
 - .1 Water leakage testing:
 - .1 Provide means for capture and disposal of water generated during the test.
 - .2 Water penetration testing under static air pressure difference:
 - .1 Conduct water penetration testing in accordance with:

- .1 AAMA 501.1
- .2 AAMA/WDMA/CSA 101/I.S.2/A440.
- .3 CSA A440S1.
- .2 Test pressure in accordance with:
 - .1 Section 08 44 13.
- .3 Frequency of Testing:
 - .1 One (1) full day of testing covering as much area as possible.

3.5 ALUMINUM WINDOWS

- .1 Provide mock-ups of aluminum windows at locations identified by the Building Envelope Commissioning Authority prior to full system installation.
 - .1 Include all detailing at head, jambs, mullions, and sill, including waterproofing, air sealing, sealants, flashings, and any other detailed assembly components.
- .2 Visual review:
 - .1 Visual reviews shall be performed by the Building Envelope Commissioning Authority to determine general conformance with requirements of the Contract Documents.
 - .1 Frequency of visual reviews:
 - .1 Once during Mock-up.
 - .2 Randomly during remainder of installation at the discretion of the Building Envelope Commissioning Authority.
- .3 Testing: Mock-Up and Functional Performance:
 - .1 Water leakage testing:
 - .1 Provide means for capture and disposal of water generated during the test.
 - .2 Water penetration testing under uniform or cyclic static air pressure difference:
 - .1 Conduct water penetration testing in accordance with:
 - .1 ASTM E1105.
 - .2 AAMA/WDMA/CSA 101/I.S.2/A440.
 - .3 CSA A440S1.
 - .3 Conduct water penetration testing as follows:
 - .1 Static pressure.
 - .2 Cyclic method.
 - .3 Include the rough opening.
 - .2 Quantitative air leakage testing:
 - .1 Air leakage testing under pressurization and depressurization:
 - .1 Conduct air leakage testing in accordance with:
 - .1 ASTM E783.
 - .2 AAMA/WDMA/CSA 101/I.S.2/A440.
 - .3 CSA A440S1.
 - .3 Qualitative air leakage testing:

- .1 Air leakage testing under pressurization or depressurization:
 - .1 Conduct air leakage testing in accordance with:
 - .1 ASTM E1186.
 - .2 AAMA/WDMA/CSA 101/I.S.2/A440.
 - .3 CSA A440S1.
- .4 Test pressure in accordance with:
 - .1 Section 08 51 13.
- .5 Frequency of Testing:
 - .1 One (1) during Mock-up of Aluminum Windows at the Renovation.
 - .2 One (1) during Mock-up of Aluminum Windows at the Addition.
 - .3 One (1) additional unit randomly selected during remainder of installation.

.4

3.6 ANALYSIS AND CORRECTIVE PROCEDURES

- .1 Repair all damages from testing.
- .2 Remediate non-conforming work identified during visual reviews and testing.
- .3 Do not cover any remediated work until reviewed by the Building Envelope Commissioning Authority, or until the Building Envelope Commissioning Authority has reviewed proof of remediation.
- .4 Re-testing of remediated work shall be at the discretion of the Building Envelope Commissioning Authority.
- .5 Costs for repairs, remediation of non-conforming work, and re-testing are the responsibility of the Contractor. No additional costs to be submitted to the City for repairs or testing.

3.7 REPORTING

- .1 Prepare reports in accordance with the specified test methods.
- .2 Reports to include modifications and repairs made to the test specimen.
- .3 Submit reports within 5 working days following field observations and testing.

END OF SECTION

Part 1 General

1.1 Related requirements

- .1 Section 01 33 00 - Submittal Procedures
- .2 Section 01 61 00 - Common Product Requirements
- .3 Section 07 21 29.03 – Sprayed Insulation – Polyurethane Foam
- .4 Section 08 71 00 - Door Hardware
- .5 Section 08 80 00 - Glazing
- .6 Section 09 91 00 - Painting

1.2 Reference standards

- .1 ASTM International (ASTM):
 - .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 B29-19, Standard Specification for Refined Lead
 - .3 ASTM B749-20, Standard Specification for Lead and Lead Alloy Strip, Sheet and Plate Products
- .2 Canadian General Standards Board (CGSB):
 - .1 CAN/CGSB-1.181-99, Ready-Mixed Organic Zinc-Rich Coating
 - .2 CGSB 41-GP-19Ma-84, Rigid Vinyl Extrusions for Windows and Doors
- .3 CSA Group (CSA):
 - .1 CSA G40.20-13/G40.21-, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel
 - .2 CSA W59-18, Welded Steel Construction (Metal Arc Welding)
- .4 Canadian Steel Door Manufacturers' Association (CSDMA):
 - .1 CSDMA, Recommended Specifications for Commercial Steel Doors and Frames, 2000
 - .2 CSDMA, Selection and Usage Guide for Commercial Steel Doors, 2009
- .5 National Fire Protection Association (NFPA):
 - .1 NFPA 80-2013, Standard for Fire Doors and Fire Windows
 - .2 NFPA 252-2022, Standard Methods of Fire Tests of Door Assemblies
- .6 South Coast Air Quality Management District (SCAQMD), California State:
 - .1 SCAQMD Rule 1113-2016, Architectural Coatings
 - .2 SCAQMD Rule 1168-2017, Adhesives and Sealants Applications
- .7 ULC Standards (ULC):
 - .1 CAN/ULC-S701-17, Standard for Thermal Insulation, Polystyrene, Boards and Pipe Covering

- .2 CAN/ULC-S702-14, Standard for Thermal Insulation, Mineral Fibre, for Buildings
- .3 CAN/ULC-S704-11, Standard for Thermal Insulation, Polyurethane and Polyisocyanurate Boards, Faced
- .4 CAN/ULC-S104-15, Standard Method for Fire Tests of Door Assemblies
- .5 CAN/ULC-S105-16, Standard Specification for Fire Door Frames Meeting the Performance Required by CAN/ULC-S104

1.3 System description

- .1 Design Requirements:
 - .1 Steel fire rated doors and frames: labelled and listed by an organization accredited by Standards Council of Canada in conformance with CAN/UC-S104 for ratings specified or indicated.
 - .2 Provide fire labelled frames for openings requiring fire protection ratings. Test products in conformance with CAN/ULC-S104, and listed by nationally recognized agency having factory inspection services.

1.4 Action and informational submittals

- .1 Provide submittals in accordance with Section Section 01 33 00 - Submittal Procedures.
- .2 Submit product data.
- .3 Submit shop drawings.
 - .1 Indicate each type of door, material, steel core thicknesses, mortises, reinforcements, location of exposed fasteners, openings, glazed, arrangement of hardware fire rating and finishes.
 - .2 Indicate each type frame material, core thickness, reinforcements, glazing stops, location of anchors and exposed fastenings , reinforcing, fire rating and finishes.
 - .3 Include schedule identifying each unit, with door marks and numbers relating to numbering on drawings and door schedule.
 - .4 Submit test and engineering data, and installation instructions.
 - .5 Submit shop drawings sealed by a professional engineer licensed to practice in the Province of Manitoba, Canada.
- .4 Sustainable Design Submittals:
 - .1 LEED submittals: in accordance with Section 01 35 20 - LEED Sustainable Requirements.
 - .2 Construction Waste Management: Refer to Section 01 74 19 - Waste Management and Disposal.
 - .3 Material product attribute documentation: Refer to Product Check Sheet as listed in 01 35 20 - LEED Sustainable Requirements to determine applicable type of documentation required for each product.
 - .4 Low-Emitting Materials:
 - .1 Submittals are required for any sealants, adhesives, paints, coatings, composite wood, flooring, wall panels, insulation or ceiling components within the inner most weather proofing barrier.

- .2 Refer to Product Check Sheet as listed in 01 35 20 LEED Sustainable Requirements to determine applicable type of documentation required for each product.
- .5 Confirm and coordinate submittal requirements with the BECxA.

1.5 Quality Assurance

- .1 Confirm and coordinate visual review, pre-installation conference, and mock-up requirements with the BECxA.

1.6 Delivery, storage, and handling

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.
 - .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 19 - Construction Waste Management and Disposal.

Part 2 Products

2.1 Materials

- .1 Hot dipped galvanized steel sheet: to ASTM 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 A653M, ZF75.
- .3 Composites: balance of core materials used in conjunction with lead: in accordance with manufacturers' proprietary design.
- .4 Coating Designations:
 - .1 Exterior Doors and Frames: Coating designation Z275 (G90).
 - .2 Interior Doors and Frames: Coating designation ZF120 (A40).

2.2 Door core materials

- .1 Honeycomb construction:
 - .1 Structural small cell, 24.5 mm maximum kraft paper 'honeycomb', weight: 36.3 kg per ream minimum, density: 16.5 kg/m³ minimum sanded to required thickness.
- .2 Polyurethane construction:
 - .1 Closed-cell polyurethane, R-11 insulation with a density of 24.03 kg/m³ (1.5pcf)

2.3 Adhesives

- .1 Honeycomb cores and steel components: heat resistant, spray grade, resin reinforced neoprene/ polychloroprene based, low viscosity, contact cement.
 - .1 Adhesive: maximum VOC content 50 g/L SCAQMD Rule 1168.
- .2 Polystyrene and polyurethane cores: heat resistant, epoxy resin based, low viscosity, contact cement.
- .3 Lock-seam doors: fire resistant, resin reinforced polychloroprene, high viscosity, sealant/adhesive.

2.4 Primer

- .1 Touch-up prime CAN/CGSB-1.181
 - .1 Maximum VOC limit 50 g/L GC-03.

2.5 Paint

- .1 Site paint steel doors and frames in accordance with Section 09 91 00 - Painting. Protect weatherstrips from paint. Provide final finish free of scratches or other blemishes.
 - .1 Maximum VOC emission level 50 g/L SCAQMD Rule 1113.

2.6 Accessories

- .1 Door silencers: single stud rubber/neoprene type.
- .2 Top and bottom caps: rigid polyvinylchloride extrusion conforming to CGSB 41-GP-19Ma.
- .3 Frame thermal breaks: rigid polyvinylchloride extrusion conforming to CGSB 41-GP-19Ma.
- .4 Fabricate glazing stops as formed channel, minimum 16 mm height, accurately fitted, butted at corners and fastened to frame sections with counter-sunk oval head sheet metal screws.
- .5 Fabricate glazing stops as formed channel, minimum 16 mm height, accurately fitted, butted at corners and fastened to frame sections with counter-sunk oval head sheet metal screws.
- .6 Door bottom seal: in accordance with Section 08 71 00 .
- .7 Metallic paste filler: to manufacturer's standard.
- .8 Fire labels: metal riveted.
- .9 Sealant: in accordance with Section 07 92 00.
- .10 Glazing: in accordance with Section 08 80 00.
- .11 Make provisions for glazing as indicated and provide necessary glazing stops.
 - .1 Provide removable stainless steel glazing beads for use with glazing tapes and compounds and secured with countersunk stainless steel screws.
 - .2 Design exterior glazing stops to be tamperproof.

2.7 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: 2.0 mm (14 gauge) welded type construction, insulated.
- .4 Interior frames: 2.0 mm (14 gauge) welded type construction.
- .5 Blank, reinforce, drill and tap frames for mortised, templated hardware, and electronic hardware using templates provided by finish hardware supplier. Reinforce frames for surface mounted hardware.
- .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.

2.8 Frame anchorage

- .1 Provide appropriate anchorage to floor and wall construction.
- .2 Locate each wall anchor immediately above or below each hinge reinforcement on hinge jamb and directly opposite on strike jamb.
- .3 Provide 2 anchors for rebate opening heights up to 1520 mm and 1 additional anchor for each additional 760 mm of height or fraction thereof.
- .4 Locate anchors for frames in existing openings not more than 150 mm from top and bottom of each jambs and intermediate at 660 mm on centre maximum.

2.9 Frames: welded type

- .1 Welding in accordance with CSA W59
- .2 Accurately mitre or mechanically joint frame product and securely weld on inside of profile.
- .3 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.
- .7 Fabricate frame products for openings.
- .8 Securely attach lead to inside of frame profile from return to jamb soffit (inclusive) on door side of frame only.

2.10 Door fabrication general

- .1 Doors: swing type, flush, with provision for glass and/or louvre openings as indicated.
- .2 Exterior doors: insulated, polyurethane construction.
- .3 Interior doors: honeycomb construction
- .4 Fabricate doors with longitudinal edges welded. Seams: grind welded joints to a flat plane, fill with metallic paste filler and sand to a uniform smooth finish.
- .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 conformance with CAN/ULC-S104 and list by nationally recognized agency having factory inspection service and construct as detailed in Follow-Up Service Procedures/Factory Inspection Manuals issued by listing agency to individual manufacturers.
- .10 Manufacturer's nameplates on doors are not permitted.

2.11 Door construction

- .1 Exterior Doors: Form face sheets for exterior doors from 1.6 mm (16 gauge) sheet steel with polyurethane core laminated under pressure to face sheets.
- .2 Interior Doors: Form face sheets for interior doors from 1.6 mm (16 gauge) sheet steel with honeycomb core laminated under pressure to face sheets.

2.12 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 polyvinylchloride 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 Manufacturer's Instructions

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

3.2 Installation 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

3.3 Examination

- .1 Confirm and coordinate visual review requirements with the BECxA.

3.4 Frame installation

- .1 Set frames plumb, square, level and at correct elevation.
- .2 Secure anchorages and connections to adjacent construction.
- .3 Coordinate with masonry, gypsum board and concrete wall construction for anchor placement and throat depths.
- .4 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.

- .5 Make allowances for deflection of structure to ensure structural loads are not transmitted to frames.
- .6 Caulk perimeter of frames between frame and adjacent material.

3.5 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 and thresholds as follows.
 - .1 Hinge side: 1.0 mm.
 - .2 Latchside and head: 1.5 mm.
 - .3 Finished floor, top of carpet and thresholds: 13 mm.
- .3 Adjust operable parts for correct function.
- .4 Install louvres.

3.6 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.

3.7 Glazing

- .1 Install glazing for doors and frames in accordance with Section 08 80 00 - Glazing.

END OF SECTION

Part 1 General

1.1 Related requirements

- .1 Section 07 92 00 - Joint Sealants
- .2 Section 08 71 00 - Door Hardware
- .3 Section 08 44 13 Glazed Aluminum Curtain Walls: applied stops for installation of aluminum doors in curtain wall framing
- .4 Section 08 80 00 - Glazing
- .5 Electrical specifications: power supply for electric/electronic hardware

1.2 Reference standards

- .1 Aluminum Association (AA)
 - .1 DAF 45, Designation System for Aluminum Finishes
- .2 Canadian General Standards Board (CGSB):
 - .1 CAN/CGSB-12.1- 2017 , Safety Glazing
 - .2 CAN/CGSB-12.20-M89, Structural Design of Glass for Buildings
- .3 CSA Group (CSA):
 - .1 AAMA/WDMA/CSA 101/I.S.2/A440- 11 , NAFS - North American Fenestration Standard/Specification for Windows, Doors, and Skylights
 - .2 CSA A440S1- 17 , Canadian Supplement to AAMA/WDMA/CSA A101/I.S.2/A440- 11 , NAFS - North American Fenestration Standard/Specification for Windows, Doors, and Skylights
 - .3 CSA A440.2- 14 , Fenestration Energy Performance
 - .4 CAN/CSA A440.4- 07 , Window, Door and Skylight Installation
 - .5 CSA G40.20/G40.21- 13 , General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel
 - .6 CSA G164- 18 , Hot Dip Galvanizing of Irregularly Shaped Articles
- .4 Fenestration & Glazing Industry Alliance (FGIA) (formerly American Architectural Manufacturers Association (AAMA)):
 - .1 AAMA 609/610- 15 , Cleaning and Maintenance Guide for Architecturally Finished Aluminum

1.3 Administrative requirements

- .1 Pre-Installation Meetings: Hold meeting 1 week before beginning work of this Section and on-site installation, with Contractor, Subcontractor, and Contract Administrator in accordance with Section 01 31 19 - Project Meetings to:
 - .1 Verify project requirements,
 - .2 Review installation and substrate conditions,
 - .3 Coordinate with other Subcontractors, and

- .4 Review manufacturer's installation instructions and warranty requirements.
- .2 Sequencing: Comply with manufacturer's recommendations for sequencing construction operations.

1.4 Action and informational submittals

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures .
- .2 Product Data:
 - .1 Submit manufacturer's instructions, product literature and data sheets for doors and frames and include product characteristics, performance criteria, physical size, finishes, and limitations.
 - .1 Indicate exterior door and frame performance ratings to AAMA/WDMA/CSA 101/I.S.2/A440 including positive design pressure, negative design pressure, water penetration resistance test pressure, and Canadian air infiltration and exfiltration level.
 - .2 Submit WHMIS SDS.
- .3 Shop Drawings:
 - .1 Shop drawings to be sealed by an engineer licensed to practice in the Province of Manitoba, Canada.
 - .2 Indicate materials and profiles and include scaled details of components for each type of door and frame. Indicate:
 - .1 Interior and exterior trim.
 - .2 Connections with adjacent construction, including air and vapour membranes.
 - .3 Connections between combination units.
 - .4 Elevations of units.
 - .5 Core thicknesses of components.
 - .6 Type and location of exposed finishes, method of anchorage, number of anchors, supports, reinforcement, and accessories.
 - .7 Location of sealants.
 - .8 Each type of door system including location.
 - .9 Arrangement of reinforcing for hardware and joints.
 - .10 Arrangement of hardware and required clearances.
 - .11 Locations of manufacturer's nameplates.
- .4 Sustainable Design Submittals: .
 - .1 LEED Canada submittals: in accordance with Section 01 35 20 - LEED Sustainable Requirements.
 - .2 Construction Waste Management: Refer to Section 01 74 19 - Construction Waste Management and Disposal.
 - .3 Material product attribute documentation: Refer to Product Check Sheet as listed in 01 35 20 – LEED Sustainable Requirements to determine applicable type of documentation required for each product.
 - .4 Low-Emitting Materials:

- .1 Submittals are required for any sealants, adhesives, paints, coatings, composite wood, flooring, wall panels, insulation or ceiling components within the inner most weather proofing barrier.
- .2 Refer to Product Check Sheet as listed in 01 35 20 – LEED Sustainable Requirements to determine applicable type of documentation required for each product.
- .5 Confirm and coordinate submittal requirements with the BECxA.

1.5 Closeout submittals

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals .
- .2 Operation and Maintenance Data: Submit maintenance data for cleaning of aluminum finishes and maintenance of operable hardware, and incorporate into manual.
- .3 Warranty Documentation: Submit manufacturer's warranty documents.

1.6 Quality assurance

- .1 Qualifications:
 - .1 Manufacturer: Obtain aluminum doors and frames from a single manufacturer.
 - .2 Installers: Three Five years of experience with installation of aluminum doors and frames of similar complexity and scope to that required for the Project.
 - .3 Testing Agencies: Provide doors and frames under label service program of a testing agency acceptable to authorities having jurisdiction (AHJ).
- .2 Certifications: Product certificates signed by manufacturer certifying materials comply with specified performance characteristics, and criteria and physical requirements.
- .3 Test and Evaluation Reports: Submit test reports from approved independent testing laboratories certifying compliance with specifications, for
 - .1 airtightness,
 - .2 watertightness,
 - .3 wind load resistance, and
 - .4 condensation resistance.
- .4 Confirm and coordinate visual review, mock-up, and pre-installation conference requirements with the BECxA.

1.7 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 with manufacturer's labels.
 - .1 Apply a temporary protective coating to finished surfaces. Use easy to remove, residue-free coatings.
 - .2 Leave protective covering in place until final cleaning of building .
- .3 Storage and Handling Requirements:
 - .1 Store materials off ground indoors in dry location and in accordance with manufacturer's recommendations in a clean, well-ventilated area to prevent sagging, bowing, or twisting.

- .2 Store and protect aluminum doors and frames from nicks, scratches, and blemishes.

1.8 Site conditions

- .1 Site Measurements: Before fabrication, verify actual dimensions of openings by measuring on-site and indicate actual measurements on shop drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
- .2 Established Dimensions: When site measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating doors and frames without site measurements. Coordinate site construction to ensure that actual site dimensions correspond to established dimensions.

1.9 Warranty

- .1 Provide a five (5) year warranty to include coverage for complete system for failure to meet specified requirements, including coverage for insulating glass units.

Part 2 Products

2.1 Manufacturers

- .1 Curtainwall framing; nominal 2.5" (63.5 mm) sightline.
 - .1 Aluminum Doors:
 - .1 Exterior Doors:
 - .1 Alumicor ThermaPorte 7700 Series, T600A with 12" (305mm) Bottom Rail. Clear anodized finish.
 - .2 Or approved equal.
 - .2 Interior Doors:
 - .1 Alumicor Canadiana Series, 600A with 12" (305mm) Bottom Rail. Clear anodized finish.
 - .2 Or approved equal.
 - .2 Aluminum frames:
 - .1 Interior:
 - .1 Alumicor FlushGlaze TL 1800 series, 1.75" (44.5mm) framing. Black anodized finish.
 - .2 Or approved equal.
- .2 Doors and frames by same manufacturer.

2.2 Materials

- .1 Aluminum Extrusions: To Aluminum Association alloy AA6063- T5 or T6 anodizing quality.
- .2 Sheet and Plate Aluminum: To ASTM B209/B209M , and Aluminum Association alloy AA1100 H14 or AA5005 H32 or H34 , anodizing quality.
- .3 Extruded Bars, Rods, Profiles, and Tubes: To ASTM B221 , and ANSI H35.1/H35.1M , AA6063-T5 or T6, anodizing quality.

- .4 Extruded Structural Pipe and Tubes: To ASTM B429/B429M and ANSI H35.1/H35.1M , AA6061-T6 or AA6063-T6, anodizing quality.
- .5 Steel Reinforcement: To CSA G40.20/G40.21 , grade 300 W, anodizing quality.
- .6 Fasteners: stainless steel 300 or 400 series. Of sufficient size and quantity for perform their intended function. Head colour of exposed fasteners to match frame finish. Use stainless steel screws for assembly of window components and for installation of finished units. No substitutes.
- .7 Door bumpers: black neoprene.
- .8 Isolation coating: alkali resistant bituminous paint.
- .9 Foam sealant: spray-applied polyurethane foam sealant, CFC and urea formaldehyde free, non-shrinking after cure. For filling shim space around perimeter frames. Ener-Foam, Insta-Seal or equal.
- .10 Sealants: as specified in Section 07 92 00 - Joint Sealing and 01 35 21 LEED Sustainable Requirements.

2.3 Door hardware

- .1 As specified in Section 08 71 00 - Door Hardware and Door Hardware Schedule.
- .2 Weather stripping: replaceable metal backed wool pile.
- .3 Door bottom seal: adjustable door seal of anodized extruded aluminum frame and vinyl weather seal, surface mounted with drip cap, closed ends.

2.4 Glass and Glazing materials

- .1 Glass and insulating glass units: as specified in Section 08 80 00 – Glazing.
- .2 Glazing gaskets, glazing tape, splines, spacer blocks as recommended by door and frame manufacturer.
- .3 Glazing sealants: as recommended by door and frame manufacturer.
- .4 Primer-sealers and cleaners: to glass manufacturer's standard.
- .5 Affix manufacturer's identification labels to all insulating glass units. Labels shall identify glass type and glass thickness of each pane. Do not remove identification labels until authorized by Contract Administrator.

2.5 Finishes

- .1 Aluminum Finishes:
 - .1 Clear Anodic Finish: To AAMA 611 :
 - .1 Class I, minimum 0.018 mm thick , AA-M10C21A41 or AA-M45C22A41

2.6 Fabrication

- .1 Doors and framing to be by same manufacturer.
- .2 Fabricate doors and frames with hardware installed to maximum extent practical.
- .3 Provide structural steel reinforcement as required.

- .4 Fit joints tightly and secure mechanically. Reinforce mechanically-joined corners of doors to produce sturdy door unit. Fabricate framing members with straight profiles, without distortions or defects and with mitered or coped corners.
- .5 Framing systems to allow condensation occurring within framing to migrate to the exterior.
- .6 Conceal fastenings.
- .7 Provide a minimum 22 -mm bite for insulating glazed units. Isolate glass and glazing from framing members.
- .8 Mortise, reinforce, drill, and tap doors, frames and reinforcements to receive hardware using templates indicated in Section 08 71 00 - Door Hardware .
- .9 Locate operating devices (e.g., handles, pulls, latches, and locks) mounted between 900 mm and 1100 mm from the floor.

2.7 Accessories

- .1 Anti-Rotational Device: Manufacturer's recommended extruded aluminum channel reinforced nylon channel high density board insulation , designed to permanently connect exterior wall assembly air membrane with pressure to aluminum frame.
- .2 Fasteners: Aluminum cadmium plated steel or stainless steel .
 - .1 Self-locking type where fasteners may be subject to loosening from thermal or structural movements, wind loads, or other vibrations.
 - .2 Provide slip joint construction at movement joints of materials.
 - .3 Where visible fasteners are unavoidable, and Departmental Representative DCC Representative Contract Administrator has accepted specific visible fastener locations, fastener finish to match adjacent material.
- .3 Anchors: 3-way adjustable type that accommodate fabrication and installation tolerances.
- .4 Isolation Coating: Alkali resistant bituminous paint Epoxy resin type
- .5 Sealant Systems: In accordance with Section 07 92 00 - Joint Sealants .
 - .1 Sealant Colours: To match adjacent surface.

Part 3 Execution

3.1 Examination

- .1 Verification of Conditions: Verify conditions of substrates previously installed are acceptable for beginning installation of aluminum doors and frames in accordance with manufacturer's instructions.
 - .1 Visually inspect substrates.
 - .2 Proceed with installation only after unacceptable conditions have been remedied.
- .2 Confirm and coordinate visual review requirements with the BECxA.

3.2 Installation

- .1 Install exterior aluminum doors and frames to CAN/CSA A440.4 .
- .2 Set frames plumb, square, and level at correct elevation in alignment with adjacent work and without warp or racking.

- .3 Anchor frames securely and rigidly.
- .4 Install doors and hardware in accordance with hardware templates and manufacturer's instructions.
- .5 Permanently isolate aluminum from direct contact with dissimilar metals, concrete, and masonry.
- .6 Make allowances for deflection of building structure to ensure structural loads are not transmitted to frames.
- .7 Glaze aluminum doors and frames in accordance with Section 08 80 00 - Glazing .
- .8 Provide weathertight joint sealant system at outside of frames in exterior walls.
- .9 Provide airtight joint sealant system inside of frames in exterior walls.
- .10 Apply sealants in accordance ASTM C1193 and Section 07 92 00 - Joint Sealants .
- .11 Adjust door components for a smooth and quiet operation with continuous contact with door edge seals.

3.3 Sealing

- .1 Fill shim space between exterior frames and building components with foam sealant to maintain continuity of thermal barrier.
- .2 Seal joints between perimeter frames and adjacent construction. Apply sealant around full perimeter of frame, on both the interior and exterior of building. Provide weather tight seal at outside and air/vapour seal at inside.
- .3 Apply sealants in accordance with Section 07 92 00 - Joint Sealing.

3.4 Tolerances

- .1 Limit variation from true location and plane to 1/8" (3 mm) in 12'-0" (3660 mm).
- .2 Limit difference between diagonal measurements to 1/8" (3 mm).

3.5 Cleaning

- .1 Progress Cleaning: Clean doors, frames, and glazing in accordance with Section 01 74 00 - Cleaning .
 - .1 Clean aluminum components in accordance with AAMA 609/610 .
 - .2 Clean as soon as possible after installation to remove construction debris and dirt.
 - .3 Clean aluminum with damp rag and manufacturer recommended non-abrasive cleaner.
 - .4 Remove excess primer, sealants, and epoxy.
- .2 Final Cleaning: Perform in accordance with Section 01 74 00 - Cleaning .
 - .1 Clean glass and glazing materials with approved non-abrasive cleaner.
- .3 Waste Management: Perform in accordance with Section 01 74 19 - Construction Waste Management and Disposal .

3.6 Protection

- .1 Protect installed products and components from damage during construction. Mark glass which may be subject to accidental breakage by Subcontractors. Use temporary markings that after removal do not stain or otherwise leave a perceptible effect.

- .2 Repair damage to adjacent materials caused by aluminum door and frame installation.

END OF SECTION

Part 1 General

1.1 Related requirements

- .1 Section 01 31 19 - Project Meetings
- .2 Section 01 33 00 - Submittal Procedures
- .3 Section 01 61 00 - Common Product Requirements
- .4 Section 01 74 00 - Cleaning
- .5 Section 01 78 00 - Closeout Submittals
- .6 Section 09 21 16 - Gypsum Board Assemblies
- .7 Section 09 30 13 - Ceramic Tiling
- .8 Section 09 65 19 - Resilient Tile Flooring

1.2 Reference standards

- .1 ASTM 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 A780/A780M-20, Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
 - .3 ASTM A1008/A1008M-13, Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable
 - .4 ASTM A666-15, Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar
 - .5 ASTM B221-20, Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
- .2 National Fire Protection Association (NFPA):
 - .1 NFPA 80-2013, Fire Doors and Other Opening Protectives
- .3 Specialty Steel Industry of North America (SSINA):
 - .1 Special Finishes for Stainless Steel, current edition
- .4 ULC Standards (ULC):
 - .1 CAN/ULC-S104-15, Standard Method for Fire Tests of Door Assemblies

1.3 Section includes

- .1 Non-rated access doors in walls and partitions
- .2 Fire-protection rated access doors in walls and partitions
- .3 Non-rated access doors in ceilings

1.4 Administrative requirements

- .1 Coordination:

- .1 Coordinate framing dimensions and installation of access doors and panels in walls and partitions with 09 21 16 - Gypsum Board Assemblies.
- .2 Coordinate work of mechanical and electrical Subcontractors to avoid , where possible, locating access doors and panels in ceilings of the following rooms:
Vestibule 100, Lobby 101, Vestibule 102
- .2 Pre-installation Meetings: Hold a meeting in accordance with Section Section 01 31 19 - Project Meetings:
 - .1 Attended by Contractor, Subcontractor responsible for this Section, mechanical Subcontractor, Contract Administrator, and other Subcontractors affected by work of this Section.
 - .2 Agenda: Discuss locations and types of access doors and panels, and obtain Contract Administrator's acceptance of doors and panels in prominent locations (e.g., feature ceilings).

1.5 Action and informational submittals

- .1 Submit in accordance with Section Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's product data for each type of access door and panel components. Indicate door designation, type and model, product characteristics, fabrication details, dimensions, latching and locking types, sound transmission class rating, and finishes.
 - .2 Submit WHMIS SDS.
- .3 Shop Drawings:
 - .1 Submit a shop drawing of reflected ceiling plan for room s, drawn to scale. Indicate all ceiling-mounted items, and items penetrating ceiling, including access doors and panels, diffusers , grilles , light fixtures , emergency lighting , sprinkler heads.
 - .2 Submit access door and panel schedule. Include types, specific room numbers, dimensions, latching and locking types.
- .4 Manufacturers' Instructions: Submit manufacturer's installation instructions.
- .5 Sustainable Design Submittals: Submit in accordance with Section 01 35 20 - LEED Sustainable Requirements.

1.6 Closeout submittals

- .1 Submit in accordance with Section Section 01 78 00 - Closeout Submittals.
- .2 Warranty Documentation: Submit manufacturer's warranty.

1.7 Quality assurance

- .1 Qualifications:
 - .1 Manufacturer: Five years manufacturing access doors similar to those required for this Project. Obtain each type of access door and panel from a single manufacturer.
 - .2 Installers: Two years of experience installing access doors and panels of similar complexity and scope to that required for the Project.

1.8 Delivery, storage, and handling

- .1 Perform in accordance with Section Section 01 61 00 - Common Product Requirements.
- .2 Delivery and Acceptance Requirements: Deliver materials to site in original factory packaging with manufacturer's labels.
 - .1 Provide temporary protection during delivery and site storage to prevent distortion, surface damage, and rust.
 - .2 After arrival on site, immediately remove wet wrapping materials, inspect doors and panels for damage, and notify delivery company and supplier if damage is found.
 - .3 Minor damage may be repaired if refinished products match new work, and are acceptable to Contract Administrator.
- .3 Storage and Handling Requirements:
 - .1 Store materials off ground, in a dry interior location away from direct sunlight, in a way that prevents sagging, bowing, or twisting, and in accordance with manufacturer's recommendations.
 - .2 Store and protect access doors and panels from nicks, scratches, distortion and rust.
 - .3 Apply a temporary protective coating or film to stainless steel finished surfaces. Leave protective coating/film in place until final cleaning of building.

1.9 Site conditions

- .1 Site Measurements: Before fabrication, verify actual dimensions of openings by measuring on site, and indicate actual measurements on shop drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
- .2 Established Dimensions: When site measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating access doors and panels without site measurements. Coordinate site construction to ensure that actual site dimensions correspond to established dimensions.

1.10 Warranty

- .1 Manufacturer's Warranty: One year warranty, free from defects in material and manufacturing.

Part 2 Products

2.1 Regulatory requirements

- .1 Rated Access Doors and Panels: At fire-resistance rated wallassemblies, provide access door and panel assemblies (comprising doors, frames, hardware and other components of the Closure) complying with CAN/ULC-S104 or NFPA 80 with a fire-protection rating to suit the surrounding assembly.
 - .1 Labelled and listed by UL, ULC, ITS Warnock Hersey, or other inspecting agency acceptable to authority having jurisdiction (AHJ). Affix appropriate label to each unit indicating the labelling requirement.

2.2 Materials

- .1 Steel Sheet: To ASTM A1008/A1008M
- .2 Galvanized Steel: To ASTM A653/A653M
- .3 Stainless Steel: To ASTM A666, Type 304
- .4 Aluminum: To ASTM B221, extruded aluminum alloy, 6063-T6

2.3 Access doors - non-rated walls and partitions

- .1 Mounting Type: Flush-mounted with only frame edge and door visible.
- .2 Clear Opening Size:
 - .1 For body entry: minimum 915 x 915mm nominal
 - .2 For hand entry: minimum 300 x 300mm nominal
- .3 Door
 - .1 Material:
 - .1 Steel, minimum 1.6mm thick, powder coat paint, colour to match wall finish.
 - .2 Door Corners: 90 degree corners.
 - .3 STC-Rated Assemblies: Acoustic insulation applied to rear of access door.
- .4 Frame:
 - .1 Material:
 - .1 Steel, minimum 1.6mm, same finish as door.
 - .2 STC-Rated Assemblies: Continuous gasket at frame perimeter to maintain STC value of wall/partition assembly.
 - .3 Expanded galvanized metal lath perimeter wings where installed in plaster, except veneer plaster.
- .5 Accessories:
 - .1 Hinges:
 - .1 Galvanized steel, concealed hinge, 120 degree swing. Removable hinge pin to allow removal of door panel from frame, with safety cable to secure door to frame.
 - .2 Hinge Location: To manufacturer's standard.
 - .2 Lock/Latch Devices:
 - .1 Flush, tamper-resistant torx head cam latch.

2.4 Access doors - non-rated in ceilings

- .1 Mounting Type: Recessed-mounted with allowance for gypsum board insert with thickness matching adjacent walls
 - .1 Clear Opening Size: 915mm x 915mm.
 - .2 Door: Mineral fiber insulation core, insulated sandwich type construction, downward opening.
- .2 Door:

- .1 Material:
 - .1 Steel, minimum 1.6mm thick, powder coat paint, colour to match wall finish.
- .2 Door Corners: 90 degree corners
- .3 Frame:
 - .1 Steel, minimum 1.6mm thick, same finish as door.
- .4 Accessories:
 - .1 Hinge: Continuoushinge with pin. Automatic closing device.
 - .2 Lock: Self latching , mortise type with provision for fitting flush lock cylinder. Lock cylinder specified in Section [08 71 00 - Door Hardware].

2.5 Access doors - fire-rated in walls and partitions

- .1 Mounting Type: Flush-mounted with only frame edge and door visible
- .2 Clear Opening Size:
 - .1 For body entry: minimum 915 x 915mm nominal
 - .2 For hand entry: minimum 300 x 300mm nominal
- .3 Door:
 - .1 Material:
 - .1 Steel, minimum 1.6mm thick, powder coat paint, colour to match wall finish.
 - .2 Door Corners: 90 degree corners
- .4 Frame:
 - .1 Material:
 - .1 Steel, minimum 1.6mm, same finish as door.
- .5 Accessories:
 - .1 Hinges:
 - .1 Concealed spring hinge, 180degree swing, removable hinge pin to allow removal of door panel from frame, with safety cable to secure door to frame.
 - .2 Lock/Latch Devices:
 - .1 Flush, tamper-resistant torx head cam latch

2.6 Fabrication

- .1 Access Door Sizes: Provide with the following clear opening dimensions, except where indicated otherwise:
 - .1 For body entry: minimum 915 x 915mm nominal
 - .2 For hand entry: minimum 300 x 300mm nominal
- .2 Fabricate access doors and panel assembly as a single unit, ready for site installation.
- .3 Fabricate large units with sufficient quantity of latches to hold door flush with frame.

- .4 Fabricate units rigid with bracing and reinforcements as required to remain square and prevent sagging.
- .5 Fabricate visible surfaces flat and smooth without embossed or imprinted manufacturer's name. Grind visible welds smooth and blended.
- .6 Touch-up factory-applied coatings and galvanized surfaces where finish was removed during fabrication.
- .7 Locate label indicating manufacturer and model and fire-protection rating on rear of panel door or other concealed surface , to NFPA 80.

Part 3 Execution

3.1 Examination

- .1 Verification of Conditions: Verify conditions of substrates previously installed are acceptable for access doors and panels installation, in accordance with manufacturer's instructions.
 - .1 Proceed with installation only after unacceptable conditions have been remedied.

3.2 Installation

- .1 Installation: locate access doors within view of equipment and ensure equipment is accessible for operating, inspecting, adjusting, servicing without using special tools.
 - .1 Install access doors and panels permitting access to service valves, traps, dampers, cleanouts, and other mechanical, electrical and conveyor control items concealed by walls and partitions, and concealed above gypsum board and acoustic panel and plaster ceilings.
- .2 Install fire protection rated access doors and panels in fire rated partitions and ceilings, in accordance with NFPA 80.
- .3 Isolate steel and aluminum from direct contact with dissimilar metals, concrete, and masonry with isolation coating of alkali-resistant bituminous paint, epoxy, or other permanent non-corrosive material recommended by manufacturer.
- .4 Set frames square and in-plane with the substrate assembly, aligned with adjacent visible finishes. Securely attach to substrates.
- .5 Access Doors above Acoustic Panel Ceilings: Install unobtrusive identification locators, such as a small self-adhering circle on the acoustic panel.

3.3 Adjusting

- .1 Touch-up with factory-applied finishes if damaged during installation.
- .2 Repair damage to zinc coatings in accordance with ASTM A780/A780M.
- .3 Repair damage to adjacent materials caused by installation of access doors and panels.
- .4 Adjust operable parts for correct function.

3.4 Cleaning

- .1 Progress and Final Cleaning: Perform in accordance with Section 01 74 00 - Cleaning and remove gypsum board compound from hinges, frames, and door edges.
- .2 Waste Management: Perform in accordance with Section 01 74 19 - Waste Management and Disposal.

END OF SECTION

Part 1 General

1.1 Section Includes

- .1 Rolling Counter Doors, manually operated.
- .2 Rolling fire service doors, power operated.
- .3 Rolling fire service doors, manually operated.

1.2 Related requirements

- .1 Section 05 50 00 - Metal Fabrications: Support framing and framed opening.
- .2 Section 08 71 00 - Door Hardware: Product Requirements for cylinder core and keys.
- .3 Section 09 90 00 - Painting
- .4 Electrical specifications

1.3 Reference standards

- .1 Aluminum Association (AA):
 - .1 AA DAF 45-03, Designation System for Aluminum Finishes
- .2 American Architectural Manufacturers Association (AAMA):
 - .1 AAMA 609/610-09, Cleaning and Maintenance Guide for Architecturally Finished Aluminum
- .3 ASTM International (ASTM):
 - .1 ASTM A167-99, Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
 - .2 ASTM A276-10, Standard Specification for Stainless Steel Bars and Shapes
 - .3 ASTM A480/A480M-11, Standard Specification for General Requirements for Flat Rolled Stainless Steel and Heat-Resisting Steel Plate, Sheet and Strip
 - .4 ASTM A653/A653M- 13, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
 - .5 ASTM A 666 - Standard Specification for Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
 - .6 ASTM A 924 - Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.
 - .7 ASTM B 221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
- .4 Architectural Woodwork Manufacturers' Association of Canada (AWMAC)/Woodwork Institute (WI):
 - .1 North American Architectural Woodwork Standards (NAAWS) 4.0
- .5 Canadian General Standards Board (CGSB):
 - .1 CAN/CGSB-12.1-M90, Tempered or Laminated Safety Glass
 - .2 CAN/CGSB-12.12-M90, Plastic Safety Glazing

- .6 CSA Group (CSA):
 - .1 CSA O141-05, Softwood Lumber
 - .2 CAN/CSA-Z809-08, Sustainable Forest Management
- .7 Electrical and Electronic Manufacturers' Association of Canada (EEMAC):
- .8 Forest Stewardship Council (FSC):
 - .1 FSC-STD-01-001-2004, FSC Principle and Criteria for Forest Stewardship
- .9 National Electrical Manufacturers Association (NEMA):
 - .1 NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).
 - .2 NEMA ICS 2 - Industrial Control and Systems: Controllers, Contactors, and Overload Relays, Rated Not More Than 2000 Volts AC or 750 Volts DC.
 - .3 NEMA MG 1 - Motors and Generators.
- .10 National Fire Protection Agency (NFPA):
 - .1 ANSI/NFPA 80-2013, Standard for Fire Doors and Other Opening Protectives
- .11 National Hardwood Lumber Association (NHLA):
 - .1 Rules for the Measurement and Inspection of Hardwood and Cypress 2011
- .12 National Lumber Grades Authority (NLGA):
 - .1 Standard Grading Rules for Canadian Lumber, 2010
- .13 South Coast Air Quality Management District (SCAQMD), California State, Regulation XI. Source Specific Standards:
 - .1 SCAQMD Rule 1168-A2017, Adhesives and Sealants Applications
- .14 Sustainable Forestry Initiative (SFI):
 - .1 SFI-2010-2014 Standard
- .15 The Master Painters Institute (MPI):
 - .1 Architectural Painting Specification Manual, current edition
- .16 ULC Standards (ULC):
 - .1 CAN/ULC-S104-15, Standard Method for Fire Tests of Door Assemblies
 - .2 CAN/ULC-S105-16, Standard Specification for Fire Door Frames

1.4 Design / Performance Requirements

- .1 Fire Rated Assemblies: Provide assemblies complying with NFPA 80 and listed in UL Directory.

1.5 Action and informational submittals

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data: Submit manufacturer's instructions, product literature and data sheets for door components and grilles and include product characteristics, performance criteria, dimensions, finishes, limitations, preparation instructions and recommendations, storage and handling requirements and recommendations, details of construction and fabrication, and installation methods.
- .3 Shop Drawings: Include detailed plans, elevations, details of framing members, required clearances, anchors, and accessories. Include relationship with adjacent construction.

- .4 Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and patterns.
- .5 Verification Samples: For each finish product specified, two samples, minimum size 6 inches (150 mm) long, representing actual product, color, and patterns.
- .6 Test Reports: When requested, submit certified test reports showing compliance with specified performance characteristics and physical properties.
- .7 Manufacturer's Certificates: Certify products meet or exceed specified requirements.
- .8 Sustainable Design Submittals: Submit in accordance with Section 01 35 20 - LEED Requirements.
 - .1 Construction Waste Management: Refer to Section 01 74 19 - Waste Management and Disposal.
 - .2 Material product attribute documentation: Refer to Product Check Sheet as listed in 01 35 20 - LEED Sustainable Requirements to determine applicable type of documentation required for each product.
 - .3 Wood Certification: Submit invoices showing FSC compliance and Chain-of-Custody Certificate number for CAN/CSA-Z809 or FSC or SFI certified wood.
 - .4 Submittals are required for any sealants, adhesives, paints, coatings, composite wood, flooring, wall panels, insulation or ceiling components within the inner most weather proofing barrier.
 - .5 Low-Emitting Materials:
 - .1 Submit listing of sealants used in building, showing compliance with VOC and chemical component restrictions.

1.6 Closeout submittals

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Operation and Maintenance Data: Submit operation and maintenance data for overhead coiling doors and grilles, and hardware and incorporate into manual.

1.7 Quality assurance

- .1 Manufacturer Qualifications: Company specializing in performing Work of this section with a minimum of five years experience in the fabrication and installation of security closures.
- .2 Installer Qualifications: Company approved by manufacturer, specializing in performing Work of this section with minimum three years experience, with IDEA Certified Installers and service technicians on staff.
- .3 Certifications: Manufacturer's product certificates certifying materials comply with specified performance characteristics and criteria and physical requirements.
- .4 Sustainable Standards Certification:
 - .1 Certified Wood: Submit listing of wood products and materials used in accordance with CAN/CSA-Z809 or FSC or SFI.

1.8 Delivery, storage, and handling

- .1 Perform in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Storage and Handling Requirements:

- .1 Store products in manufacturer's unopened packaging until ready for installation.
 - .2 Protect materials from exposure to moisture. Do not deliver until after wet work is complete and dry.
 - .3 Store materials in a dry, warm, ventilated weathertight location.
 - .4 Store and protect overhead coiling doors and grilles from nicks, scratches, and blemishes.
- .3 Develop Construction Waste Management Plan related to Work of this Section and in accordance with Section 01 35 20 - LEED Sustainable Requirements.
 - .4 Packaging Waste Management: Perform in accordance with Section 01 74 19 - Construction Waste Management and Disposal.

1.9 Project Conditions

- .1 Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.10 Coordination

- .1 Coordinate Work with other operations and installation of adjacent finish materials to avoid damage to installed materials.

1.11 Warranty

- .1 Warranty: Manufacturer's limited door warranty for 2 years for all parts and components.
 - .1 Manufacturer's limited door and operators System warranty of all parts and components of the system except counterbalance spring and finish for 3 years or 20,000 cycles, whichever comes first.
- .2 PowderGuard Finish.
 - .1 PowderGuard Premium applied to curtain and top coat for guides, bottom bar, headplates: Manufacturer's limited Zinc Finish warranty for 4 years.

Part 2 Products

2.1 Manufacturers

- .1 Acceptable Manufacturer: Overhead Door Corporation
2501 S. State Hwy. 121, Suite 200
Lewisville, TX 75067. ASD.
Tel. Toll Free: (800) 275-3290.
Phone: (469) 549-7100.
Fax: (972) 906-1499.
Web Site: www.overheaddoor.com.
E-mail: info@overheaddoor.com.
- .2 Requests for substitutions will be considered in accordance with provisions of Section 01 61 00.

2.2 Rolling Steel Counter Door - Manual Operation (Canteen)

- .1 Galvanized Steel Counter Doors: Overhead Door Corporation, 650 Series (or approved equal)

- .1 Wall Mounting Condition:
 - .1 Face-of-wall mounting.
- .2 Curtain: Interlocking slats, Type F-158 fabricated of 22 gauge galvanized steel. Endlocks attached to alternate slats to maintain curtain alignment and prevent lateral slat movement.
- .3 Finish:
 - .1 Slats and hood galvanized steel in accordance with ASTM A 653 with rust-inhibitive, roll coating process, including 0.2 mils thick baked-on prime paint, and 0.6 mils thick baked-on polyester (powder coated) top coat.
 - .1 Polyester Top Coat
 - .1 Gray polyester
- .4 Bottom Bar:
 - .1 Steel tubular locking bottom bar with weatherstrip.
- .5 Guides: Extruded aluminum.
- .6 Brackets: Steel plate to support counterbalance, curtain and hood.
- .7 Finish; Bottom Bar, Guides, Brackets:
 - .1 Finish: Black powder coat finish
- .8 Counterbalance: Helical torsion spring type housed in a steel tube or pipe barrel.
- .9 Hood: Provided with intermediate support brackets as required and fabricated of:
 - .1 Galvanized primed steel.
- .10 Operation:
 - .1 Manual push up.
 - .1 Provide pole/reacher for accessible operation (from seated position).
- .11 Locking:
 - .1 Two point dead locks with mortise cylinders.

2.3 Rolling Fire Service Door - Electric Operation / Motorized (Stores Overhead Door - 90 min Fire Separation)

- .1 Rolling Fire Service Doors: FireKing Model 630 Fire Doors.
 - .1 Label: Provide fire doors certified with the following listing.
 - .1 Rolling fire doors up to 152 sf (14.12 sm) and not exceeding 13 feet 6 inches (4.11 m) in width or height shall receive the UL or ULC 3-Hour Class A Label for installation on masonry or steel jamb walls, face mounted or between jambs. Door may be welded to the face of steel jambs.
 - .2 Provide UL labeled smoke protection where indicated. Comply with UL label for "Leakage Rated Assembly" or "S" label.
 - .1 Comply with NFPA 105 air leakage requirements.
 - .2 Pass UL test procedure 1784.

- .2 Curtain: Interlocking roll-formed slats as specified following. Endlocks shall be attached to each end of alternate slats to prevent lateral movement.
 - .1 Flat profile type F-265 for doors thru 14 feet (4.27 m) wide by 12 feet (3.65 m) high, fabricated of:
 - .1 22 gauge galvanized steel.
- .3 Finish:
 - .1 Galvanized Steel: Slats and hood galvanized steel to ASTM A 653 finished with a rust-inhibitive roll coating process, including bonderizing, a 0.2 mils thick baked prime paint, and a 0.6 mils thick baked top coat.
 - .1 Polyester Top Coat: Gray polyester
 - .2 Non-galvanized exposed ferrous surfaces shall be black powder coated.
- .4 Bottom Bar:
 - .1 Two galvanized steel angles with 1-1/2 inch by 1-1/2 inch by 1/8 inch (38 mm by 38 mm by 3 mm) minimum.
- .5 Guides: Three structural steel angles.
 - .1 Fastening Guides to Masonry Fire Walls: UL listed for fire and smoke in accordance with manufacturer's listing.
- .6 Brackets:
 - .1 Hot rolled steel to support counterbalance, curtain and hood
- .7 Finish; Bottom Bar, Guides, and Brackets:
 - .1 Finish: Black powdercoat finish.
- .8 Counterbalance: Helical torsion spring type housed in a steel tube or pipe barrel, supporting the curtain with deflection limited to 0.03 inch per foot of span. Counterbalance is adjustable by means of an adjusting tension wheel.
- .9 Hood:
 - .1 Fabricate of 24 gauge galvanized primed steel minimum for wall openings thru 19 feet (5.79 m) wide.
- .10 Electric Motor Operation: Provide electric operator as listed in the door UL file, for size as recommended by manufacturer to move door in either direction.
 - .1 Floor Resettable Electric Motor Operation.
 - .2 Sensing Edge Protection:
 - .1 Electric sensing edge.
 - .3 Operator Controls:
 - .1 Push-button operated control stations with open, close, and stop buttons.
 - .4 Automatic Closure Standard Fire Door: UL approved release mechanism equipped with a 165 degree fusible link.
 - .1 Doors will be equipped with floor resettable electric motor operation system, requiring only one sash chain to be routed to the operated side (sash chain not required to be routed to adjusting wheel side.)

- .1 Release mechanism includes planetary gear differential system.
- .2 Door will close by a thermally actuated link rated @165 degrees F, or by an optional listed releasing device, or by manually activating the release handle.
- .3 All counterbalance spring tension shall be maintained when the release mechanism is activated.
- .4 After closing by alarm activation with power on the electric motor, the door shall be able to be reset by resetting the alarm system without additional tools required.
- .5 Governor: If required by the size for chain hoist doors, provide a viscous governor to regulate the rate of descent of door in a quiet manner. Use an engagement type that is not engaged during normal door operation, but after cable release, will retard the speed during automatic door closure to under 24 inches per second and not less than 6 inches per second per NFPA 80.
- .6 Locking:
 - .1 Cylinder lock for electric operation with interlock switch.
- .7 Wall Mounting Condition:
 - .1 Face-of-wall mounting.

2.4 Rolling Fire Service Door - Manual / Chain Operated (Equip Loans Window - 90 min Fire Separation)

- .1 Rolling Fire Service Doors: FireKing Model 630 Fire Doors.
 - .1 Label: Provide fire doors certified with the following listing.
 - .1 Rolling fire doors up to 152 sf (14.12 sm) and not exceeding 13 feet 6 inches (4.11 m) in width or height shall receive the UL or ULC 3-Hour Class A Label for installation on masonry or steel jamb walls, face mounted or between jambs. Door may be welded to the face of steel jambs.
 - .2 Provide UL labeled smoke protection where indicated. Comply with UL label for "Leakage Rated Assembly" or "S" label.
 - .1 Comply with NFPA 105 air leakage requirements.
 - .2 Pass UL test procedure 1784.
 - .2 Curtain: Interlocking roll-formed slats as specified following. Endlocks shall be attached to each end of alternate slats to prevent lateral movement.
 - .1 Flat profile type F-265 for doors thru 14 feet (4.27 m) wide by 12 feet (3.65 m) high, fabricated of:
 - .1 22 gauge galvanized steel.
 - .3 Finish:
 - .1 Galvanized Steel: Slats and hood galvanized steel to ASTM A 653 finished with a rust-inhibitive roll coating process, including

- bonderizing, a 0.2 mils thick baked prime paint, and a 0.6 mils thick baked top coat.
- .1 Polyester Top Coat: Gray polyester
 - .2 Non-galvanized exposed ferrous surfaces shall be black powder coated.
 - .4 Bottom Bar:
 - .1 Two galvanized steel angles with 1-1/2 inch by 1-1/2 inch by 1/8 inch (38 mm by 38 mm by 3 mm) minimum.
 - .5 Guides: Three structural steel angles.
 - .1 Fastening Guides to Masonry Fire Walls: UL listed for fire and smoke in accordance with manufacturer's listing.
 - .6 Brackets:
 - .1 Hot rolled steel to support counterbalance, curtain and hood
 - .7 Finish; Bottom Bar, Guides, and Brackets:
 - .1 Finish: Black powdercoat finish.
 - .8 Counterbalance: Helical torsion spring type housed in a steel tube or pipe barrel, supporting the curtain with deflection limited to 0.03 inch per foot of span. Counterbalance is adjustable by means of an adjusting tension wheel.
 - .9 Hood:
 - .1 Fabricate of 24 gauge galvanized primed steel minimum for wall openings thru 19 feet (5.79 m) wide.
 - .10 Manual Operation:
 - .1 Floor resettable chain hoist.
 - .11 Automatic Closure Standard Fire Door: UL approved release mechanism equipped with a 165 degree fusible link.
 - .1 Doors will be equipped with chain hoist release mechanism, requiring only one sash chain to be routed to the operated side (sash chain not required to be routed to adjusting wheel side.)
 - .1 Release mechanism includes planetary gear differential system.
 - .2 Door will close by a thermally actuated link rated @165 degrees F, or by an optional listed releasing device, or by manually activating the release handle.
 - .3 All counterbalance spring tension shall be maintained when the release mechanism is activated.
 - .4 After closing by manual activation of the release handle, the door shall be able to be reset by one person from one side of the door (re-engaging the release handle). No tools are required to reset the release mechanism.
 - .12 Governor: If required by the size for chain hoist doors, provide a viscous governor to regulate the rate of descent of door in a quiet manner. Use an engagement type that is not engaged during normal door operation, but after cable release, will retard the speed during automatic door closure to under 24 inches per second and not less than 6 inches per second per NFPA 80.

- .13 Locking:
 - .1 Cylinder lock for manually operated doors.
- .14 Wall Mounting Condition:
 - .1 Face-of-wall mounting.

Part 3 Execution

3.1 Examination

- .1 Verification of Conditions: verify conditions of substrates previously installed are acceptable for overhead coiling doors and grilles installation in accordance with manufacturer's instructions.
 - .1 Verify opening sizes, tolerances and conditions are acceptable.
 - .2 Examine conditions of substrates, supports, and other conditions under which this work is to be performed.
 - .3 Inform Contract Administrator of unacceptable conditions immediately upon discovery.
 - .4 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Contract Administrator.

3.2 Preparation

- .1 Clean surfaces thoroughly prior to installation.
- .2 Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 Installation

- .1 Install doors and grilles in accordance with manufacturer's instructions.
- .2 Install rolling fire doors in compliance with requirements of NFPA 80. Test fire-release system and reset components after testing.
- .3 Use anchorage devices to securely fasten assembly to wall construction and building framing without distortion or stress.
- .4 Securely and rigidly brace components suspended from structure. Secure guides to structural members only.
- .5 Fit and align assembly including hardware; level and plumb, to provide smooth operation.
- .6 Coordinate installation of electrical service with electrical specifications. Complete wiring from disconnect to unit components.
- .7 Coordinate installation of sealants and backing materials at frame perimeter as specified in Section 07 92 00.
- .8 Install perimeter trim and closures.
- .9 Install electrical motors, controller units, pushbutton stations, relays and other electrical equipment required for door and grille operation.
- .10 Install electric wiring from power supply located near door and grille.
- .11 Install masterkeyed cylinder specified in Section 08 71 00 - Doors Hardware.

3.4 Adjusting

- .1 Test for proper operation and adjust as necessary to provide proper operation without binding or distortion.
- .2 Adjust hardware and operating assemblies for smooth and noiseless operation.

3.5 Site quality control

- .1 Functional testing of fire door and window assemblies shall be performed by IDEA Certified personnel with knowledge and understanding of the operating components of the type of door being subject to testing.
- .2 Have manufacturer of products supplied under this Section review Work involved in handling, installation, protection and cleaning of its products, and submit written reports in acceptable format to verify compliance of Work with Contract.

3.6 Cleaning

- .1 Clean curtain and components using non-abrasive materials and methods recommended by manufacturer.
- .2 Remove labels and visible markings.
- .3 Touch-up, repair or replace damaged products before Substantial Completion.
- .4 Progress Cleaning: clean in accordance with Section 01 74 00 - Cleaning.
 - .1 Perform cleaning of aluminum components in accordance with: AAMA 609.
- .5 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 - Cleaning.
 - .1 Clean aluminum and stainless steel with damp rag and approved non-abrasive cleaner in accordance with manufacturer's instructions.
 - .2 Remove traces of primer, sealants; clean doors and frames.

3.7 Protection

- .1 Protect installed products until completion of project.

END OF SECTION

Part 1 General

1.1 Section Includes

- .1 Electric overhead sectional door.
- .2 Operating hardware, supports, and controls.

1.2 Related requirements

- .1 Section 05 50 00 - Metal Fabrications
- .2 Section 07 92 00 - Joint Sealants
- .3 Section 08 80 00 - Glazing
- .4 Electrical specifications.

1.3 Reference standards

- .1 Aluminum Association (AA):
 - .1 AA DAF 45-03, Designation System for Aluminum Finishes
- .2 ASTM International (ASTM):
 - .1 ASTM A653/A653M-07 - Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - .2 ASTM A1008/A1008M-13, 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
 - .3 ASTM D523-14, Standard Test Method for Specular Gloss
 - .4 ASTM D822/D822M-13, Standard Practice for Filtered Open-Flame Carbon-Arc Exposures of Paint and Related Coatings
 - .5 ASTM E330-02 - Test Method for Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.
- .3 Canadian General Standards Board (CGSB):
 - .1 CAN/CGSB-1.105-M91, Quick-Drying Primer
 - .2 CAN/CGSB-1.213-04, Etch Primer (Pretreatment Coating or Tie Coat) for Steel and Aluminum
 - .3 CAN/CGSB-1.181-99, Ready-Mixed, Organic Zinc-Rich Coatings
- .4 CSA Group (CSA):
 - .1 CAN/CSA-C22.2 No. 100-04 - Motors and Generators.
 - .2 CSA C22.2-06 - Canadian Electrical Code, Part 2.
 - .3 CAN/CSA-G164-18, Hot Dip Galvanizing of Irregularly Shaped Articles
- .5 Environmental Choice Program (ECP):
 - .1 CCD-016-97, Thermal Insulation
- .6 National Electrical Manufacturer's Association (NEMA).
 - .1 NEMA 250 Enclosures for Electrical Equipment (1000 Volts Maximum)

- .2 NEMA ICS-6 Industrial Control and Systems: Enclosures.
- .3 NEMA MG1 - Motors and Generators.
- .7 UL - Fire Resistance Directory.
- .8 ULC - Fire Resistance Directory.

1.4 System Description

- .1 Panels: Flush steel, insulated. Stile and rail steel with glazed panels.
- .2 Lift Type: High lift operating style with track and hardware as described herein.
- .3 Operation: Electric.
- .4 Loads: Design and size components to withstand dead and live loads caused by pressure and suction of wind acting normal to plane of wall as measured in accordance with ASTM E330.

1.5 Action and informational submittals

- .1 Submit in accordance with Section Section 01 33 00 - Submittal Procedures.
- .2 Product Data: Submit manufacturer's instructions, product literature and data sheets for doors, hardware, operators, and accessories and include product characteristics, performance criteria, physical size, finishes, and limitations, component construction, anchorage method & hardware.
- .3 Shop Drawings:
 - .1 Provide shop drawings sealed by an engineer licensed to practice in the Province of Manitoba, Canada.
 - .2 Indicate sizes, opening dimensions and required tolerances, connection details, anchorage spacing, hardware locations, installation details, service rating, types, materials, operating mechanisms, glazing locations and details, hardware and accessories, required clearances and electrical connections.
- .4 Certificates: submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.
- .5 Test Reports: submit certified test reports showing compliance with specified performance characteristics and physical properties.
- .6 Sustainable Design Submittals:
 - .1 LEED Canada submittals: in accordance with Section 01 35 20 - LEED Sustainable Requirements.
 - .2 Construction Waste Management: Refer to Section 01 74 19 - Construction Waste Management and Disposal.
 - .3 Material product attribute documentation: Refer to Product Check Sheet as listed in 01 35 20 – LEED Sustainable Requirements to determine applicable type of documentation required for each product.
 - .4 Low-Emitting Materials:
 - .1 Submittals are required for any sealants, adhesives, paints, coatings, composite wood, flooring, wall panels, insulation or ceiling components within the inner most weather proofing barrier.

- .2 Refer to Product Check Sheet as listed in 01 35 20 – LEED Sustainable Requirements to determine applicable type of documentation required for each product.
- .7 Confirm and coordinate submittal requirements with the BECxA.

1.6 Closeout submittals

- .1 Submit in accordance with Section Section 01 78 00 - Closeout Submittals.
- .2 Operation and Maintenance Data: Submit operation and maintenance data for sectional metal doors and incorporate into manual.
 - .1 Include electrical control adjustments.
 - .2 Include data for motor and transmission, shaft and gearing, lubrication frequency, spare part sources.
- .3 Warranty Documentation: Submit manufacturer warranty and ensure forms have been completed in The City's name and registered with manufacturer.

1.7 Quality assurance

- .1 Products of This Section: Manufactured to ISO 9000 certification requirements.
- .2 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three (3) years experience.
- .3 Installer Qualifications: Company specializing in performing the work of this section with minimum three (3) years experience. approved by the manufacturer.
- .4 Certificates: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.
- .5 Confirm and coordinate visual review, mock-up, and pre-installation conference requirements with the BECxA.

1.8 Regulatory Requirements

- .1 Conform to applicable code for motor and motor control requirements

1.9 Delivery, storage, and handling

- .1 Deliver, store, and handle materials in accordance with Section Section 01 61 00 - Common Product Requirements.
- .2 Storage and Handling Requirements:
 - .1 Store materials off ground indoors in dry location and in accordance with manufacturer's recommendations in clean, well-ventilated area.
 - .2 Store and protect sectional metal doors, hardware and accessories from nicks, scratches, and blemishes.
- .3 Develop Construction Waste Management Plan related to Work of this Section and in accordance with Section Section 01 74 19 - Construction Waste Management and Disposal.
- .4 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding, and packaging materials as specified in Construction Waste Management Plan in accordance with Section Section 01 74 19 - Construction Waste Management and Disposal.

1.10 Warranty

- .1 Correct defective Work within a five (5) year period after Date of Substantial Completion.
- .2 Warranty: Include coverage for electric motor.
- .3 Provide five (5) year manufacturer warranty for electric operating equipment.

Part 2 Products

2.1 Manufacturers

- .1 Garaga Industries Model or approved equal.
- .2 Model: Garaga G-5000.
- .3 Colour: Black (premium colour).
- .4 Thickness: 50mm (2").
- .5 R value (Total): R-16.
- .6 Windows: G-4400 Sections (Full Vision), Black frames, Clear tempered glazing

2.2 Materials

- .1 Sheet Steel: ASTM A653/A653M galvanized to Z180, pre-coated with silicone polyester finish, plain surface.
- .2 Insulation: polyurethane, RSI value of 2.8 per inch, same thickness as core framing members, bonded to facing.
- .3 Metal Primer Paint: Zinc chromate type.

2.3 Panel Construction

- .1 Panels: Flush steel construction; outer steel sheet of 3.658 mm thick, flat profile; inner steel sheet of 1.5 mm thick, flat profile; core reinforcement of 3.658 mm thick sheet steel roll formed to channel Z- shape, rabbeted weather joints at meeting rails; insulated.
- .2 Door Nominal Thickness: 45 mm thick.
- .3 Glazing: 25mm (1") double thermopane, tempered glass window, supplied by this Section.
- .4 Glazed Lights: full vision glazing in one panel section, across full width of door, set in place with resilient glazing channel.

2.4 Door Components

- .1 Track: Rolled galvanized steel, 2.6 mm thick; 75 mm wide, continuous one piece per side; galvanized steel mounting brackets 6 mm thick.
- .2 Hinge and Roller Assemblies: Heavy duty hinges and adjustable roller holders of galvanized steel; floating hardened steel bearing rollers, located at top and bottom of each panel, each side.
- .3 Lift Mechanism: Torsion spring on cross head shaft, with braided galvanized steel lifting cables.
- .4 Sill Weatherstripping: Resilient semi-circular TPE tubing strip, one piece; fitted to bottom of door panel, full length contact.

- .5 Jamb Weatherstripping: Roll formed aluminum section full height of jamb, fitted with resilient weatherstripping, placed in moderate contact with door panels.
- .6 Head Weatherstripping: EPDM rubber seal, one piece full length.
- .7 Panel Joint Weatherstripping: PVC, one piece full length.
- .8 Lock: Inside side mounted, adjustable keeper, spring activated latch bar with feature to retain in locked or retracted position; interior and exterior handle; keyed according to building's master key system.

2.5 Electrical Hoist Operator

- .1 Lift Master Model MH, ½ HP/115 V Single Phase.
- .2 UL 325-2010 compliant, medium duty logic programmable integrated circuit board.
- .3 Disconnect Switch: Factory mount disconnect switch on equipment.
- .4 Electric Operator: Side mounted on cross head shaft, adjustable safety friction clutch; brake system actuated by independent voltage solenoid controlled by motor starter; enclosed gear driven limit switch; enclosed magnetic cross line reversing starter; mounting brackets and hardware.
- .5 Control Station: Standard three button (open-close-stop) momentary type, control for each electric operator; 24 volt circuit, surface mounted. Include key operated switch located at inside door jamb.
- .6 Radio Control Antenna Detector.
- .7 Photo Eye: At bottom of door panel, full width; sensitized type, wired to reverse door upon striking object; hollow neoprene rubber covered to provide weatherstrip seal.

2.6 Finishes

- .1 Exterior Surfaces: Prime & finish paint for finish specified in Section 09 91 00.
- .2 Interior Surfaces: Prime & finish paint for finish specified in Section 09 91 00.

Part 3 Execution

3.1 Examination

- .1 Verification of Conditions: Verify conditions of substrates previously installed are acceptable for sectional metal doors installation in accordance with manufacturer's instructions.
 - .1 Inspect substrates.
 - .2 Inform Contract Administrator of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied.
- .2 Confirm and coordinate visual review requirements with the BECxA.

3.2 Preparation

- .1 Prepare opening to permit correct installation of door unit to perimeter air and vapour barrier seal.

3.3 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.

3.4 Installation

- .1 Install doors and hardware in accordance with manufacturer's instructions.
- .2 Anchor assembly to wall construction and building framing without distortion or stress.
- .3 Securely brace door tracks suspended from structure. Secure tracks to structural members only.
- .4 Fit and align door assembly including hardware.
- .5 Coordinate installation of electrical service. Complete power and control wiring from disconnect to unit components.
- .6 Install operator including electrical motors, controller units, pushbutton stations, relays and other electrical equipment required for door operation.
- .7 Coordinate installation of sealants and backing materials at frame perimeter as specified in Section 07 92 00.
- .8 Install perimeter trim and closures.
- .9 Lubricate and adjust door operating components to ensure smooth opening and closing of doors.
- .10 Adjust weatherstripping to form a weather tight seal.
- .11 Adjust doors for smooth operation.

3.5 Erection Tolerances

- .1 Maximum Variation from Plumb: 1.5 mm.
- .2 Maximum Variation from Level: 1.5 mm.
- .3 Longitudinal or Diagonal Warp: Plus or minus 3 mm from 3 m straight edge.
- .4 Maintain dimensional tolerances and alignment with adjacent work.

3.6 Manufacturer's Field Services

- .1 Ensure the operation and adjustments to door assembly for specified operation.

3.7 Cleaning

- .1 Progress Cleaning: clean in accordance with Section 01 74 00 - Cleaning.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 - Cleaning.
 - .1 Remove traces of primer; clean doors and frames.
 - .2 Clean glass and glazing materials with approved non-abrasive cleaner.
- .3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 19 - Construction Waste Management and Disposal.

END OF SECTION

Part 1 General

1.1 Related requirements

- .1 Section 07 26 00 - Vapour Retarders
- .2 Section 07 84 00 - Firestopping
- .3 Section 07 92 00 - Joint Sealants
- .4 Section 08 80 00 - Glazing
- .5 Section 08 11 16 - Aluminum Doors and Frames: Aluminum doors for installation in curtain wall framing.

1.2 Reference standards

- .1 Aluminum Association (AA):
 - .1 AA DAF 45-03, Designation System for Aluminum Finishes
- .2 ASTM International (ASTM):
 - .1 ASTM A653/A653M-13, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
 - .2 ASTM B209-14, Specification for Aluminum and Aluminum-Alloy Sheet and Plate
 - .3 ASTM B221-20, Specification for Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
 - .4 ASTM C864-05, Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers
 - .5 ASTM E283-04, Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen
 - .6 ASTM E330/E330M-02, Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights, and Curtain Walls, by Uniform Static Air Pressure Difference
 - .7 ASTM E331-00, Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls, by Uniform Static Air Pressure Difference
 - .8 ASTM E547-00, Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Cyclic Static Air Pressure Difference
 - .9 ASTM E779-19, Standard Test Method for Determining Air Leakage Rate by Fan Pressurization
 - .10 ASTM E1105-00, Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls, by Uniform or Cyclic Static Air Pressure Difference
- .3 Canadian General Standards Board (CGSB):
 - .1 CAN/CGSB-12.8-97, Insulating Glass Units.

- .2 CAN/CGSB-12.20-M89, Structural Design of Glass for Buildings
- .3 CAN/CGSB-19.13-M87, Sealing Compound, One-Component, Elastomeric, Chemical Curing.
- .4 CSA Group (CSA):
 - .1 CSA A440.6:20, High exposure fenestration installation
 - .2 CAN/CSA G40.20/G40.21-13, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel
 - .3 CAN/CSA S136-16, North American Specification for the Design of Cold Formed Steel Structural Members
 - .4 CAN/CSA-S157-05/S157.1-, Strength Design in Aluminum/Commentary on CAN/CSA-S157-05, Strength Design in Aluminum
 - .5 CSA W59.2-2018, Welded Aluminum Construction
- .5 Fenestration & Glazing Industry Alliance (FGIA) (formerly American Architectural Manufacturers Association (AAMA)):
 - .1 AAMA CW-10-15, Care and Handling of Architectural Aluminum from Shop to Site
 - .2 AAMA 501-15, Methods of Test for Exterior Walls
 - .3 AAMA 611-20, Voluntary Specifications for Anodized Finishes Architectural Aluminum
 - .4 AAMA 2603-21, Voluntary Specification Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix)
 - .5 AAMA 2604-21, Voluntary Specification Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix)
 - .6 AAMA 2605-20, Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix)
 - .7 AAMA CW DG-1-96, Aluminum Curtain Wall Design Guide Manual.
 - .8 AAMA CW-10-2012, Care and Handling of Architectural Aluminum From Shop to Site.
 - .9 AAMA CW-11-1985, Design Windloads for Buildings and Boundary Layer Wind Tunnel Testing.
 - .10 AAMA-TIR A1-2004, Sound Control for Fenestration Products.
- .6 National Research Council Canada (NRC):
 - .1 National Building Code of Canada 2015 (NBC)
- .7 Society for Protective Coatings (SSPC):
 - .1 SSPC - Paint 20-2019, Zinc Rich Coating, Inorganic and Organic
 - .2 SSPC - Paint 25 - 97, BCS, Zinc Oxide, Alkyd, Linseed Oil and Primer for Use Over Hand Cleaned Steel Type 1 and Type 2
- .8 South Coast Air Quality Management District (SCAQMD), California State, Regulation XI. Source Specific Standards:

- .1 SCAQMD Rule 1113-2016, Architectural Coatings
- .2 SCAQMD Rule 1168-2017, Adhesives and Sealants Applications
- .9 Underwriters Laboratories (UL):
 - .1 UL 2761-2011, Sustainability for Sealants and Caulking Compounds
 - .2 UL 2768-2011, Sustainability for Architectural Surface Coatings
- .10 Underwriters Laboratories of Canada (ULC):
 - .1 CAN/ULC-S710.1 2005, Standard for Thermal Insulation – Bead-Applied One Component Polyurethane Air Sealant Foam, Part 1: Materials Standard for Thermal Insulation - Bead - Applied One Component Polyurethane Air Sealant Foam, Part 1: Materials.

1.3 Administrative requirements

- .1 Coordination: coordinate work of this Section with installation of vapour retarder and flashing.
- .2 Preinstallation Meetings: Convene pre-installation meeting in accordance with Section 01 31 19 - Project Meetings and Section 08 08 00 Commissioning of Openings.
 - .1 Confirm and coordinate pre-installation meeting requirements with the BECxA.

1.4 Action and informational submittals

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's product data for each type of curtain wall components, anchorage and fasteners, glass and infill, and internal drainage details and include product characteristics, performance criteria, physical size, finish and limitations and water flow diagrams.
 - .1 Submit list on curtain wall manufacturer's letterhead of materials, components and accessories to be incorporated into Work.
 - .2 Include product names, types and series numbers.
 - .3 Include contact information for manufacturer and their representative for this Project.
- .3 Shop Drawings:
 - .1 Submit drawings stamped and signed by professional engineer registered or licensed in the Province of Manitoba, Canada.
 - .2 Curtain wall panel and component dimensions, framed opening requirements and tolerances, adjacent construction, anchor details anticipated deflection under load, affected related Work, weep drainage network, expansion and contraction joint location and details, and field welding required. Indicate location of manufacturer's nameplates.
- .4 Samples:
 - .1 Submit for review and acceptance of each type of unit.
 - .2 Samples will not be returned for inclusion into work.

- .3 Submit two samples 300x 300 mm in size illustrating prefinished aluminum surface, finish, colour, texture, specified glass units, insulated infill panels, glazing materials illustrating edge and corner.
- .5 Delegated Design Submittals:
 - .1 Include framing member structural and physical characteristics, calculations, dimensional limitations, special installation requirements.
- .6 Thermal Performance: Submit verification that Insulating Glass Units used in curtain wall system meet RSI (R) values specified.
- .7 Test Reports: When requested, submit engineering data and previous test results by independent laboratory which meet specified performance criteria.
- .8 Sustainable Design Submittals:
 - .1 LEED Canada submittals: in accordance with Section 01 35 20 - LEED Sustainable Requirements.
 - .2 Construction Waste Management: Refer to Section 01 74 19 - Construction Waste Management and Disposal.
 - .3 Material product attribute documentation: Refer to Product Check Sheet as listed in 01 35 20 – LEED Sustainable Requirements to determine applicable type of documentation required for each product.
 - .4 Low-Emitting Materials:
 - .1 Submittals are required for any sealants, adhesives, paints, coatings, composite wood, flooring, wall panels, insulation or ceiling components within the inner most weather proofing barrier.
 - .2 Refer to Product Check Sheet as listed in 01 35 20 – LEED Sustainable Requirements to determine applicable type of documentation required for each product.
- .9 Confirm and coordinate submittal requirements with the BECxA.

1.5 Closeout submittals

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Operation and Maintenance Data: Submit maintenance data for glazed aluminum curtain wall for incorporation into manual.
- .3 Sustainable Design Closeout Documentation (LEED).
 - .1 Provide calculations on end-of-project recycling rates, salvage rates, and landfill rates for work of this Section demonstrating percentage of construction wastes which were recycled.
 - .2 Submit verification from recycling facility showing receipt of materials.
- .4 Warranty: Submit warranty documents specified.

1.6 Quality assurance

- .1 Manufacturer Qualifications: Company specializing in manufacturing the systems specified in this Section with minimum ten years documented manufacturing experience, with projects of similar scope installed in the Province of the Place of the Work.

- .2 Installer Qualifications: Company specializing in performing the work of this Section approved by the manufacturer.
 - .1 Submit letter verifying installer's experience with work similar to work of this Section.
- .3 Design structural support framing components to CAN3 S157 (if required) under direct supervision of a Professional Structural Engineer experienced in design of this Work and licensed at the place where the Project is located.
- .4 Confirm and coordinate visual review, testing requirements, and pre-installation conference requirements with the BECxA.
- .5 Mock-ups: Construct mock-ups in accordance with Section 01 45 00 - Quality Control.
 - .1 Construct full size mock-up of vertical glazed aluminum curtain wall using proposed procedures, materials and quality of work where directed by Contract Administrator and in accordance with Section 01 45 00 Quality Control.
 - .2 Confirm and coordinate mock-up requirements with the BECxA.
 - .3 Include intermediate mullion, corner mullion, sill, column cover, and vision glass light.
 - .4 Assemble to illustrate component assembly including glazing materials, weep drainage system, attachments, anchors, and perimeter sealant.
 - .1 Purpose: To judge quality of work and material installation.
 - .2 Do not proceed with work prior to receipt of written acceptance of mock-up by Contract Administrator.
 - .3 When accepted, mock-up will demonstrate minimum standard of quality required for work of this Section.
 - .5 Contract Administrator will require 48 hours minimum to review the mock-up.
 - .6 Mock-up may remain as part of finished work.

1.7 Delivery, storage, and handling

- .1 Perform in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Deliver glazed aluminum curtain wall materials and components in manufacturer's original packaging with identification labels intact and in sizes to suit project.
- .3 Storage and Handling Requirements:
 - .1 Handle work of this Section in accordance with AAMA CW-10.
 - .2 Store materials off ground in a dry ventilated indoor location and in accordance with manufacturer's recommendations.
 - .3 Store and protect glazed aluminum curtain wall components from nicks, scratches, deformation, and damages.
 - .4 Protect prefinished aluminum surfaces with wrapping. Do not use adhesive papers or sprayed coatings which bond when exposed to sunlight or weather.
- .4 Packaging Waste Management:
 - .1 Separate and recycle waste packaging materials in accordance with Section 01 74 19 Construction Waste Management and Disposal.

- .2 Remove waste packaging materials from site and dispose of packaging materials at appropriate recycling facilities.
- .3 Collect and separate for disposal paper and plastic material in appropriate on-site storage containers for recycling in accordance with Waste Management Plan.

1.8 Warranty

- .1 Manufacturer's warranty: Submit, for City of Winnipeg's acceptance, manufacturer's standard warranty document executed by authorized company official. Manufacturer's warranty is in addition to and not intended to limit other rights City of Winnipeg may have under Contract Conditions.

1.9 Ambient conditions

- .1 Install sealants when ambient and surface temperature is above 5°C minimum.
- .2 Maintain this minimum temperature during and for 48 hours minimum after installation of sealants.

Part 2 Products

2.1 Manufacturers

- .1 Glazed Aluminum Curtain Wall.
 - .1 Outside glazed, captured curtain wall; nominal 2.6" (64 mm) sightline; with triple pane insulating glass units.
 - .2 Structural silicone joints where indicated on Drawings.
- .2 Acceptable Material:
 - .1 Alumicor Thermawall 2600
 - .2 Or approved equal.
- .3 Curtain wall for all locations by same manufacturer.
- .4 Curtain wall and aluminum doors by same manufacturer.

2.2 Systems

- .1 Description:
 - .1 Vertical glazed aluminum curtain wall system includes thermally broken tubular aluminum sections with self supporting framing, shop fabricated, factory prefinished, vision glass, related flashings, anchorage and attachment devices.
 - .2 Assembled system to permit re-glazing of individual glass (and infill panel) units from exterior without requiring removal of structural mullion sections.
- .2 Performance Requirements:
 - .1 Design and size components to withstand dead and live loads caused by pressure and suction of wind, snow and hail for sloped glazing, acting normal to plane of system as calculated in accordance with National Building Code of Canada (NBC).
 - .2 Design and size components to withstand seismic loads and sway displacement as calculated in accordance with NBC.

- .3 Design glass unit dimensions and glass thicknesses to limits established in CAN/CGSB-12.20
- .4 Design system to accommodate the following without damage to components or deterioration of seals:
 - .1 Movement within system.
 - .2 Movement between system and perimeter framing components.
 - .3 Dynamic loading and release of loads.
 - .4 Deflection of structural support framing.
- .5 Limit air infiltration through assembly to 0.3 L/s/m² maximum of wall area to ASTM E783, ASTM E1186, ASTM E283 at differential pressure across assembly of 300 Pa.
- .6 Vapour seal with interior atmospheric pressure of 25 mm sp, 22°C, 40% relative humidity: no failure.
- .7 Water Penetration Resistance: No leakage when tested to AAMA 501.1, ASTM E331 or ASTM E1105 at a differential pressure of 390 Pa.
- .8 Condensation Index: Minimum 77 frame and 76 glass when tested to CSA-A440.
- .9 Condensation Resistance: Minimum 85 frame and 80 glass when tested to AAMA 1503.
- .10 Ensure system allows for expansion and contraction within system components when temperature range is 95°C over 12 hour period without causing detrimental affect to system components.
- .11 Drain water entering joints, condensation occurring in glazing channels, or migrating moisture occurring within system, to exterior by weep drainage network.
- .12 Maintain continuous air barrier and vapour retarder throughout assembly, primarily in line with inside pane of glass and heel bead of glazing compound.
 - .1 Position thermal insulation on exterior surface of air barrier and vapour retarder.
- .13 Ensure no vibration harmonics, wind whistles, noises caused by thermal movement transmitted to other building elements, loosening, weakening, or fracturing of attachments or components of system occur.

2.3 Materials

- .1 Extruded aluminum: Alloy and temper recommended by producer or finisher for type of use and finish indicated, and to ASTM B221.
- .2 Sheet aluminum: Alloy and temper recommended by producer or finisher for type of use and finish indicated, and to ASTM B209.
- .3 Steel Sections: To CAN/CSA G40.20/G40.21; shaped to suit mullion sections.
- .4 Anchors: 3-way adjustable hot-dip galvanized cast iron.
- .5 Fasteners, screws and bolts: Tamperproof, cadmium plated stainless steel 300 or 400 series to meet curtain wall requirements and as recommended by manufacturer.
- .6 Bituminous Paint: Listed as a MPI Approved Product for category MPI #35, without thinner.

- .7 Vertical glass units:
 - .1 Insulating glass units as specified in Section 08 80 00 - Glazing
- .8 Aluminum panels: 3 mm (0.125 inches) thick factory formed panels.
 - .1 Finish after forming to match curtain wall system.
- .9 Thermal Break: Glass fibre reinforced polyamide porthole extrusion.
- .10 Curtain wall back pan insulation: 100 mm (4 inches) thick.
 - .1 Density: 64 kg/m³ (4 lbs/cu ft) minimum.
 - .2 Thermal resistance: RSI 3.0 (R 16.8).
- .11 Sealants:
 - .1 Perimeter Sealant: Type as specified in Section 07 92 00 Joint Sealants.
 - .2 Sealant used within system (not used for glazing): Type recommended by curtain wall manufacturer.
- .12 Mullion Profile:
 - .1 Vertical members: 2 1/2" (64mm) wide x 5.25" (133.35mm) deep frames.
 - .2 Horizontal members: 2 1/2" (64mm) wide x 5.25" (133.35mm) deep frames.
 - .3 Thermally broken with interior tubular section insulated from exterior pressure plate.
 - .4 Matching stops and pressure plate of sufficient size and strength to ensure adequate bite on glass.
 - .5 Drainage holes, deflector plates and internal flashings to accommodate internal weep drainage system.
 - .6 Internal mullion baffles to eliminate "stack effect" air movement within internal spaces.
- .13 Mullions caps: manufacturers standard 3/4" (19 mm) nominal.
 - .1 Structural silicone joints where indicated on Drawings.
- .14 Sheet metal flashings, closures and trim: sheet aluminum, minimum 22 gauge (0.635 mm) thick, formed to sizes and profiles indicated. Finish to match curtain wall mullion sections. Secured with concealed fastening method.
- .15 Integral Vapour Barrier: Compatible with membrane indicated in Section 07 26 00 - Vapour Retarders.
- .16 Door stops: flush stops applied to mullions for butt hung aluminum doors specified in Section 08 11 16 – Aluminum Doors and Frames.

2.4 Fabrication

- .1 Do aluminum welding to CAN/CSA W59.2.
- .2 Fabricate aluminum assemblies of extruded sections to sizes and profiles indicated.
 - .1 Ensure vertical and horizontal members are tubular extrusions designed for shear block corner construction.
 - .2 Mullion depth sizes as indicated.
 - .3 Cap depth sizes: 19 mm (0.75 inches).
 - .4 Structural silicone joints where indicated.

- .5 Ensure caps for mullion assemblies are constructed without gap.
- .3 Construct units square, plumb and free from distortion, waves, twists, buckles or other defects detrimental to performance or appearance.
 - .1 Ensure curtain wall is fabricated with separate, integrated support for insulating glass unit.
 - .2 Do glazing in accordance with Section 08 80 00 – Glazing.
 - .3 Site glazing is permitted.
- .4 Fabricate curtain wall with minimum clearances and shim spacing around panel perimeter and ensure installation and dynamic movement of perimeter seal is enabled.
- .5 Fabricate infill panels with metal covered edge seals around perimeter of panel assembly, enabling installation and minor movement of perimeter seal.
 - .1 Reinforce interior surface of exterior infill panel sheet from deflection caused by wind and suction loads.
 - .2 Place insulation within infill panel adhered to exterior face of interior panel sheet over entire area of sheet using impale fasteners with integral discs.
- .6 Accurately fit and secure joints and corners. Make joints flush, hairline, and weatherproof.
- .7 Prepare components to receive anchor devices. Install anchors.
- .8 Use only concealed fasteners
 - .1 Ensure fasteners do not penetrate thermal break.
 - .2 Where fasteners cannot be concealed, countersunk screws finished to match adjacent material may be used upon receipt of written approval from Contract Administrator.
- .9 Prepare system components to receive exterior doors, and hardware specified in Section 08 71 00 Door Hardware .
- .10 Reinforce interior horizontal head rail to receive roller shade mounting brackets and attachments.
- .11 Reinforce framing members for external imposed loads.
- .12 Visible manufacturer's identification labels are not permitted.
- .13 Finishes:
 - .1 Finish Coatings: To AA designations.
 - .2 Exterior and interior exposed surfaces: to DAF-45 - Aluminum Association Designation System for Aluminum Finishes.
 - .1 Black anodic finish: designation AA-M12-C22-A41, Class 1.
 - .3 Shop and touch-up primer for steel components: SSPC 25 Paint red oxide.
 - .4 Touch-up primer for galvanized steel surfaces: SSPC 20 Paint zinc rich.
 - .5 Concealed steel items: galvanized in accordance with CAN/CSA-G164M to 380 g/m² or primed with iron oxide paint.
 - .6 Apply one coats of bituminous paint to concealed aluminum and steel surfaces in contact with cementitious or dissimilar materials.

2.5 Accessories

- .1 Insulation: In accordance with Section 07 21 13 Board & Semi-Rigid Insulation and Section 07 21 29.03 Sprayed Insulation - Polyurethane Foam.
- .2 Fibre board: to ASTM C612.
 - .1 Type: 1VB.
 - .2 Density: 64 kg/m³ (4 lbs per cu.ft.) minimum.
 - .3 Thickness: 100 mm (4 inches) minimum.
 - .4 Acceptable material: Roxul Inc., CurtainRock.
- .3 Gasketing: To CCD-45 Silicone compatible rubber or extruded silicone gaskets.
- .4 Setting Blocks: To CCD-45 and ASTM D2240; neoprene, EPDM, or silicone; 80 - 90 Shore A Durometer hardness.
- .5 Spacers: To CCD-45 and ASTM D2240; neoprene, EPDM, or silicone; 50 - 60 Shore A Durometer hardness.
- .6 Sealant: To CAN/CGSB-19.13, Class 40, one-component, cold-applied, non-sagging silicone.
 - .1 Acceptable material: Dow Corning 795.
- .7 Sealant Bond Breaker: Open cell foam backer rod sized to suit project requirements.
- .8 Flashings: 3 mm (0.125 inches) thick aluminum flashing to profiles indicated and in accordance with Section 07 62 00 Sheet Metal Flashing and Trim.
- .9 Liquid Foam Insulation: Single component, moisture cure, low expansion rate spray-in-place polyurethane liquid foam insulation to ULC-S710.1 and in accordance with manufacturer's written recommendations.
- .10 Miscellaneous Components: Covers, copings, special flashings, filler pieces, termination pieces, cap closures, expansion joint covers, and metal bellows to match curtain wall system as indicated.

2.6 Product Substitutions

- .1 Substitutions: In accordance with Section 01 23 13 - Product Substitution Procedures.
- .2 Ensure components come from one manufacturer.

Part 3 Execution

3.1 Installers

- .1 Use only manufacturer's authorized installers with 2 years minimum experience in work similar to work of this Section.

3.2 Examination

- .1 Verification of Conditions: Verify conditions of substrates previously installed are acceptable for aluminum curtain wall installation in accordance with manufacturer's instructions.
 - .1 Verify dimensions, tolerances, and method of attachment with other work.
 - .2 Verify wall openings and adjoining air barrier and vapour retarder materials are ready to receive work of this Section.

- .3 Proceed with installation only after unacceptable conditions have been remedied.
- .2 Confirm and coordinate visual review requirements with the BECxA.

3.3 Installation

- .1 Install curtain wall system in accordance with manufacturer's instructions and CAN/CSA-A440.6.
- .2 Do aluminum welding to CAN/CSA W59.2.
- .3 Attach curtain wall assemblies to structure plumb and level, free from warp, and allow for sufficient adjustment to accommodate construction tolerances and other irregularities.
 - .1 Maintain dimensional tolerances and align with adjacent work.
 - .2 Use alignment attachments and shims to permanently fasten elements to building structure.
 - .3 Clean welded surfaces and apply protective primer to field welds and adjacent surfaces.
- .4 Install thermal isolation where components penetrate or disrupt building insulation.
- .5 Install sill flashings, closure flashings and other flashings as indicated. Conceal fastening.
- .6 Coordinate attachment and seal of perimeter air barrier and vapour retarder materials.
- .7 Shim spaces:
 - .1 Shim spaces are defined as joints or spaces between perimeter frames and adjacent construction.
 - .2 Fill shim spaces with non-expanding spray foam sealant to maintain continuity of building thermal barrier.
- .8 Install glass and glazing in accordance with Section 08 80 00 - Glazing
- .9 Install perimeter sealant, backing materials, and installation criteria in accordance with Section 07 92 00 - Joint Sealants.

3.4 Tolerances

- .1 Maximum variation from plumb: 1.5 mm/m non-cumulative or 12 mm/30 m, whichever is less.
- .2 Maximum misalignment of two adjoining members abutting in plane: 0.8 mm
- .3 Maximum sealant space between curtain wall and adjacent construction: 1/2" (13 mm)

3.5 Site quality control

- .1 Coordinate manufacturer's services with Section 01 45 00 - Quality Control.
- .2 Submit to Contract Administrator a written agreement from the manufacturer to perform the manufacturer's services.
- .3 Schedule manufacturer's review of work procedures at stages listed:
 - .1 Product Application: 1 off site review.
 - .2 Fabrication and Handling: 1 review at authorized installers fabrication facilities.
 - .3 Installation: 3 site reviews at commencement of Work, 50% completion of Work, and Upon completion of Work.
- .4 Submit manufacturer's written reports to Contract Administrator describing:

- .1 The scope of work requested.
- .2 Date, time and location.
- .3 Procedures performed.
- .4 Observed or detected non-compliances or inconsistencies with manufacturers' recommended instructions.
- .5 Limitations or disclaimers regarding the procedures performed.
- .6 Obtain reports within seven days of review and submit immediately to Contract Administrator.

3.6 Cleaning

- .1 Progress Cleaning: Clean frames and glazing in accordance with Section 01 74 00 - Cleaning.
 - .1 Remove temporary protective material from prefinished aluminum surfaces.
 - .2 Clean aluminum surfaces promptly after installation. Exercise care to avoid damage to coatings.
 - .3 Ensure curtain wall drainage system (weepers, drainage holes, channels, etc.) are unobstructed and free of dirt and sealants.
- .2 Final Cleaning: Perform in accordance with Section 01 74 00 - Cleaning.
 - .1 Wash exposed surfaces with mild solution of detergent and warm water, using soft, clean wiping cloths. Remove dirt from corners. Wipe surfaces clean.
 - .2 Clean glass and glazing materials with approved non-abrasive cleaner.
- .3 Waste Management:
 - .1 Co-ordinate recycling of waste materials with 01 74 19 Construction Waste Management and Disposal.
 - .2 Collect recyclable waste and dispose of or recycle field generated construction waste created during construction or final cleaning related to work of this Section.
 - .3 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.7 Protection

- .1 Protect installed products and components from damage during construction. Mark glass which may be subject to accidental breakage by Subcontractors. Use temporary markings that after removal do not stain or otherwise leave a perceptible effect.
- .2 Repair damage to adjacent materials caused by glazed aluminum curtain wall installation.

END OF SECTION

Part 1 General

1.1 Section includes

- .1 This Section specifies thermally broken, rain screen designed, flush front non-operable aluminum framed windows and accessories.

1.2 Related requirements

- .1 Section 06 10 00 - Rough Carpentry: Wood framed openings; perimeter shims.
- .2 Section 07 26 00 - Vapour Retarders: Perimeter vapour seal between window frame and adjacent construction.
- .3 Section 07 27 00.01 - Air Barriers – Descriptive or Proprietary: Perimeter air seal between window frame and adjacent construction.
- .4 Section 07 62 00 – Sheet Metal Flashing and Trim: Flashings.
- .5 Section 07 92 00 - Joint Sealants: Perimeter sealant and back-up materials.
- .6 Section 08 80 00 – Glazing.

1.3 Reference standards

- .1 Aluminum Association (AA)
 - .1 DAF 45 2003, Designation System For Aluminum Finishes.
- .2 American Architectural Manufacturers Association (AAMA).
 - .1 AAMA-2603-2002, Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels.
 - .2 AAMA-2604-2005, Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels.
 - .3 AAMA-2605-2005, Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels.
 - .4 AAMA CW-10-2004, Care and Handling of Architectural Aluminum From Shop to Site.
- .3 ASTM International (ASTM).
 - .1 ASTM B209-07, Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
 - .2 ASTM B221-08, Specification for Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
 - .3 ASTM D2240 – 05, Standard Test Method for Rubber Property—Durometer Hardness.
- .4 Canada Green Building Council (CaGBC).
 - .1 LEED Canada-NC Version 4/4.1

- .5 Canadian General Standards Board (CGSB).
 - .1 CAN/CGSB-12.8-97, Insulating Glass Units.
 - .2 CAN/CGSB-12.20-M89, Structural Design of Glass for Buildings.
 - .3 CAN/CGSB-19.13-M87, Sealing Compound, One-Component, Elastomeric, Chemical Curing.
- .6 CSA International (CSA)
 - .1 CAN/CSA-S157 2005, Strength Design in Aluminum.
 - .2 CAN/CSA-S136–2007, North American Specification for the Design of Cold-Form Steel Structural Members.
 - .3 CAN/CSA W59.2 M1991(R2003), Welded Aluminum Construction.
 - .4 AAMA/WDMA/CSA 101/I.S.2/A440-17, NAFS - North American Fenestration Standard / Specification for Windows, Doors and Skylights
 - .5 CSA A440S1:19, Canadian Supplement to AAMA/WDMA/CSA 101/I.S.2/A440-17, NAFS - North American Fenestration Standard / Specification for Windows, Doors and Skylights
- .7 Environmental Choice Program (ECP)
 - .1 CCD 45 1995, Sealants and Caulking Compounds.
- .8 Underwriter’s Laboratories of Canada (ULC)
 - .1 CAN/ULC-S710.1 2005, Standard for Thermal Insulation – Bead-Applied One Component Polyurethane Air Sealant Foam, Part 1: Materials Standard for Thermal Insulation - Bead - Applied One Component Polyurethane Air Sealant Foam, Part 1: Materials.

1.4 Administrative requirements

- .1 Section 01 31 00: Project management and coordination procedures.
- .2 Co-ordination: Co-ordinate work of this Section with work of other trades for proper time and sequence to avoid construction delays.
- .3 Pre-installation Meeting: Convene pre-installation meeting after Award of Contract and one week prior to commencing work of this Section to verify project requirements, substrate conditions and coordination with other building sub-trades, and to review manufacturer’s written installation instructions.
 - .1 Comply with Section 01 31 19 Project Meetings and co-ordinate with other similar pre installation meetings.
 - .2 Notify attendees 2 weeks prior to meeting and ensure meeting attendees include as minimum:
 - .1 City of Winnipeg Representative;
 - .2 Contract Administrator;
 - .3 Glazing Subcontractor;
 - .4 Manufacturer’s Technical Representative.
 - .3 Ensure meeting agenda includes review of methods and procedures related to aluminum window installation including co-ordination with related work.

- .4 Record meeting proceedings including corrective measures and other actions required to ensure successful completion of work and distribute to each attendee within 1 week of meeting.

1.5 Action and Informational submittals

- .1 Make submittals in accordance with Contract Conditions and Section 01 33 00 Submittal Procedures.
- .2 Product Data: Submit product data including manufacturer's literature for aluminum window frames, glazing, components and accessories, indicating compliance with specified requirements and material characteristics.
 - .1 Submit list on window manufacturer's letterhead of materials, components and accessories to be incorporated into Work.
 - .2 Include product names, types and series numbers.
 - .3 Include contact information for manufacturer and their representative for this Project.
- .3 Shop Drawings: Submit drawings stamped and signed by Professional Engineer registered or licensed in the Province of Manitoba, Canada.
 - .1 Indicate materials and details in full size scale for head, jamb and sill, profiles of components, interior and exterior trim, junction between combination units, elevations of unit, anchorage details, description of related components and exposed finishes, fasteners, and caulking.
 - .2 Indicate location of manufacturer's nameplates.
- .4 Samples:
 - .1 Submit duplicate 300 x 300 mm (12 x 12 inches) sample sections showing prefinished aluminum surface, finish, colour and texture, and including frame corner details
 - .2 Submit duplicate 300 x 300 mm (12 x 12 inches) sample sections of insulating glass unit showing glazing materials and edge and corner details.
- .5 Thermal Performance: Submit verification that Insulating Glass Units used meet Usi (U) centre of glass values specified.
- .6 Test Reports:
 - .1 Submit test reports showing compliance with specified performance characteristics and physical properties including air and water infiltration.
- .7 Field Reports: Submit manufacturer's field reports within 3 days of manufacturer representative's site visit and inspection.
- .8 Sustainable Design (LEED).
 - .1 LEED Submittals: In accordance with Section 01 35 20 – LEED Requirements
- .9 Installer Qualifications:
 - .1 Submit letter verifying installer's experience with work similar to work of this Section.
- .10 Confirm and coordinate submittal requirements with the BECxA.

1.6 Closeout submittals

- .1 Operation and Maintenance Data: Supply maintenance data for windows for incorporation into manual specified in Section 01 78 00 Closeout Submittals.
- .2 Sustainable Design Closeout Documentation (LEED).
 - .1 Provide calculations on end-of-project recycling rates, salvage rates, and landfill rates for work of this Section demonstrating percentage of construction wastes which were recycled.
 - .2 Submit verification from recycling facility showing receipt of materials.
- .3 Record Documentation: In accordance with Section 01 78 00 Closeout Submittals.
 - .1 List materials used in windows work.
 - .2 Warranty: Submit warranty documents specified.

1.7 Quality assurance

- .1 Sustainability Standards Certification (LEED).
 - .1 LEED Canada-NC Version 4/4.1 submittals: in accordance with Section 01 35 20 LEED Requirements.
- .2 Confirm and coordinate visual review, testing requirements, mock-up, and pre-installation conference requirements with the BECxA.

1.8 Delivery, storage, and handling

- .1 Delivery and Acceptance Requirements:
 - .1 Deliver material in accordance with Section 01 61 00 Common Product Requirements.
 - .2 Deliver aluminum windows in manufacturer's original packaging with identification labels intact and in sizes to suit project.
 - .3 Brace frames to maintain squareness and rigidity during shipment.
- .2 Material Handling: To AAMA CW-10.
- .3 Storage and Handling Requirements: Store materials off ground and protected from exposure to harmful weather conditions and at temperature conditions recommended by manufacturer.
 - .1 Material storage: To AAMA CW-10.
- .4 Packaging Waste Management:
 - .1 Separate and recycle waste packaging materials in accordance with Section 01 74 19 Construction Waste Management and Disposal.
 - .2 Remove waste packaging materials from site and dispose of packaging materials at appropriate recycling facilities.
 - .3 Collect and separate for disposal paper and plastic material in appropriate on-site storage containers for recycling in accordance with Waste Management Plan.

1.9 Warranty

- .1 Project Warranty: Refer to Contract Conditions for project warranty provisions.

- .2 Manufacturer's warranty: Submit, for City of Winnipeg's acceptance, manufacturer's standard warranty document executed by authorized company official. Manufacturer's warranty is in addition to and not intended to limit other rights City of Winnipeg may have under Contract Conditions.
- .3 Warranty period: 1 year commencing on Date of Substantial Performance of Work.
 - .1 Insulating glass units: 10 years, on Date of Substantial Performance of Work.

Part 2 Products

2.1 Manufacturers

- .1 Manufacturer (fixed windows):
Alumicor Limited
290 Humberline Drive, Toronto, Ontario, Canada M9W 5S2
Phone: (416) 745-4222 or (877) ALUMICOR
e-mail: info@Alumicor.com
URL: www.Alumicor.com.
 - .1 Or approved equal
- .2 Manufacturer (sliding windows):
C.L. Laurence of Canada.
 - .1 Or approved equal.

2.2 Sliding Windows

- .1 Aluminum Framed Transom Sliding Windows:
 - .1 Aluminum, heavy-duty commercial sliding service window (as indicated in Drawings).
 - .1 Frame size: 1207mm W x 1207mm H (47-1/2" W x 47-3/4" H)
 - .2 Opening size: 1220mm x 1220mm (48" x 48")
 - .3 Glazing type: tempered 1/4" (6mm) clear glazing.
 - .4 Operation: Manual Open/Manual Close with Full Bottom Track
 - .5 Finish: Duranodic Bronze Anodized
 - .6 Accessories: Full bottom track and keyed lock included.
 - .7 Locations: Welcome Office 116, Equipment Loans 146
 - .8 Acceptable Material: DW Deluxe Service Window, as manufactured by C.L. Laurence of Canada.

2.3 Description - Fixed Windows

- .1 System Description:
 - .1 Thermally broken, rain screened, aluminum framed, windows with triple glazed insulating glass units and flush front design.

2.4 Performance / design criteria - Fixed Windows

- .1 Design aluminum components to CAN/CSA S157.
- .2 Window Classification: CW, in accordance with the Canadian Supplement to WDMA/CSA 101/I.S.2/A440-17, NAFS and CSA A440S1:19.

- .1 Air Leakage: Fixed Windows: Maximum 0.2 L/sm² at a pressure differential of 75Pa, when tested in accordance with WDMA/CSA 101/I.S.2/A440-17.
- .2 Air tightness: Fixed Rating, when tested in accordance with WDMA/CSA 101/I.S.2/A440-17.
- .3 Water Penetration Resistance Test: No water penetration at a pressure differential of 330Ps, when tested in accordance with WDMA/CSA 101/I.S.2/A440-17, NAFS and CSA A440S1:19.
- .3 System Design: Design and size components to withstand dead loads and live loads caused by positive and negative wind loads acting normal to plane of wall:
- .4 Assembly: To accommodate, without damage to components or deterioration of seals, movement between window and perimeter framing, deflection of lintel.
- .5 System Internal Drainage: Drain water entering joints, condensation occurring in glazing channels, or migrating moisture occurring within system, to the exterior by a weep drainage network.

2.5 Fixed Window Materials

- .1 Main Frame and glass stops: Extruded aluminum: To ASTM B221, 6063 alloy with T5 or T6 temper.
 - .1 Main Frame Depth: 153 mm (6.00 inches).
 - .2 Interior colour: black anodized.
 - .3 Exterior colour: black anodized.
- .2 Insulating glass units: In accordance with Section 08 80 00 – Glazing.
- .3 Thermal Break: Glass fibre reinforced polyamide porthole extrusion.
- .4 Primary seal gasket: EPDM, 70 Durometer
- .5 Rain screen gasket: EPDM, 70 Durometer
- .6 Glass stop pressure gasket: EPDM, 70 Durometer
- .7 Interior and Exterior Sills: Extruded aluminum to ASTM B209, of type and size to suit project conditions; minimum 3 mm thick, complete with joint covers, jamb drip deflectors, chairs, anchors and anchoring devices.

2.6 Fixed Windows

- .1 Acceptable Material: Alumicor Ltd., RainBlade 2970 Series with flush front design.
- .2 Or approved equal.

2.7 Fixed Window Fabrication

- .1 Fabricate windows to CAN/CSA A440/A440.1 and manufacturer's instructions.
 - .1 Do glazing in accordance with Section 08 80 00 – Glazing. Ensure proper installation of prime seal gasket whether shop or field glazed.
- .2 Fabricate aluminum assemblies of extruded sections to sizes and profiles indicated.
 - .1 Ensure vertical and horizontal members are tubular extrusions designed for shear block and/or screw spline corner construction.

- .2 Provide drainage path from glazing cavity in accordance with rain screen design practices and manufacturer's instructions to permit drainage of extraneous water to the exterior.
- .3 Construct units square, plumb and free from distortion, waves, twists, buckles or other defects detrimental to performance or appearance.
 - .1 Brace frames to maintain squareness and rigidity during installation.
- .4 Fabricate units square and true with tolerance of plus or minus 1.5 mm (0.06 inches) maximum for units with diagonal measurement of 1800 mm (6 feet) maximum and plus or minus 3 mm (0.125 inches) maximum for units with diagonal measurement greater than 1800 mm (6 feet).
- .5 Accurately fit and secure joints and corners.
 - .1 Ensure joints are flush, hairline, and weatherproof.
 - .2 Seal joints and corners in accordance with manufacturer's instructions
- .6 Face dimensions detailed are maximum permissible sizes.
- .7 Use only concealed tamperproof fasteners
 - .1 Where fasteners cannot be concealed, countersunk screws finished to match adjacent material may be used upon receipt of written approval from Contract Administrator.
- .8 Visible manufacturer's labels are not permitted.

2.8 Fixed Window Finishes

- .1 Exterior exposed aluminum surfaces: To AA DAF-45-M10C21A41, Architectural Class I, black anodized 18 µm (0.0007 inches) minimum thickness coloured black.
 - .1 Acceptable material: Alumicor Ltd., Class I Anodic Finish
- .2 Interior exposed aluminum surfaces: To AA DAF-45-M10C21 A41 A44, Architectural Class I, anodized 18 µm (0.0007 inches) minimum thickness coloured black.
 - .1 Acceptable material: Alumicor Ltd., Class I Anodic Finish.

2.9 Air Barrier and Vapour Retarder - Fixed Windows

- .1 Install air and vapour retarder materials as indicated on the drawings.

2.10 Accessories - Fixed Windows

- .1 Gasketing: To CCD-45 Black EPDM gaskets.
- .2 Setting Blocks: To CCD-45 and ASTM D2240, [neoprene] [EPDM] [silicone], 80 - 90 Shore A Durometer hardness. Manufacturer's standard, notched to permit water drainage through the glazing cavity.
- .3 Spacers: To CCD-45 and ASTM D2240, [neoprene] [EPDM] [silicone], 50 - 60 Shore A Durometer hardness.
- .4 Sealant: To CAN/CGSB-19.13, Class 40, one-component, cold-applied, non-sagging silicone.
 - .1 Acceptable material: Dow Corning 795 or approved equal.
- .5 Sealant Bond Breaker: Open cell foam backer rod sized to suit project requirements.

- .6 Flashings: 3 mm (0.125 inches) thick aluminum flashing to profiles indicated and in accordance with Section 07 62 00 Sheet Metal Flashing and Trim.
- .7 Shims: In accordance with CSA A440-17

2.11 Product Substitutions

- .1 Substitutions: In accordance with Section 01 33 00 - Submittal Procedures
- .2 Ensure components come from one manufacturer.

Part 3 Execution

3.1 Installers

- .1 Use only manufacturer's authorized dealers for installers with 2 years minimum experience in work similar to work of this Section.

3.2 Examination

- .1 Verification of Conditions: Verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for window installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate.
 - .2 Inform Contract Administrator of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied.
- .2 Confirm and coordinate visual review requirements with the BECxA.

3.3 Fixed Window Installation

- .1 Install windows in accordance with manufacturer's written instructions and to CAN/CSA A440/A440.1.
- .2 Install perimeter prime seal gasket in accordance with manufacturer's instructions, seal corners. Continuous wet seal heel beads are not permitted.
- .3 Arrange components to prevent abrupt variation in colour.
- .4 Co-ordinate attachment and seal of perimeter vapour retarder in accordance with Section 07 26 00 – Vapour Retarders.
- .5 Co-ordinate attachment and seal of perimeter air barrier in accordance with Section 07 27 00 – Air Barriers.

3.4 Sill Installation - Fixed Windows

- .1 Install aluminum sills with uniform wash to exterior, level in length, straight in alignment with plumb upstands and faces.
- .2 Cut sills to fit window opening.
- .3 Secure sills in place with anchoring devices located at ends and joints of continuous sills and evenly spaced 600 mm (24 inches) on centre in between.
- .4 Fasten expansion joint cover plates and drip deflectors with tamperproof, self tapping cadmium plated stainless steel screws.

- .5 Maintain 6 to 9 mm (0.25 to 0.375 inches) space between butt ends of continuous sills. For sills over 1200 mm in length, maintain 3 to 6 mm space at each end.

3.5 Caulking

- .1 Apply sealant in accordance with Section 07 92 00 - Joint Sealing. Conceal sealant within window units except where exposed use is approved in writing by Contract Administrator.
- .2 Seal joints between windows and window sills with sealant. Bed sill expansion joint cover plates and drip deflectors in bedding compound.
 - .1 Caulk between sill upstand and window frame. Caulk butt joints in continuous sills.

3.6 Field Quality Control - Fixed Windows

- .1 Coordinate field inspection with Section 01 45 00 - Quality Control.
- .2 Site Installation Tolerances: Install windows square and true with tolerance of plus or minus 1.5 mm (0.06 inches) maximum for units with diagonal measurement of 1800 mm (6 feet) maximum and plus or minus 3 mm (0.125 inches) maximum for units with diagonal measurement greater than 1800 mm (6 feet).
- .3 Coordinate manufacturer's services with Section 01 45 00 - Quality Control.
- .4 Submit to Contract Administrator a written agreement from the manufacturer to perform the manufacturer's services.
- .5 Schedule manufacturer's review of work procedures at stages listed:
 - .1 Product Application: 1 off site review.
 - .2 Fabrication and Handling: 1 review at authorized installers fabrication facilities.
 - .3 Installation: 3 site reviews: at commencement of Work , 50% completion of Work, and Upon completion of Work.
- .6 Submit manufacturer's written reports to Contract Administrator describing:
 - .1 The scope of work requested.
 - .2 Date, time and location.
 - .3 Procedures performed.
 - .4 Observed or detected non-compliances or inconsistencies with manufacturers' recommended instructions.
 - .5 Limitations or disclaimers regarding the procedures performed.
 - .6 Obtain reports within seven days of review and submit immediately to Contract Administrator.

3.7 Cleaning

- .1 Progress Cleaning: Perform cleanup as work progresses in accordance with Section 01 74 00 Cleaning and Waste Management.
 - .1 Remove sealant and caulking drippings as work progresses.
 - .2 Leave work area clean end of each day.
- .2 Final cleaning: Upon completion, remove surplus materials, rubbish, tools, and equipment in accordance with Section 01 74 00 – Cleaning and Waste Management.

- .3 Waste Management:
 - .1 Co-ordinate recycling of waste materials with 01 74 19 - Construction Waste Management and Disposal.
 - .2 Collect recyclable waste and dispose of or recycle field generated construction waste created during construction or final cleaning related to work of this Section.
 - .3 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.8 Protection

- .1 Protect installed windows and components from damage during construction.
- .2 Repair damage to adjacent materials caused by aluminum window installation.

END OF SECTION

Part 1 General

1.1 Related requirements

- .1 Section 01 33 00 - Submittal Procedures
- .2 Section 01 35 20 - LEED Sustainable Requirements
- .3 Section 01 74 00 - Cleaning
- .4 Section 01 78 00 - Closeout Submittals
- .5 Section 08 11 00 - Metal Doors and Frames
- .6 Section 08 11 16 - Aluminum Doors and Frames
- .7 Section 08 71 01 - Door Hardware Schedule

1.2 Reference standards

- .1 American National Standards Institute (ANSI) / Builders Hardware Manufacturers Association (BHMA):
 - .1 ANSI/BHMA A156.1-2016, Butts and Hinges
 - .2 ANSI/BHMA A156.2-2017, Bored and Preassembled Locks and Latches
 - .3 ANSI/BHMA A156.3-2020, Exit Devices
 - .4 ANSI/BHMA A156.4-2019, Door Controls - Closers
 - .5 ANSI/BHMA A156.5-2020, Cylinders and Input Devices for Locks
 - .6 ANSI/BHMA A156.6-2015, Architectural Door Trim
 - .7 ANSI/BHMA A156.8-2015, Door Controls - Overhead Stops and Holders
 - .8 ANSI/BHMA A156.10-2017, Power Operated Pedestrian Doors
 - .9 ANSI/BHMA A156.12-2018, Interconnected Locks
 - .10 ANSI/BHMA A156.13-2017, Mortise Locks and Latches
 - .11 ANSI/BHMA A156.14-2019, Sliding and Folding Door Hardware
 - .12 ANSI/BHMA A156.15-2015, Closer Holder, Electromagnetic and Electromechanical
 - .13 ANSI/BHMA A156.16-2018, Auxiliary Hardware
 - .14 ANSI/BHMA A156.17-2019, Self Closing Hinges and Pivots
 - .15 ANSI/BHMA A156.18-2020, Materials and Finishes
 - .16 ANSI/BHMA A156.19-2019, Power Assist and Low Energy Power - Operated Doors
 - .17 ANSI/BHMA A156.20-2017, Strap and Tee Hinges and Hasps
 - .18 ANSI/BHMA A156.21-2019, Standard For Thresholds
 - .19 ANSI/BHMA A156.22-2017, Door Gasketing and Edge Seal Systems
 - .20 ANSI/BHMA A156.26-2017, Continuous Hinges
 - .21 ANSI/BHMA A156.28-2018, Recommended Practices for Keying Systems

- .22 ANSI/BHMA A156.29-2017, American National Standard for Exit Locks, Exit Alarms, Alarms for Exit Devices
- .23 ANSI/BHMA A156.30-2020, Standard for High Security Cylinders
- .24 ANSI/BHMA A156.34-2016, Bored Locks and Mortise Locks with Ligature Resistant Trim
- .25 ANSI/BHMA A156.36-2020, Standard for Auxiliary Locks
- .2 Canadian Steel Door and Frame Manufacturers' Association (CSDMA):
 - .1 Recommended Dimensional Standards for Commercial Steel Doors and Frames, 2000
- .3 CSA Group (CSA):
 - .1 CSA B651-12, Accessible Design for the Built Environment
- .4 National Fire Protection Association (NFPA):
 - .1 NFPA 80-2013, Standard for Fire Doors and Other Opening Protectives

1.3 Action and informational submittals

- .1 Submit in accordance with Section Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for door hardware and include product characteristics, performance criteria, physical size, finishes, and limitations.
- .3 Hardware List:
 - .1 Submit contract hardware list.
 - .2 Indicate specified hardware, including make, model, material, function, size, finish and other pertinent information.
- .4 Test Reports: certified test reports showing compliance with specified performance characteristics and physical properties.
- .5 Manufacturer's Instructions: submit manufacturer's installation instructions.
- .6 Sustainable Design Submittals:
 - .1 LEED Submittals: in accordance with 01 35 20 - LEED Sustainable Requirements.
 - .2 Construction Waste Management: Refer to Section 01 74 19 Waste Management and Disposal.
 - .3 Material product attribute documentation: Refer to Product Check Sheet as listed in 01 35 20 - LEED Sustainable Requirements to determine applicable type of documentation required for each product.

1.4 Closeout submittals

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

1.5 Maintenance material submittals

- .1 Extra Stock Materials:
 - .1 Supply maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.
 - .2 Tools:
 - .1 Supply 2 sets of wrenches for door closers, locksets and fire exit hardware.

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 Certificates: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

1.7 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 Package items of hardware including fastenings, separately or in like groups of hardware, label each package as to item definition and location.
- .4 Storage and Handling Requirements:
 - .1 Store materials off ground indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect door hardware from nicks, scratches, and blemishes.
 - .3 Protect prefinished surfaces with strippable coating.

Part 2 Products

2.1 Hardware items

- .1 Use one manufacturer's products only for similar items.

2.2 Door hardware

- .1 Refer to Section 08 71 01 - Door Hardware Schedule

2.3 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.

2.4 Keying

- .1 Doors, padlocks and cabinet locks to be keyed alike. Prepare detailed keying schedule in conjunction with City of Winnipeg's Representative.
- .2 Supply keys in duplicate for every lock in this Contract.
- .3 Supply 3 master keys for each master key or grand master key group.
- .4 Stamp keying code numbers on keys and cylinders.
- .5 Supply construction cores.
- .6 Hand over permanent cores and keys to City of Winnipeg's Representative.

Part 3 Execution

3.1 Installation

- .1 Manufacturer's Instructions: comply with manufacturer's written recommendations, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.
- .2 Supply metal door and frame manufacturers with complete instructions and templates for preparation of their work to receive hardware.
- .3 Supply manufacturers' instructions for proper installation of each hardware component.
- .4 Install hardware to standard hardware location dimensions in accordance with CSDFMA Canadian Metric Guide for Steel Doors and Frames (Modular Construction)
- .5 Where door stop contacts door pulls, mount stop to strike bottom of pull.
- .6 Install key control cabinet.
- .7 Use only manufacturer's supplied fasteners.
 - .1 Use of "quick" type fasteners, unless specifically supplied by manufacturer, is unacceptable.
- .8 Remove construction cores when directed by Contract Administrator.
 - .1 Install permanent cores and ensure locks operate correctly.

3.2 Adjusting

- .1 Adjust door hardware, operators, closures and controls for optimum, smooth operating condition, safety and for weather tight closure.
- .2 Lubricate hardware, operating equipment and other moving parts.
- .3 Adjust door hardware to ensure tight fit at contact points with frames.

3.3 Cleaning

- .1 Progress Cleaning: clean in accordance with Section 01 74 00 - Cleaning.
 - .1 Clean hardware with damp rag and approved non-abrasive cleaner, and polish hardware in accordance with manufacturer's instructions.

- .2 Remove protective material from hardware items where present.
- .3 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 - Cleaning.

3.4 Demonstration

- .1 Keying System Setup and Cabinet:
 - .1 Set up key control system with file key tags, duplicate key tags, numerical index, alphabetical index and key change index, label shields, control book and key receipt cards.
- .2 Maintenance Staff Briefing:
 - .1 Brief maintenance staff regarding:
 - .1 Proper care, cleaning, and general maintenance of projects complete hardware.
 - .2 Description, use, handling, and storage of keys.
 - .3 Use, application and storage of wrenches for door closers locksets and fire exit hardware.
- .3 Demonstrate operation, operating components, adjustment features, and lubrication requirements.

3.5 Protection

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

END OF SECTION

Hardware Schedule

Project Name: Old Exhibition Arena and Associated Work

2020-136

Hardware Sets

Set: 01

Doors: 100A

Description:

2	Continuous Hinge	BSPFM85SLI-HD1	BSP	PE
1	Mullion	980S 2440mm	PC	SA
1	Rim Exit Device, Exit Only	16 43 72 AD8504 Less Trim	BSP	SA
1	Rim Exit Device, Exit Only	16 43 72 AD8510 Less Trim	BSP	SA
4	Permanent Cylinder	1C72	626	BE
1	Electric Strike	9600-LBM	BSP	HS
2	Door Pull	RM3311-72 Mtg-Type 1XHD	BSP	RO
2	OH Stop HD Concealed	1-*36 Size To Suit	630	RF
1	Surface Closer	281 OZ	BSP	SA
1	Mounting Plate	281B	BSP	SA
2	Actuator Full Height	S-I36 Ingress'r	710	WK
1	Auto Operator	HA9-SP		RE
1	Perimeter Gasketing	By Door Supplier		OT
2	Door Sweep/Drip Cap	3452APK To Suit Door Width	628	PE
1	Threshold (TB)	252 x 3AFG To Suit Door Width	627	PE
1	ElectroLynx Harness	QC-C*** To Suit (Frame)		MK
1	Relay	CX-12		CA
1	Door Contact	By Security Subcontractor	BLK	OT
1	Card Reader	By Security Subcontractor		OT
2	Guard Rail	CE-805 Manitoba Size To Suit	ALUM	CU
2	Bollard	B-6SQ-RT-DB-SM-INGR	DKB	WK
1	Power Supply	By Security Subcontractor		OT

Notes: Free egress at all times, pressing touch bar retracts latch bolt.
 Cylinder Dogging for maintained latch retraction (Push/Pull Operation)
 Key in outside cylinder retracts latch bolt on active leaf.
 Auto Operator by actuator either side on active leaf, exterior actuator disabled when latch is engaged in strike.
 Valid credential at card reader releases electric strike and enables exterior actuator.

Set: 02

Doors: 100B

Description:

2	Continuous Hinge	BSPFM85SLI-HD1	BSP	PE
1	Mullion	980S 2440mm	PC	SA
1	Rim Exit Device, Exit Only	16 43 72 AD8504 Less Trim	BSP	SA
1	Rim Exit Device, Exit Only	16 43 72 AD8510 Less Trim	BSP	SA
4	Permanent Cylinder	1C72	626	BE
1	Electric Strike	9600-LBM	BSP	HS
2	Door Pull	RM3311-72 Mtg-Type 1XHD	BSP	RO
1	OH Stop HD Concealed	1-*36 Size To Suit	BSP	RF
1	OH Stop HD Concealed	1-*36 ADJ Size To Suit	BSP	RF
1	Surface Closer	281 OZ	BSP	SA
1	Mounting Plate	281B	BSP	SA
2	Actuator Full Height	S-I36 Ingress'r	710	WK
1	Auto Operator	HA9-SP		RE
1	Perimeter Gasketing	By Door Supplier		OT
1	ElectroLynx Harness	QC-C*** To Suit (Frame)		MK
1	Relay	CX-12		CA
2	Door Contact	By Security Subcontractor	BLK	OT
1	Card Reader	By Security Subcontractor		OT
1	Power Supply	By Security Subcontractor		OT

Notes: Free egress at all times, pressing touch bar retracts latch bolt.
 Cylinder Dogging for maintained latch retraction (Push/Pull Operation)
 Key in outside cylinder retracts latch bolt on active leaf.

Auto Operator by actuator either side on active leaf, exterior actuator disabled when latch is engaged in strike.
 Valid credential at card reader releases electric strike and enables exterior actuator.

Set: 03

Doors: 100C

Description:

1	Continuous Hinge	BSPFM85SLI-HD1	BSP	PE
1	Deadlatch	4510	335	AD
1	Paddle Operator	4591-01-00	335	AD
1	Mortise Cylinder	41 101	BSP	SA
1	Electric Strike	5000C-LBM	630	HS
1	Door Pull	RM3311-72 Mtg-Type 1XHD	BSP	RO
1	OH Stop HD Surface	9-*36 Size To Suit	630	RF
2	Actuator Full Height	S-I36 Ingress'r	710	WK
1	Auto Operator	HA9-SP		RE
1	Perimeter Gasketing	By Door Supplier		OT
1	ElectroLynx Harness	QC-C*** To Suit (Frame)		MK
1	Relay	CX-12		CA
1	Door Contact	By Security Subcontractor	BLK	OT
1	Card Reader	By Security Subcontractor		OT
1	Power Supply	By Security Subcontractor		OT

Notes: Door is normally closed and locked.

Key in outside cylinder retracts latch bolt for manual override.

Auto Operator by actuator either side, exterior actuator disabled when latch is engaged in strike.

Valid credential at card reader releases electric strike and enables exterior actuator.

Set: 04

Doors: 101A

Description:

2	Continuous Hinge	FM300 2150	630	MR
2	Concealed Vert Rod Exit, Dummy	NB 16 MD8610 862	US32D	SA
2	Surface Closer	281 CPSH	EN	SA
4	Kick Plate	K1050 254mm x 25mm LDW CSK BEV	US32D	RO
2	Silencer	608-RKW		RO

Notes: Door is normally closed and locked.

Free egress at all times.

Cylinder dogging retracts latch bolt for push pull operation.

Set: 05

Doors: 101B

Description:

1	Continuous Hinge	FM300 2150	630	MR
1	Continuous Hinge	FM300 2150 EL-CEPTx32D	630	MR
1	Concealed Vert Rod Exit, Dummy	NB 16 MD8610 862	US32D	SA
1	Concealed Vert Rod Exit, Nightlatch	NB 16 53 MD8610 106 x 862	US32D	SA
1	OH Stop HD Concealed	1-*36 Size To Suit	630	RF
1	Surface Closer	281 CPSH	EN	SA
2	Actuator Full Height	S-I36 Ingress'r	710	WK
1	Auto Operator	HA9-SP		RE
4	Kick Plate	K1050 254mm x 25mm LDW CSK BEV	US32D	RO

Notes: Door is normally closed and locked.

Key in outside cylinder for manual override.

Auto operator by actuator either side, exterior actuator disabled when latch bolt is engaged in strike (53).

Cylinder dogging retracts latch bolt for push pull operation.

Set: 06

Doors: 102A

Description:

2	Continuous Hinge	BSPFM85SLI-HD1	BSP	PE
1	Mullion	980S 2440mm	PC	SA
1	Rim Exit Device, Exit Only	16 43 72 AD8504 Less Trim	BSP	SA
1	Rim Exit Device, Exit Only	16 43 72 AD8510 Less Trim	BSP	SA
2	Permanent Cylinder	1C72	626	BE
1	Electric Strike	9600-LBM	BSP	HS
2	Door Pull	RM3311-72 Mtg-Type 1XHD	BSP	RO
1	OH Stop HD Concealed	1-*36 Size To Suit	BSP	RF
1	OH Stop HD Concealed	1-*36 ADJ Size To Suit	BSP	RF
1	Surface Closer	281 OZ	BSP	SA
1	Mounting Plate	281B	BSP	SA
2	Actuator Full Height	S-I36 Ingress'r	710	WK
1	Auto Operator	HA9-SP		RE
1	Perimeter Gasketing	By Door Supplier		OT
2	Door Sweep/Drip Cap	3452APK To Suit Door Width	628	PE
1	Threshold (TB)	252 x 3AFG To Suit Door Width	627	PE
1	ElectroLynx Harness	QC-C*** To Suit (Frame)		MK
1	Relay	CX-12		CA

Notes: Free egress at all times, pressing touch bar retracts latch bolt.
 Cylinder Dogging for maintained latch retraction (Push/Pull Operation)
 Key in outside cylinder retracts latch bolt on active leaf.
 Auto Operator by actuator either side on active leaf, exterior actuator disabled when latch is engaged in strike.

Set: 07

Doors: 102B

Description:

2	Continuous Hinge	BSPFM85SLI-HD1	BSP	PE
2	Push Bar	8893	BSP	SA
2	Door Pull	RM3311-72 Mtg-Type 1XHD	BSP	RO
1	OH Stop HD Concealed	1-*36 Size To Suit	BSP	RF
1	OH Stop HD Concealed	1-*36 ADJ Size To Suit	BSP	RF
1	Surface Closer	281 OZ	BSP	SA
1	Mounting Plate	281B	BSP	SA
2	Actuator Full Height	S-I36 Ingress'r	710	WK
1	Auto Operator	HA9-SP		RE
1	Perimeter Gasketing	By Door Supplier		OT

Notes: Door is normally closed and unlocked.
 Push / Pull Operation
 Self-closing .
 Auto operator by actuator either side.

Set: 08

Doors: 124

Description:

3	Hinge, Full Mortise	TA2714 127 x 102mm	BSP	MK
1	Classroom Lock	9K3-7R-14D	622	BE
1	Surface Closer	DA 1431 O	BSP	SA
2	Kick Plate	K1050 254mm x 38mm LDW CSK BEV	US32D	RO
1	Wall Stop	406/407	BSP	RO
3	Silencer	608-RKW		RO

Notes: Key in outside locks/unlocks outside lever.
 Free egress at all times.

Set: 09

Doors: 105, 106

Description:

1	BF Pull	By Door Supplier	OT
1	Balance Of Hardware	By Door Supplier	OT

Set: 10

Doors: 107, 144

Description:

1	Hinge, Full Mortise Electric	TA2714 QC4 127 x 102mm	US26D	MK
2	Hinge, Full Mortise	TA2714 127 x 102mm	BSP	MK
1	El. Storeroom Lock	9K3-7DEL 14D (FS)	626	BE
1	Electric Strike	5000C	630	HS
2	ElectroLynx Adaptor	2004M		FO
1	Actuator Full Height	S-I36 Ingress'r	710	WK
1	Auto Operator	HA9-SP		RE
2	Kick Plate	K1050 254mm x 38mm LDW CSK BEV	US32D	RO
1	Wall Stop	406/407	BSP	RO
1	ElectroLynx Harness	QC-C*** To Suit (Door)		MK
1	ElectroLynx Harness	QC-C*** To Suit (Frame)		MK
1	Privacy Relay	CX-33		OT
2	Annunciator/Sounder	AF141SO	WHT	OT
1	Emergency Push Button	CM-450R/12 x CM-SE21A	630	OT
1	Position Switch	DPS-M-BK		SU
1	Power Supply	AQL4		SU

Notes: Door is normally closed and unlocked.

Enter manually or automatically.

Privacy mode engaged with "Push To Lock" button inside room:

Outside Lever locked electronically.

Indicator provides status "Occupied When Lit"

Emergency Access with key in outside lever.

Privacy mode reset when door opens manually or automatically.

Auto Operator by actuator either side, exterior actuator disabled by privacy mode.

Emergency Call Kit -

Pressing Button for emergency assistance

- activates Dome Light (AF141SO) Adjust volume to "0"

- Releases privacy function for access (optional)

- Confirm location for Dome Light.

Set: 11

Doors:

Description:

1	Hardware	By Door Supplier	OT
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Set: 12

Doors: 120, 121

Description:

3	Hinge, Full Mortise	TA2714 127 x 102mm	BSP	MK
1	Privacy Lock	9K3-0L 14D	622	BE
1	Surface Closer	DA 1431 O	BSP	SA
2	Kick Plate	K1050 254mm x 38mm LDW CSK BEV	US32D	RO
1	Wall Stop	406/407	BSP	RO
3	Silencer	608-RKW		RO

Set: 13A

Doors: 115, 119

Description:

3	Hinge, Full Mortise	TA2714 114 x 102mm	BSP	MK
1	Storeroom Lock	9K3-7D 14D	622	BE
1	Surface Closer	DA 1431 O	BSP	SA
2	Kick Plate	K1050 254mm x 38mm LDW CSK BEV	US32D	RO
1	Wall Stop	406/407	BSP	RO
1	Smoke Seal	S88BL To Suit Opening	BLK	PE

Notes: Key in outside retracts latch bolt.
 Free egress at all times.

Set: 13B

Doors: 131, 135, 145, 146

Description:

3	Hinge, Full Mortise	TA2714 127 x 102mm	BSP	MK
1	Storeroom Lock	9K3-7D 14D	622	BE
1	Surface Closer	DA 1431 O	BSP	SA
2	Kick Plate	K1050 254mm x 38mm LDW CSK BEV	US32D	RO
1	Wall Stop	406/407	BSP	RO
1	Smoke Seal	S88BL To Suit Opening	BLK	PE

Notes: Key in outside retracts latch bolt.
 Free egress at all times.

Set: 14

Doors: 103, 116, D139B

Description:

3	Hinge, Full Mortise	TA2714 114 x 102mm	BSP	MK
1	Storeroom Lock	9K3-7D 14D	622	BE
1	Electric Strike	5000C	630	HS
1	ElectroLynx Adaptor	2004M		FO
1	Surface Closer	1431 O	BSP	SA
1	Wall Stop	406/407	BSP	RO
3	Silencer	608-RKW		RO
1	ElectroLynx Harness	QC-C*** To Suit (Frame)		MK
1	Door Contact	By Security Subcontractor	BLK	OT
1	Card Reader	By Security Subcontractor		OT
1	Power Supply	By Security Subcontractor		OT

Notes: Door normally closed and locked.
 Valid credential at card reader releases electric strike.
 Key in outside lever retracts latch bolt for manual override.

Set: 15

Doors: 117

Description:

2	Hinge, Full Mortise	TA2714 127 x 102mm	US26D	MK
1	Hinge, Full Mortise	TA2714 QC4 127 x 102mm	US26D	MK
1	Storeroom Lock	9K3-7DEU 14D (FSE)	626	BE
1	Electric Strike	5000C	630	HS
2	ElectroLynx Adaptor	2004M		FO
2	Actuator Full Height	S-I36 Ingress'r	710	WK
1	Auto Operator	HA9-SP		RE
2	Kick Plate	K1050 254mm x 38mm LDW CSK BEV	US32D	RO
1	Wall Stop	406/407	BSP	RO

3	Silencer	608-RKW		RO
1	ElectroLynx Harness	QC-C*** To Suit (Door)		MK
2	ElectroLynx Harness	QC-C*** To Suit (Frame)		MK
1	Relay	CX-12		CA
1	Door Contact	By Security Subcontractor	BLK	OT
1	Card Reader	By Security Subcontractor		OT
1	Power Supply	By Security Subcontractor		OT

Notes: Door normally closed and locked.
 Valid credential at card reader releases electric lockset and enables manual or automatic operation.
 Access Controlled schedule locks/unlocks door during hours of operation.
 Key in outside lever retracts latch bolt for manual override.
 Auto operator by actuator either side, exterior actuator controlled by access control.

Set: 16

Doors: 118

Description:

3	Hinge, Full Mortise	TA2714 127 x 102mm	BSP	MK
1	Storeroom Lock	9K3-7D 14D	622	BE
1	Electric Strike	5000C	630	HS
1	ElectroLynx Adaptor	2004M		FO
1	OH Stop Concealed	6-*36 Size To Suit	BSP	RF
1	Surface Closer	1431 O	BSP	SA
2	Kick Plate	K1050 254mm x 38mm LDW CSK BEV	US32D	RO
3	Silencer	608-RKW		RO
1	ElectroLynx Harness	QC-C*** To Suit (Frame)		MK
1	Door Contact	By Security Subcontractor	BLK	OT
1	Card Reader	By Security Subcontractor		OT
1	Power Supply	By Security Subcontractor		OT

Notes: Door normally closed and locked.
 Valid credential at card reader releases electric strike.
 Key in outside lever retracts latch bolt for manual override.

Set: 17A

Doors: 122

Description:

3	Hinge, Full Mortise	TA2714 127 x 102mm	BSP	MK
1	Storeroom Lock	9K3-7D 14D	622	BE
1	Electric Strike	5000C	630	HS
1	ElectroLynx Adaptor	2004M		FO
2	Actuator Full Height	S-I36 Ingress'r	710	WK
1	Auto Operator	HA9-SP		RE
2	Kick Plate	K1050 254mm x 38mm LDW CSK BEV	US32D	RO
1	Wall Stop	406/407	BSP	RO
3	Silencer	608-RKW		RO
1	ElectroLynx Harness	QC-C*** To Suit (Frame)		MK
1	Relay	CX-12		CA
1	Door Contact	By Security Subcontractor	BLK	OT
1	Card Reader	By Security Subcontractor		OT
1	Power Supply	By Security Subcontractor		OT

Notes: Door normally closed and locked.
 Valid credential at card reader releases electric strike and enables manual or automatic operation.
 Key in outside lever retracts latch bolt for manual override.
 Auto operator by actuator either side, exterior actuator controlled by access control.

Set: 17B

Doors: 127, 129

Description:

3	Hinge, Full Mortise	TA2714 127 x 102mm	BSP	MK
1	Mortise Deadlock	72 4875	BSP	SA
1	Permanent Cylinder	1C72	626	BE
1	Push Bar & Pull	BF15747-2 T1HD	BSP	RO
2	Actuator Full Height	S-I36 Ingress'r	710	WK
1	Auto Operator	HA9-SP		RE
2	Kick Plate	K1050 254mm x 38mm LDW CSK BEV	US32D	RO
1	Wall Stop	406/407	BSP	RO
3	Silencer	608-RKW		RO
1	ElectroLynx Harness	QC-C*** To Suit (Frame)		MK

Notes: Door is normally closed and locked.
 Key in outside cylinder for manual override.
 Auto operator by actuator either side, actuators disabled when deadbolt engaged in strike.

Set: 18

Doors: 123

Description:

3	Hinge, Full Mortise	TA2714 127 x 102mm	BSP	MK
1	Classroom Lock	9K3-7R 14D	622	BE
1	OH Stop Concealed	6-*36 Size To Suit	BSP	RF
1	Surface Closer	DA 1431 O	BSP	SA
2	Kick Plate	K1050 254mm x 38mm LDW CSK BEV	US32D	RO
1	Smoke Seal	S88BL To Suit Opening	BLK	PE

Notes: Key in outside locks/unlocks outside lever.
 Free egress at all times.

Set: 19

Doors: 125, 128, 137

Description:

3	Hinge, Full Mortise	TA2714 127 x 102mm	BSP	MK
1	Classroom Lock	9K3-7R 14D	622	BE
2	Kick Plate	K1050 254mm x 38mm LDW CSK BEV	US32D	RO
1	Wall Stop	406/407	BSP	RO
3	Silencer	608-RKW		RO

Notes: Key in outside locks/unlocks outside lever.
 Free egress at all times.

Set: 20

Doors: 130

Description:

3	Hinge, Full Mortise	TA2714 127 x 102mm	BSP	MK
1	Classroom Lock	9K3-7R 14D	622	BE
1	OH Stop Concealed	6-*36 Size To Suit	BSP	RF
1	Kick Plate	K1050 254mm x 38mm LDW CSK BEV	US32D	RO
3	Silencer	608-RKW		RO

Notes: Key in outside locks/unlocks outside lever.
 Free egress at all times.

Set: 21

Doors: 132A

Description:

1	Continuous Hinge	BSPFM85SLI-HD1	BSP	PE
1	Rim Exit Device, Exit Only	16 43 72 AD8504 Less Trim	BSP	SA

1	Permanent Cylinder	1C72	626	BE
1	Electric Strike	9600-LBM	BSP	HS
1	OH Stop HD Concealed	1-*36 ADJ Size To Suit	BSP	RF
2	Actuator Full Height	S-I36 Ingress'r	710	WK
1	Auto Operator	HA9-SP		RE
2	Kick Plate	K1050 254mm x 38mm LDW CSK BEV	US32D	RO
1	Astragal	3572SP 2150		PE
1	Head Seal	290APK To Suit Door Width	628	PE
1	Weatherstrip Jamb	319CN To Suit Opening Height (1 pr)	628	PE
1	Door Sweep	315CN To Suit Door Width	628	PE
1	Threshold (TB)	252 x 3AFG To Suit Door Width	627	PE
1	ElectroLynx Harness	QC-C*** To Suit (Frame)		MK
1	Relay	CX-12		CA
1	Door Contact	By Security Subcontractor	BLK	OT
1	Card Reader	By Security Subcontractor		OT
1	Power Supply	By Security Subcontractor		OT

Notes: Door normally closed and locked.
 Valid credential at card reader releases electric strike.
 Key in outside lever retracts latch bolt for manual override.
 Latch Bolt Monitored.
 Auto operator by actuator either side, exterior actuator controlled by card reader.

Set: 22

Doors: 132B

Description:

1	Continuous Hinge	BSPFM85SLI-HD1	BSP	PE
2	Door Pull	RM3311-72 Mtg-Type 1XHD Mtg- Type 16	BSP	RO
1	OH Stop Concealed	6-*36 Size To Suit	BSP	RF
2	Actuator Full Height	S-I36 Ingress'r	710	WK
1	Auto Operator	HA9-SP		RE
1	Perimeter Gasketing	By Door Supplier		OT

Notes: Push/Pull Operation
 Auto operator by actuator either side.

Set: 23

Doors: 133A

Description:

2	Continuous Hinge	FM300 2150	630	MR
1	Mullion	L980S 2184mm	PC	SA
1	Rim Exit Device, Storeroom	16 43 72 8804 FLW	US32D	SA
1	Rim Exit Device, Dummy	16 8810 FLW	US32D	SA
3	Permanent Cylinder	1C72	626	BE
1	Electric Strike	9600-LBM	630	HS
1	ElectroLynx Adaptor	2004M		FO
2	OH Stop HD Surface	9-*36 Size To Suit	630	RF
1	Surface Closer	281 OZ	EN	SA
1	Mounting Plate	281B	EN	SA
2	Actuator Full Height	S-I36 Ingress'r	710	WK
1	Auto Operator	HA9-SP		RE
2	Kick Plate	K1050 254mm x 25mm LDW CSK BEV	US32D	RO
1	Head Seal	290APK To Suit Door Width	628	PE
2	Weatherstrip Jamb	319CN To Suit Opening Height (1 pr)	628	PE
2	Door Sweep	315CN To Suit Door Width	628	PE
1	Threshold (TB)	252 x 3AFG To Suit Door Width	627	PE
1	Relay	CX-12		CA
2	Door Contact	By Security Subcontractor	BLK	OT
1	Bollard	B-6SQ-RT-DB-SM-INGR	DKB	WK

Notes: Free egress at all times, pressing touch bar retracts latch bolt.
 Cylinder Dogging for maintained latch retraction (Push/Pull Operation)
 Key in outside cylinder retracts latch bolt on active leaf.
 Auto Operator by actuator either side on active leaf, exterior actuator disabled when latch is engaged in strike.

Set: 24

Doors: 133B

Description:

2	Continuous Hinge	FM300 2150	630	MR
1	Mullion	980S 2440mm	PC	SA
2	Rim Exit Device, Exit Only	8810 EO	630	SA
2	OH Stop HD Surface	9-*36 Size To Suit	630	RF
2	Surface Closer	281 OZ	EN	SA
2	Mounting Plate	281B	EN	SA
2	Kick Plate	K1050 254mm x 25mm LDW CSK BEV	US32D	RO
1	Head Seal	290APK To Suit Door Width	628	PE
2	Weatherstrip Jamb	319CN To Suit Opening Height (1 pr)	628	PE
2	Door Sweep	315CN To Suit Door Width	628	PE
1	Threshold (TB)	252 x 3AFG To Suit Door Width	627	PE
2	Door Contact	By Security Subcontractor	BLK	OT

Notes: Free egress at all times, pressing touch bar retracts latch bolt.
 Exit Only.

Set: 25

Doors: 134

Description:

5	Hinge, Full Mortise	TA2714xNRP 127 x 114mm	BSP	MK
1	Hinge, Full Mortise Electric	TA2714 QC4 127 x 102mm	US26D	MK
1	Flush Bolt	2845	BSP	RO
1	Dust Proof Strike	570	BSP	RO
1	El. Storeroom Lock	9K3-7DEU 14D (FSE)	626	BE
1	ElectroLynx Adaptor	2004M		FO
1	Coordinator	2600 To Suit	US28	RO
2	Surface Closer	281 O	BSP	SA
4	Kick Plate	K1050 254mm x 25mm LDW CSK BEV	US32D	RO
1	Astragal "Z"	By Door Supplier		OT
1	Smoke Seal	S88BL To Suit Opening	BLK	PE
1	ElectroLynx Harness	QC-C*** To Suit (Door)		MK
1	ElectroLynx Harness	QC-C*** To Suit (Frame)		MK
1	Relay	CX-12		CA
1	Door Contact	By Security Subcontractor	BLK	OT
1	Card Reader	By Security Subcontractor		OT
1	Power Supply	By Security Subcontractor		OT

Notes: Door normally closed and locked.
 Valid credential at card reader releases electric lock.
 Key in outside lever retracts latch bolt for manual override.
 Self-closing.

Set: 26

Doors: 136

Description:

3	Hinge, Full Mortise	TA2714 127 x 102mm	BSP	MK
1	Classroom Deadlock	72 4877	BSP	SA
1	Permanent Cylinder	1C72	626	BE
1	Push Bar & Pull	BF15747-2 T1HD	BSP	RO
2	Actuator Full Height	S-I36 Ingress'r	710	WK
1	Auto Operator	HA9-SP		RE

2	Kick Plate	K1050 254mm x 38mm LDW CSK BEV	US32D	RO
1	Wall Stop	406/407	BSP	RO
1	Smoke Seal	S88BL To Suit Opening	BLK	PE
1	Auto Door Bottom	4131CRL To Suit Door Width	628	PE
1	ElectroLynx Harness	QC-C*** To Suit (Frame)		MK
1	Monitor	LMS-1		SU

Notes: Door is normally closed and locked.
 Key in outside cylinder for manual override.
 Auto operator by actuator either side, actuators disabled when deadbolt engaged in strike.

Set: 27

Doors: 138, 139

Description:

6	Hinge, Full Mortise	TA2714 127 x 102mm	BSP	MK
1	Dust Proof Strike	570	BSP	RO
2	Flush Bolt	555	BSP	RO
1	Storeroom Lock	9K3-7D 14D	622	BE
2	OH Stop Concealed	6-*36 Size To Suit	BSP	RF
1	Surface Closer	DA 1431 O	BSP	SA
4	Kick Plate	K1050 254mm x 25mm LDW CSK BEV	US32D	RO
2	Silencer	608-RKW		RO

Notes: Door normally closed and locked.
 Key in outside lever retracts latch bolt for manual override.
 Self-closing.

Set: 28

Doors: 140

Description:

1	Continuous Hinge	FM300 2150	630	MR
1	Rim Exit Device, Exit Only	8810 EO	630	SA
1	OH Stop HD Surface	9-*36 Size To Suit	630	RF
1	Surface Closer	281 OZ	EN	SA
1	Mounting Plate	281B	EN	SA
2	Kick Plate	K1050 254mm x 38mm LDW CSK BEV	US32D	RO
1	Head Seal	290APK To Suit Door Width	628	PE
1	Weatherstrip Jamb	319CN To Suit Opening Height (1 pr)	628	PE
1	Door Sweep	315CN To Suit Door Width	628	PE
1	Threshold (TB)	252 x 3AFG To Suit Door Width	627	PE
1	Door Contact	By Security Subcontractor	BLK	OT

Notes: Exit Only

Set: 29

Doors: 147, 148, 149, 150

Description:

3	Hinge, Full Mortise	TA2714 127 x 102mm	BSP	MK
1	Entrance Lock	9K3-7AB 14D	622	BE
1	Surface Closer	1431 O	BSP	SA
2	Kick Plate	K1050 254mm x 38mm LDW CSK BEV	US32D	RO
1	Wall Stop	406/407	BSP	RO
3	Silencer	608-RKW		RO

Notes: Door normally closed and locked.
 Key in outside lever retracts latch bolt for manual override.

Set: 30

Doors: 151
 Description:

6	Hinge, Full Mortise	TA2714 127 x 102mm	BSP	MK
1	Dust Proof Strike	570	BSP	RO
2	Flush Bolt	555	BSP	RO
1	Storeroom Lock	9K3-7D 14D	622	BE
2	OH Stop Concealed	6-*36 Size To Suit	BSP	RF
1	Surface Closer	DA 1431 O	BSP	SA
4	Kick Plate	K1050 254mm x 25mm LDW CSK BEV	US32D	RO
1	Astragal "Z"	By Door Supplier		OT
2	Silencer	608-RKW		RO

Notes: Door normally closed and locked.
 Key in outside lever retracts latch bolt for manual override.

Set: 31

Doors: 152
 Description:

6	Hinge, Full Mortise	TA2714 127 x 102mm	BSP	MK
1	Flush Bolt	2845	BSP	RO
1	Dust Proof Strike	570	BSP	RO
1	Storeroom Lock	9K3-7D 14D	622	BE
1	Coordinator	2600 To Suit	US28	RO
2	OH Stop Concealed	6-*36 Size To Suit	BSP	RF
2	Surface Closer	DA 1431 O	BSP	SA
4	Kick Plate	K1050 254mm x 25mm LDW CSK BEV	US32D	RO
1	Astragal "Z"	By Door Supplier		OT
1	Smoke Seal	S88BL To Suit Opening	BLK	PE

Notes: Key in outside retracts latch bolt.
 Free egress at all times.

Set: 32

Doors: 153
 Description:

1	Continuous Hinge	FM300 2150	630	MR
1	Continuous Hinge	FM300 2150 EL-CEPTx32D	630	MR
1	Dust Proof Strike	570	BSP	RO
1	Flush Bolt	555	BSP	RO
1	Storeroom Lock	9K3-7D 14D	626	BE
2	OH Stop HD Surface	9-*36 Size To Suit	630	RF
2	Surface Closer	281 OZ	EN	SA
2	Mounting Plate	281B	EN	SA
4	Kick Plate	K1050 254mm x 25mm LDW CSK BEV	US32D	RO
1	Astragal	3572SP 2150		PE
1	Head Seal	290APK To Suit Door Width	628	PE
1	Weatherstrip Jamb	319CN To Suit Opening Height (1 pr)	628	PE
2	Door Sweep	315CN To Suit Door Width	628	PE
1	Threshold (TB)	252 x 3AFG To Suit Door Width	627	PE

Notes: Door normally closed and locked.
 Key in outside lever retracts latch bolt for manual override.
 Self-closing.

Set: 33

Doors: 154A
 Description:

3	Hinge, Full Mortise	TA2714xNRP 127 x 114mm	BSP	MK
1	Classroom Lock	9K3-7R 14D	622	BE

1	Electric Strike	5000C-LBM	630	HS
1	OH Stop Concealed	6-*36 Size To Suit	BSP	RF
2	Actuator Full Height	S-I36 Ingress'r	710	WK
1	Auto Operator	HA9-SP		RE
2	Kick Plate	K1050 254mm x 38mm LDW CSK BEV	US32D	RO
1	Smoke Seal	S88BL To Suit Opening	BLK	PE
1	Weatherstrip Jamb	319CN To Suit Opening Height (1 pr)	628	PE
1	Auto Door Bottom	4131CRL To Suit Door Width	628	PE
1	ElectroLynx Harness	QC-C*** To Suit (Frame)		MK
1	Door Contact	By Security Subcontractor	BLK	OT
1	Key Switch	CM-160		CM

Notes: Door normally closed and locked.
 Key in outside lever retracts latch bolt for manual override.
 Auto operator by actuator either side, exterior actuator controlled by keyswitch.

Set: 34

Doors: 154B

Description:

1	Continuous Hinge	FM300 2150	630	MR
1	Storeroom Lock	9K3-7D 14D	626	BE
1	Electric Strike	5000C-LBM	630	HS
1	OH Stop HD Surface	9-*36 Size To Suit	630	RF
2	Actuator Full Height	S-I36 Ingress'r	710	WK
1	Auto Operator	HA9-SP		RE
2	Kick Plate	K1050 254mm x 38mm LDW CSK BEV	US32D	RO
1	Astragal	3572SP 2150		PE
1	Head Seal	290APK To Suit Door Width	628	PE
1	Weatherstrip Jamb	319CN To Suit Opening Height (1 pr)	628	PE
1	Door Sweep	315CN To Suit Door Width	628	PE
1	Threshold	253x6AFG To Suit Door Width	627	PE
1	ElectroLynx Harness	QC-C*** To Suit (Frame)		MK
1	Door Contact	By Security Subcontractor	BLK	OT
1	Card Reader	By Security Subcontractor		OT
1	Remote Release Button	By Security Subcontractor		OT
1	Power Supply	By Security Subcontractor		OT

Notes: Door normally closed and locked.
 Valid credential at card reader releases electric strike. Remote release.
 Key in outside lever retracts latch bolt for manual override.
 Auto operator by actuator either side, exterior actuator enabled by access control.

Set: 35

Doors: 142b

Description:

1	Hardware	By Door Supplier		OT
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Set: 36

Doors: 142a

Description:

1	Continuous Hinge	FM300 2150	630	MR
1	Rim Exit Device, Dummy	16 8810 FLW	US32D	SA
1	Electric Strike	9600-LBM	630	HS
1	OH Stop HD Surface	9-*36 Size To Suit	630	RF
1	Surface Closer	281 OZ	EN	SA
1	Mounting Plate	281B	EN	SA
2	Kick Plate	K1050 254mm x 38mm LDW CSK BEV	US32D	RO
1	Head Seal	290APK To Suit Door Width	628	PE

1	Weatherstrip Jamb	319CN To Suit Opening Height (1 pr)	628	PE
1	Door Sweep	315CN To Suit Door Width	628	PE
1	Threshold (TB)	252 x 3AFG To Suit Door Width	627	PE
1	Remote Release Button	By Security Subcontractor		OT
1	Power Supply	By Security Subcontractor		OT

Notes: Door is normally closed and locked.
 Remote release.

Set: 37

Doors: 126

Description:

3	Hinge, Full Mortise	TA2714 127 x 102mm	BSP	MK
1	Storeroom Lock	9K3-7D 14D	622	BE
1	Electric Strike	5000C	630	HS
1	ElectroLynx Adaptor	2004M		FO
2	Actuator Full Height	S-I36 Ingress'r	710	WK
1	Auto Operator	HA9-SP		RE
2	Kick Plate	K1050 254mm x 38mm LDW CSK BEV	US32D	RO
1	Wall Stop	406/407	BSP	RO
3	Silencer	608-RKW		RO
1	ElectroLynx Harness	QC-C*** To Suit (Door)		MK
2	ElectroLynx Harness	QC-C*** To Suit (Frame)		MK
1	Relay	CX-12		CA
1	Door Contact	By Security Subcontractor	BLK	OT
1	Card Reader	By Security Subcontractor		OT
1	Power Supply	By Security Subcontractor		OT

Notes: Door normally closed and locked.
 Valid credential at card reader releases electric strike and enables manual or automatic operation.
 Key in outside lever retracts latch bolt for manual override.
 Auto operator by actuator either side, exterior actuator controlled by access control.
 Electric strike connected to fire alarm for immediate release.

Set: 38

Doors: 122B

Description:

3	Hinge, Full Mortise	TA2714xNRP 127 x 114mm	BSP	MK
1	Storeroom Lock	9K3-7D 14D	622	BE
1	Surface Closer	1431 CPS	BSP	SA
2	Kick Plate	K1050 254mm x 38mm LDW CSK BEV	US32D	RO
3	Silencer	608-RKW		RO

Notes: Key in outside retracts latch bolt.
 Free egress at all times.

Part 1 General

1.1 Related requirements

- .1 Section 07 92 00 - Joint Sealants
- .2 Section 08 11 00 Metal Doors and Frames
- .3 Section 08 11 16 Aluminum Doors and Frames
- .4 Section 08 36 16 Sectional Overhead Doors
- .5 Section 08 44 13 Glazed Aluminum Curtain Walls
- .6 Section 08 51 13 Aluminum Windows
- .7 Section 08 87 33 Decorative Films
- .8 Section 10 28 00 Toilet and Bath Accessories

1.2 Reference standards

- .1 ASTM International (ASTM):
 - .1 ASTM C542-05, Standard Specification for Lock-Strip Gaskets
 - .2 ASTM D790-17, Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials
 - .3 ASTM D1003-13, Standard Test Method for Haze and Luminous Transmittance of Plastics
 - .4 ASTM D1929-20, Standard Test Method for Determining Ignition Temperature of Plastics
 - .5 ASTM D2240-15e1, Standard Test Method for Rubber Property - Durometer Hardness
 - .6 ASTM E84-20, Standard Test Method for Surface Burning Characteristics of Building Materials
 - .7 ASTM E330-02, Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference
 - .8 ASTM F1233-08, Standard Test Method for Security Glazing Materials and Systems
- .2 Canadian General Standards Board (CGSB):
 - .1 CAN/CGSB-12.1-2017, Safety Glazing
 - .2 CAN/CGSB-12.3-M91, Flat, Clear Float Glass
 - .3 CAN/CGSB-12.8-2017, Insulating Glass Units
- .3 National Glass Association with GANA (NGA):
 - .1 GANA Glazing Manual - 2008
- .4 Flat Glass Manufacturers Association (FGMA)
 - .1 FGMA Glazing Manual

- .5 South Coast Air Quality Management District (SCAQMD), California State, Regulation XI. Source Specific Standards:
 - .1 SCAQMD Rule 1168-2017, Adhesives and Sealants Applications

1.3 Administrative requirements

- .1 Pre-Installation Meetings: Convene meeting 1 week before beginning work of this Section and on-site installation, with Contractor, Subcontractor and Contract Administrator in accordance with Section Section 01 31 19 - Project Meetings:
 - .1 Verify project requirements.
 - .2 Review installation and substrate conditions.
 - .3 Coordination with other Subcontractors.
 - .4 Review manufacturer's written installation instructions and warranty requirements.
- .2 Sequencing: Comply with manufacturer's recommendations for sequencing construction operations.

1.4 Action and informational submittals

- .1 Submit in accordance with Section Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, product literature and data sheets for glass, sealants, and glazing accessories and include product characteristics, performance criteria, physical size, finish, and limitations.
 - .2 Submit WHMIS SDS.
- .3 Shop Drawings: Submit drawings stamped and signed by professional engineer registered or licensed in the Province of Manitoba, Canada.
- .4 Samples:
 - .1 Submit for review and acceptance of each type of unit.
 - .2 Samples will not be returned for inclusion into Work.
- .5 Sustainable Design Submittals:
 - .1 LEED Canada submittals: in accordance with Section 01 35 20 - LEED Sustainable Requirements.
 - .2 Construction Waste Management: Refer to Section 01 74 19 - Construction Waste Management and Disposal.
 - .3 Material product attribute documentation: Refer to Product Check Sheet as listed in 01 35 20 – LEED Sustainable Requirements to determine applicable type of documentation required for each product.
 - .4 Low-Emitting Materials:
 - .1 Submittals are required for any sealants, adhesives, paints, coatings, composite wood, flooring, wall panels, insulation or ceiling components within the inner most weather proofing barrier.
 - .2 Refer to Product Check Sheet as listed in 01 35 20 – LEED Sustainable Requirements to determine applicable type of documentation required for each product.

1.5 Closeout submittals

- .1 Submit in accordance with Section Section 01 78 00 - Closeout Submittals.
- .2 Operation and Maintenance Data: Submit maintenance data for glazing and incorporate into manual.

1.6 Quality assurance

- .1 Perform work in accordance with FGMA Glazing Manual for glazing installation methods.
- .2 Confirm and coordinate visual review and pre-installation conference requirements with the BECxA.
- .3 Mock-ups: Construct mock-ups in accordance with Section Section 01 43 00 - Quality Assurance.
 - .1 Mock-up will be used:
 - .1 To judge quality of work, substrate preparation, and material application.
 - .2 Confirm and coordinate mock-up requirements with the BECxA.

1.7 Delivery, storage, and handling

- .1 Deliver, store, and handle materials in accordance with Section Section 01 61 00 - Common Product Requirements.
- .2 Storage and Handling Requirements:
 - .1 Store materials off ground indoors in a clean dry location and in accordance with manufacturer's recommendations.
 - .2 Store and protect glazing from nicks, scratches, and edge damage.
 - .3 Protect prefinished aluminum surfaces with wrapping.
 - .4 Replace defective or damaged materials with new.

1.8 Ambient conditions

- .1 Ambient Requirements:
 - .1 Install glazing when ambient temperature is 10°C minimum. Maintain ventilated environment for 24 hours after application.
 - .2 Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.
 - .3 Refer to manufacturer's instructions for minimum ambient temperature for application of bird deterrent glazing film.

1.9 Extended Warranty

- .1 Provide five (5) year warranty to include coverage for sealed glass units for seal failure, inter-pane dusting or misting, and replacement of same at no cost to City of Winnipeg.

Part 2 Products

2.1 Materials

- .1 Design Criteria:

- .1 Ensure continuity of building enclosure vapour and air barrier using glass and glazing materials as follow:
 - .2 Utilize inner lite of multiple lite sealed units for continuity of air and vapour seal.
 - .3 Size glass to withstand wind loads, dead loads and positive and negative live loads acting normal to plane of glass to design pressure to ASTM E330.
 - .4 Limit glass deflection to 1/200 flexural limit of glass with full recovery of glazing materials.
 - .5 If required heat strengthen outboard light of float glass on insulating glass units to withstand wind loads, dead loads and positive and negative live loads acting normal to plane of glass.
 - .6 Design glass units to withstand thermal stresses created by solar heat gain, shadowing of exterior components or assemblies (soffits, sunshades, buildings, trees) and elevated interstitial space temperatures, and from solar heat gain.
- .2 Flat Glass:
- .1 Tempered Safety glass: to CAN/CGSB-12.1, transparent.
 - .1 Type 2-tempered.
 - .2 Class B-float
 - .3 Category 2.
 - .4 Thickness as indicated.
 - .2 Silvered mirror glass: to ASTM C1503, 6 mm thick.
 - .1 Type 3A-tempered.
 - .2 Polish and grind edges
 - .3 Accessories:
 - .1 CRL Stainless Steel Canadian Style 1/4" Deep Nose 'J' Channel (or approved equal) around perimeter of mirror.
- .3 Backpainted Glass:
- .1 Fully Tempered, Low Iron
 - .2 Glass Thickness: Minimum 6mm
 - .3 Edges: Polished
 - .4 Pattern: Full coverage LCBA opaque coating applied to second surface.
 - .5 Colour: Custom colour to match PT-5 (yellow)
 - .6 Size: Refer to drawings
 - .7 Location: Lobby 101
 - .8 Basis of Design: Goldray Glass Solid Colour+
 - .9 Installation: Concealed, integrated mounting system
 - .1 Basis of Design: Goldray Mosaic Cladding System, Single Open Profile.
 - .10 Sealants: In accordance with Section 07 92 00 - Joint Sealants

- .1 VOC limit 250 g/L maximum to SCAQMD Rule 1168.
- .2 VOC limit: 5% maximum by weight to CCD-045.
- .3 Ensure sealant does not contain chemical restrictions to CCD-045.
- .4 Insulating Glass Units:
 - .1 Insulating glass units (Type 1): to CAN/CGSB-12.8, hermetically sealed, triple-pane unit, transparent, tempered safety glass.
 - .1 Glazing:
 - .1 Inner pane: 6mm (1/4") clear, tempered glass
 - .2 Middle pane: 6mm (1/4") clear, tempered glass
 - .3 Outer pane: 6mm (1/4") clear, tempered glass
 - .2 Cavity:
 - .1 Thickness: 13mm (1/2") air space between panes.
 - .2 Inert gas: Argon filled.
 - .3 Coating:
 - .1 Low-Emissivity coating on surface #2 and #5.
 - .2 Hard, pyrolytic deposition.
 - .3 Standard of acceptance: Solarban® 60, by Vitro Architectural Glass (formerly PPG).
 - .4 Edges:
 - .1 High performance thermal separator, warm edge spacer, dual silicone seal, black.
 - .2 Standard of acceptance: Edgetech Superspacer Premium Plus or equal.
 - .2 Insulating glass units (Type 2): to CAN/CGSB-12.8, hermetically sealed, dual-pane unit, transparent, tempered safety glass.
 - .1 Glazing:
 - .1 Inner pane: 6mm (1/4") clear, tempered glass.
 - .2 Outer pane: 6mm (1/4") clear, tempered glass.
 - .2 Cavity:
 - .1 Thickness: 13mm (1/2") air space between panes.
 - .2 Inert gas: Argon filled.
 - .3 Coating:
 - .1 Low-Emissivity coating on surface #2.
 - .2 Hard, pyrolytic deposition.
 - .3 Standard of acceptance: Solarban® 60, by Vitro Architectural Glass (formerly PPG) or equal.
 - .4 Edges:
 - .1 High performance thermal separator, warm edge spacer, dual silicone seal, black.

- .2 Standard of acceptance: Edgetech Superspacer Premium Plus or equal.
- .5 Sealant: in accordance with Section 07 92 00 - Joint Sealants.

2.2 Accessories

- .1 Setting blocks: neoprene or EPDM, 80-90 Shore A durometer hardness to ASTM D2240, size to suit glazing method, glass light weight and area.
- .2 Spacer shims: neoprene, 50-60 Shore A durometer hardness to ASTM D2240, 3" (75 mm) long x one half height of glazing stop x thickness to suit application. Self-adhesive on one face.
- .3 Glazing tape:
 - .1 Preformed butyl compound with integral resilient tube spacing device, 10-15 Shore A durometer hardness to ASTM D2240; coiled on release paper; size to suit; black colour.
- .4 Glazing splines: resilient polyvinyl chloride, extruded shape to suit glazing channel retaining slot.
- .5 Glazing clips: manufacturer's standard type.
- .6 Lock-strip gaskets: to ASTM C542.
- .7 Mirror attachment accessories:
 - .1 Stainless steel clips.

Part 3 Execution

3.1 Examination

- .1 Verification of Conditions: Verify conditions of substrates previously installed are acceptable for beginning glazing installation in accordance with manufacturer's instructions.
 - .1 Verify that openings for glazing are correctly sized and within tolerance.
 - .2 Verify that surfaces of glazing channels or recesses are clean, free of obstructions, and ready to receive glazing.
 - .3 Visually inspect substrates.
 - .4 Inform Contract Administrator of unacceptable conditions immediately upon discovery.
 - .5 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Contract Administrator.
- .2 Confirm and coordinate visual review requirements with the BECxA.

3.2 Preparation

- .1 Clean contact surfaces with solvent and wipe dry.
- .2 Seal porous glazing channels or recesses with substrate compatible primer or sealer.
- .3 Prime surfaces scheduled to receive sealant.
- .4 All surfaces receiving glazing material shall be thoroughly wiped with a clean cloth, dampened with the appropriate cleaner, as approved by the sealant/glazing tape

manufacturer. Special precautions must be taken in cold weather to ensure the surfaces are free from frost.

- .5 All framing members of windows shall be checked prior to glazing to make certain that the frame is square, plumb, and secure in order that uniform face and edge clearances are maintained. Inspect all butt and mitre joints. If these joints are open, they shall be sealed with sealant prior to glazing. All vents shall be properly adjusted. Maintain 3mm (1/8") minimum face clearance between glass and metal, on both sides, unless otherwise indicated by glazing manufacturer.
- .6 Preparation - Glazing films:
 - .1 Clean glazing before beginning installation using neutral cleaning solution.
 - .2 Ensure no deleterious material adheres to glazing.
 - .3 Ensure dust, grease, and chemical residue are removed from surface of glazing before installation of film.
 - .4 Examine glazing under natural daylight and identify cracks, blisters, bubbles, discolouration, edge defects or other anomalies that may cause film to delaminate or cause vision transparency or distortion problems.

3.3 Installation: mirrors

- .1 Set mirrors with adhesive, applied in accordance with adhesive manufacturer's instructions.
- .2 Install mirrors in locations as indicated on drawings. Refer to Interior Elevations.
- .3 Set mirrors with stainless steel clips. Anchor rigidly to wall construction.
- .4 Set in frame.
- .5 Place plumb and level.

3.4 Installation: plastic film

- .1 Install plastic film in accordance with film manufacturer's instructions..
- .2 In accordance with Section 08 87 33 Decorative Films

3.5 Cleaning

- .1 Progress Cleaning: clean in accordance with Section 01 74 00 - Cleaning.
 - .1 Remove traces of primer and sealants.
 - .2 Remove glazing materials from finish surfaces.
 - .3 Remove labels.
 - .4 Clean glass and mirrors using approved non-abrasive cleaner in accordance with manufacturer's instructions.
- .2 Waste Management: Perform in accordance with Section 01 74 19 - Waste Management and Disposal.

3.6 Protection

- .1 Protect installed products and components from damage during construction.
- .2 After installation, mark each lite with an "X" by using removable plastic tape or paste.
 - .1 Do not mark heat absorbing or reflective glass units.

- .3 Repair damage to adjacent materials caused by glazing installation.

3.7 Schedule

- .1 Hollow Metal Doors:
 - .1 Interior - Not fire rated.
 - .1 Glass: 1/4" (6mm) thick tempered safety glass.
 - .2 Glazing Method: As per manufacturer's written recommendations.
 - .2 Aluminum Doors:
 - .1 Interior: 1/4" (6mm) thick tempered safety glass.
 - .2 Exterior Openings: Type 2 insulating glass units (double-pane)
 - .3 Glazing Method: As per manufacturer's written recommendations.
- .3 Glazed Aluminum Curtain Wall:
 - .1 Glass - Type 1 insulating glass units (triple-pane)
 - .2 Glazing Method: As per manufacturer's written recommendations.
- .4 Punched Aluminum Windows:
 - .1 Glass - Type 1 insulating glass units (triple-pane)
 - .2 Glazing Method: As per manufacturer's written recommendations.

END OF SECTION

Part 1 General

1.1 Section includes

- .1 ASTM International
 - .1 ASTM E903 - Test Method for Solar Absorptance, Reflectance, and Transmittance of Materials Using Integrating Spheres.

1.2 Related sections

- .1 Glazing 08 80 00

1.3 Actions and Information Submittals

- .1 Submit in accordance with Section 01 33 00 - Submittals Procedures
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for glass, sealants, and glazing accessories and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Include product data indicating sustainable design characteristics.
- .3 Samples:
 - .1 For each type of decorative film specified, provide (2) samples, 305mm square.
- .4 Certificates: Submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

1.4 Close out submittals

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Operation and Maintenance Data: submit for decorative film.

1.5 Quality assurance

- .1 Manufacturer Qualifications: A qualified manufacturer that has a minimum of 10 years of documented experience manufacturing decorative films similar to be used for this project.
- .2 Installer Qualification: A firm that is authorized by decorative film manufacturer to install film in accordance with guidelines set forth by the manufacturer.
- .3 Source Limitations: Obtain each type of decorative film from same manufacturer.
 - .1 Mock-Ups: Build mock-ups to verify selections made under sample submittals and to evaluate surface preparation techniques and application workmanship.
 - .2 Construct mock-ups in the location and of the size indicated or, if not indicated, as desired by Contract Administrator.
 - .3 Approved mock-ups may become part of the completed work if undisturbed at time of Substantial Completion.

1.6 Delivery, storage and handling

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements with manufacturer's written instructions.
- .2 Store and protect materials according to manufacturer's written recommendations to prevent damage from condensation, temperature changes, direct exposure to sun or other causes.
- .3 Develop Construction Waste Management Plan related to Work of this Section and in accordance with Section 01 35 20 - LEED Sustainability Requirements.
- .4 Packaging Waste Management: remove and return for reuse by manufacturer of crates, pallets, padding, 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 Materials

- .1 Decorative Film (VF-1)
 - .1 % of Light Transmission: 1
 - .2 % Diffuse Visible Light Reflectance (exterior): 87
 - .3 Privacy Film Rating: 10
 - .4 Thickness without Liner: .127mm
 - .5 Film Colour: 100% white out
 - .6 Pattern: Refer to Elevations
 - .7 Substrate: All Interior and Exterior Glazing
 - .8 Product: Llumar White (NRMW PS3)

2.2 Accessories

- .1 General: Provide accessories either manufactured by or acceptable to Decorative film manufacturer for application indicated, and with a proven record of compatibility with surfaces contacted in installation.
- .2 Pressure Sensitive Adhesive: This adhesive is activated by pressure and water. It is characterized by its permanently tacky nature and its installation ease.
- .3 Cleaners, Primers, and Sealers: Types recommended by film manufacturer.

Part 3 Execution

3.1 Preparation

- .1 Comply with manufacturer's written instruction for surface preparation.
- .2 Clean substrate thoroughly prior to installation.
- .3 Prepare substrates using methods recommended by film manufacturer to achieve the best results for the substrate under project conditions.
- .4 Protect window frames and surrounding surfaces to prevent damage during installation.

3.2 Installation

- .1 Install in accordance with manufacturer's written instructions.
- .2 Install with no gaps or overlaps.
- .3 If seamed, make seams non-overlapping.
- .4 Do not remove release liner from film until just before each piece of film is cut and ready for installation.
- .5 Custom cut to the glass with neat, square corners and edges to within 3mm of the window frame.
- .6 Remove air bubbles, blisters, and other defects. Be careful to remove "fingers" to eliminate any contamination or excess water pockets. It is crucial to remove as much water as possible during installation.

3.3 Cleaning and Protecting

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Clean
 - .1 leave Work area clean at end of each day.
 - .1 Remove excess mounting solution at finishes seams, perimeter edges and adjacent surfaces.
 - .2 Use cleaning methods recommended by film manufacturer.
 - .3 Replace films that cannot be cleaned.
 - .4 Protect installed products until completion of project.
 - .5 Touch-up, repair or replace damaged products before Substantial Completion.
 - .2 Final Cleaning: Upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
- .2 Waste Management: Separate waste materials for recycling in accordance with Section 01 74 19 - Waste Management and Disposal.

END OF SECTION

Part 1 General

1.1 Related requirements

- .1 Section 07 92 00 - Joint Sealants
- .2 Section 08 11 00 Metal Doors and Frames
- .3 Section 08 11 16 Aluminum Doors and Frames
- .4 Section 08 36 16 Sectional Overhead Doors
- .5 Section 08 44 13 Glazed Aluminum Curtain Walls
- .6 Section 08 51 13 Aluminum Windows
- .7 Section 08 87 33 Decorative Films
- .8 Section 10 28 00 Toilet and Bath Accessories

1.2 Reference standards

- .1 ASTM International (ASTM):
 - .1 ASTM C542-05, Standard Specification for Lock-Strip Gaskets
 - .2 ASTM D790-17, Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials
 - .3 ASTM D1003-13, Standard Test Method for Haze and Luminous Transmittance of Plastics
 - .4 ASTM D1929-20, Standard Test Method for Determining Ignition Temperature of Plastics
 - .5 ASTM D2240-15e1, Standard Test Method for Rubber Property - Durometer Hardness
 - .6 ASTM E84-20, Standard Test Method for Surface Burning Characteristics of Building Materials
 - .7 ASTM E330-02, Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference
 - .8 ASTM F1233-08, Standard Test Method for Security Glazing Materials and Systems
- .2 Canadian General Standards Board (CGSB):
 - .1 CAN/CGSB-12.1-2017, Safety Glazing
 - .2 CAN/CGSB-12.3-M91, Flat, Clear Float Glass
 - .3 CAN/CGSB-12.8-2017, Insulating Glass Units
- .3 National Glass Association with GANA (NGA):
 - .1 GANA Glazing Manual - 2008
- .4 Flat Glass Manufacturers Association (FGMA)
 - .1 FGMA Glazing Manual

- .5 South Coast Air Quality Management District (SCAQMD), California State, Regulation XI. Source Specific Standards:
 - .1 SCAQMD Rule 1168-2017, Adhesives and Sealants Applications

1.3 Administrative requirements

- .1 Pre-Installation Meetings: Convene meeting 1 week before beginning work of this Section and on-site installation, with Contractor, Subcontractor and Contract Administrator in accordance with Section Section 01 31 19 - Project Meetings:
 - .1 Verify project requirements.
 - .2 Review installation and substrate conditions.
 - .3 Coordination with other Subcontractors.
 - .4 Review manufacturer's written installation instructions and warranty requirements.
- .2 Sequencing: Comply with manufacturer's recommendations for sequencing construction operations.

1.4 Action and informational submittals

- .1 Submit in accordance with Section Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, product literature and data sheets for glass, sealants, and glazing accessories and include product characteristics, performance criteria, physical size, finish, and limitations.
 - .2 Submit WHMIS SDS.
- .3 Shop Drawings: Submit drawings stamped and signed by professional engineer registered or licensed in the Province of Manitoba, Canada.
- .4 Samples:
 - .1 Submit for review and acceptance of each type of unit.
 - .2 Samples will not be returned for inclusion into Work.
- .5 Sustainable Design Submittals:
 - .1 LEED Canada submittals: in accordance with Section 01 35 20 - LEED Sustainable Requirements.
 - .2 Construction Waste Management: Refer to Section 01 74 19 - Construction Waste Management and Disposal.
 - .3 Material product attribute documentation: Refer to Product Check Sheet as listed in 01 35 20 – LEED Sustainable Requirements to determine applicable type of documentation required for each product.
 - .4 Low-Emitting Materials:
 - .1 Submittals are required for any sealants, adhesives, paints, coatings, composite wood, flooring, wall panels, insulation or ceiling components within the inner most weather proofing barrier.
 - .2 Refer to Product Check Sheet as listed in 01 35 20 – LEED Sustainable Requirements to determine applicable type of documentation required for each product.

1.5 Closeout submittals

- .1 Submit in accordance with Section Section 01 78 00 - Closeout Submittals.
- .2 Operation and Maintenance Data: Submit maintenance data for glazing and incorporate into manual.

1.6 Quality assurance

- .1 Perform work in accordance with FGMA Glazing Manual for glazing installation methods.
- .2 Confirm and coordinate visual review and pre-installation conference requirements with the BECxA.
- .3 Mock-ups: Construct mock-ups in accordance with Section Section 01 43 00 - Quality Assurance.
 - .1 Mock-up will be used:
 - .1 To judge quality of work, substrate preparation, and material application.
 - .2 Confirm and coordinate mock-up requirements with the BECxA.

1.7 Delivery, storage, and handling

- .1 Deliver, store, and handle materials in accordance with Section Section 01 61 00 - Common Product Requirements.
- .2 Storage and Handling Requirements:
 - .1 Store materials off ground indoors in a clean dry location and in accordance with manufacturer's recommendations.
 - .2 Store and protect glazing from nicks, scratches, and edge damage.
 - .3 Protect prefinished aluminum surfaces with wrapping.
 - .4 Replace defective or damaged materials with new.

1.8 Ambient conditions

- .1 Ambient Requirements:
 - .1 Install glazing when ambient temperature is 10°C minimum. Maintain ventilated environment for 24 hours after application.
 - .2 Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.
 - .3 Refer to manufacturer's instructions for minimum ambient temperature for application of bird deterrent glazing film.

1.9 Extended Warranty

- .1 Provide five (5) year warranty to include coverage for sealed glass units for seal failure, inter-pane dusting or misting, and replacement of same at no cost to City of Winnipeg.

Part 2 Products

2.1 Materials

- .1 Design Criteria:

- .1 Ensure continuity of building enclosure vapour and air barrier using glass and glazing materials as follow:
 - .2 Utilize inner lite of multiple lite sealed units for continuity of air and vapour seal.
 - .3 Size glass to withstand wind loads, dead loads and positive and negative live loads acting normal to plane of glass to design pressure to ASTM E330.
 - .4 Limit glass deflection to 1/200 flexural limit of glass with full recovery of glazing materials.
 - .5 If required heat strengthen outboard light of float glass on insulating glass units to withstand wind loads, dead loads and positive and negative live loads acting normal to plane of glass.
 - .6 Design glass units to withstand thermal stresses created by solar heat gain, shadowing of exterior components or assemblies (soffits, sunshades, buildings, trees) and elevated interstitial space temperatures, and from solar heat gain.
- .2 Flat Glass:
- .1 Tempered Safety glass: to CAN/CGSB-12.1, transparent.
 - .1 Type 2-tempered.
 - .2 Class B-float
 - .3 Category 2.
 - .4 Thickness as indicated.
 - .2 Silvered mirror glass: to ASTM C1503, 6 mm thick.
 - .1 Type 3A-tempered.
 - .2 Polish and grind edges
 - .3 Accessories:
 - .1 CRL Stainless Steel Canadian Style 1/4" Deep Nose 'J' Channel (or approved equal) around perimeter of mirror.
- .3 Backpainted Glass:
- .1 Fully Tempered, Low Iron
 - .2 Glass Thickness: Minimum 6mm
 - .3 Edges: Polished
 - .4 Pattern: Full coverage LCBA opaque coating applied to second surface.
 - .5 Colour: Custom colour to match PT-5 (yellow)
 - .6 Size: Refer to drawings
 - .7 Location: Lobby 101
 - .8 Basis of Design: Goldray Glass Solid Colour+
 - .9 Installation: Concealed, integrated mounting system
 - .1 Basis of Design: Goldray Mosaic Cladding System, Single Open Profile.
 - .10 Sealants: In accordance with Section 07 92 00 - Joint Sealants

- .1 VOC limit 250 g/L maximum to SCAQMD Rule 1168.
- .2 VOC limit: 5% maximum by weight to CCD-045.
- .3 Ensure sealant does not contain chemical restrictions to CCD-045.
- .4 Insulating Glass Units:
 - .1 Insulating glass units (Type 1): to CAN/CGSB-12.8, hermetically sealed, triple-pane unit, transparent, tempered safety glass.
 - .1 Glazing:
 - .1 Inner pane: 6mm (1/4") clear, tempered glass
 - .2 Middle pane: 6mm (1/4") clear, tempered glass
 - .3 Outer pane: 6mm (1/4") clear, tempered glass
 - .2 Cavity:
 - .1 Thickness: 13mm (1/2") air space between panes.
 - .2 Inert gas: Argon filled.
 - .3 Coating:
 - .1 Low-Emissivity coating on surface #2 and #5.
 - .2 Hard, pyrolytic deposition.
 - .3 Standard of acceptance: Solarban® 60, by Vitro Architectural Glass (formerly PPG).
 - .4 Edges:
 - .1 High performance thermal separator, warm edge spacer, dual silicone seal, black.
 - .2 Standard of acceptance: Edgetech Superspacer Premium Plus or equal.
 - .2 Insulating glass units (Type 2): to CAN/CGSB-12.8, hermetically sealed, dual-pane unit, transparent, tempered safety glass.
 - .1 Glazing:
 - .1 Inner pane: 6mm (1/4") clear, tempered glass.
 - .2 Outer pane: 6mm (1/4") clear, tempered glass.
 - .2 Cavity:
 - .1 Thickness: 13mm (1/2") air space between panes.
 - .2 Inert gas: Argon filled.
 - .3 Coating:
 - .1 Low-Emissivity coating on surface #2.
 - .2 Hard, pyrolytic deposition.
 - .3 Standard of acceptance: Solarban® 60, by Vitro Architectural Glass (formerly PPG) or equal.
 - .4 Edges:
 - .1 High performance thermal separator, warm edge spacer, dual silicone seal, black.

- .2 Standard of acceptance: Edgetech Superspacer Premium Plus or equal.
- .5 Sealant: in accordance with Section 07 92 00 - Joint Sealants.

2.2 Accessories

- .1 Setting blocks: neoprene or EPDM, 80-90 Shore A durometer hardness to ASTM D2240, size to suit glazing method, glass light weight and area.
- .2 Spacer shims: neoprene, 50-60 Shore A durometer hardness to ASTM D2240, 3" (75 mm) long x one half height of glazing stop x thickness to suit application. Self-adhesive on one face.
- .3 Glazing tape:
 - .1 Preformed butyl compound with integral resilient tube spacing device, 10-15 Shore A durometer hardness to ASTM D2240; coiled on release paper; size to suit; black colour.
- .4 Glazing splines: resilient polyvinyl chloride, extruded shape to suit glazing channel retaining slot.
- .5 Glazing clips: manufacturer's standard type.
- .6 Lock-strip gaskets: to ASTM C542.
- .7 Mirror attachment accessories:
 - .1 Stainless steel clips.

Part 3 Execution

3.1 Examination

- .1 Verification of Conditions: Verify conditions of substrates previously installed are acceptable for beginning glazing installation in accordance with manufacturer's instructions.
 - .1 Verify that openings for glazing are correctly sized and within tolerance.
 - .2 Verify that surfaces of glazing channels or recesses are clean, free of obstructions, and ready to receive glazing.
 - .3 Visually inspect substrates.
 - .4 Inform Contract Administrator of unacceptable conditions immediately upon discovery.
 - .5 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Contract Administrator.
- .2 Confirm and coordinate visual review requirements with the BECxA.

3.2 Preparation

- .1 Clean contact surfaces with solvent and wipe dry.
- .2 Seal porous glazing channels or recesses with substrate compatible primer or sealer.
- .3 Prime surfaces scheduled to receive sealant.
- .4 All surfaces receiving glazing material shall be thoroughly wiped with a clean cloth, dampened with the appropriate cleaner, as approved by the sealant/glazing tape

manufacturer. Special precautions must be taken in cold weather to ensure the surfaces are free from frost.

- .5 All framing members of windows shall be checked prior to glazing to make certain that the frame is square, plumb, and secure in order that uniform face and edge clearances are maintained. Inspect all butt and mitre joints. If these joints are open, they shall be sealed with sealant prior to glazing. All vents shall be properly adjusted. Maintain 3mm (1/8") minimum face clearance between glass and metal, on both sides, unless otherwise indicated by glazing manufacturer.
- .6 Preparation - Glazing films:
 - .1 Clean glazing before beginning installation using neutral cleaning solution.
 - .2 Ensure no deleterious material adheres to glazing.
 - .3 Ensure dust, grease, and chemical residue are removed from surface of glazing before installation of film.
 - .4 Examine glazing under natural daylight and identify cracks, blisters, bubbles, discolouration, edge defects or other anomalies that may cause film to delaminate or cause vision transparency or distortion problems.

3.3 Installation: mirrors

- .1 Set mirrors with adhesive, applied in accordance with adhesive manufacturer's instructions.
- .2 Install mirrors in locations as indicated on drawings. Refer to Interior Elevations.
- .3 Set mirrors with stainless steel clips. Anchor rigidly to wall construction.
- .4 Set in frame.
- .5 Place plumb and level.

3.4 Installation: plastic film

- .1 Install plastic film in accordance with film manufacturer's instructions..
- .2 In accordance with Section 08 87 33 Decorative Films

3.5 Cleaning

- .1 Progress Cleaning: clean in accordance with Section 01 74 00 - Cleaning.
 - .1 Remove traces of primer and sealants.
 - .2 Remove glazing materials from finish surfaces.
 - .3 Remove labels.
 - .4 Clean glass and mirrors using approved non-abrasive cleaner in accordance with manufacturer's instructions.
- .2 Waste Management: Perform in accordance with Section 01 74 19 - Waste Management and Disposal.

3.6 Protection

- .1 Protect installed products and components from damage during construction.
- .2 After installation, mark each lite with an "X" by using removable plastic tape or paste.
 - .1 Do not mark heat absorbing or reflective glass units.

- .3 Repair damage to adjacent materials caused by glazing installation.

3.7 Schedule

- .1 Hollow Metal Doors:
 - .1 Interior - Not fire rated.
 - .1 Glass: 1/4" (6mm) thick tempered safety glass.
 - .2 Glazing Method: As per manufacturer's written recommendations.
 - .2 Aluminum Doors:
 - .1 Interior: 1/4" (6mm) thick tempered safety glass.
 - .2 Exterior Openings: Type 2 insulating glass units (double-pane)
 - .3 Glazing Method: As per manufacturer's written recommendations.
- .3 Glazed Aluminum Curtain Wall:
 - .1 Glass - Type 1 insulating glass units (triple-pane)
 - .2 Glazing Method: As per manufacturer's written recommendations.
- .4 Punched Aluminum Windows:
 - .1 Glass - Type 1 insulating glass units (triple-pane)
 - .2 Glazing Method: As per manufacturer's written recommendations.

END OF SECTION

Part 1 General

1.1 Section includes

- .1 ASTM International
 - .1 ASTM E903 - Test Method for Solar Absorptance, Reflectance, and Transmittance of Materials Using Integrating Spheres.

1.2 Related sections

- .1 Glazing 08 80 00

1.3 Actions and Information Submittals

- .1 Submit in accordance with Section 01 33 00 - Submittals Procedures
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for glass, sealants, and glazing accessories and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Include product data indicating sustainable design characteristics.
- .3 Samples:
 - .1 For each type of decorative film specified, provide (2) samples, 305mm square.
- .4 Certificates: Submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

1.4 Close out submittals

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Operation and Maintenance Data: submit for decorative film.

1.5 Quality assurance

- .1 Manufacturer Qualifications: A qualified manufacturer that has a minimum of 10 years of documented experience manufacturing decorative films similar to be used for this project.
- .2 Installer Qualification: A firm that is authorized by decorative film manufacturer to install film in accordance with guidelines set forth by the manufacturer.
- .3 Source Limitations: Obtain each type of decorative film from same manufacturer.
 - .1 Mock-Ups: Build mock-ups to verify selections made under sample submittals and to evaluate surface preparation techniques and application workmanship.
 - .2 Construct mock-ups in the location and of the size indicated or, if not indicated, as desired by Contract Administrator.
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1.6 Delivery, storage and handling

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements with manufacturer's written instructions.
- .2 Store and protect materials according to manufacturer's written recommendations to prevent damage from condensation, temperature changes, direct exposure to sun or other causes.
- .3 Develop Construction Waste Management Plan related to Work of this Section and in accordance with Section 01 35 20 - LEED Sustainability Requirements.
- .4 Packaging Waste Management: remove and return for reuse by manufacturer of crates, pallets, padding, 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 Materials

- .1 Decorative Film (VF-1)
 - .1 % of Light Transmission: 1
 - .2 % Diffuse Visible Light Reflectance (exterior): 87
 - .3 Privacy Film Rating: 10
 - .4 Thickness without Liner: .127mm
 - .5 Film Colour: 100% white out
 - .6 Pattern: Refer to Elevations
 - .7 Substrate: All Interior and Exterior Glazing
 - .8 Product: Llumar White (NRMW PS3)

2.2 Accessories

- .1 General: Provide accessories either manufactured by or acceptable to Decorative film manufacturer for application indicated, and with a proven record of compatibility with surfaces contacted in installation.
- .2 Pressure Sensitive Adhesive: This adhesive is activated by pressure and water. It is characterized by its permanently tacky nature and its installation ease.
- .3 Cleaners, Primers, and Sealers: Types recommended by film manufacturer.

Part 3 Execution

3.1 Preparation

- .1 Comply with manufacturer's written instruction for surface preparation.
- .2 Clean substrate thoroughly prior to installation.
- .3 Prepare substrates using methods recommended by film manufacturer to achieve the best results for the substrate under project conditions.
- .4 Protect window frames and surrounding surfaces to prevent damage during installation.

3.2 Installation

- .1 Install in accordance with manufacturer's written instructions.
- .2 Install with no gaps or overlaps.
- .3 If seamed, make seams non-overlapping.
- .4 Do not remove release liner from film until just before each piece of film is cut and ready for installation.
- .5 Custom cut to the glass with neat, square corners and edges to within 3mm of the window frame.
- .6 Remove air bubbles, blisters, and other defects. Be careful to remove "fingers" to eliminate any contamination or excess water pockets. It is crucial to remove as much water as possible during installation.

3.3 Cleaning and Protecting

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Clean
 - .1 leave Work area clean at end of each day.
 - .1 Remove excess mounting solution at finishes seams, perimeter edges and adjacent surfaces.
 - .2 Use cleaning methods recommended by film manufacturer.
 - .3 Replace films that cannot be cleaned.
 - .4 Protect installed products until completion of project.
 - .5 Touch-up, repair or replace damaged products before Substantial Completion.
 - .2 Final Cleaning: Upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
- .2 Waste Management: Separate waste materials for recycling in accordance with Section 01 74 19 - Waste Management and Disposal.

END OF SECTION

Part 1 General

1.1 Related requirements

- .1 Section 05 50 00 - Metal Fabrications
- .2 Section 06 10 00 - Rough Carpentry
- .3 Section 06 40 00 - Architectural Woodwork
- .4 Section 07 21 13 – Board & Semi Rigid Insulation.
- .5 Section 07 21 29.03 - Sprayed Insulation – Polyurethane Foam
- .6 Section 07 26 00 - Vapour Retarders
- .7 Section 07 84 00 - Firestopping
- .8 Section 07 92 00 - Joint Sealants
- .9 Section 09 22 16 – Non-Structural Metal Framing
- .10 Section 09 30 13 - Ceramic Tiling
- .11 Section 09 51 13 - Acoustical Panel Ceilings
- .12 Section 09 91 00 - Painting
- .13 Section 10 28 00 - Toilet and Bath Accessories

1.2 Reference standards

- .1 Aluminum Association (AA)
 - .1 AA DAF 45-03(R2009), Designation System for Aluminum Finishes.
- .2 American Society for Testing and Materials (ASTM)
 - .1 ASTM C475-02(2015), Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board.
 - .2 ASTM C514-04(2014), Standard Specification for Nails for the Application of Gypsum Board.
 - .3 ASTM C557-03(2009)e1, Standard Specification for Adhesives for Fastening Gypsum Wallboard to Wood Framing.
 - .4 ASTM C840-16, Standard Specification for Application and Finishing of Gypsum Board.
 - .5 ASTM C954-15, Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs From 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness.
 - .6 ASTM C1002-14, Standard Specification for Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.
 - .7 ASTM C1047-14a, Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base.
 - .8 ASTM C1177/C1177M-13, Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing.

- .9 ASTM C1178/C1178M-13, Standard Specification for Glass Mat Water-Resistant Gypsum Backing Board.
- .10 ASTM C1280-13a, Standard Specification for Application of Gypsum Sheathing.
- .11 ASTM C1396/C1396M-14a, Standard Specification for Gypsum board.
- .3 Association of the Wall and Ceilings Industries International (AWCI)
 - .1 AWCI Levels of Gypsum Board Finish-GA-214-2015.
- .4 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-51.34-M86(R1988), Vapour Barrier, Polyethylene Sheet for Use in Building Construction.
 - .2 CAN/CGSB-71.25-M88, Adhesive, for Bonding Drywall to Wood Framing and Metal Studs.
- .5 South Coast Air Quality Management District (SCAQMD), California State, Regulation XI. Source Specific Standards
 - .1 SCAQMD Rule 1113-A2007, Architectural Coatings.
 - .2 SCAQMD Rule 1168-A2005, Adhesives and Sealants Applications.
- .6 Underwriters' Laboratories of Canada (ULC)
 - .1 CAN/ULC-S102-10, Standard Method of Test of Surface Burning Characteristics of Building Materials and Assemblies.

1.3 Action and informational submittals

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for gypsum board assemblies and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Certifications:
 - .1 Submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .4 Sustainable Design Submittals:
 - .1 LEED Canada submittals: in accordance with Section 01 35 20 - LEED Sustainable Requirements.
 - .2 Construction Waste Management: Refer to Section 01 74 19 - Construction/Demolition Waste Management and Disposal.
 - .3 Material product attribute documentation: Refer to Product Check Sheet as listed in 01 35 20 – LEED Sustainable Requirements to determine applicable type of documentation required for each product.
 - .4 Low-Emitting Materials:
 - .1 Submittals are required for any sealants, adhesives, paints, coatings, composite wood, flooring, wall panels, insulation or ceiling components within the inner most weather proofing barrier.

- .2 Refer to Product Check Sheet as listed in 01 35 20 – LEED Sustainable Requirements to determine applicable type of documentation required for each product.

1.4 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 and applicable standard designation.
- .3 Exercise care in unloading gypsum board materials shipment to prevent damage.
- .4 Storage and Handling Requirements in accordance with ASTM C 840-16:
 - .1 Store gypsum board assemblies materials level flat off ground indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect gypsum board assemblies from nicks, scratches, and blemishes.
 - .3 Protect gypsum board from direct exposure to rain, snow, sunlight, or other excessive weather conditions.
 - .4 Protect ready mix joint compounds from freezing, exposure to extreme heat and direct sunlight.
 - .5 Protect from weather, elements and damage from construction operations.
 - .6 Handle gypsum boards to prevent damage to edges, ends or surfaces.
 - .7 Replace defective or damaged materials with new.
- .5 Develop Construction Waste Management Plan related to Work of this Section and in accordance with Section 01 35 20 - LEED Requirements.
- .6 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding, and packaging materials as specified in Construction Waste Management Plan in accordance with Section 01 74 19 - Waste Management and Disposal.

1.5 Ambient conditions

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

Part 2 Products

2.1 Acceptable Manufacturers

- .1 The following manufacturers of gypsum board are deemed to be acceptable for the supply of gypsum board for this project:
 - .1 Certainteed
 - .2 Canadian Gypsum Company (CGC)

2.2 Materials

- .1 Interior Gypsum Board (GWB): to ASTM C1396/C1396M-14 , paper-faced; 48" wide (1220mm wide) x maximum available length, ends square cut, tapered edges.
 - .1 Fire Rated Gypsum board (Type X): ASTM C36; fire resistive type, UL or WH rated; 5/8" (16mm) thick, maximum available length, ends square cut, tapered edges.
 - .1 Standard of Acceptance:
 - .1 CertainTeed Type X Gypsum Board
 - .2 GC/USG Sheetrock Brand Firecode X Gypsum Board
 - .3 or approved equal.
 - .2 Moisture and Mold Resistant, 16 mm (5/8 inch) thick for wet locations
 - .1 Standard of Acceptance:
 - .1 CertainTeed M2TECH Moisture and Mold Resistant
 - .2 CGC/USG Sheetrock Brand Mold Tough
 - .3 or approved equal.
 - .3 Abuse Resistant, 16 mm (5/8 inch) thick.
 - .1 Standard of Acceptance:
 - .1 CertainTeed Abuse Resistant
 - .2 CGC/USG FibreRock Brand AR Interior Panels
 - .3 or approved equal.
 - .2 Exterior gypsum sheathing board: to ASTM C1396/C1396M-14, Type X, 16mm (5/8 inch) thick, 1200 mm (48") wide x maximum practical length.
 - .1 Standard of Acceptance:
 - .1 CertainTeed Glasroc Exterior Sheathing 2015
 - .2 or approved equal.
 - .2 Note: Product may require priming to accept air barrier. Refer to Section 07 27 27 - Air Barriers – Self-Adhered.
 - .3 Ceramic Tile Wall Backer (TBB): Fully embedded glass mat gypsum tile backer meeting the requirements of ASTM C 1178, Flame spread: ASTM E 84: Class A and Smoke developed: ASTM E 84: Class A.
 - .1 Type and Thickness: Type X, 5/8 inch (15.9 mm) thick where indicated and as otherwise required to meet fire rating for specific element. 1/2 inch (12.7 mm) elsewhere.
 - .2 Standard Size: 4 feet by 8 feet (1219 by 2438 mm)
 - .3 Standard of Acceptance:
 - .1 Diamondback GlasRoc Tile Backer” with EGRG Technology by CertainTeed Gypsum, Inc.
 - .4 Ceiling Suspension: Contractor has the option of using either a proprietary suspension system or a three-component direct-hung system to suspend gypsum board ceilings.
 - .1 Drywall Grid Ceiling Framing

- .1 Standard of Acceptance: Armstrong Drywall Grid Ceiling Framing or approved equal.
- .2 Manufacturer Approved method using steel studs and channels suspended by hangar wire
- .5 Nails: to ASTM C514-14
- .6 Steel drill screws: to ASTM C1002-14
- .7 Stud adhesive: to CAN/CGSB-71.25 or ASTM C557.
- .8 Laminating compound: as recommended by manufacturer, asbestos-free.
- .9 Casing beads: to ASTM C1047, GA-216, metal G90 Zinc finish, perforated flanges, one piece length per location.
 - .1 Product: D-100, manufactured by Bailey Metal Products Ltd. or approved equal
- .10 Corner beads: to ASTM C1047, metal commercial grade sheet steel with G90 Zinc finish perforated and knurled 32mm (1 ¼ inch) flanges; one piece length per location.
- .11 Edge Trim: to ASTM C1047, GA-216; Galvanized steel with J Type casing bead, tapeable.
- .12 Drywall metal trim: galvanized steel.
 - .1 Product: D-200, manufactured by Bailey Metal Products Ltd. or approved equal
- .13 Reveal Joints, Corners: extruded alloy 6063 T5 aluminum, colour to be selected.
 - .1 Products: profile to suit, as manufactured by Fry Reglet Ltd. or approved equal.
- .14 Joint Materials: ASTM C475; GA-201 and GA-216; reinforcing tape, joint compound, adhesive, and water.
- .15 Fiberglass tape and joint compound and accessories for waterproof gypsum board.
- .16 Foam tape for acoustic partitions and insulation.
- .17 Sealants: in accordance with Section 07 92 00 - Joint Sealants and 01 35 20 LEED Sustainable Requirements.
 - .1 VOC limit 250 g/L maximum to SCAQMD Rule 1168.
 - .2 Acoustic sealant: in accordance with Section 07 92 00 - Joint Sealants.
- .18 Polyethylene: to CAN/CGSB-51.34, Type 2
- .19 Insulating strip: rubberized, moisture resistant, 1/8" (3 mm) thick closed cell neoprene strip, 1/2" (12 mm) wide, with self-sticking permanent adhesive on one face, lengths as required.
- .20 Joint compound: to ASTM C475, asbestos-free
- .21 Acoustic insulation: Refer to Section 07 21 16 Blanket Insulation.

2.3 Finishes

- .1 Texture finish: asbestos-free standard white texture coating and primer-sealer, recommended by gypsum board manufacturer.

Part 3 Execution

3.1 Examination

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

3.2 Erection

- .1 Do application and finishing of gypsum board to ASTM C840-16 except where specified otherwise
- .2 Do application of gypsum sheathing to ASTM C1280-13a
- .3 Erect hangers and runner channels for suspended gypsum board ceilings to ASTM C840-16 except where specified otherwise
- .4 Support light fixtures by providing additional ceiling suspension hangers within 6" (150 mm) of each corner and at maximum 24" (610 mm) around perimeter of fixture.
- .5 Install work level to tolerance of 1:1200.
- .6 Frame with furring channels, perimeter of openings for access panels, light fixtures, diffusers, grilles, etc.
- .7 Install 3/4" x 2 1/2" (19 x 64 mm) furring channels parallel to, and at exact locations of steel stud partition header track.
- .8 Furr for gypsum board faced vertical bulkheads within and at termination of ceilings.
- .9 Furr above suspended ceilings for gypsum board fire and sound stops and to form plenum areas as indicated.
- .10 Install wall furring for gypsum board wall finishes to ASTM C840-16, except where specified otherwise
- .11 Furr openings and around built-in equipment, cabinets, access panels, etc., on four sides. Extend furring into reveals. Check clearances with equipment suppliers.
- .12 Furr duct shafts, beams, columns, pipes and exposed services where indicated.

3.3 Application

- .1 Apply gypsum board after bucks, anchors, blocking, sound attenuation, electrical and mechanical work have been approved.
- .2 Apply single layer gypsum board to metal furring or framing using screw fasteners. Maximum spacing of screws 12" (300) mm on centre.
 - .1 Single-Layer Application:
 - .1 Apply gypsum board on ceilings prior to application of walls to ASTM C840-16

- .2 Apply gypsum board on walls vertically or horizontally, providing sheet lengths that will minimize number of board edges or end joints.
- .2 Double-Layer Application:
 - .1 Install gypsum board for base layer and exposed gypsum board for face layer.
 - .2 Apply base layer to ceilings prior to base layer application on walls; apply face layers in same sequence. Offset joints between layers at least 10" (250 mm).
 - .3 Apply base layers at right angles to supports unless otherwise indicated.
 - .4 Apply base layer on walls and face layers vertically with joints of base layer over supports and face layer joints offset at least 10" (250 mm) with base layer joints.
- .3 Apply water-resistant gypsum board where indicated. Apply water-resistant sealant to edges, ends, cut-outs which expose gypsum core and to fastener heads. Do not apply joint treatment on areas to receive tile finish.
- .4 Apply 1/2" (12 mm) diameter bead of acoustic sealant continuously around periphery of each face of partitioning to seal gypsum board/structure junction where partitions abut fixed building components. Seal full perimeter of cut-outs around electrical boxes, ducts, etc, in partitions where perimeter sealed with acoustic sealant.
- .5 Install ceiling boards in direction that will minimize number of end-butt joints. Stagger end joints at least 10" (250 mm).
- .6 Install gypsum board on walls vertically to avoid end-butt joints. At stairwells and similar high walls, install boards horizontally with end joints staggered over studs, except where local codes or fire-rated assemblies require vertical application.
- .7 Install gypsum board with face side out.
- .8 Do not install damaged or damp boards.
- .9 Locate edge or end joints over supports. Stagger vertical joints over different studs on opposite sides of wall.

3.4 Installation

- .1 Erect accessories straight, plumb or level, rigid and at proper plane. Use full length pieces where practical. Make joints tight, accurately aligned and rigidly secured. Mitre and fit corners accurately, free from rough edges. Secure at 6" (150mm) on centre using contact adhesive for full length.
- .2 Install casing beads around perimeter of suspended ceilings.
- .3 Install casing beads where gypsum board butts against surfaces having no trim concealing junction and where indicated. Seal joints with sealant.
- .4 Install insulating strips continuously at edges of gypsum board and casing beads abutting metal window and exterior door frames, to provide thermal break.
- .5 Construct control joints of preformed units set in gypsum board facing and supported independently on both sides of joint.
- .6 Provide continuous polyethylene dust barrier behind and across control joints.

- .7 Locate control joints at changes in substrate construction, or where indicated on the drawings. Locate control joints over door openings aligned with the corner of door frame and carry up to top of partition,.
- .8 Install control joints straight and true.
- .9 Ensure that screws or nails are properly applied in process of attaching gypsum board to framing without damaging of gypsum board edges and ends.
- .10 Install expansion joint straight and true.
- .11 Splice corners and intersections together and secure to each member with 3 screws.
- .12 Install access doors to electrical and mechanical fixtures specified in respective sections.
 - .1 Rigidly secure frames to furring or framing systems.
- .13 Finish face panel joints and internal angles with joint system consisting of joint compound, joint tape and taping compound installed according to manufacturer's directions and feathered out onto panel faces.
- .14 Gypsum Board Finish: finish gypsum board walls and ceilings to following levels in accordance with AWCI Levels of Gypsum Board Finish:
 - .1 Levels of finish:
 - .1 Level 0: no tapping, finishing or accessories required.
 - .2 Level 1: embed tape for joints and interior angles in joint compound. Surfaces free of excess joint compound; tool marks and ridges are acceptable.
 - .3 Level 2: embed tape for joints and interior angles in joint compound and apply one separate coat of joint compound over joints, angles, fastener heads and accessories; surfaces free of excess joint compound; tool marks and ridges are acceptable.
 - .4 Level 3: embed tape for joints and interior angles in joint compound and apply two separate coats of joint compound over joints, angles, fastener heads and accessories; surfaces smooth and free of tool marks and ridges.
 - .5 Level 4: embed tape for joints and interior angles in joint compound and apply three separate coats of joint compound over joints, angles, fastener heads and accessories; surfaces smooth and free of tool marks and ridges.
 - .6 Level 5: embed tape for joints and interior angles in joint compound and apply three separate coats of joint compound over joints, angles, fastener heads and accessories; apply a thin skim coat of joint compound to entire surface; surfaces smooth and free of tool marks and ridges.
- .15 Finish corner beads, control joints and trim as required with two coats of joint compound and one coat of taping compound, feathered out onto panel faces.
- .16 Fill screw head depressions with joint and taping compounds to bring flush with adjacent surface of gypsum board, invisible after surface finish is completed.
- .17 Sand lightly to remove burred edges and other imperfections. Avoid sanding adjacent surface of board.
- .18 Completed installation smooth, level or plumb, free from waves and other defects and ready for surface finish.
- .19 Mix joint compound slightly thinner than for joint taping.

- .20 Apply thin coat to entire surface using trowel or drywall broad knife to fill surface texture differences, variations or tool marks.
- .21 Allow skim coat to dry completely.
- .22 Remove ridges by light sanding or wiping with damp cloth.
- .23 Fire Rated Assemblies:
 - .1 Construct fire rated assemblies where indicated.
 - .2 Provide fire rated slip joint head track where fire rated walls meet structure.
 - .3 For fire rated partitions and ceilings apply first and second layers with screw fasteners.
No adhesives permitted. Screw spacing as follows:
 - .1 Ceilings: 6" (150 mm) on centre around perimeter and 12" (300 mm) on centre in field of sheet.
 - .2 Walls: 8" (200 mm) on centre around perimeter and 12" (300 mm) on centre in field of sheet.
 - .4 At door openings in fire rated walls and partitions install gypsum board filler full width and length of opening to cover stud header as specified in National Building Code.

3.5 Cleaning

- .1 Progress Cleaning: clean in accordance with Section 01 74 00 - 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 00 - Cleaning.
- .2 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 19 - Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.6 Protection

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

3.7 Schedules

- .1 Level 2: Above finished ceilings concealed from view.
- .2 Level 4: Walls and ceilings exposed to view
- .3 Construct fire rated assemblies where indicated.

END OF SECTION

Part 1 General

1.1 Section Includes

- .1 Formed metal framing of studs and furring, at interior locations.
- .2 Framing accessories.
- .3 Gypsum board and joint treatment.
- .4 Light gauge metal stud wall framing.
- .5 Refer to Section 05 41 00 for exterior steel stud framing.

1.2 Related requirements

- .1 Section 07 21 13 - Board and Semi-Rigid Insulation.
- .2 Section 07 92 00 - Joint Sealants
- .3 Section 08 11 00 - Metal Doors and Frames
- .4 Section 08 11 16 - Aluminum Doors and Frames
- .5 Section 08 44 13 - Glazed Aluminum Curtain Walls
- .6 Section 09 22 16 - Gypsum Board Assemblies
- .7 Section 09 30 13 - Ceramic Tiling

1.3 Reference standards

- .1 ASTM International (ASTM)
 - .1 ASTM A123/A123M-09 - Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
 - .2 ASTM C645- 14e1, Standard Specification for Nonstructural Steel Framing Members.
 - .3 ASTM A653/A653M- 07, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvanized) by the Hot-Dip Process.
 - .4 ASTM C754- 15, Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products.
 - .5 ASTM C1002-07 - Steel Self-Piercing, Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.
- .2 CAN/CSA-S136-07 - North American Specification for the Design of Cold-Formed Steel Structural Members.
- .3 CSA W47.1-03 (R2008) - Certification of Companies for Fusion Welding of Steel Structures.
- .4 The Association of Wall and Ceiling Contractors (AWCC)
 - .1 Wall and Ceiling Specification Standards Manual.

1.4 Action and informational submittals

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:

- .1 Submit manufacturer's instructions, printed product literature and data sheets for metal framing and include product characteristics, performance criteria, physical size, finish and limitations.
- .2 Submit 2 copies of WHMIS SDS in accordance with Section 01 35 29.06 - Health and Safety Requirements
- .3 Shop Drawings:
 - .1 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.
 - .3 Indicate welds by welding symbols as defined in CSA W59.
 - .4 Each shop drawing submitted shall bear the stamp of a qualified professional engineer licensed to practice in the Province of Manitoba, Canada.
 - .5 Steel studs to be designed by the stud supplier.
- .4 Sustainable Design Submittals:
 - .1 LEED Canada submittals: in accordance with 01 35 20 - LEED Requirements.
 - .2 Construction Waste Management: Refer to Section 01 74 19 - Construction/Demolition Waste Management and Disposal.
 - .3 Material product attribute documentation: Refer to Product Check Sheet as listed in 01 35 20 – LEED Sustainable Requirements to determine applicable type of documentation required for each product.
 - .4 Low-Emitting Materials:
 - .1 Submittals are required for any sealants, adhesives, paints, coatings, composite wood, flooring, wall panels, insulation or ceiling components within the inner most weather proofing barrier.
 - .2 Refer to Product Check Sheet as listed in 01 35 20 – LEED Sustainable Requirements to determine applicable type of documentation required for each product.

1.5 Administrative Requirements

- .1 Coordination:
 - .1 Coordinate with other work having a direct bearing on work of this section.
 - .2 Coordinate the placement of components within the stud framing assembly specified elsewhere.

1.6 Quality assurance

- .1 Perform Work to ASTM C754 Association of Wall and Ceiling Contractors (A.W.C.C.) Specification Standards Manual.
- .2 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three (3) years experience.
- .3 Installer Qualifications: Company specializing in performing the work of this section with minimum three (3) years documented experience.

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

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 indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect metal framing from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.
- .4 Develop Construction Waste Management Plan related to Work of this Section and in accordance with Section 01 35 20 - LEED Requirements.
- .5 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding, and packaging materials as specified in Construction Waste Management Plan in accordance with Section 01 74 19 - Waste Management and Disposal.

Part 2 Products

2.1 Materials

- .1 Non-load bearing channel stud framing: to ASTM C645, hot dipped zinc-coated (galvanized) steel sheet in accordance with ASTM A653, Z180, for screw attachment of gypsum board.
 - .1 Thickness: Gauge of stud framing to be specified by steel stud supplier to suit steel stud depth and site conditions/height of walls.
 - .1 Shop drawings submitted shall bear the stamp of a qualified professional engineer licensed to practice in the Province of Manitoba, Canada.
 - .2 Knock-out service holes at 460mm (18") centres.
- .2 Floor and ceiling tracks: to ASTM C645, in widths to suit stud sizes, and as follows:
 - .1 Steel stud supplier to provide slotted deflection top tracks where required to suit site conditions.
 - .1 Shop drawings submitted shall bear the stamp of a qualified professional engineer licensed to practice in the Province of Manitoba, Canada.
 - .2 Slotted Deflection Track for Fire Separations: Pre manufactured slotted top runner with 2 1/2" (63 mm) down standing legs and having 1/4" x 1 1/2" (6 mm wide x 38 mm) high slots spaced at 25 mm on centre along length of runner; tested and certified for use in fire rated wall construction.
 - .3 Double Runner Deflection Track: Outside runner using 2" (50mm) flanges; inner runner 1 1/4" (33 mm); maintaining 1" (25 mm) minimum deflection space.

- .4 Deep Leg Deflection Track: Top runner having 3" (75mm) down standing legs; maintaining 1/2" (13 mm) minimum deflection space.
- .5 Base Runner: Bottom track with 1 1/4" (33 mm) upstanding legs.
- .3 Furring Channels: Commercial steel sheet in accordance with ASTM A653, Z180, hot dipped zinc-coated (galvanized), as follows:
 - .1 Hat Shaped, Rigid Furring Channels: ASTM C645, 0.75 mm (22 gauge) thickness x 22 mm (7/8") deep.
 - .2 Resilient Furring Channels: 0.46 mm (26 gauge) thickness x 13 mm (1/2") deep members designed to reduce sound transmission having asymmetrical face attached to single flange by a slotted leg (web).
- .4 Metal channel stiffener: 1/2" (13mm) x 3/4" (19mm) size, 16 gauge (1.4mm) thick cold rolled steel, galvanized.
- .5 Fasteners: ASTM C1002, self-drilling, self-tapping screws.
 - .1 Non-load bearing channel stud framing: to ASTM 645-76. "Non-load Bearing Steel Studs, runners (Track), and Rigid Furring Channels for Screws". Screws for the application to steel studs, runners and furring channels: to ASTM C646-78a "Steel Drill Screws for the Application of Gypsum Sheet Material to Light Gauge Steel Studs".
 - .2 Screws for the application to steel studs, runners and furring channels: to ASTM C646-78a "Steel Drill Screws for the Application of Gypsum Sheet Material to Light Gauge Steel Studs".
 - .3 Screw penetration beyond joined materials shall not be less than 3 exposed threads.
 - .4 Thread types and drilling capability shall conform to the manufacturer's recommendations.
 - .5 Screws covered by sheathing materials shall have low profile heads.
- .6 Acoustical Insulating Tape: Interior Steel Studs and Furring of the Association of Wall and Ceiling Contractors (A.W.C.C.) Specification Standards Manual.
- .7 Bracing: cross-bracing 25mm (1 inch) x 1.52mm (16ga.) galvanized metal strapping for diagonal bracing.
- .8 Acoustic Sealant: As specified in Section 09 21 16.
- .9 Touch-Up Primer for Galvanized Surfaces: CAN/CGSB-1.181.
- .10 Sill Gasket: Neoprene purpose made closed cell sill gasket to be installed under base track of exterior steel studs.
 - .1 Insulating gasket strip: rubberized, moisture resistant, neoprene strip with self-sticking adhesive on one face, lengths as required. 3mm thick.

2.2 Fabrication

- .1 Fabricate assemblies of framed sections to sizes and profiles required.
- .2 Fit, reinforce, and brace framing members to suit design requirements.
- .3 Fit and assemble in largest practical sections for delivery to Site, ready for installation.

2.3 Finishes

- .1 Accessories: Same finish as framing members.

2.4 Stud Height Limits

- .1 Stud height limitations (stud limiting heights) shall be in accordance with AWCC Wall and Ceiling Specification Manual, Table 9.7/5 and calculated using a lateral pressure of 5 psf and deflection limit of:
 - .1 L/240: with gypsum board only on one or both sides of partition, and wall is finished with flexible finish such as paint or wall paper.
 - .2 L/360: with gypsum board on one or both sides and wall is finished with rigid material such as plaster or ceramic tile.
- .2 Where stud heights exceed maximum limiting heights indicated in Table 9.7/5 either decrease stud spacing or increase base steel thickness of studs to ensure stud limiting heights fall within maximum limits indicated in the Table. Do not increase stud depths without prior written approval from the Contract Administrator.
- .3 Where stud heights fall outside the maximum allowable limiting heights indicated in Table 9.7/5 notify the Contract Administrator and await further instruction before commencing installation.

Part 3 Execution

3.1 Examination

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for non-structural metal framing application in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate.
 - .2 Verify that rough-in utilities are in proper location.
 - .3 Inform Contract Administrator of unacceptable conditions immediately upon discovery.
 - .4 Proceed with installation after unacceptable conditions have been remedied and after receipt of written approval to proceed from Contract Administrator.

3.2 Erection

- .1 Erect partitions in accordance with framing requirements of ASTM C754
- .2 Align partition tracks at floor and ceiling and secure at 610mm on centre maximum.
- .3 Install damp proof course under stud shoe tracks of partitions on slabs on grade.
- .4 Place studs vertically at 2" (50mm) on centre and not more than 2" (50mm) from abutting walls, and at each side of openings and corners.
 - .1 Position studs in tracks at floor and ceiling. Cross brace steel studs as required to provide rigid installation to manufacturer's instructions.
- .5 Erect metal studding to tolerance of 1:1000.
- .6 Attach studs to ceiling and bottomtrack using screws.

- .7 Co-ordinate simultaneous erection of studs with installation of service lines. Align web openings when erecting studs.
- .8 Co-ordinate erection of studs with installation of door/window frames and special supports or anchorage for work specified in other Sections.
- .9 Provide two studs extending from floor to ceiling at each side of openings wider than stud centres specified.
 - .1 Secure studs together, 2" (50mm) apart using column clips or other approved means of fastening placed alongside frame anchor clips.
- .10 Install heavy gauge single jamb studs at openings.
- .11 Erect track at head of door/window openings and sills of sidelight/window openings to accommodate intermediate studs.
 - .1 Secure track to studs at each end, in accordance with manufacturer's instructions.
 - .2 Install intermediate studs above and below openings in same manner and spacing as wall studs.
- .12 Frame openings and around built-in equipment, cabinets, access panels, on four sides. Extend framing into reveals. Check clearances with equipment suppliers.
- .13 Provide 1 1/2" (40mm) stud or furring channel secured between studs for attachment of fixtures behind lavatory basins, toilet and bathroom accessories, and other fixtures including grab bars and towel rails, attached to steel stud partitions.
- .14 Install steel studs or furring channel between studs for attaching electrical and other boxes.
- .15 Extend partitions to ceiling height except where noted otherwise on drawings.
- .16 Maintain clearance under beams and structural slabs to avoid transmission of structural loads to studs.
 - .1 Use double track slip joint.
- .17 Install continuous insulating strips to isolate studs from uninsulated surfaces.
- .18 Install two continuous beads of acoustical sealant under studs and tracks around perimeter of sound control partitions.
- .19 Coordinate erection of studs with requirements of door frames and window frames; install supports and attachments.
- .20 Coordinate installation of wood bucks, anchors, and wood blocking with electrical and mechanical work to be placed within or behind stud framing.
- .21 Blocking: Install blocking for support of plumbing fixtures, toilet partitions, wall cabinets, toilet accessories, hardware, opening frames, and all other wall mounted installations.
 - .1 Secure wood blocking to studs.
- .22 Refer to Drawings for indication of partitions extending to finished ceiling only and for partitions extending through the ceiling to the structure above. Maintain clearance under structural building members to avoid deflection transfer to studs. Provide extended leg ceiling runners.
- .23 Access Panels: Co-ordinate the work and prepare openings for access panels in gypsum wallboard partitions and ceilings.

3.3 Cleaning

- .1 Progress Cleaning: clean in accordance with Section 01 74 00 - 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 00 - Cleaning.
- .3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 19 - Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.4 Protection

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

END OF SECTION

Part 1 General

1.1 Section includes

- .1 Portland cement stucco system.
- .2 Metal furring and lathing.

1.2 Related requirements

- .1 Section 05 41 00 - Structural Metal Lightweight Framing
- .2 Section 06 10 00 - Rough Carpentry
- .3 Section 09 21 16 - Gypsum Board Assemblies.

1.3 Reference standards

- .1 ASTM C150/C150M-22 Standard specification for Portland cement
- .2 ASTM C207-18 Standard specification for hydrated lime for masonry purposes
- .3 ASTM C665-23 Standard specification for mineral-fiber blanket thermal insulation for light frame construction and manufactured housing
- .4 ASTM C847-18 Standard specification for metal lath
- .5 ASTM C897-15(2020) Standard specification for aggregate for job-mixed Portland cement-based plasters
- .6 ASTM C926-24 Standard specification for application of Portland cement-based plaster
- .7 ASTM C1002-22 Standard specification for steel self-piercing tapping screws for application of gypsum panel products or metal plaster bases to wood studs or steel studs
- .8 ASTM C1063-23 Standard specification for installation of lathing and furring to receive interior and exterior Portland cement-based plaster
- .9 ASTM E119-24 Standard test methods for fire tests of building construction and materials
- .10 CAN/ULC-S101 - Standard Methods of Fire Endurance Tests of Building Construction and Materials.
- .11 CAN/ULC-S702 - Standard for Mineral Fibre Thermal Insulation for Buildings.
- .12 STD A3000-18 Cementitious materials compendium. (Withdrawn)
- .13 Portland cement plaster/stucco manual
- .14 UL - Fire Resistance Directory.
- .15 ULC - Fire Resistance Directory.

1.4 Action submittals

- .1 Section 01 33 00: Submission procedures.
- .2 Product Data: Provide data on plaster materials, characteristics and limitations of products specified.
- .3 Samples: Submit two (2) samples, 100mm x 100mm in size illustrating finish colour and texture.

- .1 Finish and thickness to match existing garage.

1.5 Informational submittals

- .1 Section 01 33 00: Submission procedures.
- .2 Installation Data: Manufacturer's special installation requirements.
- .3 Sustainable Design:
 - .1 To Section 01 35 20: LEED Sustainable Requirements.
 - .2 Manufacturer's Certificate: Certify that Products meet or exceed specified requirements.

1.6 Closeout submittals

- .1 Section 01 78 00: Submission procedures.
- .2 Sustainable Design Closeout Documentation: to Section 01 30 20.

1.7 Quality assurance

- .1 Products of This Section: Manufactured to ISO 9000 certification requirements.
- .2 Perform Work in accordance with ASTM C926 and PCA Plaster/Stucco Manual. Maintain one (1) copy of document on site.
- .3 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three (3) years documented experience.
- .4 Installer Qualifications: Company specializing in performing the work of this section with minimum three (3) years documented experience.
- .5 Regulatory Requirements: Conform to applicable code requirements for finish system.
- .6 Mock-Up: Provide a mock-up of each type of stucco installation, using materials and systems specified in this Section; include at least one example of each type of accessory material.
 - .1 Indicate texture, color and workmanship of finished work.
 - .2 Proceed with work only after the mock-up has been approved.
 - .3 Maintain the mock-up on site and remove at the completion of the project.
 - .4 Confirm and coordinate mock-up requirements with the BECxA.
- .7 Designing and Detailing:
 - .1 Follow the stucco manufacturers written installation instructions, published details, and technical information in the design of the stucco systems.
 - .2 Sealants and backer rod are required at dissimilar materials and expansion joints within the stucco system to provide a watertight system.
 - .3 Minimum slope for all projections shall be 1;2 with a maximum length of 12" (30.5cm).
- .8 Substrate Systems:
 - .1 Deflection of the substrate systems shall not exceed L/360.
 - .2 Acceptable substrates for stucco systems are water-resistant core exterior grade gypsum sheathing (ASTM C1396), Dens-Glass Gold® sheathing (ASTM C1177), fiberboard ANSI/AHA A 194, exposure 1 (Grade C-D or better)

plywood, expanded polystyrene insulation board ASTM C578, exposure 1 oriented strand board, cement board (ASTM C1325), poured concrete, and masonry units.

- .3 Painted and otherwise coated surfaces of brick, unit masonry, stucco and concrete shall be inspected and prepared as approved by Manufacturer's technical department before application. Paint-on surface consolidates or primers shall not be used to bond stucco to painted surfaces.
- .4 Consult Manufacturer's Technical Department for written approval of other substrates prior to beginning stucco work.
- .5 Applicator to verify that the proposed substrate is acceptable prior to the stucco installation.
- .9 System Joints:
 - .1 Expansion joints in the system are required at building expansion joints, at prefabricated panel joints, where substrates change and where structural movement is anticipated. Control joints are required at a minimum of every 144 ft. (13 sq. m) of wall surface area and where specified by the design professional. The maximum uncontrolled length or width is 18 lineal feet (5.5 lineal meters) and a maximum uncontrolled length to height ratio of 2-1/2:1.
- .10 Pre-Installation Meeting: At least three weeks prior to commencing stucco work conduct a meeting at the project site to discuss contract requirements and job conditions; require the attendance of stucco installation Subcontractor, and installers of related materials; notify Architect in advance of meeting.
 - .1 Confirm and coordinate visual review and pre-installation conference requirements with the BECxA.

1.8 Delivery, Storage, and Handling

- .1 Delivery: Deliver all materials to the construction site in their original, unopened packaging with labels intact.
- .2 Inspection: Inspect the materials upon delivery to assure that specified products have been received. Report defects or discrepancies to the responsible party according to the construction documents; do not use reported material for application.
- .3 Storage: Store all products per manufacturer's recommendations. Generally, store materials in a cool, dry location; away from direct contact with the ground and/or concrete; out of direct sunlight; and protect from weather and other damage.
- .4 Handle all products with appropriate precautions and care per MSDS.

1.9 Site conditions

- .1 Environmental Requirements: Follow product manufacturer's recommendations for environmental conditions and surface preparation.
- .2 Comply with ASTM C 926 requirements.
- .3 Do not apply stucco materials in ambient temperatures below 4°C/40°F. Provide supplementary heat during installation and drying period when temperatures less than 4°C/40°F prevail.
- .4 Do not apply stucco materials to frozen surfaces.

- .5 Maintain ambient temperature at or above 4°C/40°F during and at least 24 hours after stucco installation and until dry.
- .6 All wood based products covered shall be dry and have a moisture content below 19% . Do not cover wet framing.
- .7 Existing Conditions: Contractor shall walk the project prior to starting work and notify the Contract Administrator of any deficiencies that will negatively impact the plaster assembly. Do not proceed until remedied.
- .8 Good Practice: During the rainy season, colored plaster can be damaged if the gutters and downspouts are not in place. It is recommended to have gutters and downspouts installed as soon as possible after plastering is complete.

1.10 Sequencing and Scheduling

- .1 Coordinate and schedule installation of the stucco materials with related work of other sections.
- .2 Coordinate and schedule installation of trim, flashing, and joint sealers to prevent water infiltration behind the system.

1.11 Warranty

- .1 Warranty: Submit documentation on all products. At completion of work, Contractor shall provide a written warranty documentation for the assembly and products used.
- .2 Warranty Length: Shall start at the time of substantial completion.

1.12 Maintenance Materials

- .1 The following materials shall be presented to the City of Winnipeg following the application of the work:
 - .1 One container of finish for each color and texture utilized on the project.
 - .2 Supply a maintenance program for City of Winnipeg's O&M manual as required.

Part 2 Products

2.1 Description

- .1 System Description:
 - .1 Wood Sheathing Substrate: 2-coat, Portland cement plaster applied over [wood] or [steel] studs and wood sheathing consisting of the following:
 - .1 Air Barrier over sheathing.
 - .2 Self-furring metal lath.
 - .3 2-coat plaster system.
 - .1 Fiber Base Coat (FBC) - thickness to match existing stucco
 - .2 Finish Coat - thickness to match existing stucco

2.2 Manufacturers

- .1 Acceptable Manufacturer: Spec Mix®, Inc., which is located at: 1230 Eagan Industrial Road, Suite 160, Eagan, MN 55121; Toll Free Tel: 888-SPEC-MIX (773-2649); Tel: 651-994-7120; Email: request info (info@specmix.com); Web: www.specmix.com

- .1 Or approved equal.
- .2 Obtain products from a single manufacturer.

2.3 Metal Lath

- .1 Expanded-Metal Lath: ASTM C 847 with ASTM A 653/A 653M, G60, hot-dip galvanized zinc coating.
 - .1 Diamond-Mesh Lath: Self-furring.
 - .1 One-Coat Application: Minimum 2.5 lb/sq. yd. b.
 - .2 Three-Coat Application: Minimum 3.4 lb/sq. yd.
 - .3 Match existing stucco lath where possible.
 - .2 Wire-Fabric Lath:
 - .1 Woven-Wire Lath: ASTM C 1032; self-furring or Welded-Wire Lath: ASTM C 933; self-furring.
 - .1 One-Coat Application: Minimum No. 20 gauge, 1" galvanized steel fabric
 - .2 Three-Coat Application: Minimum No. 17 gauge, 1" galvanized steel fabric.
 - .3 Match existing stucco lath where possible.

2.4 Plaster Materials

- .1 Scratch & Brown Pre-Blended Stucco: SPEC MIX Scratch & Brown Pre-Blended Stucco is a dry pre-blended cement based stucco mix containing Portland cement, hydrated lime, sand, aggregates and performance admixtures formulated to be used in a three coat or a two coat application.
 - .1 Applicable Standards: ASTM C 144, ASTM C 150, ASTM C 207, ASTM C 270, ASTM C 595, ASTM C 897, ASTM C 926, ASTM C 1328.
- .2 Fiber Base Coat Pre-Blended Stucco: SPEC MIX Fiber Base Coat (FBC), Pre-Blended Stucco is a dry pre-blended cement based stucco mix containing Portland cement, hydrated lime, polyester and fiberglass fibers, sand, aggregates and performance admixtures formulated to be used in a three coat or a two coat application.
 - .1 Applicable Standards: ASTM C 144, ASTM C 150, ASTM C 157, ASTM C 207, ASTM C 348, ASTM C 595, ASTM C 897, ASTM C 926, ASTM C 1328.
- .3 Colored Finish Coat Stucco: SPEC MIX Colored Finish Coat Stucco is a dry pre-blended cement based stucco mix containing Portland cement, hydrated lime, sand, aggregates and performance admixtures formulated for optimum workability and reduced shrinkage.
 - .1 Applicable Standards: ASTM C 144, ASTM C 150, ASTM C 207, ASTM C 270, ASTM C 595, ASTM C 897, ASTM C 926, ASTM C 979, ASTM C 1328.
 - .2 Pigments:
 - .1 Natural and synthetic, milled, blended iron oxides.
 - .2 Carbon added for darker colors shall not exceed 4 percent.
 - .3 Produce uniform and consistent color.
 - .4 Inert, stable to atmospheric conditions, sunfast, weather resistant, alkali resistant, water insoluble, lime proof and non-bleeding.

- .5 Free of deleterious fillers and extenders.
- .3 Colour: to match existing - selected from Manufacturer's full range.

2.5 Accessories

- .1 General: Comply with ASTM C 1063 and coordinate depth of trim and accessories with thicknesses and number of plaster coats required.
- .2 Metal Accessories:
 - .1 Weep Screed/Kick-out Flashing: Fabricated from hot-dip galvanized-steel sheet, ASTM A 653/A 653M, G60 (Z180) zinc coating. Beveled edge design to terminate finish system and drain internal moisture.
 - .2 Cornerite: Fabricated from metal lath with ASTM A 653/A 653M, G60 (Z180), hot-dip galvanized zinc coating.
 - .3 Corner Bead: Small nose corner bead with expanded flanges fabricated from zinc-coated (galvanized) steel.
 - .4 Casing Bead: Square-edged style with expanded flanges fabricated from zinc-coated (galvanized) steel.
 - .5 Control Joint: W-shaped accordion profile style with perforated flanges fabricated from zinc-coated (galvanized) steel.
 - .6 Expansion Joint: Two piece type slip-joint design fabricated from zinc-coated (galvanized) steel for application of backer rod sealant bead.
- .3 Secondary Weather Barrier: A secondary weather barrier must be installed over sheathing substrates and wrapped into rough openings prior to installation of the stucco materials. In accordance with 07 27 00.01 Air Barriers.
 - .1 One layer of Grade D 60 minute paper with one layer of EPS or extruded polystyrene with tongue and groove edges.
 - .2 Two layers Grade D 60 minute paper are required by International Building Code (IBC) for wood-based sheathings. Check the applicable code and code compliance report for appropriate type.
 - .3 Two layers Asphalt-Saturated Organic Felt: ASTM D 226, Type I (No. 15 asphalt felt), un-perforated.
 - .4 Other approved secondary moisture barriers as approved by Spec Mix and acceptable by current code jurisdictions.
- .4 Flexible Flashing: 9" wide, 20 mil thick, self-sealing, self-healing rubberized asphalt laminated to a poly-ethylene film. Use over weather barrier at rough openings.

2.6 Miscellaneous Materials

- .1 Water: Clean and potable without foreign matter.
- .2 Bonding Compound: Complying with ASTM C 932 and as recommended by Spec Mix® Inc.
- .3 Steel Drill Screws: For metal-to-metal fastening, ASTM C 1002 or ASTM C 954, as required by thickness of metal being fastened; with pan head that is suitable for application; in lengths required to achieve penetration through joined materials of no fewer than three exposed threads.
- .4 Fasteners for Attaching Metal Lath to Substrates: Complying with ASTM C 1063.

- .5 Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, not less than 0.0475-inch (1.21-mm) diameter.
- .6 Sealant: As specified in Section 07 92 00 - Joint Sealants.

Part 3 Execution

3.1 Examination

- .1 Examine areas and substrates, with Installer present, and including hollow-metal frames, cast-in anchors, structural framing, and lath for compliance with requirements and other conditions affecting performance of the Work.
- .2 Substrates:
 - .1 Verify that acceptable substrates have been installation. Refer to Quality Assurance Article above.
 - .2 Wall sheathings must be securely fastened per applicable building code requirements.
 - .3 Examine surfaces to receive system and verify that substrate and adjacent materials are dry, clean, and sound. Verify substrate surface is flat, free of fins or planar irregularities greater than 1/4" in 10'-0".
- .3 Flashings:
 - .1 Heads, jambs and sills of all openings must be flashed with a minimum 9" strip of flexible flashing prior to window/door, HVAC, etc. installation.
 - .2 Windows and openings to be flashed according to design and building code requirements.
 - .3 Individual windows that are ganged to make multiple units require continuous head flashing and/or the joints between the units must be fully sealed.
- .4 Utilities:
 - .1 The system must be properly terminated (back-wrapped, sealed, flashed) at all lighting fixtures, electrical outlets, hose bibs, vents, etc. Refer to Spec Mix® Inc., typical Details.
- .5 Decks:
 - .1 Wood decks must be properly flashed prior to system application. For proper application, refer to Spec Mix® Inc. typical Details. The system must be terminated a minimum of 1" above all decks, patios, sidewalks, etc.
- .6 Secondary Moisture Barrier:
 - .1 Verify that the secondary moisture barrier is installed over the substrate per applicable building code requirements, manufacturer's specifications and Spec Mix® Inc. typical Details prior to stucco application.
- .7 Roof:
 - .1 Verify that all roof flashings have been installed in accordance with the guidelines set by the Asphalt Roofing Manufacturers Association (ARMA) and project design documents.
- .8 Weep Screed/Kick-out Flashing:

- .1 Verify that Weep Screeds and Kick-out Flashings are installed where required prior to the stucco application. The flashing must be leak-proof and angled (min 100°) to allow for proper drainage and water diversion. Refer to Spec Mix® Inc. typical Details.
- .9 Do not proceed with stucco work until surfaces and conditions comply with requirements indicated in referenced installation standard and manufacturer's printed instructions.
- .10 Confirm and coordinate visual review requirements with the BECxA.

3.2 Preparation

- .1 Protect adjacent work from soiling, spattering, moisture deterioration, and other harmful effects caused by plastering work.

3.3 Secondary Moisture Barrier Installation

- .1 Install secondary moisture barrier horizontally, overlapping in shingle pattern with 150mm (6") edge and end lap. Fasten to sheathing with corrosion-resistant staples. Secondary moisture barrier to be installed over all sheathing to receive plaster finish.

3.4 Installing Metal Lath

- .1 Metal Lath: Install according to ASTM C 1063.
 - .1 Install metal lath with minimum 1-1/2" side and end laps.
 - .2 When end laps occur between supports, lace or wire ties the ends of the sheets with galvanized steel wire.
 - .3 Corrosion-resistant fasteners for lath attachment to penetrate a minimum 1" into wood framing.
 - .4 Secure lath is to metal framing using No.8-18, S-12, pan head, self-tapping screws spaced a maximum of 6 inches vertical on center to studs.

3.5 Installing Accessories

- .1 General:
 - .1 Install trim in accordance with manufacturer's specifications.
 - .2 Install trim components in longest piece length possible to minimize joints.
 - .3 Allow 1/8" - 3/16" gap between the abutting trim pieces. Do not overlap trim. Set intersection of trim in a minimum 4" bed of trim sealant approved by Spec Mix®, Inc.
 - .4 Set intersection of trim in a minimum 4" bed of trim sealant approved by Spec Mix®, Inc.
 - .5 Miter all corners at intersections of trim.
 - .6 Install according to ASTM C 1063 and at locations indicated on Drawings or as follows.
- .2 Reinforcement for External Corners:
 - .1 Install corner bead at exterior corner locations.
- .3 Control Joints: Install control joints at locations indicated on Drawings and as follows:

- .1 As required to delineate plasterwork into areas (panels) of the following maximum sizes:
 - .1 Vertical Surfaces: 144 sq. ft.
 - .2 Horizontal and other Non-vertical Surfaces: 100 sq. ft.
- .2 At distances between control joints of not greater than 18 feet o.c.
- .3 As required to delineate plasterwork into areas (panels) with length-to-width ratios of not greater than 2-1/2:1.
- .4 Where control joints occur in surface of construction directly behind plaster.
- .5 Where plasterwork areas change dimensions, to delineate rectangular-shaped areas (panels) and to relieve the stress that occurs at the corner formed by the dimension change.

3.6 Plaster Mixing

- .1 General:
 - .1 Comply with ASTM C 926 for applications indicated.
 - .2 Mix pre-packaged stucco materials with clean water to comply with manufacturer's written instructions.
 - .3 No additives are permitted unless specified in product mixing instructions. Close containers when not in use. Prepare in a container that is clean and free of foreign substances. Do not use a container which has contained or been cleaned with a petroleum-based product. Use a mixer which is clean and free of foreign substances. Clean tools with soap and water immediately after use.
- .2 Bag Mixing Spec Mix® Stucco: 80 lb. Bag
 - .1 Place 1.2-1.5 gallons of potable water into the mixer for each 80 lb. bag.
 - .2 Slowly pour the contents of the bag(s) into the mixer.
 - .3 Mix for 4 to 5 minutes and then let the mixture slake for 3 to 4 minutes.
 - .4 Re-mix to break the initial set and add small amounts of water to adjust the consistency.
 - .5 Do not exceed a total volume of 2 gallons of water for each 80 lb. bag.
 - .6 Mixing time and procedures should be consistent with every batch for consistent material. 6. Prepare only enough mix as can be applied in one hour.
- .3 Silo System Mixing Spec Mix® Stucco:
 - .1 Place 75% of the needed water into the mixer. A double mixer batch requires approximately four (4) full five (5) gallon pails.
 - .2 Pull open the silo handle to dispense the Spec Mix stucco product into mixer.
 - .3 Mix for 4 to 5 minutes and then let the mixture slake for 3 to 4 minutes.
 - .4 Re-mix to break the initial set and add small amounts of water to adjust the consistency.
 - .5 Mixing time and procedures should be consistent with every batch for consistent material.
 - .6 Prepare only enough mix as can be applied in one hour.

3.7 Plaster Application

- .1 Apply plaster materials in accordance with manufacturer's written installation instructions for the specific systems indicated.
- .2 General: Comply with ASTM C 926.
 - .1 Bonding Compound: Apply on plaster bases if required for adequate stucco bonding to substrate.
 - .2 Apply cement plaster with sufficient force to develop full adhesion between plaster and the substrate.
 - .3 Apply the base coat to completely embed lath or wire and to completely fill the thickness of the casing, screeds, or expansion/control joint.
 - .4 It is acceptable to use the double back method of application, whereby the first pass of base coat covers the lath or wire and the second pass of base coat fills in the casing, screed, or control/expansion joints.
 - .5 Finish plaster flush with metal frames and other built-in metal items or accessories that act as a plaster ground unless otherwise indicated. Where casing bead does not terminate plaster at metal frame, cut base coat free from metal frame before plaster sets and groove finish coat at junctures with metal.
 - .6 Once the base coat has been applied to the required thickness, a rod should be used to level the base coat with screeds, to provide a true, flat plane. Follow this by wood floating or darbying the surface. Fill all voids and dress surface for the finish coat.
 - .1 Do not deviate more than plus or minus 1/4 inch in 10 feet from a true plane in finished plaster surfaces, as measured by a 10-foot straightedge placed on surface.
 - .7 Allow base coat stucco to achieve its initial set (2-4 hours) prior to moisture curing. Moisture cure for at least 48 hours by lightly and evenly fogging the surface with water at least twice a day. Direct sunlight, hot temperatures, low humidity and wind may make additional fogging necessary.

3.8 Plaster Repairs

- .1 Repair or replace work to eliminate cracks, dents, blisters, buckles, crazing and check cracking, dry outs, efflorescence, sweat outs, and similar defects and where bond to substrate has failed.

3.9 Cleaning

- .1 Clean stucco material from adjacent surfaces as recommended by manufacturer.
- .2 Remove surplus material and debris, including field sample, from site.

3.10 Protection

- .1 Protect installed stucco surfaces from rain, snow and frost for 48-72 hours following application.

END OF SECTION

Part 1 General

1.1 Related requirements

- .1 Section 07 92 00 - Joint Sealants
- .2 Section 09 21 16 Gypsum Board Assemblies
- .3 Section 10 28 00 Toilet and Bath Accessories
- .4 Mechanical - Coordination with sinks and associated plumbing

1.2 Reference standards

- .1 American National Standards Institute (ANSI):
 - .1 ANSI A108/A118/A136.1: 2020, Installation of Ceramic Tile
 - .2 ANSI A137.1: 2021, Standard Specifications for Ceramic Tile
- .2 ASTM International (ASTM):
 - .1 ASTM C144-18, Standard Specification for Aggregate for Masonry Mortar
 - .2 ASTM C207-18, Standard Specification for Hydrated Lime for Masonry Purposes
 - .3 ASTM C847-18, Standard Specification for Metal Lath
- .3 Canadian General Standards Board (CGSB):
 - .1 CAN/CGSB-25.20-95, Surface Sealer for Floors
 - .2 CAN/CGSB-51.34-M86, Vapour Barrier, Polyethylene Sheet for Use in Building Construction
 - .3 CGSB 71-GP-22M-78, Adhesive, Organic, for Installation of Ceramic Wall Tile
 - .4 CAN/CGSB-75.1-M88, Tile, Ceramic
- .4 CSA Group (CSA):
 - .1 CSA A123.3-05, Asphalt Saturated Organic Roofing Felt
 - .2 CAN/CSA-A3000-18, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005)
- .5 Terrazzo Tile and Marble Association of Canada (TTMAC):
 - .1 Tile Specification Guide 09 30 00 2019/2021, Tile Installation Manual
 - .2 Hard Surface Maintenance Guide 2017-2019
 - .3 Tile Installer Technical Manual, 2018-2019
- .6 Tile Council of North America (TCNA):
 - .1 TCNA Handbook for Ceramic, Glass, and Stone Tile Installation, 2021

1.3 Action and informational submittals

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit product data for each type of product and accessory specified. Indicate compliance with this Section.

- .1 Include manufacturer's information on:
 - .1 Ceramic tile, marked to show each type, size, and shape required.
 - .2 Chemical resistant mortar and grout (Epoxy and Furan).
 - .3 Cementitious backer unit.
 - .4 Dry-set cement mortar and grout.
 - .5 Divider strip.
 - .6 Elastomeric membrane and bond coat.
 - .7 Reinforcing tape.
 - .8 Levelling compound.
 - .9 Latex cement mortar and grout.
 - .10 Commercial cement grout.
 - .11 Organic adhesive.
 - .12 Slip resistant tile.
 - .13 Waterproofing isolation membrane.
 - .14 Fasteners.
- .3 Samples for Initial Selection: Submit samples of the following:
 - .1 Actual tiles or sections of tiles showing the full range of colours, textures, and patterns available for each type of tile indicated.
 - .2 Edging and trim accessories showing the full range of colours available.
 - .3 Actual sections of grout showing the full range of colours available for each type of grout indicated.
- .4 Sustainable Design Submittals:
 - .1 LEED Canada submittals: in accordance with Section 01 35 20 - LEED Sustainable Requirements.
 - .2 Construction Waste Management: Refer to Section 01 74 19 - Construction/Demolition Waste Management and Disposal.
 - .3 Material product attribute documentation: Refer to Product Check Sheet as listed in 01 35 20 – LEED Sustainable Requirements to determine applicable type of documentation required for each product.
 - .4 Low-Emitting Materials:
 - .1 Submittals are required for any sealants, adhesives, paints, coatings, composite wood, flooring, wall panels, insulation or ceiling components within the inner most weather proofing barrier.
 - .2 Refer to Product Check Sheet as listed in 01 35 20 – LEED Sustainable Requirements to determine applicable type of documentation required for each product.

1.4 Closeout submittals

- .1 Warranty Documentation: Submit manufacturers' warranties.

1.5 Maintenance material submittals

- .1 Extra Stock Materials: Supply maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.
 - .1 Supply a minimum two full cartons of each type and colour of tile required for the Project for maintenance use.
 - .2 Supply maintenance materials from same the production run as installed materials.
 - .3 Unused tile from open cartons become the property of the City of Winnipeg.
 - .4 Deliver store, protect, and handle materials to site and store where directed. Provide written receipt, signed by Contractor, verifying delivery.

1.6 Quality assurance

- .1 Qualifications:
 - .1 Installers: Skilled in ceramic tile installation with fiveyears of experience completing tile installations similar in material and scope as this Project , and member in good standing with TTMAC.
 - .2 Provide epoxy adhesive and epoxy grout from the same manufacturer.
- .2 Prior to start of work conduct test on tile materials to ensure that setting materials, bond coats, pigmented or sanded grouts, sealers and waxes do not permanently stain, scratch, mar or otherwise disfigure tile finishes.
- .3 Allow for Contract Administrator's review and acceptable of test samples. If un-compatibility is evident notify respective material manufacturers for suggested remedies. Contract Administrator shall approve any material changes.
- .4 Quality Assurance Submittals:
 - .1 Manufacturer's Instructions: manufacturer's installation instructions.

1.7 Delivery, storage, and handling

- .1 Perform in accordance with Section 01 61 00 - Common Product Requirements, and as follows:
 - .1 Examine materials upon delivery. Open boxes and confirm that materials match accepted samples, are free from defects and damage detrimental to final appearance and installation. Tile materials that are factory marked as seconds or that are not consistent with materials submitted for review are not acceptable.
 - .2 Verify that tiles with colour/pattern variations have been blended at the factory, so that tile units taken from one package show the same range of colours/patterns as those taken from other packages. If tiles are packaged without factory blending, blend tiles on site before installation.
 - .3 Store cementitious materials indoors, in dry location, protected from foreign materials.
 - .4 Protect adhesives, fillers, and sealants from freezing.

1.8 Ambient conditions

- .1 Maintain air temperature and substrate temperature at tile installation area above 12 degrees C for 48 hours before, during, and 48 hours after installation.
- .2 Do not install tiles at temperatures less than 12 degrees C or above 38 degrees C.
- .3 Do not install epoxy mortar and grouts at temperatures below 15 degrees C or above 25 degrees C.
- .4 Provide additional heat when there is a risk that surface temperatures may drop below manufacturer's recommended temperatures.

Part 2 Products

2.1 Performance criteria

- .1 Perform work of this Section in accordance with TTMAC Tile Installer Technical Handbook as a minimum requirement.

2.2 Wall tile

- .1 Ceramic tile (CT-1): to CAN/CGSB-75.1, Type 5, Class MR 4, smooth surface, 100mm (4") x 405 mm (16") x 9.5 mm (3/8") thickness, as indicated on drawings.
 - .1 Product:
 - .1 Colour: Arctic White, Matte
 - .2 Pattern: Vertical Stacked Bond
 - .3 Manufacturer:
 - .1 Olympia Tile, Colour & Dimensions
 - .2 Ceramic tile (CT-2): to CAN/CGSB-75.1, Type 5, Class MR 4, smooth surface, 100mm (4") x 405 mm (16") x 9.5 mm (3/8") thickness, as indicated on drawings.
 - .1 Product:
 - .1 Colour: Citron, Bright
 - .2 Pattern: Vertical Stacked Bond
 - .3 Manufacturer:
 - .1 Olympia Tile, Colour & Dimensions
 - .3 Ceramic tile (CT-3): to CAN/CGSB-75.1, Type 5, Class MR 4, smooth surface, 100mm (4") x 405 mm (16") x 9.5 mm (3/8") thickness, as indicated on drawings.
 - .1 Product:
 - .1 Colour: Dark Grey, Matte
 - .2 Pattern: Vertical Stacked Bond
 - .3 Manufacturer:
 - .1 Olympia Tile, Colour & Dimensions

2.3 Tile Backer Board

- .1 Refer to Section 09 21 16 - Gypsum Board Assemblies for Wall Backer (TBB)

2.4 Tile trims & Edge Protection

- .1 Finishing and Edge-Protection Profiles for walls: purpose made metal extrusion; anodized aluminum type, profile with square visible surface, integrated trapezoid-perforated anchoring leg, and integrated grout joint spacer.
 - .1 Tile Trim for Base-to-floor provide integral covered, vertical and horizontal joint. (TR-5)
 - .1 Product: Schluter, Dilex-Ahka, Satin Anodized
 - .2 Tile Trims at External Wall Corners (TR-6):
 - .1 Product: Schluter Jolly, Satin Anodized
 - .3 Metal Edge Floor Strip (TR-7):
 - .1 Product: Schluter Schiene, Stainless Steel

2.5 Mortar, adhesive, and grout materials

- .1 Primer: Low viscosity primer as recommended by manufacturer to suit substrate and site conditions. Submit proof of bonding ability of setting system if manufacturer says primer is not necessary. Ensure primer is in accordance with Section 01 35 21 LEED Sustainable Requirements.
- .2 Surface Preparation Materials: Provide the following underlayment materials:
 - .1 Fibre reinforced, polymer modified thin set mortar.
 - .1 Standard of Acceptance: X77 Microtec by Ardex or approved equal.
 - .2 Epoxy grout and adhesive:
 - .1 100% solids epoxy grout.
 - .2 Solvent free, low VOC, two component system.
 - .3 Job coloured grout are not acceptable.
 - .1 Product: Mapei
 - .2 Colour: 27 Silver

2.6 Accessories

- .1 Cleavage plane: polyethylene film to CGSB 51-34.
- .2 Prefabricated Movement Joints: purpose made, having a Shore A Hardness not less than 60 and elasticity of plus or minus 40 percent when used in accordance to TTMAC Detail 301EJ.
- .3 Reinforcing Mesh: Welded wire fabric flat sheets, 50 x 50 -mm openings, 1.6-mm-diameter galvanized steel wire.
- .4 Water: Potable, clean and free of chemicals and contaminants detrimental to mortar and grout mixes.
- .5 Sealant: In accordance with Section 07 92 00 - Joint Sealants and 01 35 21 LEED Sustainable Requirements.
- .6 Sealer: silicone based, clear, low viscosity penetrating sealer of type as recommended by tile and grout manufacturers.
- .7 Floor sealer and protective coating: to CAN/CGSB 25.20, to tile and grout manufacturers recommendations.

2.7 Mixes

- .1 Mix premanufactured mortars and grouts in accordance with ANSI A108/A118/A136.1, and mortar and grout manufacturers' instructions. Perform site mixing to add water only.

2.8 Cleaning Compounds

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

Part 3 Execution

3.1 Manufacturer's Instructions

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

3.2 Workmanship

- .1 Do tile work in accordance with the latest edition of TTMAC Tile Installation Manual, "Ceramic Tile", except where specified otherwise.
- .2 Apply tile or backing coats to clean and sound surfaces.
- .3 Fit tile around corners, fitments, fixtures, drains and other built-in objects. Maintain uniform joint appearance. Cut edges smooth and even. Do not split tiles.
- .4 Maximum surface tolerance 1:800.
- .5 Make joints between tile uniform and approximately 1.5 mm wide, plumb, straight, true, even and flush with adjacent tile. Ensure sheet layout not visible after installation. Align patterns.
- .6 Lay out tiles so perimeter tiles are minimum 1/2 size.
- .7 Sound tiles after setting and replace hollow-sounding units to obtain full bond.
- .8 Use metal trims at all inside and outside corners and at floor to wall transitions.
- .9 Use metal trims at termination of wall tile panels.
- .10 Allow minimum 24 hours after installation of tiles, before grouting.
- .11 Clean installed tile surfaces after installation and grouting cured.
- .12 Make expansion joints at 20'-0" max, both directions.

3.3 Examination

- .1 Verification of Conditions:
- .2 Examine substrates and conditions where tile will be installed for compliance with requirements for installation tolerances and other conditions affecting performance of installed tile.
 - .1 Verify that substrates for bonding tile are firm, dry, clean, and free from oil, waxy films, and curing compounds.

- .2 Verify substrates are within starting flatness tolerances as specified in accordance with TTMAC Tile Installer Technical Handbook, and are ready for application.
- .3 Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar products located in, behind, or through tiling is complete.

3.4 Preparation

- .1 Thoroughly clean substrate surfaces. Remove grease, oil, dust film, concrete surface film forming products, concrete curing agents, and other contaminants that could reduce adhesion within bonding systems, and as follows:
 - .1 Clean the back of each tile before installation to remove surface contaminants and cutting residue, firing release dust, and other debris detrimental to bond and final surface appearance.
- .2 Prepare surfaces in accordance with manufacturer's instructions whose setting materials or additives are being used.
- .3 Do not seal substrate unless recommended by manufacturer.
- .4 Prime substrate when recommended by manufacturer.
- .5 Seal substrate surface cracks with filler.
- .6 Apply latex cementitious leveling coat to bring substrates within acceptable surface tolerances of 1/4" (6 mm) in 10' (3050 mm) when measures with a 10' (3050 mm) straight edge.

3.5 Installation - general

- .1 Perform tile work in accordance with TTMAC Tile Installer Technical Manual, parts of ANSI A108 Series of tile installation standards that apply to types of bonding and grouting materials, and to methods required for complete tile installation as minimum requirements.
- .2 Fit tile around corners, fitments, fixtures, drains, and other built-in objects.
- .3 Accurately form intersections and returns. Cut and drill tile without marring visible surfaces:
 - .1 Cut, drill, and fit tile to accommodate work of other Subcontractors penetrating and abutting work of this Section.
 - .2 Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints.
- .4 Lay tile in pattern indicated on Drawings and as follows:
 - .1 Align joints when adjoining tiles on floor, base, walls, and trim are the same size.
 - .2 Lay out tile Work and centre tile sites in both directions in each space or on each wall area.
 - .3 Centre tile patterns between control and movement joints; notify Contract Administrator for further instructions where tile patterns do not align with control or movement joints.
- .5 Cut tile accurately and without damage.
- .6 Smooth exposed cut edges with abrasive stone, where visible.

- .7 Minimum tile width is halfunit size unless specifically indicated otherwise on Drawings.
- .8 Adjust tile layout to minimize tile cutting.
- .9 Provide uniform joint widths.
- .10 Make joints between tile sheets the same width as joints within tile sheets so joints between sheets are not apparent in finished Work. Align tile sheet patterns.
- .11 Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so that plates, collars, and covers overlap tile.
- .12 Make joints between tile uniform, plumb, straight, true, and flush with adjacent tile.
- .13 Maximum Surface Tolerance: 1:800.
- .14 Lay out tiles so perimeter tiles are at least 1/2 of a full size.
- .15 Sound tiles after setting and replace hollow-sounding units to obtain full bond.
- .16 Wait a minimum of 24 hours after installation of tiles, before grouting.
- .17 Installation - Bonding Bed: Set tile in place while bond coat is wet and tacky.
 - .1 Apply a coat of mortar with pressure using the trowel's flat side to key the mortar into the substrate. Apply additional mortar, combing it in a single direction parallel to the tile's shortest dimension, with the trowel's notched side.
 - .2 Provide sufficient bond coat to achieve at least 80% contact for tiles smaller than 12" x 12" (300 mm x 300 mm) with bonding material evenly dispersed and pressed into back of tile. Perform back buttering for larger tiles and installations having moderate or higher loadbearing performance requirements.
 - .3 Place tiles firmly into the wet mortar. Push tiles back and forth in a direction perpendicular to trowel lines, to collapse the mortar ridges and help achieve maximum coverage.
 - .4 Verify that corners and edges are fully supported by bonding material. Periodically pick up freshly installed tile and inspect.
 - .5 Keep two-thirds of grout joint depth free of bonding materials.
 - .6 Clean excess bonding materials from tile surface before bonding materials' final set.
 - .7 Sound tiles after bonding materials have cured. Replace hollow sounding tiles before grouting.

3.6 Installation - Wall Tile

- .1 Install in accordance with TTMAC details.
- .2 Level substrate with smoothing / ramping mortar specified if required prior to tile installation.
- .3 Ensure cement board is securely fastened so that no deflection is present.
- .4 All mortars to be applied in a unidirectional manner.
- .5 Fit tile around corners, fitments, fixtures, drains and other built in objects. Maintain uniform joint appearance. Cut edges smooth and even. Do not split tiles.
- .6 Clean installed tile surfaces after installation and grouting cured.

3.7 Installation - grout

- .1 Grouting: Install grout in accordance with manufacturer's written instructions, the requirements of TTMAC Tile Installer Technical Manual, and as follows:
 - .1 Allow proper setting time before application of grout.
 - .2 Pre-seal or wax tiles that require protection from grout staining.
 - .3 Force grout into the joints with a rubber grout float. Make sure all joints are well-compacted and free of voids and gaps.
 - .4 Remove excess grout in accordance with manufacturer's instructions and polish tile with clean cloths.

3.8 Cleaning

- .1 Perform cleaning in accordance with Section 01 74 00 - Cleaning. Clean tile surfaces so they are free of foreign matter using manufacturer recommended cleaning products and methods after completing grouting, and as follows:
 - .1 Remove latex-Portland cement and epoxy grout residue from tile as soon as possible.
 - .2 Unglazed tile may be cleaned with acid solutions only when permitted by tile and grout manufacturer's instructions, but no sooner than 10 days after installation. Protect metal surfaces, cast iron, and vitreous plumbing fixtures from effects of acidic solution cleaning.
 - .3 Flush surface with clean water before and after cleaning.
- .2 Waste Management and Disposal: Perform in accordance with Section 01 74 19 - Waste Management and Disposal.

3.9 Protection

- .1 Protect finished tile floor areas from traffic until setting materials have sufficiently cured in accordance with TTMAC Tile Installer Technical Manual.
- .2 Protect wall tiles and bases from impact, vibration, and heavy hammering on adjacent and opposite walls for a minimum of 7 days after installation.

END OF SECTION

Part 1 General

1.1 Related requirements

- .1 Section 09 21 16 Gypsum Board Assemblies
- .2 Mechanical specifications - Louvres, Intakes and Vents: Air inlets and outlets to be coordinated with ceiling work.

1.2 Reference standards

- .1 ASTM International (ASTM)
 - .1 ASTM C423-09, Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method
 - .2 ASTM C635/C635M-13a, Standard Specifications for the Manufacture, Performance and Testing of Metal Suspension Systems for Acoustical Tile and Lay-In Panel Ceilings.
 - .3 ASTM C636/C636M-08, Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels.
 - .4 ASTM E1264-14, Standard Classification for Acoustical Ceiling Products.
 - .5 ASTM E1414/E1414M 11ae1 Standard Test Method for Sound Attenuation between Rooms Sharing a Common Ceiling Plenum.
 - .6 ASTM F1667-15 Standard Specification for Driven Fasteners: Nails, Spikes and Staples.
- .2 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Safety Data Sheets (SDS).
- .3 Underwriter's Laboratories of Canada (ULC)
 - .1 CAN/ULC-S102-2003, Surface Burning Characteristics of Building Materials and Assemblies.

1.3 Coordination

- .1 Do not begin erection of ceiling suspension system until work above ceiling has been inspected by Contract Administrator.
- .2 Do not proceed with installation until all wet work such as concrete, terrazzo, plastering and painting has been completed and thoroughly dried out, unless expressly permitted by manufacturer's printed recommendations.

1.4 Action and informational submittals

- .1 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for acoustical suspension, acoustic panels, acoustic tiles, and system accessories. Include product characteristics, performance criteria, physical size, finish and limitations.

- .3 Samples:
 - .1 Submit duplicate 6" x 4" (150 mm x 100 mm) samples of each type of acoustical unit.
- .4 Acoustical Certifications: Manufacturer's certifications that products follow specified requirements, including laboratory reports showing compliance with specified tests and standards. For acoustical performance, each carton of material must carry an approved independent laboratory classification of NRC, CAC, and AC.
- .5 Sustainable Design Submittals:
 - .1 LEED Canada Submittals: in accordance with Section 01 35 20 - LEED Requirements .
 - .2 Construction Waste Management: Refer to Section 01 74 19 - Construction/Demolition Waste Management and Disposal.
 - .3 Low-Emitting Materials:
 - .1 Submittals are required for any sealants, adhesives, paints, coatings, composite wood, flooring, wall panels, insulation or ceiling components within the inner most weather proofing barrier.
 - .2 Refer to Product Check Sheet as listed in 01 35 20 – LEED Sustainable Requirements to determine applicable type of documentation required for each product.

1.5 Closeout submittals

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Submit operation and maintenance data for acoustical suspension for incorporation into manual.
- .3 Submit final certificate from design professional responsible for delegated detail design of ceiling indicating conformity with accepted shop drawings.

1.6 Maintenance materials

- .1 Provide extra acoustical units in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Provide acoustical units amounting to 2% of gross ceiling area for each pattern and type of acoustical panel or tile, suspension system and trim required for project, minimum 1 complete factory-sealed package of each.
- .3 Ensure extra materials are from same production run as installed materials.
- .4 Deliver extra materials for each type of acoustical unit in original unopened packages clearly identified, including colour and texture.
- .5 Deliver to City of Winnipeg, upon completion of the work of this section.

1.7 Certifications

- .1 Fire-resistance rated suspension system: certified by a Canadian Certification Organization accredited by Standards Council of Canada.
- .2 Certifications: submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements. Include certification of sustainable requirements.

1.8 Quality Assurance

- .1 Single-Source Responsibility: Provide acoustical panel units and grid components by a single manufacturer.
- .2 Surface Burning Characteristics: As follows, tested per ASTM E 84 and complying with ASTM E 1264 Classification.

1.9 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 acoustical ceiling units in a fully enclosed space where they will be protected against damage from moisture, direct sunlight, surface contamination, and other causes.
 - .2 Before installing acoustical ceiling units, permit them to reach room temperature and a stabilized moisture content.
 - .3 Handle acoustical ceiling units carefully to avoid chipping edges or damaged units in any way.
 - .4 Replace defective or damaged materials with new.
 - .5 Store extra materials required for maintenance, where directed by Contract Administrator.
- .4 Waste Management and Disposal:
 - .1 Separate waste materials for reuse and recycling or disposal in accordance with Section 01 74 19 - Waste Management and Disposal.

1.10 Project Conditions

- .1 Space Enclosure:
 - .1 HumiGuard Plus Ceilings: Building areas to receive ceilings shall be free of construction dust and debris. Products with HumiGuard Plus performance and hot dipped galvanized steel, aluminum or stainless-steel suspension systems can be installed up to 120°F (49°C) and in spaces before the building is enclosed, where HVAC systems are cycled or not working.

1.11 Environmental requirements

- .1 Permit wet work to dry before beginning to install.
- .2 Maintain uniform minimum temperature of 15 degrees C and humidity of 20-40% before and during installation.
- .3 Store materials in work area 48 hours prior to installation.

1.12 Warranty

- .1 Acoustical Panel: Submit a written warranty executed by the manufacturer, agreeing to repair or replace panels that fail within the warranty period. Failures include, but are not limited to the following:

- .1 Acoustical Panels: Sagging and warping
- .2 Grid System: Rusting and manufacturer's defects
- .2 Warranty Period:
 - .1 Ceiling System: Thirty (30) years from date of substantial completion
- .3 The Warranty shall not deprive the City of Winnipeg of other rights the City of Winnipeg may have under other provisions of the Contract Documents and will be in addition to and run concurrent with other warranties made by the Contractor under the requirements of the Contract Documents.

Part 2 Products

2.1 Design criteria

- .1 Design Requirements:
 - .1 Intermediate duty system to ASTM C635/ASTM C635M.
 - .2 Maximum deflection: 1/360th of span to ASTM C635/ASTM C635M deflection test.

2.2 Manufacturers

- .1 Ceiling Panels:
 - .1 Armstrong World Industries, Inc. Ultima
 - .2 Or approved equal.
- .2 Suspension Systems:
 - .1 Armstrong World Industries, Inc.
 - .2 Or approved equal.
- .3 Felt Baffles:
 - .1 Hush Acoustics
 - .2 Or approved equal.

2.3 Acoustical ceiling tiles

- .1 Acoustical Panels (ACT-1)
 - .1 Surface Texture: Fine Texture
 - .2 Composition: Mineral Fiber
 - .3 Color: White
 - .4 Size: 24 in x 24 in
 - .5 Edge Profile: Beveled Tegular
 - .6 Noise Reduction Coefficient (NRC) ASTM C 423 Classified w/ UL label on product carton 0.85
 - .7 Ceiling Attenuation Class (CAC): ASTM C 1414; Classified with UL label on product carton 35
 - .8 Articulation Class (AC): ASTM E 1111; Classified with UL label on product carton 170
 - .9 Flame Spread: ASTM E 1264; Class A (HPVA)

- .10 Light Reflectance (LR) White Panel: ASTM E 1477; 0.88
- .11 Dimensional Stability: HumiGuard Plus
- .12 Recycle Content: Up to 87% total recycled content. (Total recycled content: pre-consumer, post-consumer and post-industrial)
- .13 Material Ingredient Transparency: Health Product Declaration (HPD); Declare Label
- .14 Life Cycle Assessment: Third Party Certified Environmental Product Declaration (EPD)
- .15 Acceptable Product: Ultima High NRC as manufactured by Armstrong World Industries
 - .1 Or approved equal.
- .2 Acoustical Panels (ACT-2)
 - .1 Surface Texture: Smooth
 - .2 Composition: Mineral Fiber
 - .3 Color: White
 - .4 Size: 24 in x 24 in 15/16-in 9/16-in Beveled Teg
 - .5 Edge Profile: Beveled Tegular
 - .6 Noise Reduction Coefficient (NRC) ASTM C 423 Classified w/ UL label on product carton
 - .1 24 in x 24 in x 7/8 - 15/16in Beveled Teg – 80 NRC
 - .7 Ceiling Attenuation Class (CAC): ASTM C 1414; Classified with UL label on product carton
 - .1 24 in x 24 in x 3/4in – 35 CAC
 - .8 Articulation Class (AC): ASTM E 1111; Classified with UL label on product carton
 - .1 Ultima High NRC - 170
 - .9 Flame Spread: ASTM E 1264; Class A (ULI)
 - .10 Light Reflectance (LR) White Panel: ASTM E 1477; 0.86
 - .11 Dimensional Stability: HumiGuard Plus
 - .12 Recycle Content: Up to 76% total recycled content.
 - .13 Material Ingredient Transparency: Health Product Declaration (HPD); Declare Label
 - .14 Life Cycle Assessment: Third Party Certified Environment Product Declaration (EPD)
 - .15 Acceptable Product: Ultima Health Zone as manufactured by Armstrong World Industries
 - .1 Or approved equal

2.4 Suspended Acoustic Linear Beams - Baffle Ceiling (BFL)

- .1 Felt Beam Baffles (BFL-1) Suspended Ceiling:
 - .1 Composition: 100% PET (Polyethylene Terephthalate)

- .2 Recycled Content: 60%
- .3 Fire Rating: ASTM E-84, Class A
- .4 NRC Rating: 0.85
- .5 Profile: Linear 'Beam'
- .6 PET Thickness: 12 mm
- .7 Size: 80mm W x 80mm H x 2790mm L
- .8 Installation: Suspended T-Bar track (angle to match steel joists)
 - .1 Suspension system to be rigid - system to prevent movement due to adjacent wall grilles/HVAC and be impact resistant.
 - .2 Suspension system to be black colour or painted to match the exposed steel deck above.
- .9 Colour: Oyster (to be selected from Manufacturer's standard range of colour options).
- .10 Location: Lobby 101
- .11 Standard of acceptance: Beams by Hush Acoustics (or approved equal).

2.5 Acoustical ceiling suspension

- .1 Components:
 - .1 Main beams and cross tees, base metal and end detail, fabricated from commercial quality hot dipped galvanized steel complying with ASTM A 653. Main beams and cross tees are double-web steel construction exposed flange design. Exposed surfaces chemically cleansed, capping prefinished galvanized steel in baked polyester paint. Main beams and cross tees shall have rotary stitching.
 - .1 Structural Classification: ASTM C 635 Intermediate or Heavy Duty.
 - .2 Color: White or match the actual color of the selected ceiling tile, unless noted otherwise.
 - .3 Sustainability: Environmental Product Declaration (EPD), Health Product Declaration (HPD)
 - .4 Acceptable Product: Prelude XL 15/16" Exposed Tee as manufactured by Armstrong World Industries.
 - .1 Or approved equal.
 - .2 Attachment Devices: Size for five times design load indicated in ASTM C 635, Table 1, Direct Hung unless otherwise indicated.
 - .3 Wire for Hangers and Ties: ASTM A 641, Class 1 zinc coating, soft annealed, with a yield stress load of at least three design load, but not less than 12 gauge.
 - .4 Edge Moldings and Trim
 - .5 Accessories: splices, clips, wire ties, retainers and wall moulding, to complement suspension system components, as recommended by system manufacturer.
 - .6 Touch-up paint: in accordance with manufacturer's recommendations for surface conditions.

- .2 Carrying channels: steel channels, size to suit.

2.6 Accessories

- .1 Accessories: splices, clips, wire ties, retainers and wall molding, to complete suspension system, as recommended by manufacturer.
- .2 Hanger wire: galvanized soft annealed steel wire, 3.6 mm diameter for lay-in tile ceilings.
- .3 Hanger inserts: purpose made.
- .4 Carrying channels: steel channels, size to suit as required.
- .5 Touch-up paint: in accordance with manufacturer's recommendations for surface conditions.
- .6 Polyethylene: to CAN/CGSB-51.34, 0.15 mm thick.
- .7 Hold down clips: purpose made clips to secure panel/ tile to suspension system, approved for use in fire-rated systems.
- .8 Edge trim for floating ceilings: Sheet metal channels, finished to match suspension grid, straight or curved to radius indicated.

Part 3 Execution

3.1 Examination

- .1 Verify conditions of substrates previously installed under other Sections or Contracts are acceptable for acoustical ceiling tile and track installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate.
 - .2 Inform Contract Administrator of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Contract Administrator.

3.2 Preparation

- .1 Measure each ceiling area and establish layout of acoustical units to balance border widths at opposite edges of each ceiling. Avoid use of less than half width units at borders and comply with reflected ceiling plans. Coordinate panel layout with mechanical and electrical fixtures.
- .2 Coordination: Furnish layouts for preset inserts, clips, and other ceiling anchors whose installation is specified in other sections.
 - .1 Furnish concrete inserts and similar devices to other trades for installation well in advance of time needed for coordination of other work.

3.3 Interface with other work

- .1 Coordinate ceiling work to accommodate components of other sections, such as light fixtures, diffusers, speakers, sprinkler heads, to be built into acoustical ceiling components.

3.4 Suspension system installation

- .1 Comply with manufacturer's written installation instructions and recommendations, including product technical bulletins, product carton installation instructions, and data sheets.
- .2 Install suspension system and panels in compliance with ASTM C 636 and with the authorities having jurisdiction.
- .3 Lay out system according to reflected ceiling plan with border units not less than 50% of standard unit width.
- .4 Finished ceiling system to be square with adjoining walls and level within 1:1000.
- .5 Suspend main beam from overhead construction with hanger wires spaced 4'-0" on center along the length of the main runner. Install hanger wires plumb and straight.
- .6 Install wall moldings at intersection of suspended ceiling and vertical surfaces. Miter corners where wall moldings intersect or install corner caps.
- .7 Install acoustical panels in coordination with suspended system, with edges resting on flanges of main runner and cross tees. Cut and fit panels neatly against abutting surfaces. Support edges by wall moldings.
- .8 Secure hangers to overhead structure using attachment methods acceptable to manufacturer.
- .9 Ensure suspension system is coordinated with location of related components. Provide carrying channels as necessary to bridge at unavoidable interference between suspension system and other work above ceiling.
- .10 Install wall moulding to provide correct ceiling height.
- .11 Completed suspension system to support super-imposed loads, such as lighting fixtures diffusers grilles and speakers.
- .12 Support at light fixtures and diffusers with additional ceiling suspension hangers within 6" (150 mm) of each corner and at maximum 24" (610 mm) around perimeter of fixture.
- .13 Attach cross member to main runner to provide rigid assembly.
- .14 Frame at openings for light fixtures, air diffusers, speakers and at changes in ceiling heights.
- .15 Install access splines to provide 25 % ceiling access.
- .16 Expansion joints:
 - .1 Erect two main runners parallel, 25 mm apart, on building expansion joint line. Lay in strip of acoustic tile/board, painted black, 25% narrower than space between 2 'T' bars.
 - .2 Supply and install "Z" shaped metal trim pieces at each side of expansion joint. Design to accommodate plus or minus 25 mm movement and maintain visual closure. Finish metal components to match adjacent exposed metal trim. Provide backing plates behind butt joints.

3.5 Acoustical ceiling panel installation

- .1 Install lay-in acoustical panels in ceiling suspension system in accordance with manufacturer's instructions and as indicated.

3.6 Cleaning

- .1 Replace damaged and broken panels.
- .2 Clean exposed surfaces of acoustical ceilings, including trim, edge moldings, and suspension members. Comply with manufacturer's instructions for cleaning and touch up of minor finish damage. Remove any ceiling products that cannot be successfully cleaned and or repaired. Replace with attic stock or new product to eliminate evidence of damage.
- .3 Progress Cleaning: clean in accordance with Section 01 74 00 - Cleaning.
 - .1 Leave Work area clean at end of each day.
- .4 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 - Cleaning.
 - .1 Touch up scratches, abrasions, voids and other defects in painted surfaces.
- .5 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 19 - Waste Management and Disposal/01 35 21 - LEED Requirements.

3.7 Protection

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

END OF SECTION

Part 1 General

1.1 Summary

- .1 This Section includes requirements for the following:
 - .1 Resilient sheet flooring
 - .2 Resilient tile flooring
 - .3 Resilient base
 - .4 Flooring accessories

1.2 Related requirements

- .1 Section 03 30 00 Cast-In-Place Concrete

1.3 Reference standards

- .1 ASTM International (ASTM):
 - .1 ASTM E96/E96M-13, Water Vapor Transmission of Materials
 - .2 ASTM F710-21, Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring
 - .3 ASTM F1303-04, Standard Specification for Sheet Vinyl Floor Covering with Backing
 - .4 ASTM F1861-21, Standard Specification for Resilient Wall Base
 - .5 ASTM F1869-16a, Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride
 - .6 ASTM F1913-19, Standard Specification for Vinyl Sheet Floor Covering Without Backing
 - .7 ASTM F2170-19A, Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes
 - .8 ASTM F3010-18, Standard Practice for Two-Component Resin Based Membrane-Forming Moisture Mitigation Systems for Use Under Resilient Floor Coverings
- .2 CSA Group (CSA):
 - .1 CSA B651-12, Accessible Design for the Built Environment
- .3 National Fire Protection Association (NFPA):
 - .1 NFPA 258, Test Method for Specific Density of Smoke Generated by Solid Materials
- .4 ULC Standards (ULC):
 - .1 CAN/ULC-S102.2-10, Test for Surface Burning Characteristics of Flooring, Floor Coverings, and Miscellaneous Materials and Assemblies

1.4 Administrative requirements

- .1 Coordination:

- .1 Coordinate floor substrate penetration with Section 02 41 19.16 Selective Interior Demolition. Demolition may include mechanical or chemical removal of existing floor coverings, adhesives, sealers, paint, curing agents, and other surface contaminants. Verify after demolition is complete, that substrates are suitable to begin work of this Section.
- .2 Coordinate wood substrate floor flatness and levelness tolerances as required to begin resilient sheet floor installation with Section 06 08 99 - Rough Carpentry for Minor Works.
- .3 Coordinate door thresholds with Section 08 71 00 - Door Hardware.
- .4 Coordinate installation of floor drains, trenches, and clean-outs with Section 22 05 15 - Plumbing Specialties and Grilles.
- .5 Coordinate conduit and other related materials penetrating concrete floors with Section 27 05 28 - Pathways for Communication Systems.
- .2 Pre-installation Meetings: Conduct a meeting two weeks before levelling floor with the Contractor, flooring Subcontractor, resilient flooring Subcontractor, and Contract Administrator in accordance with Section 01 31 19 - Project Meetings to discuss the following:
 - .1 Review substrate conditions including substrate flatness and levelness.
 - .2 Substrate test results for moisture content, water vapor emissions, alkalinity, bond strength, and porosity.
 - .3 Review manufacturer's installation instructions and warranty requirements.
- .3 Sequencing: Install flooring after painting and ceiling work is complete.

1.5 Action and informational submittals

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data: Submit manufacturer's instructions, product literature, and data sheets for resilient sheet flooring and accessories. Include product characteristics, performance criteria, dimensions, finishes, and limitations.
- .3 Shop Drawings: Submit shop drawings indicating the following:
 - .1 Each resilient sheet floor type, installation method, and locations of building movement joints.
- .4 Samples for Initial Selection: Submit the following for Contract Administrator's initial selection of colours:
 - .1 300 x 300-mm samples of each type of resilient sheet flooring
 - .2 Small samples of resilient base
 - .3 Samples of sheet flooring welding beads
 - .4 Samples of accessories where exposed to view
- .5 Samples for Verification:
 - .1 Submit duplicate 300 x 300-mm sample pieces of sheet material, 300-mm-long base, and edge strips.
- .6 Site Quality Control Submittals:
 - .1 Submit floor substrate test results prior to beginning flooring installation. Include comparison of sheet flooring manufacturer's acceptable alkaline level and

recommended maximum moisture emission rates to site test results for each type of flooring.

- .2 Submit information in accordance with NFCA QAP procedures and requirements. Submit inspection results and reports for review. When deviations from specified physical conditions or performance criteria are found, Do not proceed without written acceptance of Contract Administrator.

1.6 Closeout submittals

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Operations and Maintenance Data: Submit manufacturer's cleaning and repair recommendations in accordance with Section 01 78 00 - Closeout Submittals.
- .3 Record Documentation: Submit a list of materials installed, including adhesives, wall base, and accessories. Indicate manufacturers, products, types, patterns, and colour names and numbers. Indicate room/area where installed.
- .4 Warranty Documentation: Submit manufacturer's warranties.

1.7 Maintenance material submittals

- .1 Operations and Maintenance Data: Submit manufacturer's cleaning and repair recommendations in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Submit Subcontractor's maintenance bond.
- .3 Warranty Documentation: Submit manufacturer's warranties.
- .4 Extra Materials: Supply extra materials in accordance with Section 01 78 00 - Closeout Submittals, and as follows:
 - .1 Provide minimum 5% extra of each colour, pattern, and type of flooring. material required for project maintenance use.
 - .2 Supply 1500 mm of resilient base , in each specified type, colour and size.
 - .3 Supply extra materials in one piece, and from the same production run as installed materials.
 - .4 Label each roll of sheet flooring and each container of adhesive.

1.8 Quality assurance

- .1 Manufacturer Qualifications: Provide resilient flooring manufactured by a firm with a minimum of 10 years' experience with resilient flooring of type equivalent to those specified.
 - .1 Manufacturer's quality management system must have ISO 9001:2000 approval.
 - .2 Provide resilient flooring products and accessories from one manufacturer to ensure compatibility.
 - .3 Manufacturer shall be capable of providing technical training and technical field service representation.
- .2 Installer Qualifications: Acceptable to manufacturer of resilient flooring or INSTALL (International Standards & Training Alliance) resilient certified for the requirements of the project with a minimum of 4 years' experience with resilient flooring of type equivalent to those specified.

- .1 It is recommended to have a minimum of one installer per working party with the ability to provide proof of current credentials at request.
 - .2 Has obtained and maintained current credentials from manufacturer's training program.
 - .3 Installers shall be able to exhibit proficient skills with flash cove detailing, both hot and cold-welding techniques, adhesives, specialty adhesive systems and seam cutting.
 - .4 The installing parties shall provide a submittal of their skills in the form of mock-ups of the specified material. These mock-ups will be accepted as proof of their skills and benchmarking for the proposed project.
- .3 Mock-Ups: Construct mock-up in accordance with Section 01 45 00 - Quality Control, and as follows:
- .1 Construct a mock-up of resilient sheet flooring including a flooring seam and integral cove base at an outside wall corner.
 - .2 Acceptable mock-up may remain as part of the completed work.
- .4 Sustainable Design Requirements:
- .1 ISO 14001 Environmental Management Systems certification.
 - .2 Construction waste take back program for the purpose of reducing jobsite waste by taking back uninstalled waste flooring.
 - .3 Flooring surfaces that are easily cleaned and do not require coatings, stripping, or use of chemicals that may be hazardous to human health.
 - .4 Supply all required products that are CA 01350 compliant.
 - .5 Flooring that contains no polyvinyl chloride or phthalate plasticizers.
 - .6 Flooring that contains no halogenated polymers.
 - .7 Flooring that contains no asbestos.

1.9 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, with manufacturer's labels.
 - .1 Deliver materials sufficiently in advance of installation to condition materials to the required temperature for 48-hours prior to installation.
- .3 Storage and Handling Requirements:
 - .1 Store and handle in strict compliance with manufacturer's recommendations. Protect from damage due to weather, excessive temperatures, and construction operations.
 - .2 Store materials off ground, indoors, in a clean dry location, and in accordance with manufacturer's recommendations in well-ventilated area.
 - .3 Protect adhesives, fillers, and sealants from freezing.
 - .4 Store and protect materials from nicks, scratches, and blemishes.
- .4 Packaging Waste Management: Perform in accordance with Section 01 74 19 - Waste Management and Disposal.

1.10 Site conditions

- .1 The installation area must be fully enclosed, weather tight, and climate controlled between 63°F and 75°F and 40% to 60% ambient relative humidity (RH) for at least 48 hours prior, during and 72 hours after installation (do not use gas fueled blowers). Dew point must be avoided. The substrate must be at least 5°F above dew point to be considered acceptable.

1.11 Warranty

- .1 Provide manufacturer's standard limited warranty for wear, defect, bond, and conductivity.

Part 2 Products

2.1 Regulatory requirements

- .1 Meet requirements of CAN/ULC S102.2 for required Flame Spread Ratings labelled and listed by ULC Standards or another agency acceptable to Authorities Having Jurisdiction (AHJ).

2.2 Manufacturers

- .1 Rubber tile flooring:
 - .1 Tarkett North America
30000 Aurora Road
Solon, Ohio 44139
800.899.8916
tarkett.com
 - .1 Or approved equal.
- .2 Sheet vinyl flooring:
 - .1 Tarkett North America
30000 Aurora Road
Solon, Ohio 44139
800.899.8916
tarkett.com
 - .1 Or approved equal.

2.3 Materials

- .1 Rubber tile flooring for commercial traffic:
 - .1 Rubber Floor Tile (RBF-1)
 - .1 Product name: Colour Splash 2mm
 - .2 ASTM Specification: ASTM F1344 Standard Specification for Rubber Floor Tile
 - .3 Limited Wear Warranty: 5 years
 - .4 Material: Tiles are manufactured from a homogeneous composition of 100% synthetic rubber, high quality additives and colorants to meet the performance requirements of ASTM F 1344, Class 1- B Standard Specification for Rubber Floor Tile.

- .5 Composition: Homogeneous rubber compound with a random speckle
- .6 Color: Dusty Palouse VE6
- .7 Surface: Hammered
- .8 Back of Tile: Double-sanded smooth
- .9 Material Size (ASTM F2055): 24 inches by 24 inches (610mm by 610mm)
- .10 Squareness (ASTM F2055): Meets requirements
± 0.010 inches (± 0.254mm) is required
- .11 Thickness (ASTM F386): 0.125 inches (3.17mm)
- .12 Flammability (E648/NFPA 253): NBSIR 75 950, 0.92
≥ 0.45 watts/sq. cm for Class 1 is required
- .13 Smoke Density (ASTM E662/NFPA 258): NBS, 267 (flaming) and 130
(non-flaming)
< 450 is required
- .14 Surface Burning (CAN/ULC-S102.2): FSC1 of 70 and SD of 470
- .15 Burn Resistance: Resistant to cigarette and solder burns
- .16 Slip Resistance (ASTM D2047): Static coefficient of friction, .80 (≥ 0.5
is required)
- .17 Bacteria Resistance (ASTM E2180/ASTM G21): Resistant to bacteria,
fungi, and micro-organism activity
- .18 Hardness (ASTM D2240): Shore type “A”, 85
- .19 Static Load (ASTM F970): 250 psi
- .20 Rolling Load Limit (ASTM F2753): ≤ 850 lbs. / sq. inch; for forklift
traffic nora polyurethane adhesive is required
- .21 Cleaning:
 - .1 Comply with manufacturer's written instructions for cleaning and
protection of resilient products.
 - .2 Wait 72 hours after installation before performing initial
cleaning.
 - .3 Perform the following operations immediate after completing
resilient product installation:
 - .1 Remove adhesive and other blemishes from exposed
surfaces.
 - .2 Sweep and vacuum surfaces thoroughly.
 - .3 Damp-mop surfaces to remove marks and soil.
- .22 Substrate Preparation: Per ASTM F710 and the manufacturer's written
instruction to ensure proper adhesion of rubber tile.
- .2 Rubber Tactile Warning Surface (RBF-2)
 - .1 Product name: Safe Sense Tactile Walking Surface Indicator TWI-27
 - .2 ASTM Specification: ASTM F1344 Standard Specification for Rubber
Floor Tile

- .3 Limited Wear Warranty: 5 years
- .4 Material: Tiles are manufactured from a homogeneous composition of 100% synthetic rubber, high quality additives and colorants to meet the performance requirements of ASTM F 1344, Class 1- B Standard Specification for Rubber Floor Tile.
- .5 Color: Ta4 Gateway
- .6 Texture: Attention Tile
- .7 Back of Tile: Double-sanded smooth
- .8 Material Size (ASTM F2055): 24 inches by 24 inches (610mm by 610mm)
- .9 Squareness (ASTM F2055): Meets requirements
 ± 0.010 inches (± 0.254 mm) is required
- .10 Thickness (ASTM F386): 0.125 inches (3.17mm)
- .11 Flammability (E648/NFPA 253): NBSIR 75 950, 0.92
 ≥ 0.45 watts/sq. cm for Class 1 is required
- .12 Smoke Density (ASTM E662/NFPA 258): NBS, 267 (flaming) and 130 (non-flaming)
< 450 is required
- .13 Surface Burning (CAN/ULC-S102.2): FSC1 of 70 and SD of 470
- .14 Burn Resistance: Resistant to cigarette and solder burns
- .15 Slip Resistance (ASTM D2047): Static coefficient of friction, .80 (≥ 0.5 is required)
- .16 Bacteria Resistance (ASTM E2180/ASTM G21): Resistant to bacteria, fungi, and micro-organism activity
- .17 Hardness (ASTM D2240): Shore type "A", 85
- .18 Static Load (ASTM F970): 250 psi
- .19 Rolling Load Limit (ASTM F2753): ≤ 850 lbs. / sq. inch; for forklift traffic nora polyurethane adhesive is required
- .20 Cleaning:
 - .1 Comply with manufacturer's written instructions for cleaning and protection of resilient products.
 - .2 Wait 72 hours after installation before performing initial cleaning.
 - .3 Perform the following operations immediate after completing resilient product installation:
 - .1 Remove adhesive and other blemishes from exposed surfaces.
 - .2 Sweep and vacuum surfaces thoroughly.
 - .3 Damp-mop surfaces to remove marks and soil.
- .21 Substrate Preparation: Per ASTM F710 and the manufacturer's written instruction to ensure proper adhesion of rubber tile.
- .2 Sheet Vinyl without Backing (RSF-1): To ASTM F1913, and as follows:

- .1 Type II - PVC binder content 34%
- .2 Grade: 1
- .3 Pattern: Homogeneous, Mottled, Allover.
- .4 Texture: Smooth
- .5 Format Type: Roll, supplied in 2m widths.
- .6 Installation: Glue down
- .7 Flexibility (ASTM F137): Passes
- .8 Chemical Resistance (ASTM F925): Passes
- .9 Static Load Limit (ASTM F970): Passes 250 psi
- .10 Heat Stability: to ASTM F1514
- .11 Light Stability: to ASTM F1515
- .12 Slip Resistance (ASTM D2047): Greater or equal to 0.5 SCOF
- .13 Flammability (ASTM 648): Class 1
- .14 Impact sound transmission: to ASTM E492
- .15 Warranty: 10 year limited
- .16 Colour: Beluga 886
- .17 Thickness: 2.0 mm nominal
- .18 Standard of Acceptance: Tarkett iQ Optima (or approved equal)
- .3 Resilient Base: To ASTM F1861, : With manufactured end stops and external corners, same dye lot for entire Project, and as follows:
 - .1 (RB-1):
 - .1 Type: TV, Thermoplastic Vinyl with Toe
 - .2 Height: 150mm
 - .3 Length: Manufactured in continuous rolls
 - .4 Colour: TA5 Colonial Grey
 - .2 (RB-2):
 - .1 Type: TV, Thermoplastic Vinyl with Toe
 - .2 Height: 150mm
 - .3 Length: Manufactured in continuous rolls
 - .4 Colour: TA4 Gateway
 - .3 (RB-3):
 - .1 Type: TV, Thermoplastic Vinyl with Toe
 - .2 Height: 150mm
 - .3 Length: Manufactured in continuous rolls
 - .4 Colour: TG1 Snowbound
 - .4 (CFB-1):
 - .1 Type: Cove Flash Base (using RSF-1)
 - .2 Height: 150mm

- .3 Accessories:
 - .1 Cove filler Strip:
 - .1 Product: Tarkett CFS-00 cove filler strip
 - .2 Flash Cove Base Cap, vinyl, rounded, slim top profile, 2mm thick
 - .1 Product: Tarkett SCC-TA4-D
 - .1 Colour: As selected from manufacturer's standard range of finishes.

2.4 Accessories

- .1 Primer: Where recommended by sheet flooring manufacturer for site conditions and application.
 - .1 VOC Emissions: Maximum limit as indicated in Section 01 35 20 - LEED Sustainable Requirements.
- .2 Concrete Moisture Emission Reducer: Moisture insensitive, epoxy modified, forming a permanent moisture barrier, water vapour permeability less than 6 ng/Pa·s·m when tested to ASTM E96 (wet method), other test methods will be considered.
 - .1 VOC Emissions: Maximum limit as indicated in Section 01 35 20 - LEED Sustainable Requirements.
- .3 Adhesives: Types recommended by flooring manufacturer for substrate; above, on, or below grade.
 - .1 Cove base adhesives: Type recommended by base manufacturer to suit application.
- .4 Sub-floor Filler and Leveller: As recommended by flooring manufacturer for use with their product.
- .5 Heat Welding Bead: Solid strand product, recommended by sheet flooring manufacturer for heat welding seams, and as follows:
 - .1 Colour and pattern: Matching colour and pattern of resilient sheet flooring.
- .6 Chemical Bonding Compound: Type recommended by sheet flooring manufacturer for chemically bonding seams.
- .7 Resilient Transition and Edge Strips: Meeting CSA B651 for height and slope, extruded vinyl.
 - .1 From Rubber Floor Tile to Concrete (TR-1):
 - .1 Product: Tarkett Vinyl Reducer, RRS-XX-B
 - .1 Colour: As selected from manufacturer's standard range of finishes.
 - .2 From Carpet Tile to Concrete (TR-2):
 - .1 Product: Tarkett Vinyl Reducer, SSR-XX-B
 - .1 Colour: As selected from manufacturer's standard range of finishes.
 - .3 From Sheet Vinyl Flooring to Concrete (TR-3):
 - .1 Product: Tarkett Vinyl Reducer, RRS-XX-B

- .1 Colour: As selected from manufacturer's standard range of finishes.
- .4 From Sheet Vinyl Flooring to Carpet Tile (TR-4):
 - .1 Product: Tarkett Vinyl Reducer, CTA-XX-X
 - .1 Colour: As selected from manufacturer's standard range of finishes.
- .5 From Rubber Tile to Sheet Vinyl Flooring (TR-8):
 - .1 Product: Tarkett Vinyl Reducer, CTA-XX-Y
 - .1 Colour: As selected from manufacturer's standard range of finishes.
- .8 Flash Cove Base Filler Strip: Pre-formed radius to support flash cove base, 45 mm radius, PVC.
 - .1 Product: Johnsonite CFS-00 cove filler strip.
 - .2 Modify cove former or use purpose-built product where cove transitions to a taper, consult manufacturers instructions for reducing cove sticks.
- .9 Flash Cove Base Cap: Vinyl, rounded, slim top profile, 2.0 mm thick.
 - .1 Standard of Acceptance: Johnsonite SCC-XX-D.
 - .1 Colour: To be selected from manufacturer's standard range of finishes.
- .10 Sealer and Wax: If recommended by sheet flooring manufacturer, type recommended by manufacturer.

Part 3 Execution

3.1 Examination

- .1 Verification of Conditions: Verify that substrate conditions are clean, free of cracks, ridges, depressions, scale, foreign materials, and acceptable for resilient sheet flooring installation in accordance with manufacturer's instructions.
 - .1 Proceed with installation only after unacceptable conditions are remedied.
- .2 Pre-installation Testing: Perform tests to verify concrete floors are dry, with low moisture vapour emission rate, and low alkalinity. Perform tests to ASTM F2170, except where sheet flooring manufacturer recommends more stringent test methods and requirements. Notify Contract Administrator of testing date so they may choose to attend at their discretion.

3.2 Preparation

- .1 If concrete floor substrate vapour emissions exceed manufacturer's recommendations, prepare substrate in accordance with ASTM F3010.
- .2 Prepare concrete floor substrates to ASTM F710, and wood subfloors to ASTM F1482.
- .3 Remove subfloor ridges and bumps.
- .4 Clean floor of dust, mould, mildew, alkaline salts, laitance, concrete film-forming curing compounds, paint, solvents, wax, oil, grease, residual adhesive, adhesive removing compounds, sealants, soap, and other foreign material.

- .5 Fill low spots, cracks, joints, holes and other defects with sub-floor filler. Trowel and float to leave smooth, flat hard surface. Prohibit traffic until filler is dry and cured.
- .6 Prime plywood sub-floor and Seal concrete slab to resilient flooring manufacturer's recommendations.
- .7 Do not use permanent markers on floor substrates.

3.3 Installation - flooring

- .1 Provide high ventilation rate maximizing outside air during installation, and for 48 to 72 hours after installation. If possible, vent directly to outside. Do not let contaminated air recirculate through building air distribution system. Maintain extra ventilation for at least one month following building occupation.
- .2 Apply adhesive uniformly using manufacturer's recommended trowel, followed by a roller or similar tool to knock down trowel ridges and eliminate them from telegraphing through finished flooring. Do not spread more adhesive than can be covered by sheet flooring before initial set takes place.
- .3 Lay flooring with seams in direction of traffic to produce a minimum number of seams. Border widths shall be a minimum 1/3 the width of full material.
- .4 Double cut sheet joints and continuously heat weld according to manufacturer's instructions.
- .5 Do no install flooring over building expansion joints.
- .6 As installation progresses, and after installation roll sheet flooring with a minimum 45 - kg roller, or other weight where indicated in manufacturer's installation recommendations, for full adhesion and to expel air bubbles.
- .7 Promptly remove excess adhesive.
- .8 Cut flooring neatly around fixed objects.
- .9 Install feature strips and special patterns where indicated. Fit joints tightly.
- .10 Install flooring in pan type floor access covers. Maintain continuity of floor pattern.
- .11 Install sheet flooring continuously in areas which will be under built-in furniture.
- .12 Install sheet flooring continuously through areas to receive demountable partitions.
- .13 Terminate flooring under centreline of door, in openings where adjacent floor finish materials or colours are dissimilar.
- .14 Install edge strips at unprotected and exposed edges where sheet flooring terminates.

3.4 Installation - base

- .1 Lay out resilient base to keep the number of joints at a minimum.
- .2 Clean substrate and apply one coat of adhesive.
- .3 Set resilient base against wall and floor surfaces tightly by using 3-kg hand roller.
- .4 Install straight and level, to variation of 1:1000.
- .5 Scribe, cut, and fit wall base to door frames and other obstructions. Install premoulded end pieces at flush door frames.
- .6 Cope wall base at internal corners. Install formed straight wall base for external corners.. Install formed straight wall base for non-90 degree corners.

- .7 Profiled wall base (RB) installation:
 - .1 Mitre all inside and outside corners. Where RB does not abut inside corner or finished surface, chamfer the exposed edge.
- .8 Integral cove base (CFB-1) installation:
 - .1 Fit joints tight and vertical. Mitre internal corners. At external corners, "v" cut back of base strip to 2/3 of thickness and fold. Install base on solid backing. Bond tight to wall and floor surfaces. Scribe and fit to door frames and other interruptions. Finish top of integral cove base with cove cap.
- .9 Refer to Finish Schedule for locations of base types.

3.5 Site quality control

- .1 Manufacturer's Site Services:
 - .1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, protecting and initial cleaning of product and submit Manufacturer's Site Reports.
 - .2 Provide manufacturer's site services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.
- .2 For specialty resilient flooring materials or systems, the manufacturer's representative shall review all surfaces and conditions for material applications and provide sufficient site reviews and reports to ensure installation conforms with the product warranty requirements.

3.6 Contractor Responsibilities - Resilient Tile Flooring Installation

- .1 Supply a safe, climate-controlled building and subfloor as detailed in the manufacturer's Installation Instructions.
- .2 A subfloor that meets the requirements of ASTM F710 Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring is required, or as detailed in the manufacturer's Installation Instructions.
- .3 A secure storage area that is fully enclosed, weather tight, and climate controlled between 63°F and 75°F and 40% to 60% ambient relative humidity (RH) for at least 48-hours prior and during the installation, so the flooring Subcontractor can acclimate all materials.
- .4 An installation area that is fully enclosed, weather tight, and climate controlled between 63°F and 75° and 40% to 60% ambient relative humidity (RH) for at least 48-hours prior, during, and 72-hours after installation (do not use gas fueled blowers). If this is not possible, contact the manufacturer.

3.7 Flooring Contractor Responsibilities - Resilient Tile Flooring Installation

- .1 Provide trained installers that have at least one of the following:
 - .1 It is recommended to have a minimum of one installer per working party with the ability to provide proof of current credentials at request.
 - .2 An effective installation manager to manage the project, installers, and ensure that all the required procedures are followed as detailed in the manufacturer's Installation Instructions.
- .2 Follow all requirements in the appropriate manufacturer's Installation Instructions.

3.8 Cleaning

- .1 Progress Cleaning: Clean in accordance with Section 01 74 00 - Cleaning.
- .2 Final Cleaning: Perform in accordance with Section 01 74 00 - Cleaning.
 - .1 Clean flooring base , and transition strip surfaces to manufacturer's recommendations.
- .3 Waste Management: Perform in accordance with Section 01 74 19 - Construction Waste Management and Disposal.

3.9 Protection

- .1 Prohibit traffic on floor for a minimum of 48 hours after installation. Protect new floors until adhesive is fully cured.
- .2 Where flooring areas will receive heavy traffic, rolling loads, or pallet jacks, protect flooring with 6-mm-thick temporary hardboard panels. Sweep or vacuum under panel areas prior to placement.

END OF SECTION

Part 1 General

1.1 Related requirements

- .1 Section 06 40 00 - Architectural Woodwork
- .2 Section 09 65 16 - Resilient Flooring

1.2 Reference standards

- .1 ASTM International (ASTM):
 - .1 ASTM D297-15, Standard Test Methods for Rubber Products-Chemical Analysis
 - .2 ASTM D1335-21, Standard Test Method for Tuft Bind of Pile Yarn Floor Coverings
 - .3 ASTM D1667-17, Standard Specification for Flexible Cellular Materials-Poly (Vinyl Chloride) Foam (Closed-Cell)
 - .4 ASTM D5252-20, Standard Practice for the Operation of the Hexapod Tumble Drum Tester
 - .5 ASTM D5417-16, Standard Practice for Operation of the Vettermann Drum Tester
- .2 Canadian General Standards Board (CGSB):
 - .1 CAN/CGSB-4.129-93, Carpet for Commercial Use
- .3 Carpet and Rug Institute (CRI):
 - .1 CRI 104-2015, Standard for Installation of Commercial Carpet
 - .2 CRI 204-2019, Commercial Carpet Standard for Maintenance and Cleaning
 - .3 CRI Green Label Indoor Air Quality Testing Program
 - .4 CRI Green Label Plus Indoor Air Quality Testing Program
- .4 CSA Group (CSA):
 - .1 CSA B651-18, Accessible Design for the Built Environment
- .5 ULC Standards (ULC):
 - .1 CAN/ULC-S102.2:2018, Standard Method of Test for Surface Burning Characteristics of Flooring, Floor Coverings, and Miscellaneous Materials and Assemblies

1.3 Administrative requirements

- .1 Sequencing:
 - .1 Install tile carpeting after
 - .1 area is enclosed and weatherproofed,
 - .2 wet-work in area is completed and dry, and
 - .3 ceilings and work above ceilings is completed.
 - .2 Install tile carpeting before
 - .1 millwork are installed.

1.4 Action and informational submittals

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit the following action submittals before starting work of this Section:
 - .1 Product Data: Manufacturer's product literature and data sheets for each type of carpet tile, adhesive and subfloor patching compound. Include product characteristics, performance criteria, size, handling recommendations, and limitations.
 - .1 Submit WHMIS SDS.
 - .2 Shop Drawings:
 - .1 Installation pattern (monolithic, ashlar, quarter turn, etc.).
 - .2 Locations where cut-outs are required.
 - .3 Locations of transition and edge strips.
 - .3 Verification Samples:
 - .1 Carpet tiles: Manufacturer's full size samples to verify specified colours, patterns, variations, textures, and finishes.
 - .2 Transition and edge strips: Manufacturer's standard size samples to verify specified colours, patterns, variations, textures, and finishes.
 - .3 Samples will not be returned for inclusion into work.
 - .4 Site Quality Control Submittals: Substrate moisture emission and alkalinity test results.
- .3 Submit the following informational submittals as work progresses:
 - .1 Test and Evaluation Reports: Indicate carpet tile flame-spread rating and smoke developed classification acceptable to the authority having jurisdiction.
 - .2 Manufacturer's Instructions: Indicate special storage and handling requirements, installation instructions and sequence, and cleaning procedures. Keep a copy on site during installation.
 - .3 Sustainable Design Submittals: Information demonstrating sustainability characteristics specified in this Section 01 35 20 - LEED Requirements.

1.5 Closeout submittals

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Operation and Maintenance Data:
 - .1 Submit maintenance and cleaning procedures to ensure maximum lifespan and appearance of carpeting.
 - .2 Submit information on future recycling of tile carpeting, such as manufacturer's reprocessing program.
- .3 Warranty Documentation: Submit manufacturer's material warranty.

1.6 Maintenance material submittals

- .1 Extra Stock Materials: Supply extra materials from the same production run as installed Products in accordance with Section 01 78 00 - Closeout Submittals. Package extra materials with protective covering and identify with descriptive labels.

- .1 Quantity: Minimum 5% of installed area of each type of carpet tile with minimum one box. Include enough adhesive for future maintenance installation.

1.7 Quality assurance

- .1 Qualifications:
 - .1 Manufacturer:
 - .1 Minimum 5 years experience manufacturing Products similar to requirements of Project.
 - .2 Capable of providing site service representation during construction and inspection of installation quality.
 - .2 Installers:
 - .1 Minimum 2 years of successful experience in work of this Section.

1.8 Delivery, storage, and handling

- .1 Perform in accordance with Section 01 61 00 - Common Product Requirements.
 - .1 Store carpet and adhesive at a minimum 18°C and relative humidity of a maximum 65%, for a minimum 48 hours before installation.

1.9 Site conditions

- .1 Moisture: Substrate within moisture emission limits and alkalinity limits recommended by manufacturer.
- .2 Temperature: Maintain ambient temperature of a minimum 18°C from 48 hours before installation to a minimum 48 hours after completion of work.
- .3 Relative Humidity: Maintain between 10% and 65% for 48 hours before, continuously during, and 48 hours after installation.
- .4 Ventilation:
 - .1 Use portable supply and exhaust fans.
 - .2 Ventilate installation areas in accordance with Section 01 51 00 - Temporary Utilities.
 - .3 Ventilate during and after carpet installation. Run ventilation system 24 hours per day during installation. Provide continuous ventilation for 7 days after completion of carpet installation.

1.10 Warranty

- .1 Submit warranty information in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Manufacturer's Warranty: Submit manufacturer's 10-year, non-prorated warranty document, executed by an authorized company official, for Contract Administrator's acceptance. Manufacturer's warranty is in addition to, and not a limitation of, other rights the City of Winnipeg may have under the Contract.
 - .1 Warranty Coverage:
 - .1 Excessive surface wear: More than 15 % loss of pile fibre weight.
 - .2 Excessive static electricity: More than 3.5 kV to AATCC TM 134.
 - .3 Delamination of backing.

- .4 Edge ravel.
- .5 Zippering.
- .6 Colourfastness to light: To AATCC TM 16.1, AATCC TM 16.2, and AATCC TM 16.3.
- .7 Colourfastness to atmospheric contaminants: To AATCC TM 23, and AATCC TM 129.
- .2 Exclusions: Where caster wheeled chairs are located directly over seams without chair protectors.

Part 2 Products

2.1 Description

- .1 Regulatory Requirements:
 - .1 Surface Burning Characteristics: To CAN/ULC-S102.2.
 - .1 Flame-Spread Rating: Maximum 300
 - .2 Smoke Developed Classification: Maximum 450
 - .2 Sustainability Characteristics:
 - .1 Products in accordance with CRI, Green Label Indoor Air Quality Test Program Section 01 35 20 - LEED Requirements.

2.2 Carpet Tile (CPT-1)

- .1 Configuration:
 - .1 Carpet Tile Size: 24" (610 mm)x 24" (610 mm) nominal.
 - .2 Pattern: Patcraft, Dichroic 10675 : .
 - .3 Colour: Granite 00120
- .2 Carpet Construction Type: Non-Woven Composite
- .3 Dyeing Method: Solution dyed.
- .4 Finished Pile Height: .157" (4mm)
- .5 Tile Backing:
 - .1 Primary Backing: Non Woven
- .6 Installation Method
 - .1 Brick Pattern
 - .2 Full spread adhesive application

2.3 Walk-Off Entry Carpet System (CPT-2)

- .1 Configuration:
 - .1 Tile Size: 7.87" (200 mm) x 7.87" (200 mm) nominal.
 - .2 Pattern: Obex Gird 11mm Closed CutX: .
 - .1 Manufacturer: Milliken & Company
 - .2 Textile Colour: Grey Fizz FZX5-27
 - .3 Grid Colour: Black

- .2 Carpet Construction Type: Tufted, Cut Pile
- .3 Dyeing Method: Precision Dye, Printed.
- .4 Total Nominal Thickness: .43" (11mm)
- .5 Textile Carpet Tile Backing:
 - .1 Primary Backing: PVC-Free WellBAC Comfort Plus Cushion
- .6 Installation Method
 - .1 Refer to Architectural Drawings for Tile Orientation
 - .2 Full spread adhesive application
 - .3 Edgers: Remove edge connectors around the perimeter of the recess and provide a clean finish.
 - .4 Expansion: Provide a 1/8" (3mm) gap around perimeter of installation to allow for expected dimensional change due to temperature variation. The gap can be filled with a flexible sealant, or hidden under the edging/ skirting.
- .7 Accessories:
 - .1 Trim: Provide Schluter, Schiene (TR-7) in stainless steel finish around perimeter of recessed concrete. Refer to Architectural Drawings for locations of edge trim.
- .8 Maintenance: Provide (2) additional boxes for maintenance material.

2.4 Accessories

- .1 Subfloor Patching Compound: Smooth trowelling, fast setting, non-shrinking, pre-mixed filler with Portland cement and polymeric modifiers, suitable for substrate conditions, and in accordance with manufacturer's instructions.
 - .1 28-day compressive strength: Minimum 20 MPa
- .2 Water Vapour Emission Sealer: Liquid-applied, epoxy-based, 100% solids.
 - .1 Reduces water vapour emissions through concrete slab to acceptable levels and provides a permanent barrier between concrete alkalinity and carpeting.
- .3 Primer: When recommended for site conditions, type in accordance with manufacturer's instructions for surface conditions.
- .4 Adhesive: Full spread adhesive application using Patcraft #4151 pressure sensitive adhesive.
- .5 Edge and Transition Strips: To CSA B651 for height and slope, and as follows:
 - .1 Resilient Vinyl:
 - .1 From Carpet Tile to Concrete Floor (TR-2)
 - .1 Product: Tarkett, Vinyl Reducer, RRS-XXB
 - .1 Colour: To be selected from manufacturer's standard range of finishes.
 - .2 From Carpet Tile to Resilient Sheet Flooring (TR-4)
 - .1 Product: Tarkett, Vinyl Reducer, CTA-XX-X
 - .1 Colour: To be selected from manufacturer's standard range of finishes.
- .6 Resilient Base: In accordance with Section 09 65 16 - Resilient Flooring.

- .1 Rubber Wall Base (RB):
 - .1 Product: Tarkett Traditional Vinyl 1/8" (3mm) Base with Toe, 6" (152mm) High
 - .1 Colour: To be selected from manufacturer's standard range of finishes.

Part 3 Execution

3.1 Examination

- .1 Verify conditions in accordance with Section 01 71 00 - Examination and Preparation.
 - .1 Ensure concrete substrates are cured, clean, dry, and free of paint, dirt, grease, oil, curing- or parting-agents, and other contaminants, including sealers, that interfere with adhesion.
- .2 Pre-Installation Testing: Test concrete substrates, for moisture emission rates and alkalinity in accordance with manufacturer's requirements.

3.2 Preparation

- .1 Concrete substrates should be tested for Internal Relative Humidity according to ASTM F 2170 and must not exceed requirements of the adhesive.
 - .1 Concrete floors shall be flat and smooth within 1/8" (3mm) in 6'-0" (1830mm)
 - .2 Comply with manufacturer's instructions for maximum patch thickness.
 - .3 Prime large patch areas with compatible primer.
 - .4 Where powdery or porous concrete surface is encountered, apply primer compatible with adhesive to provide suitable surface for glue-down installation.
 - .5 If moisture emission rate or alkalinity exceed carpet tile recommendations, install water vapour emission sealer.
- .2 Pre-condition tile carpeting for a minimum 48 hours in accordance with manufacturer's recommendations.

3.3 Installation

- .1 Install tile carpeting in accordance with manufacturer's instructions, reviewed shop drawings, and reviewed shop drawings.
- .2 Install carpet tiles from same dye lot within each room/visual area.
- .3 Installation Pattern: Brick.
- .4 Install tile carpeting with tight joints.
 - .1 Measure distance covered by eleven carpet tiles (ten joints) and confirm distance is within manufacturer's recommendations.
- .5 Apply thin film of pressure-sensitive adhesive in accordance with manufacturer's instructions.
- .6 Fit tightly to architectural, mechanical, electrical, and communications features, furniture, and fitments.
- .7 Fit tightly to room perimeters, into recesses, and around projections.

- .8 Install tile carpeting into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.
- .9 Do not bridge building expansion joints with tile carpeting.
- .10 Install tile carpeting in pan type floor access covers.
- .11 Install tile carpeting with continuous, level surface without bubbles, puckers, gaps, conspicuous seams, burring, or other deficiencies.
- .12 Install edge strips at exposed carpet tile edges and transition strips where adjacent to other flooring materials.

3.4 Base installation

- .1 Resilient Base: In accordance with Section 09 65 16 - Resilient Flooring.

3.5 Cleaning

- .1 Clean in accordance with Section 01 74 00 - Cleaning.
 - .1 Clean excess adhesive off tile carpeting promptly after installation using methods and materials recommended by carpet tile and adhesive manufacturers. Replace carpet tiles that cannot be cleaned to the acceptance of Contract Administrator.
 - .2 Vacuum carpets immediately after completion of installation in accordance with manufacturer's recommended instruction.

3.6 Protection

- .1 Protect Work in accordance with Section 01 61 00 - Common Product Requirements and:
 - .1 Temporarily protect carpet with manufacturer's recommended material.

END OF SECTION

Part 1 General

1.1 Related requirements

- .1 Section 05 50 00 Metal Fabrications
- .2 Section 06 10 00 Rough Carpentry
- .3 Section 07 42 46 Fibre Reinforced Cementitious Panels
- .4 Section 08 11 00 Metal Doors and Frames
- .5 Section 09 21 16 Gypsum Board Assemblies.

1.2 Reference standards

- .1 Environmental Protection Agency (EPA)
 - .1 Test Method for Measuring Total Volatile Organic Compound Content of Consumer Products, EPA Method 24 - Surface Coatings.
 - .2 SW-846, Test Method for Evaluating Solid Waste, Physical/Chemical Methods.
- .2 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Safety Data Sheets (SDS).
- .3 Master Painters Institute (MPI)
 - .1 Architectural Painting Specification Manual - current edition.
 - .2 Standard GPS-1- 12, MPI Green Performance Standard.
 - .3 Standard GPS-2- 12, MPI Green Performance Standard.
- .4 National Research Council Canada (NRC)
 - .1 National Fire Code of Canada 2015 (NFC).
- .5 Society for Protective Coatings (SSPC)
 - .1 Systems and Specifications, SSPC Painting Manual 2011.
- .6 South Coast Air Quality Management District (SCAQMD), California State
 - .1 SCAQMD Rule 1168, Adhesives and Sealants Applications.

1.3 Action and informational submittals

- .1 Provide in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Provide manufacturer's instructions, printed product literature and data sheets for paint and paint products and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Submit 2 copies of WHMIS SDS.
 - .3 Confirm products to be used are in MPI's approved product list.
 - .4 Upon completion, provide records of products used. List products in relation to finish system and include the following:
 - .1 Product name, type and use.

- .2 Manufacturer's product number.
 - .3 Colour number s.
 - .4 MPIEnvironmentally Friendly classification system rating.
 - .5 Manufacturer's Safety Data Sheets (SDS).
 - .6 MPI #.
- .3 Samples:
- .1 Submit duplicate samples of each paint, clear coating and stain in specified colours, gloss/sheen, and textures required to MPI Architectural Painting Specification Manual standards.
 - .2 For finishes over gypsum board and other smooth surfaces, submit sample drawdowns applied using 4 mil WFT drawdown bar on Leneta form WD plain white coated cards, size 100 by 150 mm, mounted on 216 by 280 mm sheets.
 - .1 Label each card with the following:
 - .1 Job name
 - .2 Date.
 - .3 Product name.
 - .4 Product number.
 - .5 Colour number as stated in the colour schedule.
 - .6 Name, address, and phone number of the supplying facility.
 - .3 For metal and wood surfaces, provide duplicate 8" x 12" (200 x 300 mm) sample panels of each paint with specified paint or coating in colours, gloss/sheen and textures required to MPI Architectural Painting Specification Manual standards submitted on following substrate materials:
 - .1 1/8" (3 mm) plate steel for finishes over metal surfaces.
 - .2 1/2" (13 mm) douglas firplywood for finishes over wood surfaces.
 - .4 When approved, samples shall become acceptable standard of quality for appropriate on-site surface with one of each sample retained on-site.
 - .5 Provide full range of available colours where colour availability is restricted.
 - .4 Certificates: Provide certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties. MPI Gateway #.
 - .5 Schedule: If requested, submit schedule for various stages of work when painting occupied areas for City of Winnipeg's review and approval.
 - .6 Sustainable Design Submittals:
 - .1 LEED Canada submittals: in accordance with Section 01 35 20 - LEED Sustainable Requirements.
 - .2 Construction Waste Management: Refer to Section 01 74 19 - Construction Waste Management and Disposal.
 - .3 Material product attribute documentation: Refer to Product Check Sheet as listed in 01 35 20 – LEED Sustainable Requirements to determine applicable type of documentation required for each product.
 - .4 Low-Emitting Materials:

- .1 Submittals are required for any sealants, adhesives, paints, coatings, composite wood, flooring, wall panels, insulation or ceiling components within the inner most weather proofing barrier.
- .2 Refer to Product Check Sheet as listed in 01 35 20 – LEED Sustainable Requirements to determine applicable type of documentation required for each product.
- .5 Submit LEED documentation on VOC's as per 01 35 20 - LEED Sustainable Requirements to ensure products meet State of California's South Coast Air Quality District (SCAQMD) Rule 1113 (effective date of January 1, 2019) and have a general emissions evaluation certificate.

1.4 Closeout submittals

- .1 Provide in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Operation and Maintenance Data: Provide operation and maintenance data for painting materials for incorporation into manual.
- .3 Include:
 - .1 Product name, type and use.
 - .2 Manufacturer's product number.
 - .3 Colour number s.
 - .4 Manufacturer's Material Safety Data Sheets (MSDS).

1.5 Maintenance material submittals

- .1 Extra Stock Materials:
 - .1 Provide maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.
 - .2 Submit four litre can of each type and colour of finish coating. Identify colour and paint type in relation to established colour schedule and finish system.
 - .3 Label each container with colour, sheen, room location, and date.

1.6 Quality assurance

- .1 Qualifications:
 - .1 Contractor: to have a minimum of 5 years proven satisfactory experience. When requested, provide list of last 3 comparable jobs including, job name and location, specifying authority, and project manager.
 - .2 Qualified journeypersons as defined by local jurisdiction to be engaged in painting work
 - .3 Apprentices: may be employed provided they work under direct supervision of qualified journeyperson in accordance with trade regulations.
 - .4 Conform to latest MPI requirements for exterior painting work including preparation and priming.
 - .5 Materials: in accordance with MPI Painting Specification Manual "Approved Product" listing and from a single manufacturer for each system used.

- .6 Retain purchase orders, invoices and documents to prove conformance with noted MPI requirements when requested by Contract Administrator.
- .7 All products used in exits shall have a flame spread rating of 25 or less when tested in accordance with ASTM-E84.
- .8 All paint applications shall be "premium grade" unless specified otherwise.
- .9 Only Qualified journeymen who have a "Tradesman Qualification Certificate of Proficiency" shall be engaged in painting and decorating work. Apprentices may be employed provided they work under the direct supervision of a qualified Journeyman in accordance with trade regulations.
- .10 Acceptable manufacturer's, materials, workmanship and all items affecting the work of this section is to be in accordance with the specifications in the first instance and the MPI Manual.
- .11 Standard of Acceptance:
 - .1 Walls: no defects visible from a distance of 3'-0" (1000 mm) at 90 degrees to surface.
 - .2 Soffits: no defects visible from floor at 45 degrees to surface when viewed using final lighting source.
 - .3 Final coat to exhibit uniformity of colour and uniformity of sheen across full surface area.

1.7 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.
 - .1 Labels: to indicate:
 - .1 Manufacturer's name and address.
 - .2 Type of paint or coating.
 - .3 Compliance with applicable standard.
 - .4 Colour number in accordance with established colour schedule.
- .3 Remove damaged, opened and rejected materials from site.
- .4 Storage and Handling Requirements:
 - .1 Store materials off ground indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Observe manufacturer's recommendations for storage and handling.
 - .3 Store materials and supplies away from heat generating devices.
 - .4 Store materials and equipment in well ventilated area with temperature range 7 degrees C to 30 degrees C.
 - .5 Keep areas used for storage, cleaning and preparation, clean and orderly to approval of Contract Administrator. After completion of operations, return areas to clean condition to approval of Contract Administrator.

- .6 Remove paint materials from storage only in quantities required for same day use.
- .7 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling storage, and disposal of hazardous materials.
- .8 Fire Safety Requirements:
 - .1 Provide one 9kg Type ABC fire extinguisher adjacent to storage area.
 - .2 Store oily rags, waste products, empty containers and materials subject to spontaneous combustion in ULC approved, sealed containers and remove from site on a daily basis.
 - .3 Handle, store, use and dispose of flammable and combustible materials in accordance with the National Fire Code of Canada (NFC).
- .9 Replace defective or damaged materials with new.
- .10 Take necessary precautionary and safety measures to prevent fire hazards and spontaneous combustion and to protect the environment from hazard spills.

1.8 Waste Management and Disposal

- .1 .Dispose materials that cannot be reused. Treat as hazardous waste in appropriate manner.
- .2 Place materials defined as hazardous or toxic waste, including used sealant and adhesive tubes and containers, in containers or areas designated for hazardous waste.
- .3 Reduce amount of contaminants entering waterways, sanitary/storm drain systems as follows:
 - .1 Retain cleaning water for water-based materials to allow sediments to be filtered out. Do not clean equipment using free draining water.
 - .2 Retain cleaners, thinners, solvents and excess paint and place in designated containers and ensure proper disposal.
 - .3 Return solvent and oil soaked rags used during painting operations for contaminant recovery, proper disposal, or appropriate cleaning and laundering.
 - .4 Dispose of contaminants in approved legal manner in accordance with hazardous waste regulations.
 - .5 Dry empty paint cans before recycling or disposing.
 - .6 Close and seal tightly partly used cans of materials including sealant and adhesive containers and store protected in well ventilated fire-safe area at moderate temperature.
- .4 Collect waste paint by type and provide for delivery to recycling or collection facility or dispose of at hazardous waste facility.
- .5 Develop Construction Waste Management Plan related to Work of this Section and in accordance with Section 01 35 20 - LEED Sustainable Requirements.
- .6 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding, and packaging materials as specified in Construction Waste Management Plan in accordance with Section 01 74 19 - Construction Waste Management and Disposal.

1.9 Site conditions

- .1 Ambient Conditions:
 - .1 Heating, Ventilation and Lighting:
 - .1 Ventilate enclosed spaces .
 - .2 Do not perform painting work unless adequate and continuous ventilation and sufficient heating facilities are in place to maintain ambient air and substrate temperatures above 10degrees C for 24hours before, during and after paint application until paint has cured sufficiently.
 - .3 Where required, provide continuous ventilation for seven days after completion of application of paint.
 - .4 Coordinate use of existing ventilation system with City of Winnipeg and ensure its operation during and after application of paint as required.
 - .5 Provide temporary ventilating and heating equipment where permanent facilities are not available or supplemental ventilating and heating equipment if ventilation and heating from existing system is inadequate to meet minimum requirements.
 - .6 Perform no painting work unless a minimum lighting level of 323Lux is provided on surfaces to be painted. Adequate lighting facilities to be provided by Contractor.
 - .2 Temperature, Humidity and Substrate Moisture Content Levels:
 - .1 Unless specifically pre-approved by specifying body, Paint Inspection Agency and, applied product manufacturer, perform no painting work when:
 - .1 Ambient air and substrate temperatures are below 10degrees C.
 - .2 Substrate temperature is over 32degrees C unless paint is specifically formulated for application at high temperatures.
 - .3 Substrate and ambient air temperatures are expected to fall outside MPIor paint manufacturer's prescribed limits.
 - .4 Relative humidity is above 85 % or when dew point is less than 3degrees 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 hard wood.
 - .3 17 % for soft wood.
 - .4 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 Application Requirements:
 - .1 Apply paint finish in areas where dust is no longer being generated by related construction operations or when wind or ventilation conditions are such that airborne particles will not affect quality of finished surface.
 - .2 Apply paint to adequately prepared surfaces and to surfaces within moisture limits noted herein.
 - .3 Apply paint when previous coat of paint is dry or adequately cured.
 - .4 Apply paint finishes when conditions forecast for entire period of application fall within manufacturer's recommendations.
 - .5 Do not apply paint when:
 - .1 Temperature is expected to drop below 10degrees 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 City of Winnipeg such that painted surfaces will have dried and cured sufficiently before occupants are affected.

Part 2 Products

2.1 Materials

- .1 Only paint materials listed in latest edition of MPI Approved Products List (APL) are acceptable for use on this project.
- .2 Materials (primers, paints, coatings, fillers, thinners, solvents, etc.): highest quality product of an approved manufacturer, and from a single manufacturer for each system used.
 - .1 Acceptable manufacturers: Benjamin Moore, Sherwin Williams/General Paint, PPG/Dulux.
- .3 Other materials such as linseed oil, shellac, turpentine: highest quality product of an MPI listed manufacturer, compatible with paint materials being used.
- .4 Lead- and mercury-free, and low or no VOC content where possible.
- .5 Where required, paints and coatings shall meet flame spread and smoke developed ratings designated by local Code requirements or authorities having jurisdiction.

- .6 Only qualified products with E2 or E3 "Environmentally Friendly" rating are acceptable for use on this project.
- .7 Paints, coatings, adhesives, solvents, cleaners, lubricants, and other fluids, to be as follows:
 - .1 water-based.
 - .2 non-flammable biodegradable.
 - .3 Be manufactured without compounds which contribute to ozone depletion in 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.
- .8 Water-borne surface coatings must be manufactured and transported in a manner that steps of processes, including disposal of waste products arising there from, 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).
- .9 Water-borne surface coatings must not be formulated or manufactured with aromatic solvents, formaldehyde, halogenated solvents, mercury, lead, cadmium, hexavalent chromium or their compounds.
- .10 Water-borne surface coatings and recycled water-borne surface coatings must have flash point of 61.0 degrees C or greater.
- .11 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 15mg/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 15mg/L to a natural watercourse or a sewage treatment facility lacking secondary treatment.

2.2 Colours

- .1 Unless otherwise specified, provide MPI Premium Grade paint system.
- .2 Paint Colour Schedule as follows:
 - .1 (PT-1) : Main Wall Colour - Sherwin Williams, Satin Finish, Snowbound SW 7004
 - .2 (PT-2): Accent Wall Colour 1 - Benjamin Moore, Satin Finish, Iron Mountain 2134-30
 - .3 (PT-3): Door & Frame Colour - Sherwin Williams, Semi-Gloss, Ellie Gray SW 7650
 - .4 (PT-4): Door & Frame Colour - Benjamin Moore, Semi-Gloss, Iron Mountain 2134-30
 - .5 (PT-5): Doors Accent Colour - Sherwin Williams, Semi-Gloss, Nugget SW 6697

- .6 (PT-6): Not Used
 - .7 (PT-7): Ceilings & Bulkheads - Sherwin Williams, High Reflective White 7757
 - .8 (PT-8): Doors Accent Colour 2 - Benjamin Moore, Semi-Gloss, Black Satin 2131-10
 - .9 (PT-9): Exposed Steel Structure - Benjamin Moore, Semi-Gloss, Iron Mountain 2134-30
 - .10 (PT-10): Door Frame Accent Colour - Sherwin Williams, Semi-Gloss, Snowbound SW 7004
 - .11 (EP-1): Epoxy Paint Main Wall Colour - Sherwin Williams, Snowbound SW 7004
 - .12 (EP-2): Epoxy Paint Accent Wall Colour 1 - Benjamin Moore, Iron Mountain 2134-30
 - .13 (WP-1): Fir Plywood Wall Panels - Polyurethane, Clear, 2-component finish, Satin Finish, Shop Applied Spray Finish
- .3 Generally and unless otherwise specified or noted on Finish Schedule the quantity of colours and finishes shall be based on the following criteria:
- .1 Ceilings: Paint white unless indicated otherwise.
 - .2 Paint access doors, prime coated hardware, registers, radiators and covers, exposed piping and electrical panels to match adjacent surfaces including colour, texture and sheen, unless otherwise noted or where pre-finished.
 - .3 Back-prime and paint plywood service panels including edges flat grey or to match surrounding wall as directed. Paint inside of duct work behind louvres, grills and diffusers a minimum of 18" (460mm) or beyond sight line, whichever is greater, using flat black non-reflecting paint.
 - .4 Paint inside of duct work behind louvres, grilles and diffusers a minimum of 460mm or beyond sight line, whichever is greater, using flat black non-reflecting paint.
 - .5 Paint all exposed steel structure (columns, beams, steel deck, etc.) as scheduled.
- .4 Second coat in three coat system to be tinted slightly lighter colour than top coat to show visible difference between coats.

2.3 Mixing and tinting

- .1 Perform colour tinting operations prior to delivery of paint to site. On-site tinting of painting materials is not permitted.
- .2 Mix paste, powder or catalyzed paint mixes in accordance with manufacturer's written instructions.
- .3 Add thinner to paint manufacturer's recommendations. Do not use kerosene or organic solvents to thin water-based paints.
- .4 Thin paint for spraying according in accordance with paint manufacturer's instructions. If directions are not on container, obtain instructions in writing from manufacturer and provide copy of instructions to Contract Administrator.
- .5 Re-mix paint in containers prior to and during application to ensure break-up of lumps, complete dispersion of settled pigment, and colour and gloss uniformity.

2.4 Gloss/sheen ratings

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

.1

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

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

- .1 Walls (typical): satin finish (G4)
- .2 Walls (Mechanical/Electrical/Janitor Areas): semi-gloss (G5)
- .3 Doors/Frames: semi-gloss (G5)
- .4 Ceilings (GWB): matte (G1)
- .5 Structural Steel: semi-gloss (G5)
- .6 Ductwork (overhead exposed): matte (G1)
- .7 Steel Decking (overhead exposed): matte (G1)
- .8 Metal Fabrications: semi-gloss (G5)
- .9 Metal Doors and Frames: semi-gloss (G5)
- .10 Dressed Lumber (Fir Plywood Wall Panels): (G4)

2.5 Interior painting systems

- .1 Paint interior surfaces in accordance with the following MPI Painting Specification Manual requirements.
- .2 All paint systems specified herein are premium grade unless otherwise indicated.
- .3 Structural Steel and Metal Fabrications: columns, beams, joists, etc.
 - .1 INT 5.1C - Waterborne Dry Fall (for overhead surfaces).
 - .2 INT 5.1R - High Performance Architectural Latex.
- .4 Galvanized Metal: doors, frames, railings, misc. steel, pipes, overhead decking, ducts, etc
 - .1 INT 5.3H - Waterborne Dry Fall (for overhead surfaces).
 - .2 INT 5.3M - High Performance Architectural Latex (over W.B. galvanized primer).

- .5 Plaster and gypsum board: gypsum wallboard, drywall, "sheet rock type material", and textured finishes:
 - .1 INT 9.2B - High performance architectural latex finish.
 - .2 INT 9.2E - Epoxy (tile-like) G5 (over latex primer/ sealer) finish
 - .1 Location: Where indicated on Room Finish Schedule
- .6 Concrete Vertical Surfaces: Grade beams, pilasters
 - .1 INT 3.1C - High performance architectural latex (over W.B. alkali-resistant primer)
 - .2 INT 3.1F – Epoxy (tile-like) G5 for smooth concrete
 - .1 Location: Where indicated on Room Finish Schedule
- .7 Concrete Horizontal Surfaces: floors
 - .1 INT 3.2C - Epoxy finish, slip resistant (semi gloss)
- .8 Concrete Masonry Units: smooth face block
 - .1 INT 4.2D - High performance architectural latex (over latex block filler).
 - .2 INT 4.2G - Epoxy (tile-like) G5 (over latex block filler) for wet environments.
 - .1 Location: Where indicated on Room Finish Schedule
- .9 Dressed Lumber - wood panels:
 - .1 INT 6.3Z – Polyurethane, Clear, 2-component, G4 satin finish.

2.6 Exterior painting systems

- .1 Paint exterior surfaces in accordance with the following MPI Painting Specification Manual requirements.
- .2 All paint systems specified herein are premium grade unless otherwise indicated.
- .3 Asphalt Surfaces: one/traffic marking for drive and parking areas, etc.
 - .1 In accordance with Section 32 17 23 Pavement Marking
- .4 Fibre Reinforced Cementitious Panels:
 - .1 Prime and paint exterior fibre cement exterior wall panels on all exposed faces and edges.
 - .1 Primer: in accordance with manufacturer's recommendations.
 - .2 Finish Coat:
 - .1 Standard of Acceptance:
 - .1 Duration exterior acrylic latex by Sherwin Williams (or approved equal).
- .5 Prime and paint all exterior exposed metal components, which includes but is not limited to: metal doors, overhead doors, metal plates and angles, metal jamb plates at overhead doors, metal bollards and roof top screen posts.
 - .1 Primer: epoxy, exterior; first coat. G4 finish, 3-4mil DFT.
 - .1 Standard of Acceptance:
 - .1 Macropoxy 646 Fast Cure Epoxy, by Sherwin Williams (or approved equal)

- .2 Finish Coat: aliphatic urethane, final coat. G4 finish. 3-4mil DFT.
 - .1 Standard of Acceptance:
 - .1 Corothane II Low VOC Polyurethane, by Sherwin Williams (or approved equal)
 - .3 Sand for sandblasting: to SSPC (Steel Structures Painting Council).
 - .4 Provide powdercoat finish where indicated on drawings.
- .6 Dimension Lumber: columns, beams, exposed joists, underside of decking, siding, fencing, etc.
 - .1 EXT 6.2M - Latex G4 finish (over latex primer).
- .7 Plastic: vinyl siding and trim, ABS/PVA/PVC materials, fabrications, etc.
 - .1 EXT 6.8A - Latex G4 finish (over W.B. bonding primer).
- .8 Canvas and Cotton Coverings: pipes, ductwork, etc.
 - .1 EXT 10.1A - Latex G1 finish.

Part 3 Execution

3.1 Manufacturer's instructions

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

3.2 General

- .1 Perform preparation and operations for interior painting in accordance with MPI Architectural Painting Specifications Manual except where specified otherwise
- .2 Apply paint materials in accordance with paint manufacturer's written application instructions.
- .3 Paint all new work, except prefinished items or where indicated otherwise.
- .4 Paint all existing areas impacted by new construction to match adjacent surfaces. Paint entire surfaces to nearest internal/external corner, column or control joint to provide a logical end point.

3.3 Examination

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable to be painted in accordance with manufacturer's written instructions:
 - .1 Visually inspect substrate.
 - .2 Inform Contract Administrator of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Contract Administrator.
- .2 Exterior repainting work: inspected by MPI Accredited Paint Inspection Agency (inspector) acceptable to specifying authority and local Painting Contractor's Association. Painting Subcontractor to notify Paint Inspection Agency minimum of one week prior to

commencement of work and provide copy of project repainting specification and Finish Schedule.

- .3 Exterior surfaces requiring repainting: inspected by both painting Subcontractor and Paint Inspection Agency who will notify Contract Administrator in writing of defects or problems, prior to commencing repainting work, or after surface preparation if unseen substrate damage is discovered.
- .4 Where assessed degree of surface degradation of DSD-1 to DSD-3 before preparation of surfaces for repainting is revealed to be DSD-4 after preparation, repair or replacement of such unforeseen defects discovered are to be corrected, as mutually agreed, before repainting is started.
- .5 Where "special" repainting or recoating system applications (i.e. elastomeric coatings) or non- MPI listed products or systems are to be used, paint or coating manufacturer to provide as part of work, certification of surfaces and conditions for specific paint or coating system application as well as on site supervision, inspection and approval of their paint or coating system application as required at no additional cost to Contract Administrator.

3.4 Preparation

- .1 Perform preparation and operations for exterior painting in accordance with MPI Maintenance Repainting Manual except where specified otherwise
- .2 Apply paint materials in accordance with paint manufacturer's written application instructions.
- .3 Clean and prepare exterior surfaces to be painted in accordance with MPI Maintenance Repainting Manual requirements. Refer to the MPI Manual in regard to specific requirements and as follows:
 - .1 Remove dust, dirt, and surface debris by vacuuming, wiping with dry, clean cloths or compressed air.
 - .2 Wash surfaces with a biodegradable detergent and bleach where applicable and clean warm water using a stiff bristle brush to remove dirt, oil and other surface contaminants.
 - .3 Rinse scrubbed surfaces with clean water until foreign matter is flushed from surface.
 - .4 Allow surfaces to drain completely and allow to dry thoroughly. Allow sufficient drying time and test surfaces using electronic moisture meter before commencing work.
 - .5 Use water-based cleaners in place of organic solvents where surfaces will be repainted using water based paints.
 - .6 Many water-based paints cannot be removed with water once dried. Minimize use of kerosene or such organic solvents to clean up water-based paints.
- .4 Clean metal surfaces to be painted by removing rust, dirt, oil, grease and foreign substances in accordance with MPI requirements. Remove such contaminants from surfaces, pockets and corners to be repainted by brushing with clean brushes, blowing with clean dry compressed air, or brushing/vacuum cleaning as required.
- .5 Prevent contamination of cleaned surfaces by salts, acids, alkalis, other corrosive chemicals, grease, oil and solvents before priming and between applications of remaining

coats. Touch-up, spot prime, and apply primer, paint, or pretreatment as soon as possible after cleaning and before deterioration occurs.

- .6 Do not apply paint until prepared surfaces have been accepted by Contract Administrator.
- .7 Sand and dust between coats as required to provide adequate adhesion for next coat and to remove defects visible from a distance up to 3'-0" (914mm).

3.5 Existing conditions

- .1 Investigate existing substrates for problems related to proper and complete preparation of surfaces to be painted. Report to Contract Administrator 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 Contract Administrator. Do not proceed with work until conditions fall within acceptable range as recommended by manufacturer.
- .3 Do not proceed with work until conditions fall within acceptable range as recommended by manufacturer.

3.6 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 Contract Administrator.
- .2 Protect items that are permanently attached such as Fire Labels on doors and frames.
- .3 Protect factory finished products and equipment.
- .4 Protect building occupants in and about building.
- .5 Remove electrical cover plates, light fixtures, surface hardware on doors, and other surface mounted equipment, fittings and fastenings prior to undertaking painting operations. Store items and re-install after painting is completed.
- .6 Move and cover exterior furniture and portable equipment as necessary to carry out painting operations. Replace as painting operations progress.
- .7 As painting operations progress, place "WET PAINT" signs in pedestrian and vehicle traffic areas to approval of Contract Administrator.

3.7 Application

- .1 Method of application to be as approved by Contract Administrator. 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 to 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.
 - .6 Wood, stucco, concrete, cement masonry units CMU's and brick; if sprayed, must be back rolled.
- .4 Use dipping, sheepskins or daubers when no other method is practical in places of difficult access .
- .5 Apply coats of paint as 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.
- .10 Finish closets and alcoves as specified for adjoining rooms.
- .11 Doors and frames:
 - .1 Finish surfaces of doors and frames that will be concealed behind protective plates and coverings, door frame guards. Use same finish formula specified for visible portion of door.
 - .2 For exterior doors and frames indicated for painting/staining, use exterior quality paint/stain on both interior and exterior sides of door and frame.
- .12 Paint wall and ceiling surfaces inside of lighting valences, including surfaces behind louvered panels and diffusers, with primer and two coats flat white paint.
- .13 Apply one coat of primer sealer to wall surfaces to receive wall finishes bonded to walls with adhesive.
- .14 Finish wall surfaces that will be concealed behind wall hung fixtures and equipment such as cabinets and visual display boards. Use same finish formula specified for visible portion of wall.
- .15 Paint underside of steel shelf angles and steel angle lintels exposed in final assembly

- .16 Clean shop applied paint surfaces that become marked. Touch up with primer and paint as required.
- .17 Paint steel pipe bollards.
- .18 Do not paint:
 - .1 Door hardware, miscellaneous hardware, unless indicated otherwise.
 - .2 Nameplates, signage, fire labels, or other markers or signs indicated to remain.
 - .3 stainless steel, aluminum and other bright metals, unless specified otherwise.

3.8 Mechanical/electrical equipment

- .1 Interior Painting:
 - .1 Unless otherwise specified, paint exterior exposed conduits, piping, hangers, duct work and other mechanical and electrical equipment with colour and finish to match adjacent surfaces, except as noted otherwise.
 - .2 Do not paint electrical and mechanical items where painting will void the item's warranty, is not permitted by the manufacturer, or where painting will cause damage to the item.
 - .3 Do not paint over nameplates.
 - .4 Paint electrical panel boards in finished areas with colour and finish to match adjacent surfaces. Panel boards in mechanical rooms and utility spaces factory finish.
 - .5 In mechanical/electrical/service rooms and other unfinished areas: leave exposed conduits, piping, hangers, ductwork and other mechanical and electrical equipment in original finish and touch up scratches and marks.
 - .6 Do not paint interior electrical and refrigeration equipment.
 - .7 Electrical Fire retardant backboards: Paint only with fire retardant paint if required by Contract Administrator.
- .2 Exterior Painting:
 - .1 Unless otherwise specified, paint exterior exposed conduits, piping, hangers, duct work and other mechanical and electrical equipment with colour and finish to match adjacent surfaces, except as noted otherwise.
 - .2 Do not paint exposed sprinkler heads, outdoor transformers, and substation equipment.
 - .3 Do not paint electrical and mechanical items where painting will void the item's warranty, is not permitted by the manufacturer, or where painting will cause damage to the item.
- .3 Paint fire protection piping red.
- .4 Paint natural gas piping yellow.

3.9 Re-Painting

- .1 Cleaning and preparation of surfaces:
 - .1 Clean and prepare previously finished surfaces in accordance with MPI Painting Specification Manual requirements. Refer to MPI Manual in regard to specific requirements and as follows:

- .1 Remove any loose or flaked paint or paper.
 - .2 Remove dirt, dust, grease, oil and other deleterious substances.
 - .3 Dull glossy areas with sand paper.
 - .4 Sand to remove rough edges and leave feather smooth.
 - .5 Fill minor cracks and holes with patching compound. Sand smooth and wipe clean.
 - .6 Spot prime patched areas with finishing coat.
- .2 Paint existing walls, ceilings, doors and frames, and other previously painted surfaces where indicated.
 - .3 Paint patchwork on previously painted surfaces indicated. Match existing paint finish as closely as possible, except where indicated otherwise.
 - .4 Painting of patchwork shall include for painting of existing surfaces up to nearest change in direction or surface interruption (e.g. door jamb, corner, bulkhead). Make neat termination and feather out to make patchwork inconspicuous.
 - .5 Wherever repainting of existing partitions or walls is indicated, paint both sides of all doors and frames, and other items requiring painting, which occur within the wall.
 - .6 Paint both sides of new partitions and walls, regardless of whether both sides are indicated in the Room Finish Schedule.
 - .7 Paint both sides of new doors and frames, windows or other items that require painting, which are installed in existing walls. Paint adjacent patchwork.

3.10 Site quality control

- .1 Standard of Acceptance:
 - .1 Walls: no defects visible from a distance of 3'-0" (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.
- .2 Advise Contract Administrator when surfaces and applied coating is ready for inspection. Do not proceed with subsequent coats until previous coat has been approved.
- .3 Retain purchase orders, invoices and other documents to prove conformance with noted MPI requirements when requested by Contract Administrator.

3.11 Cleaning

- .1 Progress Cleaning: clean in accordance with Section 01 74 00 - 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 00 - Cleaning.
- .3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 19 - Construction Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.12 Restoration

- .1 Clean and re-install hardware items removed before undertaken painting operations.
- .2 Remove protective coverings and warning signs as soon as practical after operations cease.
- .3 Remove paint splashings on exposed surfaces that were not painted. Remove smears and spatter immediately as operations progress, using compatible solvent.
- .4 Protect freshly completed surfaces from paint droppings and dust to approval of Contract Administrator. Avoid scuffing newly applied paint.
- .5 Restore areas used for storage, cleaning, mixing and handling of paint to clean condition as approved by Contract Administrator.

END OF SECTION

Part 1 General

1.1 Section includes

- .1 Interior signs
- .2 Exterior signs

1.2 Price and payment procedures

- .1 Allowances: Section 01 21 00 - Cash allowances affecting this section.
 - .1 Allowance includes purchase, delivery, and installation of plastic signs; installation is included in this section and is part of the Contract Sum/Price.
 - .2 Allowance includes purchase, delivery, and installation of exterior steel signs; installation is included in this section and is part of the Contract Sum/Price.

1.3 Reference standards

- .1 Applicable Building Code: National Building Code of Canada 2020 (NBCC 2020), City of Winnipeg Accessibility Guidelines (WADS) 2018

1.4 Action and Informational Submittals

- .1 Section 01 33 00: Submission procedures.
- .2 .2 Product Data: For each type of product indicated.
- .3 Shop Drawings: Show fabrication and installation details for signs.
 - .1 Show sign mounting heights, locations of supplementary supports, and accessories.
 - .2 Provide message list, typestyles, graphic elements, and layout for each sign.
- .4 Samples for Verification: For each of the following products and for the full range of colour, finish, and sign material indicated, of sizes indicated:
 - .1 Dimensional Characters: Full-size Samples of each type of dimensional character (one upper case and one lower case letter and sample of braille).

1.5 Closeout submittals

- .1 Section 01 78 00: Submission procedures.
 - .1 Maintenance Data: For signs to include in maintenance manuals.
 - .1 Include precautions against harmful cleaning materials and methods.

1.6 Quality assurance

- .1 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three (3) years documented experience.

1.7 Delivery, storage, and handling

- .1 Section 01 61 00: Transport, handle, store, and protect products.
- .2 Package signs, labeled in name groups.

- .3 Store adhesive attachment tape at ambient room temperatures.
- .4 Leave protective covering in place until final cleaning of building. Provide instructions for removal of protective covering.

1.8 Site conditions

- .1 Ambient Conditions:
 - .1 Do not install signs when ambient temperature is lower than recommended by manufacturer.
 - .2 Maintain this minimum temperature during and after installation of signs.

Part 2 Products

2.1 Description

- .1 Regulatory Requirements:
 - .1 Conform to applicable code for requirements for barrier-free design.

2.2 Raised letter signs - interior

- .1 Base Material: Solid colour acrylic plastic:
 - .1 Two-ply engraved plastic "Lamacoid".
 - .2 Base colour: As indicated on drawings.
 - .1 Allow for more than one colour acrylic/Lamacoid, final colours to be selected by Contract Administrator.
 - .3 Thickness: 3 mm.
 - .4 Height: as indicated on drawings.
 - .5 Edges: Square with no sharp edges.
 - .6 Character Font: Arial Bold.
 - .7 Refer to interior elevations and signage schedule.
- .2 Raised Character Size and Style: Acrylic plastic, character adhered to base material:
 - .1 Character Colour: As indicated on drawings.
 - .2 Character Thickness: Indicated on drawings.
 - .3 Height: 25 mm.
 - .4 Edges: Square with no sharp edges.
 - .5 Character Font: Arial Bold.
 - .6 Character Case: Upper case.
 - .7 Refer to interior elevations and signage schedule.

2.3 Raised letter signs - exterior

- .1 Base Material: Black Anodized Aluminum
 - .1 Thickness: 3mm (1/8")
 - .2 Total Height: ±174mm (to match face height of HPL siding)
 - .3 Edges: No sharp edges

- .4 Character Font: Arial Bold
- .5 Refer to exterior elevations and signage schedule.
- .2 Raised Character Size and Style: UV printed, tactile
 - .1 Character Colour: White
 - .2 Character Thickness: indicated on drawings.
 - .3 Height: As indicated on drawings.
 - .4 Edges: No sharp edges
 - .5 Character Font: Arial Bold
 - .6 Character Case: Upper case.

2.4 Accessories

- .1 Mounting Hardware (exterior signage): Provide concealed, secure, and tamperproof mounting system to fasten signs to HPL siding.
 - .1 Anchors and Inserts: Provide non-ferrous-metal or hot-dip galvanized anchors and inserts as required for corrosion resistance.
- .2 Tape Adhesive (interior signage): Extra strength double-sided tape, permanent adhesive.
- .3 Mounting Hardware (interior signage at thin brick and concrete block): Provide concealed, secure, and tamperproof mounting system to fasten signs to thin brick wall finish or concrete block.

2.5 Finishes, General

- .1 Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- .2 Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

Part 3 Execution

3.1 Examination

- .1 Section 01 71 00: Verify existing conditions before starting work.
- .2 Verify that substrate surfaces are ready to receive work.
- .3 Verify that items, including anchor inserts, are sized and located to accommodate signs.
- .4 Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 Installation

- .1 Locate signs and accessories where indicated, using mounting methods of types described and complying with manufacturer's written instructions.
 - .1 Install signs level, plumb, and at heights indicated, with sign surfaces free of distortion and other defects in appearance.

- .2 Interior Signs: Mount typical interior signs using double-sided tape. At concrete block and thin brick finish - provide concealed, secure, and tamperproof mounting system.
- .3 Exterior Signs: Provide concealed, secure, and tamperproof mounting system to fasten exterior signs to HPL siding. Align face of sign with face of HPL siding.

3.3 Schedules

- .1 Refer to drawings for signage schedule.

END OF SECTION

Part 1 General

1.1 Related requirements

- .1 Section 09 21 16 - Gypsum Board Assemblies.

1.2 Reference standards

- .1 Canada Green Building Council (CaGBC)
 - .1 LEED Canada v4.1 - ID+C: Commercial Interiors
 - .1 LEED (Leadership in Energy and Environmental Design): Green Buildings Rating Systems Reference Guide.
 - .2 South Coast Air Quality Management District (SCAQMD), California State, Regulation XI. Source Specific Standards
 - .1 SCAQMD Rule 1168-A2005, Adhesives and Sealants Applications.

1.3 Action and informational submittals

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for wall and corner guards and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Installation Drawings:
 - .1 Indicate on drawings large scale details, materials, finishes, dimensions, anchorage and assembly.
- .4 Samples:
 - .1 Submit duplicate 300 mm long samples of profiles and colours for corner guards.
- .5 Sustainable Design Submittals:
 - .1 LEED Canada submittals: in accordance with 01 35 20 - LEED Requirements.

1.4 Quality assurance

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

1.5 Delivery, storage and handling

- .1 Deliver, store and handle materials in accordance with Section with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

- .3 Storage and Handling Requirements:
 - .1 Store materials indoors and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect corner guards from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.
- .4 Develop Construction Waste Management Plan related to Work of this Section and in accordance with Section 01 35 20 - LEED Requirements.

Part 2 Products

2.1 Materials

- .1 (CG-1): Rigid vinyl corner guard: 1.6 mm thick, 50mm x 50mm wing size, full height of wall
 - .1 Product: Inpro Blu Nose, High Impact Corner Guard 160BN for 90 degree corners
 - .1 Colour: Feather 0238
- .2 (CG-2): Stainless Steel Wall Cap: 16 Ga., 50mm x 50mm wing size, full height of wall
 - .1 Product: Inpro Stainless Steel Surface Mount End Wall Protector
 - .1 Colour: Stainless Steel, Type 304

2.2 Accessories

- .1 Fasteners: All fasteners to be non-corrosive and compatible with aluminum retainers. All necessary fasteners to be supplied by the manufacturer.
- .2 Adhesive: water resistant type as recommended by manufacturer for substrate.

Part 3 Execution

3.1 Examination

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

3.2 Manufacturer's instructions

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

3.3 Installation

- .1 Install units on solid backing and erect with materials and components straight, tight and in alignment.
- .2 Mechanically fasten corner guards as indicated. Provide additional anchorage at corner guards with adhesives.

3.4 Cleaning

- .1 Progress Cleaning: clean in accordance with Section 01 74 00 - Cleaning.
 - .1 Leave Work area clean at end of each day.
- .2 Perform cleaning after installation to remove construction and accumulated environmental dirt.
- .3 Clean surfaces after installation using manufacturer's written recommended cleaning procedures.
- .4 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.
- .5 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 - Cleaning.
- .6 Waste Management: separate waste materials for recycling in accordance with Section 01 74 19 - Waste Management and Disposal and 01 35 20 - LEED Requirements.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.5 Protection

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

END OF SECTION

Part 1 General

1.1 Related requirements

- .1 Section 06 10 00 Rough Carpentry.
- .2 Section 08 80 00 - Glazing
- .3 Section 09 21 16 – Gypsum Board Assemblies
- .4 Section 09 30 13 Ceramic Tiling

1.2 Reference standards

- .1 ASTM International (ASTM)
 - .1 ASTM A167-99(2009), Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
 - .2 ASTM B456-03, Standard Specification for Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium.
 - .3 ASTM A653/A653M-09, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - .4 ASTM A924/A924M-09, Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.
- .2 Canada Green Building Council (CaGBC)
 - .1 LEED Canada-NC Version 4/4.1
- .3 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-1.81-M90, Air Drying and Baking Alkyd Primer for Vehicles and Equipment.
 - .2 CAN/CGSB-1.88-92, Gloss Alkyd Enamel, Air Drying and Baking.
 - .3 CGSB 31-GP-107MA-90, Non-inhibited Phosphoric Acid Base Metal Conditioner and Rust Remover.
- .4 CSA Group (CSA)
 - .1 CAN/CSA-B651-04, Accessible Design for the Built Environment.
 - .2 CAN/CSA-G164-M92(R2003), Hot Dip Galvanizing of Irregularly Shaped Articles.

1.3 Action and informational submittals

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Provide manufacturer's printed product literature and data sheets and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Sustainable Design Submittals:
 - .1 LEED Canada submittals: in accordance with Section 01 35 20 - LEED Sustainable Requirements.

- .2 Construction Waste Management: Refer to Section 01 74 19 - Construction Waste Management and Disposal.
- .3 Material product attribute documentation: Refer to Product Check Sheet as listed in 01 35 20 – LEED Sustainable Requirements to determine applicable type of documentation required for each product.
- .4 Low-Emitting Materials:
 - .1 Submittals are required for any sealants, adhesives, paints, coatings, composite wood, flooring, wall panels, insulation or ceiling components within the inner most weather proofing barrier.
 - .2 Refer to Product Check Sheet as listed in 01 35 20 – LEED Sustainable Requirements to determine applicable type of documentation required for each product.

1.4 Closeout submittals

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

1.5 Maintenance material submittals

- .1 Tools:
 - .1 Provide special tools required for assembly, disassembly or removal for toilet and bath accessories in accordance with requirements specified in Section 01 78 00 - Closeout Submittals.
 - .2 Deliver special tools to Contract Administrator.

1.6 Delivery, storage and handling

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials off ground indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect toilet and bathroom accessories from nicks, scratches, and blemishes
 - .3 Replace defective or damaged materials with new.
- .4 Packaging Waste Management: remove for reuse and return by manufacturer of crates, padding, and packaging materials in accordance with Section 01 74 19 - Construction Waste Management and Disposal.

Part 2 Products

2.1 Materials

- .1 Sheet steel: to ASTM A653/A653M with ZF001 designation zinc coating.
- .2 Stainless steel sheet metal: to ASTM A167, Type 304, with AISI No.4 finish.

- .3 Stainless steel tubing: Type 304, commercial grade, seamless welded, 1.2 mm wall thickness.
- .4 Fasteners: concealed screws and bolts hot dip galvanized, exposed fasteners to match face of unit. Expansion shields fibre, lead or rubber as recommended by accessory manufacturer for component and its intended use.

2.2 Components

- .1 As indicated below.

Name	Description	Acceptable Material
Grab Bar 1 (GB1)	610mm in length, Bar 1" or 1-1/4" diameter x 18 gauge stainless steel tube, satin finish, concealed flange with snap-on cover.	Bobrick B-5806 Series Frost 1001-SP Series
Grab Bar 2 (GB2)	915mm in length, Bar 1" or 1-1/4" diameter x 18 gauge stainless steel tube, satin finish, concealed flange with snap-on cover.	Bobrick B-5806 Series Frost 1001-SP Series
Grab Bar 3 (GB3)	760mm in length, Bar 1." diameter x 18 gauge stainless steel tube, satin finish, concealed flange with snap-on cover.	Bobrick B-5806 Series Frost 1001-SP Series
Swing-up Grab Bar 4 (GB4)	1-1/4" (32mm) diameter tubing, 16-18 gauge. Satin-Finish, slip-resistant surface stainless steel grab bar.	Bobrick B-4998 Frost 1055-W
L-Shaped Grab Bar 5 (GB5)	1-1/4" (32mm) diameter tubing, 18-gauge. Satin-Finish, stainless steel 30" x 30" (762 x 762mm) 90-degree grab bar. Concealed mounting flanges.	Bobrick B-5898.99 Frost 1003-NP Series
Soap Dispenser 1 (SD1 - automatic, counter-mounted)	Stainless steel vertical tank, surface mounted, touchless foam.	Bobrick B-828 Frost 718
Soap Dispenser 2 (SD2 - surface-mounted)	Stainless steel, corrosion-resistant valve.	Contura Series, Bobrick 818615 Frost 708-A
Mirror 1 (MI1 - Framed)	460W x 760H (18"W x 30"H) Stainless steel channel frame, 6mm float glass mirror.	Bobrick B-165 Frost 941-SS
Mirror 2 (MI2 - multi-stall washroom)	Refer to 08 80 00 Glass & Glazing	Provide Stainless Steel J-Trim around outside perimeter of mirror
Hand Dryer - Electric (HD)	Provided by Division 26 - Electrical	Refer to electrical.

Toilet Paper Dispenser (TP)	Stainless steel, double roll, vandal resistant, surface mounted.	Trimline Series, Bobrick B-3588
Paper Towel Dispenser (PTD)	22 gauge stainless steel with all-welded construction, surface mounted, exposed surfaces shall have satin finish. 180mm (7-1/8") high. Door shall be secured to cabinet with a full-length stainless steel piano-hinge and equipped with a keyed lock.	Bobrick B-26212
Feminine Napkin / Tampon Disposal (SND)	Stainless steel housing. Surface mounted.	ConturaSeries, Bobrick B-270Frost 622
Coat Hook (RH)	Single hook, 18 ga. Satin finish stainless steel. Collapsible. Vandal resistant.	Frost 1150
Mop and Broom Holder (MH)	Combination stainless steel shelf with mop and broom holder, 610mm in length.	Bobrick B-223 x 24 & Bobrick B-295 x 24
Shelf (SH)	Surface mounted, 18 ga. stainless steel shelf. Satin finish. 455mm long.	Bobrick B-295 x 18Frost 950-4x18
Toilet Backrest (BR)	Stainless steel and solid plastic laminate. Concealed fasteners.	Frost 1028
Toilet Partitions	Floor to Ceiling Toilet Partition, Max Privacy (Gapless), Compact Laminate Finish. Provide (4) Barrel Hinges and (1) Occupancy Indicator Latch with Emergency Access at each partition door. Provide sliding latches at accessible height in Accessible Stalls (2 total).	Bobrick, Duraline, Extended Height, Gapless in Compact Laminate Finish;Partition Doors: Brushed Aluminum 0328 FHPartition Stiles: Charcoal 0077 FH
D-pull (DP)	Door Pulls minimum 5.5" (140mm) long, with Black finish to contrast partition doors. Must be compatible with toilet partition thickness. Coordinate reinforcement in door with toilet partition. Provide back-to-back vertical pulls and horizontal pulls as shown on interior elevations. Provide concealed mounting for horizontal D-pull.	By partition supplier.

2.3 Fabrication

- .1 Weld and grind joints of fabricated components flush and smooth. Use mechanical fasteners only where approved.
- .2 Wherever possible form exposed surfaces from one sheet of stock, free of joints.
- .3 Brake form sheet metal work with 1/16" (1.5 mm) radius bends.

- .4 Form surfaces flat without distortion. Maintain flat surfaces without scratches or dents.
- .5 Back paint components where contact is made with building finishes to prevent electrolysis.
- .6 Hot dip galvanize concealed ferrous metal anchors and fastening devices to CAN/CSA-G164
- .7 Shop assemble components and package complete with anchors and fittings.
- .8 Deliver inserts and rough-in frames to job site at appropriate time for building-in. Provide templates, details and instructions for building in anchors and inserts.
- .9 Provide steel anchor plates and components for installation on studding and building framing.

2.4 Finishes

- .1 Chrome and nickel plating: to ASTM B456, finish as specified by item.

2.5 Keying

- .1 Supply two (2) keys for each accessory to City of Winnipeg.
- .2 Master key all accessories

Part 3 Execution

3.1 Examination

- .1 Verification of Conditions: verify that conditions of substrates and surfaces to receive toilet and bathroom accessories previously installed under other Sections or Contracts are acceptable for product installation in accordance with manufacturer's instructions prior to toilet and bathroom accessories installation.
- .2 Inform Contract Administrator of unacceptable conditions immediately upon discovery.
- .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval from Contract Administrator.

3.2 Installation

- .1 Install in locations using dimensions shown on drawings.
- .2 Manufacturer's Instructions
 - .1 Comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.
- .3 Install and secure accessories rigidly in place as follows:
 - .1 Stud walls: install steel back-plate to stud prior to plaster or drywall finish. Provide plate with threaded studs or plugs.
 - .2 Hollow masonry units, existing plaster or drywall: use toggle bolts drilled into cell or wall cavity.
 - .3 Solid masonry, marble, stone or concrete: use bolt with lead expansion sleeve set into drilled hole.

- .4 Install grab bars on built-in anchors provided by bar manufacturer. Grab bars to resist more than 900lbs (408 kg) load without causing damage to bar or fastener pull out.
- .5 Use tamper proof screws/bolts for fasteners.
- .6 Fill units with necessary supplies shortly before final acceptance of building.
- .7 Install mirrors in accordance with Section 08 80 00 - Glazing.

3.3 Adjusting

- .1 Adjust toilet and bathroom accessories components and systems for correct function and operation in accordance with manufacturer's written instructions.
- .2 Lubricate moving parts to operate smoothly and fit accurately.

3.4 Cleaning

- .1 Progress Cleaning: clean in accordance with Section 01 74 00 - 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 00 - Cleaning.
- .3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 19 - Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.5 Protection

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

END OF SECTION

Part 1 General

1.1 Reference standards

- .1 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Safety Data Sheets (SDS).
- .2 National Fire Protection Association (NFPA)
 - .1 NFPA 10-2006, Standard for Portable Fire Extinguishers.

1.2 Action and informational submittals

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's printed product literature and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Include product data indicating sustainable design characteristics.
 - .3 Submit WHMIS SDS - Safety Data Sheets.
- .3 Provide shop drawings.
- .4 Sustainable Design Submittals:
 - .1 LEED Submittals: in accordance with Section 01 35 20 LEED Sustainable Requirements.
- .5 Quality Assurance Submittals:
 - .1 Manufacturer's Instructions: Submit manufacturer's installation instructions and special handling criteria, installation sequence, and cleaning procedures.
 - .2 Manufacturer's Field Reports: submit manufacturer's written reports within 3 days of review, verifying compliance of Work, as described in PART 3, SITE QUALITY CONTROL.
- .6 Closeout Submittals:
 - .1 Provide operation and maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.3 Delivery, storage and handling

- .1 Packing, shipping, handling and unloading:
 - .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Waste Management and Disposal:
 - .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 19 - LEED Waste Management and Disposal.

Part 2 Products

2.1 Multi-purpose dry chemical extinguishers

- .1 Stored pressure rechargeable type with hose and shut-off nozzle, ULC labelled for A, B and C class protection
 - .1 Size 4.5 kg or as indicated.
 - .2 Quantity: Refer to drawings for quantities and locations.

2.2 Recessed Cabinets (FE1)

- .1 Semi-recessed type as indicated, constructed of 1.6 mm thick steel, 180 degrees opening door of 2.5 mm thick steel with latching device.
- .2 Cabinet to maintain fire resistive rating of construction in which they occur.
- .3 Cabinet door: with 5 mm full glass panel.
- .4 Finish:
 - .1 Tub: 1.6mm (16 ga.) painted steel, 230 x 610 x 102mm, recessed into stud wall.
 - .2 Frame: 2.5mm (12 ga.) stainless steel with 50mm turn-back, No. 4 satin finish.
 - .3 Door: 2.5m (12 ga.) stainless steel with 5mm safety glass viewing panel, concealed hinges, flush stainless steel door latch.
- .5 Standard of Acceptance: National Fire Equipment Ltd. - Model CE-950-3-2-SS or equal.
- .6 Quantity: Refer to drawings for quantities and locations.

2.3 Surface Mounted Cabinets (FE2)

- .1 Provide and install N.F.E. Model ECS-999-3 (10 1/2" x 24 1/4" x 6 1/2") surface mounted fire extinguisher cabinet constructed of 18 ga. steel tub and steel door & trim, a full length semi-concealed piano hinge and flush stainless steel door latch. Entire cabinet finished in baked enamel paint and glazed with 3/16" (5mm) clear glass.
- .2 Standard of Acceptance: National Fire Equipment Ltd. Model ECS-999 or approved equal.
- .3 Quantity: Refer to drawings for quantities and locations.

2.4 Extinguisher brackets (FE3)

- .1 Type recommended by extinguisher manufacturer.
- .2 Quantity: Refer to drawings for quantities and locations.

2.5 Identification

- .1 Identify extinguishers in accordance with recommendations of CAN/ULC-S508 and ANSI/NFPA 10.
- .2 Attach bilingual tag or label to extinguishers, indicating month and year of installation. Provide space for service dates.

Part 3 Execution

3.1 Manufacturer's instructions

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

3.2 Installation

- .1 Install or mount extinguishers in cabinets or on brackets in accordance with NFPA 10.

3.3 Site quality control

- .1 Manufacturer's Field Services:
 - .1 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

END OF SECTION

Part 1 General

1.1 Reference standards

- .1 Aluminum Association (AA)
 - .1 AA DAF 45-03(R2009), Designation System for Aluminum Finishes.
- .2 ASTM International
 - .1 ASTM A490M-12, Standard Specification for High-Strength Steel Bolts, Classes 10.9 and 10.9.3, for Structural Steel Joints Metric.
 - .2 ASTM A653/A653M-13, Standard Specification for Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by Hot-Dip Process.
- .3 Canada Green Building Council (CaGBC)
 - .1 LEED Canada-NC Version 4/4.1, LEED (Leadership in Energy and Environmental Design): Green Building Rating System Reference Guide for New Construction and Major Renovations (including Addendum July 2022 and later).
- .4 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-1.81-M90(R1990), Air Drying and Baking Alkyd Primer for Vehicles and Equipment.
 - .2 CAN/CGSB-1.88-92, Gloss Alkyd Enamel, Air Drying and Baking.
 - .3 CGSB 31-GP-107Ma-90, Non-inhibited Phosphoric Acid Base Metal Conditioner and Rust Remover.
- .5 CSA Group (CSA)
 - .1 CSA G40.20/G40.21-13, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
 - .2 CSA W59-13, Welded Steel Construction (Metal Arc Welding).

1.2 Action and informational submittals

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for metal shelving and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
 - .1 Indicate shelving layouts, number of bays, number of shelves, number and size of drawers, bins, number of dividers, system of bracing and anchoring devices.
- .4 Samples:
 - .1 Submit representative sample bay of specified shelving showing finish colour and including accessories.
- .5 Sustainable Design Submittals:

- .1 LEED Canada submittals: in accordance with Section 01 35 20 - LEED Sustainable Requirements.
- .2 Construction Waste Management:
 - .1 Submit project Waste Management Plan highlighting recycling and salvage requirements.

1.3 Delivery, storage and handling

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect specified materials from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.
- .4 Develop Construction Waste Management Plan related to Work of this Section and in accordance with Section 01 35 20 - LEED Sustainable Requirements.
- .5 Packaging Waste Management: remove for reuse and return of pallets, crates, padding, and packaging materials as specified in Construction Waste Management Plan in accordance with Section 01 74 19 - Waste Management and Disposal.

Part 2 Products

2.1 Wire Storage Shelving (WSH)

- .1 Open style, prefinished, self supporting, adjustable metal storage shelving consisting of the following components:
 - .1 Posts:
 - .1 Posts provide visual guide for positioning and adjusting shelves.
 - .2 Stationary shelving units to include and adjustable leveling foot to compensate for surface irregularities.
 - .3 Constructed of heavy-gauge carbon steel or Type 304 stainless steel.
 - .4 Chrome or stainless-steel finish.
 - .2 Shelves:
 - .1 Open wire shelving constructed of heavy-gauge carbon steel or Type 304 stainless steel.
 - .2 Ribs running front to back.
 - .3 Chrome or stainless-steel finish.
 - .3 Plastic split sleeves: Sleeve snaps together around each post, shelf corners slide over sleeves to provide a positive lock.
 - .4 Provide wall connections for stabilization of shelving units as recommended by the manufacturer.
- .2 Sizes and Configurations:

- .1 Shelving Unit Type-1 (**WSH-1**): 18" (457mm) deep by 60" (1524mm) wide by 74" (1876mm) high, stationary shelving unit, five shelves per unit.
 - .1 Location: Wading Pool Storage 130
 - .2 Weight Capacity: maximum load capacity (evenly distributed) of 2,000 lbs. (907kg) per shelving unit.
- .2 Shelving Unit Type-2 (**WSH-2**): 18" (457mm) deep by 36" (914mm) wide by 74" (1876mm) high, stationary shelving unit, five shelves per unit.
 - .1 Location: Wading Pool Storage 130
 - .2 Weight Capacity: maximum load capacity (evenly distributed) of 2,000 lbs. (907kg) per shelving unit.
- .3 Shelving Unit Type-3 (**WSH-3**): 24" (610mm) deep by 60" (1524mm) wide by 74" (1876mm) high, stationary shelving unit, five shelves per unit.
 - .1 Location: WASAC Storage 123 & 124
 - .2 Weight Capacity: maximum load capacity (evenly distributed) of 2,000 lbs. (907kg) per shelving unit.
- .4 Shelving Unit Type-4 (**WSH-4**): 24" (610mm) deep by 72" (1829mm) wide by 74" (1876mm) high, stationary shelving unit, five shelves per unit.
 - .1 Location: Wading Pool Storage 130, Janitor 145
 - .2 Weight Capacity: maximum load capacity (evenly distributed) of 2,000 lbs. (907kg) per shelving unit.
- .5 Shelving Unit Type-5 (**WSH-5**): 24" (610mm) deep by 54" (1327mm) wide by 74" (1876mm) high, stationary shelving unit, five shelves per unit.
 - .1 Location: WASAC Storage 123 & 124
 - .2 Weight Capacity: maximum load capacity (evenly distributed) of 2,000 lbs. (907kg) per shelving unit.
- .6 Shelving Unit Type-6 (**WSH-6**): 24" (610mm) deep by 48" (1220mm) wide by 74" (1876mm) high, stationary shelving unit, five shelves per unit.
 - .1 Location: WASAC Storage 123
 - .2 Weight Capacity: maximum load capacity (evenly distributed) of 2,000 lbs. (907kg) per shelving unit.
- .3 Acceptable Products:
 - .1 Metro Super Erecta Chrome Wire Shelving
 - .2 Global Industrial Nexel Chrome Wire Shelving
 - .3 ULINE Adjustable Wire Shelving.

2.2 Solid Steel Shelving (SS)

- .1 Solid, self supporting, adjustable metal storage shelving consisting of the following components:
 - .1 Posts:
 - .1 Posts provide visual guide for positioning and adjusting shelves.
 - .2 Stainless steel stationary posts are fitted with adjustable leveling bolts to compensate for uneven surfaces.

- .3 Constructed of heavy-gauge carbon steel or Type 304 stainless steel.
- .4 Stainless-steel finish.
- .2 Shelves:
 - .1 18-gauge solid steel shelves with 3.2mm riased edges on all four sides of the shelving.
 - .2 Galvanized finish.
- .3 Split sleeves: Sleeve snaps together around each post, shelf corners slide over sleeves to provide a positive lock.
- .4 Provide wall & floor connections for stabilization of shelving units as recommended by the manufacturer.
- .2 Sizes and Configurations:
 - .1 Shelving Unit Type-1 (**SS-1**): 24" (610mm) deep by 72" (1829mm) wide by 74.5" (1892mm) high, stationary shelving unit, four shelves per unit.
 - .1 Location: Wash Bay 154
 - .2 Weight Capacity: maximum load capacity (evenly distributed) of 300 Ibs. (136kg) per shelf.
 - .2 Shelving Unit Type-2 (**SS-2**): 24" (610mm) deep by 48" (1219mm) wide by 74.5" (1892mm) high, stationary shelving unit, four shelves per unit.
 - .1 Location: Wash Bay 154
 - .2 Weight Capacity: maximum load capacity (evenly distributed) of 800 Ibs. (363kg) per shelf.
- .3 Acceptable Products:
 - .1 Metro Super Erecta Solid Shelving (18 Gauge)
 - .2 Approved equal

2.3 Wide Span Storage Racks (WSSR)

- .1 14 gauge steel. Shelves snap into place and adjust at 1-1/2" (38mm) increments. 3 shelves hold up to 1,800 lbs. (816 kg) each. 96" (2440mm) boards ship in two pieces. Smooth, solid 5/8" (16mm) particle board eliminates item fall-through. Includes shelf supports and particle boards.
 - .1 Accessories:
 - .1 Anchor Plates for Wide Span Storage Racks: Attach anchor plates to uprights to secure to floor. Bottom shelf beam must be 3 rivets up to attach anchor plate. Use with Wide Span Storage Racks. 1 set of anchors per rack. ULINE H-1523ANCHOR or approved equal.
 - .2 Sizes and Configurations:
 - .1 Wide Span Storage Rack Type-1 (**WSSR-1**) : 72" (1830mm) wide by 24" (610 mm) deep by 84" (2135mm) high, 3 shelves per unit.
 - .1 Locations: Staging Area 142, Secure Storage 153
 - .2 Quantity: Refer to drawings
 - .2 Wide Span Storage Rack Type-2 (**WSSR-2**) : 48" (1220mm) wide by 24" (610 mm) deep by 84" (2135mm) high, 3 shelves per unit.

- .1 Locations: Staging Area 142, Secure Storage 153
- .2 Quantity: Refer to drawings
- .2 Acceptable Products:
 - .1 ULINE Wide Span Storage Racks or approved equal
 - .1 ULINE H-1061 or approved equal (**WSSR-1**)
 - .2 ULINE H-1060 or approved equal (**WSSR-2**)

2.4 Heavy Duty Pallet Racks (PR-1)

- .1 Highest capacity storage for bulky machinery, large IBC tanks and heavy pallets. Boltless assembly. Beams lock into place and adjust in 2" (50mm) increments. Welded 14-gauge steel frame. 16-gauge steel beams. Includes 2 upright frames and 4 beams.
 - .1 Accessories:
 - .1 Concrete Installation Kit (4 anchors, 2 kits per starter rack, 1 kit per add-on rack). ULINE H-3722 or approved equal.
 - .2 Pallet Rack Accessories:
 - .1 Additional Beams: Boltless assembly. Beams lock into place and adjust in 2" increments. 16-gauge steel beams hold up to 7,000 lbs. per level. Includes 2 beams per level. ULINE H-10520 or approved equal.
 - .1 Quantity: Provide 1 pair of additional beams per rack (for the additional shelf).
 - .2 Wire decking: Galvanized 2-1/2" (64mm) x 4" (102mm) mesh maximizes sprinkler efficiency. Resists rust and corrosion. No tools required. Includes 4 support channels. Waterfall edge drops into place. 3,500 lb. load capacity. ULINE H-10518S or approved equal.
 - .1 Quantity: Provide 6 units per rack (2 units per shelf, 3 shelves per rack)
 - .3 Pallet Rack Enclosures: At back-to-back racks, provide back panels between racks. 16-gauge steel frame. 8-gauge wire mesh panels with 2" (50mm) square openings. Back panels extend 1" or 6" beyond rack for pallet overhang. ULINE H-9890 or approved equal.
 - .1 Quantity: Provide 2 enclosure units per rack
 - .4 Magnetic Vinyl Envelopes: 2 magnetic strips keep envelopes secure. Works well with barcode systems. Durable non-rip seams. Will not scratch racking. Tough 8 mil vinyl with short-side opening. ULINE S-3832 or approved equal.
 - .1 Quantity: Provide 20 cartons in total (50 envelopes per carton).
 - .5 Poly Box Trucks: Sturdy, high-capacity trucks. Tough, seamless polyethylene, easy to clean. 4" (102mm) polyurethane swivel casters offer easy mobility. 20 bushel capacity. ULINE H-1956 or approved equal.

- .1 Colour: To be selected from manufacturer's full range.
- .2 Quantity: Provide 2 trucks per rack for 33 racks (66 trucks total)
- .6 Spring Lift: For 20 Bushel Poly Box Trucks. Spring loaded. Raises and lowers for easy loading. Attaches to poly box truck with steel clips. Vinyl-covered steel wire platform and springs. ULINE H-8768 or approved equal.
 - .1 Quantity: Provide 1 spring lift per 2 poly box trucks (33 lifts total)
- .7 Jumbo Rack Bins for 42" Deep Racks: Sized to fit pallet racks. Heavy-duty polypropylene construction with molded handles. 180 lb. stacking capacity. Anti-slide ledges keep bins steady. Requires wire decking on racks. ULINE H-10000 or approved equal.
 - .1 Quantity: Provide 4 bins per rack for 33 racks (132 bins total)
- .2 Sizes and Configurations:
 - .1 Pallet Racking Unit Type-1 (**PR-1**) : 96" (2440mm) wide by 42" (1067 mm) deep by 96" (2440mm) high, 3 shelves per unit.
 - .1 Locations: Stores Open Storage 140
 - .2 Quantity: 42 Heavy Duty Pallet Racks (total). Starter and add-on configuration to suit layout shown on drawings.
 - .3 Weight Capacity: 3,084 kg (6,800 lbs.) per pair of beams.
- .2 Acceptable Products:
 - .1 ULINE Heavy-Duty Pallet Rack Starter and Add-On Units
 - .1 ULINE H-10504 or approved equal
 - .2 ULINE H-10504-ADD or approved equal

2.5 24" (610mm) Deep Pallet Racks (PR-2)

- .1 Narrow, 24" deep racking provides efficient storage. Boltless assembly. Beams lock into place and adjust in 2" (50mm) increments. Welded 14-gauge steel frame. 16-gauge steel beams. Includes 2 upright frames and 4 beams.
 - .1 Accessories:
 - .1 Concrete Installation Kit (4 anchors, 2 kits per starter rack, 1 kit per add-on rack). ULINE H-3722 or approved equal.
 - .2 Pallet Rack Accessories:
 - .1 Additional Beams: Boltless assembly. Beams lock into place and adjust in 2" increments. 16-gauge steel beams hold up to 5,000 lbs. per level. Includes 2 beams per level. ULINE H-5953 or approved equal.
 - .1 Quantity: Provide 1 pair of additional beams per rack (for the additional shelf).

- .2 Wire decking: Galvanized 2-1/2" (64mm) x 4" (102mm) mesh maximizes sprinkler efficiency. Resists rust and corrosion. No tools required. Includes 3 support channels. Waterfall edge drops into place. 2,500 lb. load capacity. ULINE H-8618 or approved equal.
 - .1 Quantity: Provide 6 units per rack (2 units per shelf, 3 shelves per rack)
- .3 Pallet Rack Enclosures: At back-to-back racks, provide back panels between racks. 16-gauge steel frame. 8-gauge wire mesh panels with 2" (50mm) square openings. Back panels extend 1" or 6" beyond rack for pallet overhang. ULINE H-9890 or approved equal.
 - .1 Quantity: Provide 2 enclosure units per rack
- .4 Magnum Hopper Bins: Extra thick walls and wide ledges hold 150 lbs. for secure stacking. Outside dimensions - 24" (610mm) L x 17" (432mm) W x 11" (280mm) H. ULINE H-3053 or approved equal.
 - .1 Colour: To be selected from manufacturer's full range.
 - .2 Quantity: Provide 10 bins per rack (410 bins total)
- .5 Bin Dividers: Black plastic dividers fit snugly into Magnum Hopper bins. For bin sized 24" (610mm) L x 11" (280mm) H. ULINE H-3053D or approved equal.
 - .1 Quantity: Provide 5 bin dividers per rack (205 dividers total)
- .2 Sizes and Configurations:
 - .1 Pallet Racking Unit Type-2 (**PR-2**) : 96" (2440mm) wide by 24" (610 mm) deep by 96" (2440mm) high, 3 shelves per unit.
 - .1 Locations: Stores Open Storage 140, Multi-Purpose Workspace 141
 - .2 Quantity: 41 - 24" (610mm) Deep Pallet Racks (total). Starter and add-on configuration to suit layout shown on drawings.
 - .3 Weight Capacity: 2,268 Kg (5,000 lbs.) per pair of beams.
- .2 Acceptable Products:
 - .1 ULINE 24" (610mm) Deep Pallet Rack Starter and Add-On Units
 - .1 ULINE H-8611 or approved equal
 - .2 ULINE H-8611-ADD or approved equal

2.6 Steel Carton Stands (SCS)

- .1 All steel construction provides superior strength. Single Tier. 20" (508mm) dividers. 9" (230mm) space between dividers. Casters make stands portable. Size: 42" (1067mm) L x 18" (457mm) W x 23" (585mm) H.
 - .1 Accessories:
 - .1 Set of 4 Swivel Casters (1 set per stand, 2 sets total)

- .2 Quantity: Two (2) Steel Carton Stands (total)
- .3 Location: Stores Open Storage 140
- .2 Acceptable Products:
 - .1 ULINE H-1073 or approved equal (steel stands).
 - .2 ULINE H-1074 or approved equal (casters).

2.7 Steel Finishes

- .1 Wire Storage Shelving: Manufacturer's standard chrome-plated or stainless steel finish. Rust-resistant finish.
- .2 Pallet Racks: Manufacturer's standard powder coated steel.
- .3 Wide Span Storage Racks: Manufacturer's standard powder coated steel.

2.8 Schedule

- .1 Refer to finish plans for locations and quantities of all shelving and racking.

Part 3 Execution

3.1 Examination

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

3.2 Installation

- .1 Do metal storage shelving work except where specified otherwise.
- .2 Install metal storage shelving in accordance with reviewed layout.
- .3 Brace, secure and anchor shelving units in place.
- .4 Make good baked enamel surfaces damaged during shipment or installation.

3.3 Cleaning

- .1 Progress Cleaning: clean in accordance with Section 01 74 00 - 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 00 - Cleaning.
- .3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 19 - Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

Part 1 General

1.1 Section includes

- .1 Provide manual roller window shades including but not limited to following:
 - .1 manually operated roller window sun control shade assemblies.

1.2 Related sections

- .1 Section 01 33 00 Submittal Procedures
- .2 Section 01 35 20 LEED Sustainable Requirements
- .3 Section 01 73 19 Waste Management and Disposal
- .4 Section 08 44 13 Glazed Aluminum Curtain Walls
- .5 Section 08 51 13 Aluminum Windows
- .6 Section 09 21 16 Gypsum Board Assemblies - Provision of gypsum board substrate at bulkhead and accessories.

1.3 Submittals

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Shop drawings:
 - .1 Submit Shop Drawings which clearly indicate shade sizes, locations, operation, methods of attachment, and description of components, indicating for each component, size, shape, material, thickness, gauge, finish, methods of joining, joint locations, and methods of attachment and relationship with adjacent components and construction, fastening devices, anchorage components and adjacent materials.
- .3 Samples:
 - .1 Submit sample shade fully representing shades to be provided complete with head rail, end caps, gears, sprocket wheels, brackets and similar accessories. Submit samples of fabrics complete with edge reinforcing and finish colours for selection. Fabric sample minimum 300 mm (12") square. Submit samples of roller shade component colours for review. Roller shade components include but are not limited to fascia, guide rails and blackout channels. Do not order material until colour samples have been accepted.
- .4 Certificates:
 - .1 Submit written certification that materials, systems and assemblies have been installed in accordance with manufacturer's requirements.
- .5 Test and Evaluation Reports:
 - .1 Submit test data substantiating proposed shade fabric meets performance criteria specified herein. Submit independent test results showing properties and acceptable fire hazard classification of shade fabric.
- .6 Schedule:

- .1 Provide schedule indicating each location in relation to room numbers on drawings. Indicate sizes and dimensions, location of different types, fabrics, colours, and other distinguishing characteristics.

1.4 Closeout submittals

- .1 Maintenance Data:
 - .1 Provide maintenance data for incorporation into manual specified in Section 017800 - Closeout Submittals.
 - .2 Include information regarding cleaning and maintenance, properties of stain resistance, maintenance procedures, and recommended procedures for removal of stains.

1.5 Site Conditions

- .1 Verify all site dimensions prior to fabrication. Indicate site dimensions on shop drawings.
- .2 Check site conditions that may affect proper installation and operation of roller blinds. Report any defects or unusual site condition to Contract Administrator and await remedial measures.
- .3 Check heat/ventilation grilles and appliances with regard to installation of blinds to prevent possible scorching, billowing or damage.

1.6 Quality assurance

- .1 Qualifications:
 - .1 Installers: Provide work of this Section executed by competent installers with minimum 5 years experience in the application of Products, systems and assemblies specified and with approval and training of the Product manufacturers.
- .2 Mock-Ups:
 - .1 Erect 1 full size site mock-up of roller window shade at designated location for review. Once reviewed with no objections recorded mock-up sets standard for balance of work. Mock-up may be left as work of this Contract.

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

1.8 Warranty

- .1 Manufacturer Warranty: Warrant work of this Section for a period of 5 years against defects and/or deficiencies in accordance with General Conditions of the Contract. Promptly correct any defects or deficiencies which become apparent within warranty period, to satisfaction of Contract Administrator and at no expense to the City of

Winnipeg. Defects include but are not limited to deformation of members, mechanical failure, failure of system to operate as designed or faulty or poor quality of work.

Part 2 Products

2.1 Manufacturer

- .1 Products of following manufacturers are acceptable subject to conformance to requirements of Drawings, Schedules and Specifications:
 - .1 Altex Inc; www.altexdesign.com
 - .2 Or approved equal.

2.2 Materials

- .1 System:
 - .1 Performance/Design Criteria:
 - .1 Design with final determination of limitation on site to meet requirements indicated on Drawings.
 - .2 Manually operated roller window shade system with wands for easy lifting, fingertip control, with infinite positioning so shade is capable of stopping and holding at any position within window opening. Provide assemblies to suit adjacent ceilings and finishes. Ensure removal does not require disassembly of shade unit. Left or right hand operative option available to suit design requirements.
 - .3 System must allow for the ability to lower the shade by pulling on the hembar without damage to the clutch or spring.
 - .4 Lifting Force:
 - .1 Required lifting force of 2.5 pounds (1.134 kg) to a maximum of 4 pounds (1.814 kg) to raise or lower the shade.
 - .5 Shade system must have an embedded upper limit stop device to ensure a constant upper position and avoid the shade to be over lifted
 - .6 Roller shade system must be capable of being raised or lowered at a minimum rate of 1 meter per second (1 m/s).
 - .7 Accessibility:
 - .1 System must be operable with one hand, using a closed fist position.
 - .2 System must be operable without requiring tight grasping, pinching, or twisting of the wrist.
 - .3 System must be operable at any height while sitting.
 - .8 Durability:
 - .1 System must be tested for a minimum of 5500 cycles (one cycle means the shade is fully raised and then fully lowered) without any failure.
 - .9 Safety:

- .1 System must not have any reachable cord in static or dynamic mode for an optimum safety.
- .10 Dual Wand System: Extruded aluminium wands.
 - .1 Front wand: To raise the shade.
 - .2 Back wand: To lower the shade.
- .11 Ada Loop: Loops with a minimum diameter of 5 inches and a maximum diameter of 6 inches are to be attached to each end of the wands.
- .2 Fabrication
 - .1 Coordinate and verify job site dimensions affecting this work. Submit in writing dimensions or conditions which vary from those on reviewed Shop Drawings or detrimental to installation. Obtain corrective measures from Contract Administrator prior to fabrication. Ensure suitability of adjacent building components in relationship to work of this Section.
 - .2 Submit in writing defects in work prepared under other Sections. Commencement of work implies acceptance of substrates and conditions.
 - .3 Formed Aluminum: ASTM B221, Aluminum alloy 6063-T5. Ensure surfaces are free from defects impairing appearance, strength and durability.
 - .4 Roller Window Shade Assembly:
 - .1 Design and fabricate heavy-duty roller window shade assembly to keep maintenance to minimum.
 - .2 Ensure clutch, spring and sprocket of the roller window shade assembly operates smoothly having capability to control rate of fall, to adjust stop and hold at an infinite number of positions as required.
 - .3 Ensure assembly allows fingertip control with built-in shock absorber system to prevent clutch breakage under normal operating conditions, even when shades are lowered by pulling on the hembar. Factory set for size and travel of shades.
 - .4 Ensure assembly mechanism has structural capacity to accommodate specified shades in window sizes required for this Project. Design assembly mechanism to suit size of windows and mass of system.
 - .5 Roller Tube: Extruded aluminum roller tube to suit assembly design.
 - .1 Ensure roller tube is sized and reinforced internally as necessary to prevent excessive deflection in span of tube.
 - .2 Fabric Mounting Spline: Fabricate slipped-in-place spline of extruded vinyl with asymmetrical insertion locking channels and embossed fabric guide. Ensure spline has sufficient capacity to hold shades when spline is slipped and locked into the tube.
 - .6 Fascia:
 - .1 89 mm square fascia system covering the front and bottom in a one piece extrusion.

- .7 Shade Fabric Hem Tube:
 - .1 Hem tube may be extruded aluminum, ellipse in shape, designed to hang perfectly perpendicular and contained within a heat welded fabric pocket. Decorative plastic end caps will be flush to the fabric.
- .3 Finishes:
 - .1 Aluminium: Ensure exposed aluminum surfaces are finished (clear anodized, black, or white), as per the Contract Administrator's choice. Colour to match aluminum punch window frames or aluminum curtain wall mullions.
 - .2 Wand/ADA Loop system to be colour contrasted from background surfaces. Contract Administrator to select from manufacturer's full range of colours.
- .4 Basis of design: District collection, Newton High-Speed Lite-Lift with Fascia and Ada Loop by Altex inc.
- .2 Fabric:
 - .1 General:
 - .1 Do necessary cutting and sewing of fabric to produce finished Product having neat, even appearance and meeting performance requirements specified.
 - .2 Fabricate shades with no vertical or horizontal seams.
 - .3 Ensure fabric tracks perfectly straight in its movement to within $\pm 1\%$ of its width from fully open to fully closed position and when rolled onto tube, ensure it is stacked in layers to within ± 3 mm ($\pm 1/8$ ") of edge alignment.
 - .4 Fabric Performance: Hang flat shade fabric without buckling or distortion. When trimmed, hang edge straight without ravelling. Ensure unguided roller shade cloth rolls true and straight without shifting sideways more than 3 mm ($1/8$ ") in either direction due to wrap distortion or weave design.
 - .2 3% Solar shade type:
 - .1 Description: Solar Screen fabric with 3% Openness, made of polyester (30%) and vinyl on polyester (70%), maximum thickness of 0.58mm, maximum weight of 470 g/m², GREENGUARD Gold certified, CAN/ULC-S109-03 Small & Large Flame Test certified. Basketweave screen construction fabric available in 300 cm wide roll (118''). Color as per Contract Administrator's choice from the manufacturer's standard range.
 - .2 Basis of design: 10103, 3%, by Altex inc.
 - .3 Colour: 10103-04 Light Grey

Part 3 Execution

3.1 Examination

- .1 Verification of Conditions: Verify actual site dimensions and location of adjacent materials prior to commencing work. Notify Contract Administrator in writing of any conditions which would be detrimental to the installation.
- .2 Evaluation and Assessment: Commencement of work implies acceptance of previously completed work.

3.2 Installation

- .1 Coordinate installation and fastenings with trades providing adjacent components. Coordinate location of support framing and blocking for installation of roller window shades.
- .2 Install shades in accordance with manufacturer's instructions in accordance with reviewed Shop Drawings and as indicated, in true, flat planes.
- .3 Securely attach installation fittings to their mounting surfaces with screws of correct length and type and with compatible plugs or anchors where required.

3.3 Site Quality Control

- .1 Non-Conforming Work: Replace damaged work which cannot be satisfactorily repaired, restored or cleaned, to satisfaction of Contract Administrator at no cost to the City of Winnipeg.

3.4 Cleaning

- .1 Leave shades in raised position at completion of work of this Section.
- .2 Upon completion of work of this Section, remove Products, materials, debris and equipment from site.
- .3 Leave site in a neat and tidy condition, acceptable to Contract Administrator.
- .4 Do touch-up required to satisfaction of Contract Administrator.

3.5 Schedule

- .1 Refer to reflected ceiling plans for roller shade locations.
- .2 Refer to window schedule for sizes.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

- .1 All fire suppression work shall be considered a “Design-Build” component of this project. Work shall meet applicable code requirements, and also shall meet any requirements laid out in this specification that may be above and beyond minimum code requirements.
- .2 This section gives guidance on the common work pertaining to fire suppression.
- .3 All fire suppression work shall be completed in conformance with, and subject to, the latest manufacturer, supplier and documentation available (printed, electronic, or website), including installation and cautionary notes.
- .4 Refer to specific fire suppression sections for further guidance.

1.2 RELATED SECTIONS

- .1 Section 01 33 00 – Submittal Procedures
- .2 Section 01 74 00 – Cleaning and Waste Management
- .3 Section 01 78 00 – Closeout Submittals
- .4 Section 22 05 53 – Identification for Plumbing Piping and Equipment

1.3 REFERENCES

- .1 National Fire Protection Association (NFPA)
 - .1 NFPA 25 Inspection, Testing, and Maintenance of Water-based Fire Protection Systems

1.4 CONTRACTOR RESPONSIBILITY

- .1 It is the fire suppression Subcontractor’s responsibility to provide and install the necessary components for a complete and functional fire suppression system.
- .2 The fire suppression Subcontractor shall hire a fire suppression Engineer who will take responsibility for zone hazard classifications, sprinkler layout, equipment selections, flow design, and calculations for this project. The City of Winnipeg Representative writing this specification is only responsible for conveying the general project requirements and any other requirements that may be beyond minimum code compliance. The fire suppression Engineer hired by the fire suppression Subcontractor shall ultimately be responsible for the completed system.
- .3 The fire suppression Subcontractor shall be responsible for obtaining architectural and structural plans to appropriately design the fire suppression systems.
- .4 The fire suppression Subcontractor is responsible for paying for and obtaining all necessary permits and authorizations for work.

- .5 The fire suppression Subcontractor is responsible for providing suitable submittals pertaining to this work.
- .6 It is the responsibility of the fire suppression Subcontractor to coordinate with other trades such that all work can be accomplished in a suitable manner.
- .7 All coring, rough openings and penetrations greater than 6" (150 mm) diameter, and all patching, flashing and sealing shall be the responsibility of the Contractor.
- .8 The fire suppression Subcontractor shall coordinate with the Contractor arranging for, and being available during, inspections by the authority having jurisdiction and professional fire suppression Engineer at:
 - .1 Rough piping work completion prior to any areas covered, and
 - .2 Substantial completion for the purpose of obtaining final certification.
- .9 It is the responsibility of the fire suppression Subcontractor to communicate clearly to the City of Winnipeg the need for routine inspections, testing, and maintenance of the installed system(s) starting after the installation work is done and the project is substantially complete. It shall be communicated that this responsibility will be the City of Winnipeg, shall follow requirements found in NFPA 25, the National Fire Code, and any local codes deemed relevant by the authority having jurisdiction, and be conducted by people qualified to inspect, test, and maintain fire suppression systems.

1.5 SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 – Submittal Procedures
- .2 Fire suppression submittals shall be submitted to both the fire suppression Engineer hired by the fire suppression Subcontractor, and the City of Winnipeg representative writing this specification. Reviewing of shop drawing submittals is the responsibility of the fire suppression Engineer hired by the fire suppression Subcontractor only.
- .3 Refer to specific sections for any additional submittal requirements.
- .4 Shop Drawings:
 - .1 The intent of shop drawings is to give confidence to the City of Winnipeg representative that the fire suppression Subcontractor is using the proper products and will be installed properly so the work is done as intended by the fire suppression Engineer. Generic catalog or sales information shall not be part of a shop drawing unless it specifically meets the intent.
 - .2 Shall clearly indicate job-specific products. If the manufacturers cut sheet shows multiple products, indicate which one is applicable.
 - .3 Shall include performance data, a dimensioned drawing with required clearances and connection points, and specified capacity required as applicable for each product.
 - .4 Shall indicate the supplier's name and contact information.
 - .5 Shall indicate compliance to applicable codes and standards.
 - .6 Fire Suppression Subcontractor shall submit a shop drawing for unique mounting arrangements or supports if required at the discretion of the City of Winnipeg representative.

- .5 Closeout Submittals:
 - .1 Provide operation and maintenance data and incorporate into manual specified in Section 01 78 00 - Closeout Submittals.
 - .2 Approvals:
 - .1 Submit two (2) copies of draft Operation and Maintenance Manual to's Representative for approval. Submission of individual data will not be accepted unless directed by the City of Winnipeg representative.
 - .2 Submit Material and Test Certificates to the authorities upon request.
 - .3 Submit a copy of the As-Built drawings.
 - .4 Make changes as required and re-submit as directed by the City of Winnipeg representative.
 - .3 Operation and maintenance manual approved by, and final copies deposited with, the City of Winnipeg representative before final inspection.
 - .4 Operation and Maintenance (O&M) Manual:
 - .1 Operation data to include:
 - .1 Control and piping schematics for systems.
 - .2 Description of systems and their controls.
 - .3 Operation instruction for systems and components.
 - .4 Description of actions to be taken in event of equipment failure.
 - .2 Maintenance data to include:
 - .1 Servicing, maintenance, operation and troubleshooting instructions for each item of equipment. Instructions to include maintenance schedule and tools required.
 - .2 A parts list.
 - .3 Performance data to include:
 - .1 Stamped sprinkler design submittal
 - .2 Site reports (i.e. incoming water pressure)
 - .3 Equipment performance verification test results (i.e. flow test report)
 - .4 Material and Test Certificates
 - .5 Additional data:
 - .1 Prepare and insert into the O&M manual additional data when need for it becomes apparent during specified demonstrations and instructions.
 - .6 Site records:
 - .1 City of Winnipeg's Representative will provide one (1) set of reproducible mechanical drawings or AutoCAD files. Provide sets of white prints as required for each phase of work. Mark changes as work progresses and as changes occur.
 - .2 Use different color for each service.

- .3 Make available for reference purposes and inspection.
- .7 As-built drawings:
 - .1 Identify each drawing in lower right hand corner in letters at least 12 mm high as follows: - "AS BUILT DRAWINGS: THIS DRAWING HAS BEEN REVISED TO SHOW FIRE SUPPRESSION SYSTEMS AS INSTALLED" (Signature of fire suppression Subcontractor) (Date).
 - .2 Submit completed reproducible as-built drawings with Operating and Maintenance Manuals.
- .8 One copy of NFPA 25.

1.6 DELIVERY, STORAGE AND DISPOSAL

- .1 Packing, shipping, handling and unloading:
 - .1 Deliver and handle in accordance with manufacturer's written instructions.
 - .2 Deliver materials to site in original factory packaging, labeled with manufacturer's name, address.
- .2 Storage and Protection:
 - .1 Protect from weather and physical damage.
 - .2 Store at temperatures and conditions required by manufacturer.
- .3 Waste Management and Disposal:
 - .1 Verify with City of Winnipeg on storage or disposal of existing City of Winnipeg equipment. Handle accordingly.
 - .2 Separate waste materials for reuse and recycling.
 - .3 Place excess or unused materials in designated containers.
 - .4 Divert unused metal materials from landfill to metal recycling facility approved by City of Winnipeg's Representative.
 - .5 Dispose of unused adhesive material at official hazardous material collections site approved by City of Winnipeg's Representative.

PART 2 - PRODUCTS

2.1 QUALITY ASSURANCE

- .1 Specific sections may have additional requirements, or modifications to these requirements. In the case of contradiction, the requirement in the specific section is to be adhered to. In cases of no clear contradiction, these requirements shall be adhered to.
- .2 If any specification section includes the words "prior approval" or "unless otherwise approved", this is to mean a request must be made to the stamping fire suppression

Engineer responsible for this design component of the project prior to any product being considered as acceptable. Upon acceptance by written confirmation, the fire suppression Subcontractor may use it. Upon denial by written confirmation, the fire suppression Subcontractor shall not use it. No other entity shall grant approval to the fire suppression Subcontractor.

- .3 All products to be manufactured by companies with qualifications including:
 - .1 Ten (10) years of history providing this product (or applicably similar product) to the Canadian market. Reduction of this requirement is possible at the discretion of the City of Winnipeg Representative only.
 - .2 Engineering, design and application support available in a timely manner. This includes acknowledgement of an inquiry within 24 hours, and a suitable response to an inquiry within five (5) working days.
 - .3 Documented case studies of three (3) similar applications of the product showing similar usage and acceptable longevity of the product. Contact information for the City of Winnipeg/maintenance provider of each case study shall be available upon request.
 - .4 Wholly owned test facilities with access available upon request.
 - .5 Provision of products meeting all applicable testing standards, ratings, and certifications for the Canadian market.
- .4 All products to be supplied by suppliers with qualifications including:
 - .1 Five (5) years of history providing this product (or applicably similar product) to the Canadian market.
 - .2 Manufacturer support including, being the manufacturer's designated representative of the product, being factory trained on the product, and having access to current engineering support from the manufacturer.
 - .3 Human on site availability (with any required security clearances or specific entry requirements up to date prior to visit) within 48 hours of initial contact for the purpose of commissioning the product or investigation of problems potentially involving the product. Suppliers shall provide a phone number that will be answered during regular working hours.

PART 3 - EXECUTION

3.1 INSTALLATION

- .1 All products to be installed by workers with qualifications including:
 - .1 Five (5) years of experience installing the product (or applicably similar product).
 - .2 A comprehensive knowledge of the product manufacturer's installation requirements.

- .3 An understanding as to the reasons why proper installation is required, and what problems occur with an improper installation.
- .2 Installation shall be the responsibility of a qualified journeyman licensed to perform the work required.
- .3 Installation shall be in accordance with the applicable National Fire Protection Association (NFPA) standards and local codes.
- .4 Installation of service items (example: flow valves, drain valves, etc.) shall be coordinated with the Contractor and other Subtrades (example: wall boarding Subcontractor) so access to service items is easy and unencumbered. Ultimately, this is the responsibility of the fire suppression Subcontractor.

3.2 PERFORMANCE VERIFICATION

- .1 Ensure piping is properly anchored, connected to system, and effectively sloped for draining.
- .2 Affix applicable labels with directional arrows in accordance with Section 22 05 53 – Identification for Plumbing Piping and Equipment.
- .3 The fire suppression Subcontractor shall be available to accompany the authority having jurisdiction and the fire suppression Engineer on site inspections. The fire suppression Subcontractor shall have the ability to test all items during inspections.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

- .1 This section provides guidance on handling thermal expansion of sprinkler piping systems.

1.2 RELATED SECTIONS

- .1 Section 21 05 00 – Common Work Results for Fire Suppression
- .2 Section 21 05 29 – Hangers and Supports for Fire-Suppression Piping and Equipment
- .3 Section 21 12 00 – Fire-Suppression Standpipes
- .4 Section 21 13 00 – Fire-Suppression Sprinkler Systems

1.3 REFERENCES

- .1 American Society for Testing and Materials International (ASTM)
 - .1 ASTM A536 Standard Specification for Ductile Iron Castings

1.4 BASIC INFORMATION

- .1 Fire suppression Subcontractor shall be aware that piping changes length when undergoing changes in temperature. Plastic piping like CPVC changes much more than steel.
- .2 By default, all sprinkler piping shall be able to handle a 40 F (22 C) temperature change. However, physical allowances shall be made to handle pipe length changes due to thermal expansion/contraction in all cases. Special consideration shall be given to:
 - .1 Initial installation of piping systems in cold weather where the finished environment will be warmer, or vice-versa
 - .2 Piping that is located outdoors
 - .3 Piping that continues from one thermal zone to another (i.e. from conditioned space to an unconditioned attic space or garage)
- .3 Common pipe materials and their respective changes in length [per 100 feet (30 m) of pipe] are listed for reference purposes:
 - .1 CPVC:
 - .1 1.7" (42 mm) length change for every 40 F (22 C) temperature change
 - .2 4.1" (104 mm) length change for every 100 F (56 C) temperature change
 - .2 Steel:
 - .1 0.3" (8 mm) length change for every 40 F (22 C) temperature change

- .2 0.7" (18 mm) length change for every 100 F (56 C) temperature change

PART 2 - PRODUCTS

2.1 PIPE CONNECTORS

- .1 For grooved steel pipe:
 - .1 "Flexible Coupling" style
 - .2 Gasket: EPDM
 - .3 Housing: ductile iron to ASTM A536
 - .4 Pressure rating: 1000 psi (68.9 bar)
 - .5 Temperature rating: -30 F (-34 C) to 230 F (110 C)

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION

- .1 The intent is to allow the Fire suppression Subcontractor some flexibility to implement appropriate expansion compensation techniques for piping systems. The Fire suppression Subcontractor shall review the proposed piping layouts on site and install either suitable expansion products or utilize a multi-elbow piping offset to allow for linear movement due to temperature changes.
- .2 Fire suppression Subcontractor shall be aware of the temperature of the pipe and environment during installation, and account for thermal expansion/contraction that will occur before the work is complete and functioning as designed.
- .3 Utilize points of fixed movement where required to control expansion in a particular direction.

3.2 SPECIFIC APPLICATIONS

- .1 In the absence of other thermal expansion/contraction methods, provide the following for every 100 feet (30 m) of piping:
 - .1 For any application where potential temperature changes are <40 F (22 C):
 - .1 CPVC: 4-elbow 'U' joint with 4 foot (1220 mm) legs and 2 foot (610 mm) base
 - .2 Steel: 4-elbow 'U' joint with 24" (610 mm) legs and 12" (300 mm) base

- .2 For all outdoor piping, unconditioned attic piping, unconditioned crawlspace piping, or any application where potential temperature changes are up to 100 F (<56 C):
 - .1 CPVC: 4-elbow 'U' joint with 6 foot (1830 mm) legs and 3 foot (914 mm) base
 - .2 Steel: 4-elbow 'U' joint with 24" (610 mm) legs and 12" (300 mm) base

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

- .1 This section includes guidance on hanging or supporting sprinkler piping and equipment.
- .2 This section includes:
 - .1 Pipe Hangers and Supports
 - .2 Hanger Rods
 - .3 Inserts
 - .4 Flashing
 - .5 Sleeves and Seals
 - .6 Formed Steel Channel
 - .7 Equipment Bases and Supports
 - .8 Metal Framing Systems
 - .9 Fasteners
 - .10 Pipe Positioning Systems

1.2 RELATED SECTIONS

- .1 Section 01 33 00 – Submittal Procedures
- .2 Section 05 50 00 – Metal Fabrications
- .3 Section 07 84 00 – Firestopping
- .4 Section 21 05 00 – Common Work Results for Fire Suppression
- .5 Section 21 05 16 – Expansion Fittings and Loops for Fire-Suppression Piping
- .6 Section 21 12 00 – Fire-Suppression Standpipes
- .7 Section 21 13 00 – Fire-Suppression Sprinkler Systems

1.3 REFERENCES

- .1 International Association of Plumbing and Mechanical Officials (IAPMO)
 - .1 IAPMO PS 42 Pipe Alignment and Secondary Support Systems
- .2 Manufacturers Standardization Society of the Valve and Fittings Industry (MSS)
 - .1 MSS SP-58 Pipe Hangers and Supports – Materials, Design, Manufacture, Selection, Application and Installation

- .2 MSS SP-127 Bracing for Piping Systems: Seismic – Wind – Dynamic Design, Selection and Application
- .3 National Fire Protection Association (NFPA)
 - .1 NFPA 13 Standard for the Installation of Sprinkler Systems

1.4 SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Shop Drawings:
 - .1 All trapeze pipe hangers, metal framing systems, and fabricated equipment support designs require a detailed, job-specific drawing submittal labeled with equipment weights to the City of Winnipeg Representative for approval.

PART 2 - PRODUCTS

2.1 GENERAL INFORMATION

- .1 When a product is required to be listed, it must be listed by an approved agency. Approved listing agencies include:
 - .1 Underwriters Laboratory (UL) and affiliates (i.e. ULC)

2.2 PIPE HANGERS AND SUPPORTS

- .1 Hangers must meet one of the following:
 - .1 Be certified by a professional engineer licensed to practice in the jurisdiction of this project to meet the following criteria:
 - .1 Hangers shall be designed to support five (5) times the weight of the applicable water-filled pipe section plus 250 lbs (114 kg);
 - .2 Hangers shall be supported at points to adequately support the whole system;
 - .3 Hangers spacing shall not exceed the table in 3.5 Horizontal Pipe Support Spacing;
 - .4 Hanger components shall be ferrous (with dielectric break for copper); and
 - .5 Detailed calculations showing developed stresses in hangers, piping, and fittings with appropriate safety factors shall be available for submission upon request.
 - .2 Or, hangers shall meet all requirements in the remainder of the specification.
- .2 Trapeze hangers shall be designed to meet requirements in NFPA 13. Designs shall be submitted to the City of Winnipeg Representative for approval.
- .3 Hangers and components shall be ferrous (with dielectric break for copper), or

nonferrous if proven to be adequately reliable in fire and hazard environments. Proof shall be provided upon request.

- .4 U-hook hangers shall not be used for pipes over NPS 8. U-hook hangers shall be:
 - .1 5/16" (8 mm) diameter for pipes up to and including NPS 2
 - .2 3/8" (10 mm) diameter for pipes up to and including NPS 6
 - .3 1/2" (13 mm) diameter for pipes up to and including NPS 8
- .5 Eye rod hangers shall not be used for pipes over NPS 8. Eye rod hangers shall be:
 - .1 3/8" (10 mm) diameter for pipes up to and including NPS 4
 - .2 1/2" (13 mm) diameter for pipes up to and including NPS 6
 - .3 3/4" (19 mm) diameter for pipes up to and including NPS 8
- .6 Insulated pipe shall be supported with a hanger or support with a supporting diameter the same as the fully insulated pipe diameter with an included rigid insulation shield. The insulation shall not be compressed or otherwise have a reduction in insulating ability as a result of hanging or supporting the pipe.
- .7 Riser clamps that support risers with set screws are prohibited.

2.3 HANGER RODS

- .1 Unless otherwise indicated, hanger rods shall be zinc-plated steel, fully threaded rod.
- .2 Size based on the following diameter of hung pipe:
 - .1 For pipe up to and including 4" (100 mm), use 3/8" (10 mm) rod;
 - .2 For 5" (125 mm) to 9" (225 mm), use 1/2" (13 mm) rod;
 - .3 For 10" (250 mm) and 12" (300 mm), use 5/8" (16 mm) rod;
 - .4 For pipe over 12" (300 mm), use other type of supporting system.

2.4 CONCRETE INSERTS

- .1 Inserts shall be listed. Insert shall be a malleable iron case with a location-adjustable nut with a galvanized finish for threaded connection. Inserts shall have capability for lateral adjustment, a top slot for reinforcing rods, and lugs for attaching to forms. Insert internal threads to match hanger rod threads.

2.5 FLASHING

- .1 Metal flashing shall be 26 gage galvanized steel.
- .2 Metal counterflashing shall be 22 gage galvanized steel.
- .3 Caps shall be 22 gage steel for non-fire resistance rated separations and 16 gage steel for fire resistance rated separations.

2.6 SLEEVES AND SEALS

- .1 Exterior, underground wall penetrations:
 - .1 Schedule 40 steel pipe with welded wall collar embedded in concrete. Pipe and collar bituminous coated and lined.
 - .2 Hydrostatic pipe closure, "Link-Seal" or approved equal.
- .2 Exterior, aboveground wall penetrations:
 - .1 Concrete wall: Schedule 40 steel pipe with welded wall collar embedded in concrete. Pipe and collar bituminous coated and lined. Wall attached pipe clamp attached to interior face of exterior wall. Expanding foam between pipe and sleeve. Thermally broken and caulked escutcheons on exterior and interior face.
 - .2 Framed wall: 18 gage galvanized steel. Wall attached pipe clamp attached to interior face of exterior wall. Expanding foam between pipe and sleeve. Thermally broken and caulked escutcheons on exterior and interior face.
- .3 Interior, fire rated wall penetration:
 - .1 Concrete wall: Schedule 40 steel pipe with welded wall collar embedded in concrete. Pipe and collar bituminous coated and lined. Firestopping material as per section 07 84 00 between pipe and sleeve. 16 gage steel escutcheons on exposed faces of wall.
 - .2 Framed wall: 18 gage galvanized steel. Firestopping material as per section 07 84 00 between pipe and sleeve. 16 gage steel escutcheons on exposed faces of wall.
- .4 Interior, non-rated wall penetration:
 - .1 Concrete wall: Schedule 40 steel pipe with welded wall collar embedded in concrete. Pipe and collar bituminous coated and lined. Closed cell foam spray between pipe and sleeve. 16 gage steel escutcheons on exposed faces of wall.
 - .2 Framed wall: No sleeve required. 16 gage steel escutcheons on exposed faces of wall.
- .5 Floor penetration:
 - .1 Cored or drilled hole to be coordinated with City of Winnipeg Representative for reinforcement requirements. Firestopping material as per section 07 84 00. 2" (50 mm) high oversized schedule 40 steel pipe curb secured and caulked on finished floor. Riser clamp rests on curb. Material deviations may be accepted upon prior approval from the mechanical engineer. Submit in accordance with Section 01 33 00 – Submittal Procedures.

2.7 FORMED STEEL CHANNEL

- .1 Shall be manufactured by a member company of the Metal Framing Manufacturers Association.

2.8 EQUIPMENT BASES AND SUPPORTS

- .1 Structural carbon steel shapes, coated with corrosion prevention primer.
- .2 Material deviations may be accepted upon prior approval from the mechanical engineer. Submit in accordance with Section 01 33 00 – Submittal Procedures.

2.9 METAL FRAMING SYSTEMS

- .1 Shall be manufactured by a member company of the Metal Framing Manufacturers Association.

2.10 FASTENERS

- .1 Powder-actuated fasteners:
 - .1 Powder-actuated fasteners shall be listed.
 - .2 Fasteners shall include a threaded steel stud with pull out, tension and shear capacities appropriate for supported load and building structure material.
 - .3 Fasteners shall not be used to hang pipe greater than NPS 5.
- .2 Mechanical expansion anchors:
 - .1 Mechanical expansion anchors shall be listed.
 - .2 Insert wedge type, stainless steel anchors with pull out, tension and shear capacities appropriate for supported load and building structure material.
- .3 Through bolts for steel beams:
 - .1 For hanging pipe with a diameter up to and including 4" (100 mm):
 - .1 Through bolts (for use through the side of beams) shall be 3/8" diameter
 - .2 For hanging pipe with a diameter up to and including 8" (200 mm):
 - .1 Through bolts (for use through the side of beams) shall be 1/2" diameter
 - .3 For hanging pipe with a diameter up to and including 10" (250 mm):
 - .1 Through bolts (for use through the side of beams) shall be 5/8" diameter
 - .4 For hanging pipe with a diameter up to and including 12" (300 mm):
 - .1 Through bolts (for use through the side of beams) shall be 3/4" diameter
- .4 Fasteners for wood only:
 - .1 For hanging pipe with a diameter up to and including 2" (50 mm):
 - .1 Wood screws (for use with ceiling flanges) shall be #18 x 1.5"
 - .2 Wood drive screws (for use with U-hooks) shall be #16 x 2"
 - .3 Lag screws (for use with 2-hole ceiling flanges) shall be 5/16 x 1.5"
 - .4 Coach screw rod (axial loading only) shall be 3/8 x 3"

- .5 Lag screws or through bolt (for use on the side of beams) shall be 3/8 x 2.5"
- .2 For hanging pipe with a diameter from 2.5" (65 mm) to 3.5" (90 mm):
 - .1 Lag screws (for use with ceiling flanges) shall be 3/8 x 2"
 - .2 Lag screws (for use with U-hooks) shall be 3/8 x 2.5"
 - .3 Coach screw rod (axial loading only) shall be 3/8 x 3"
 - .4 Lag screws or through bolt (for use on the side of beams) shall be 1/2 x 3"
- .3 For hanging pipe with a diameter from 4" (100 mm) to 6" (150 mm):
 - .1 Lag screws (for use with ceiling flanges) shall be 1/2 x 2"
 - .2 Lag screws (for use with U-hooks) shall be 1/2 x 3"
 - .3 Lag screws or through bolt (for use on the side of beams) shall be 1/2 x 3"
- .4 For hanging pipe with a diameter of 8" (200 mm):
 - .1 Lag screws (for use with ceiling flanges) shall be 5/8 x 2"
 - .2 Lag screws (for use with U-hooks) shall be 5/8 x 3"
 - .3 Lag screws or through bolt (for use on the side of beams) shall be 5/8 x 3"

2.11 PIPE POSITIONING SYSTEMS

- .1 Shall be manufactured to IAPMO PS 42.

PART 3 - EXECUTION

3.1 QUALITY ASSURANCE

- .1 Installer qualified in performing work in this section shall have at least five (5) years successful experience in similar installations.
- .2 Products shall be installed per their listing requirements. Fire suppression Subcontractor shall make documentation available during inspections as needed.
- .3 Fabricated trapeze hangers, metal framing systems, and equipment support designs are to be submitted to the City of Winnipeg Representative for approval.

3.2 GENERAL INSTALLATION

- .1 Refer to Part 2 – Products for additional guidance on installing a product or an assembly of products for a particular application.
- .2 Non-system accessory piping shall be installed per MSS SP-58 and MSS SP-127 as required.

- .3 Install supports to secure equipment in place, prevent vibration, maintain grade and allow for expansion and contraction.
- .4 Piping shall be supported from structure in locations able to support five (5) times the weight of the applicable water-filled pipe section plus 250 lbs (114 kg).
 - .1 Exception: Listed, flexible sprinkle hose fittings no greater than 6 feet (1.8 m) in length and their anchoring systems do not need to meet this requirement.
 - .2 Exception: Branch line hangers attached to metal deck shall be permitted for support of 1" (25 mm) diameter pipe or smaller by using through bolts located at least 3/4" (20 mm) from the bottom of the vertical structural support of the metal deck.
- .5 Loading on a hanger rod shall be axial only.
 - .1 If a piping branch line is pitched 6/12 or greater, additional supporting shall be provided to restrict lateral movement and bending force on the hanger rod. A lateral sway brace or equivalent means of support shall be added to prevent lateral forces on the hanger rod.
- .6 Wire or perforated strap is not acceptable to use for hanging pipes or equipment.
- .7 Include expansion fittings and offsets as per Section 21 05 16 – Expansion Fittings and Loops for Fire-Suppression Piping.
- .8 Eye rod hangers shall be installed using lock washers and flat washers.
- .9 A hanger that supports branch piping located in the ceiling space which includes pendant sprinklers in the ceiling, shall also support the pipe from upward movement.
- .10 Vertical risers shall be supported at every floor level and every 12' (3.6 M) by riser clamps. Support shall not be to a wall via horizontally positioned hanger rods.
- .11 Risers shall include thrust bracing on the bottom horizontal-to-vertical elbow and top vertical-to-horizontal elbow.
- .12 Vertical sprigs over 48" (1.2 m) long shall be restrained against lateral movement.
- .13 Insulated pipe shall be supported with a hanger or support with a supporting diameter the same as the fully insulated pipe diameter with an included rigid insulation shield. The insulation shall not be compressed or otherwise have a reduction in insulating ability as a result of hanging or supporting the pipe.
- .14 Locate support adjacent to equipment. Prevent excessive stresses on piping and equipment connections.
- .15 Do not support piping or equipment from other piping or from equipment. Fire protection hangers shall only support fire protection piping or equipment.
- .16 For horizontally hung multiple pipe runs, use a trapeze support assembly.
- .17 On multiple pipe runs, allow minimum 1" (25 mm) clearance between finished (including insulation) pipes.

3.3 SPECIFIC INSTALLATION – FASTENERS

- .1 Fasten supports to building structural system (steel, concrete, wood) or cast-in-place inserts in concrete construction for new construction.

- .2 Concrete fasteners are acceptable when holding strength of finished concrete has been established. Cinder concrete and gypsum are not suitable for fasteners.
- .3 Powder-actuated fasteners for concrete shall be tested on site with a suitably representative sampling being subjected to the following:
 - .1 Fastener shall support 750 lb (341 kg) for hanging 2" (50 mm) or less diameter pipe;
 - .2 Fastener shall support 1000 lb (454 kg) for hanging 2.5" (65 mm) to 3.5" (90 mm) diameter pipe;
 - .3 Fastener shall support 1200 lb (545 kg) for hanging 4" (100 mm) to 5" (125 mm) diameter pipe.
- .4 Mechanical expansion anchors for concrete shall be installed into tight fitting holes horizontally into concrete beams above the beam centerline or above the bottom reinforcement rods. Alternatively, mechanical expansion anchors may be installed into tight fitting holes vertically into concrete if support spacing is every 10 feet (3 m) apart or less.
- .5 Screws installed horizontally into beams, or bolts installed horizontally through wood beams, shall not be less than 3" (75 mm) from the bottom of the beam for hanging main piping, or 2.5" (64 mm) from the bottom of the beam for hanging branch piping.
- .6 Pre-drill holes for lag screws and coach screw rods 1/8" (3.2 mm) less diameter than the maximum root diameter of the thread.
- .7 Holes for bolts through all beams shall be no greater than 1/16" (1.6 mm) larger diameter than the bolt diameter. Install bolts with flat washers and nut.

3.4 SPECIFIC INSTALLATION – PLASTIC PIPE

- .1 Plastic pipe sized 2" (50 mm) diameter and under may be supported using rigid PVC or PVC coated steel conduit fittings.
- .2 Ensure pipe will not be subject to abrasion by supports during expansion and contraction.

3.5 HORIZONTAL PIPE SUPPORT SPACING

- .1 Install supports within 12" (300 mm) of a horizontal fitting or sprinkler head.
 - .1 Exception: If sprinkler head-to-head spacing is less than 6 feet (1.8 m), then a support is not required within 12" (300 mm) of every fitting; spacing may be up 12 feet (3.7 m).
 - .2 Exception: If the piping is copper, the piping shall be supported in both vertical directions (against upward and downward movement) within 6" (150 mm) of the end of a branch fitting or pendant sprinkler head.
- .2 Install at least one support for every section of horizontal piping longer than 6 feet (1.8 m).
- .3 Hanger supports shall not be located with 3" (75 mm) of an upright sprinkler head.
- .4 Support horizontal straight sections of piping as follows, unless otherwise specified by a

particular product listing installation requirement:

Nominal Pipe Size	Maximum Distance Between Supports		
	<i>Steel (liquid)</i>	<i>Copper (liquid)</i>	<i>Plastic (liquid)</i>
<i>Pipe Material & Service -----></i>			
¾" (19mm)	N/A	8' (2.4m)	5'6" (1.7m)
1" (25mm)	12' (3.7m)	8' (2.4m)	6' (1.8m)
1¼" (32mm)	12' (3.7m)	10' (3.0m)	6'6" (2.0m)
1½" (39mm)	12' (3.7m)	10' (3.0m)	7' (2.1m)
2" (50mm)	12' (3.7m)	12' (3.7m)	8' (2.4m)
2½" (64mm)	12' (3.7m)	12' (3.7m)	9' (2.7m)
3" (75mm)	12' (3.7m)	12' (3.7m)	10' (3.0m)
4" (100mm)	15' (4.6m)	15' (4.6m)	N/A
6" (150mm)	15' (4.6m)	15' (4.6m)	N/A
8" (200mm)	15' (4.6m)	15' (4.6m)	N/A

- .5 Provide additional supports for concentrated loads such as valves, specialties and pipe fittings and every change in direction.

3.6 EQUIPMENT SUPPORTS

- .1 Generally, install as per manufacturer's requirements.
- .2 Generally, mount equipment such that movement during start and stop is less than 1/4" (6 mm). The intent is to reduce stresses applied to the equipment attachments (i.e. piping) to within a safe working range thereby eliminating potential damage.
- .3 Equipment support springs shall be statically loaded to 50% compression by weight of equipment. Include a 1/4" (6 mm) neoprene acoustic pad under each spring support.
- .4 Coordinate concrete base or inertia concrete block requirements for each piece of equipment with Contractor prior to installation. Concrete work and any associated structural reinforcement is by Contractor; vibration and acoustic isolation of equipment support is by mechanical Subcontractor.

3.7 PERFORMANCE VERIFICATION

- .1 Upon completion of piping installation, and before system operation, examine all fasteners, inserts and attachments for looseness, movement, or other factors that would reduce their ability to act at their rated capacity.
- .2 Examine all pipe hangers for movement before and after system operation. Reinforce any area of hanger movement.
- .3 Prior to system operation, examine spring supports for available movement. Loaded springs shall rest in a 50% compressed state.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

- .1 This section gives guidance on fire department connections.
- .2 Refer to specific fire suppression sections for further guidance.

1.2 RELATED SECTIONS

- .1 Section 21 05 00 – Common Work Results for Fire Suppression
- .2 Section 22 05 53 – Identification for Plumbing Piping and Equipment

1.3 REFERENCES

- .1 National Fire Protection Association (NFPA)
 - .1 NFPA 13 Standard for the Installation of Sprinkler Systems
 - .2 NFPA 14 Installation of Standpipe and Hose Systems
 - .3 NFPA 1963 Standard for Fire Hose Connections

1.4 CONTRACTOR RESPONSIBILITY

- .1 It is the fire suppression Subcontractor's responsibility to provide and install fire department connections that are the same size of the connected piping, and the type of service required.
- .2 It is the responsibility of the fire suppression Subcontractor to coordinate with other trades such that connection can be installed in a useable manner.
- .3 The fire suppression Subcontractor shall get approval for the exact, installed location from the local fire department representative prior to installation.

PART 2 - PRODUCTS

2.1 FIRE DEPARTMENT CONNECTION

- .1 The connection shall be a STORZ type, matching the connected piping size and local Fire Department requirement. The connection shall meet the requirements of NFPA 1963.
- .2 The connection shall include a tethered cap and identification provided by the connection supplier.

- .3 A listed check valve is required in the fire-department connection piping at least 4 feet (1.2 m) downstream of the building penetration/fire-department connection point. The check valve shall include an automatic drip drain.

PART 3 - EXECUTION

3.1 WHEN REQUIRED

- .1 A fire department connection is required for all buildings except:
 - .1 A single storey building less than 2000 sq.ft. (186 sq.m.), or
 - .2 When it is not required through permission of the local fire department.

3.2 INSTALLATION

- .1 Installation per NFPA 13 for sprinkler systems and NFPA 14 for standpipe systems.
- .2 Installation shall be the responsibility of a qualified journeyman.
- .3 Installation shall be in accordance with the manufacturer's documentation.
- .4 Installation of the fire departments connection shall be coordinated with the fire suppression Subcontractor and other trades so access and visual recognition of the fire department connection is easy and unencumbered. Ultimately, this is the responsibility of the fire suppression Subcontractor.
- .5 The piping check valve automatic drip drain shall connect indirectly over a sanitary drain.
- .6 Outdoor signage shall have at least 1" (25 mm) high characters, either raised or engraved, indicating:
 - .1 Portion of the building it serves,
 - .2 Type of service, and
 - .3 Pressure required (for area of greatest demand)
- .7 Label the piping immediately inside the wall of the fire department connection per Section 22 05 53.
- .8 Upon completion flush the fire department connection pipe from the building entry point to the check valve to remove debris and construction residue.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

- .1 All fire suppression work shall be considered a “Design-Build” component of this project. Work shall meet applicable code requirements, and also shall meet any additional requirements or instructions laid out in this specification that may deviate from, or go beyond minimum code requirements.
- .2 Unless otherwise required or not required, a standpipe shall be required for:
 - .1 Any building more than three (3) storeys or 14 meters (46 feet) high, as measured from grade to the uppermost ceiling level; or
 - .2 Any unsprinklered building of occupancy type defined in the National Building Code of Canada (NBC) with an area greater than indicated in the following table.

Occupancy Type	Building Area, sq.m. (sq.ft.)		
	One Storey	Two Storey	Three Storey
Group A	2500 (26910)	2000 (21528)	1500 (16146)
Group C	2000 (21528)	1500 (16146)	1000 (10764)
Group D	4000 (43056)	3000 (32292)	2000 (21528)
Group F, Div 2	1500 (16146)	1500 (16146)	1000 (10764)
Group F, Div 3	3000 (32292)	2000 (21528)	1000 (10764)

- .3 This section gives additional requirements for water-based fire suppression Class I, II, and III standpipes, including automatic wet or dry, semi-automatic, and combined systems as required.
- .4 This section does not include manual type standpipes that rely on the fire department connection as the only water source.
- .5 This section does not include protection of special hazards.
- .6 This section does not include sprinkler piping, or fire department connections.

1.2 RELATED SECTIONS

- .1 Section 01 33 00 – Submittal Procedures
- .2 Section 01 78 00 – Closeout Submittals
- .3 Section 07 84 00 – Firestopping
- .4 Section 21 05 00 – Common Work Results for Fire Suppression
- .5 Section 21 05 29 – Hangers and Supports for Fire-Suppression Piping and Equipment
- .6 Section 21 11 19 – Fire Department Connections
- .7 Section 22 05 53 – Identification for Plumbing Piping and Equipment

1.3 REFERENCES

- .1 American National Standards Institute (ANSI)/American Society of Mechanical Engineers International (ASME)
 - .1 ANSI/ASME B16.1 Cast Iron Pipe Flanges and Flanged Fittings
 - .2 ANSI/ASME B16.3 Malleable Iron Threaded Fittings
 - .3 ANSI/ASME B16.4 Cast Iron Threaded Fittings
 - .4 ANSI/ASME B16.5 Pipe Flanges and Flanged Fittings
 - .5 ANSI/ASME B16.9 Factory-Made Wrought Steel Butt-welding Fittings
 - .6 ANSI/ASME B16.11 Forged Fittings, Socket-Welding and Threaded
 - .7 ANSI/ASME B16.18 Cast Copper Alloy Solder Joint Pressure Fittings
 - .8 ANSI/ASME B16.22 Wrought Copper and Copper Alloy Solder Joint Pressure Fittings
 - .9 ANSI/ASME B16.24 Cast Copper Alloy Pipe Flanges and Flanged Fittings: Classes 150, 300, 600, 900, 1500 and 2500
 - .10 ANSI/ASME B16.25 Buttwelding Ends
- .2 American Society for Testing and Materials (ASTM International)
 - .1 ASTM A53 Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
 - .2 ASTM A234 Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service
 - .3 ASTM A795 Standard Specification for Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use
 - .4 ASTM B75 Standard Specification for Seamless Copper Tube
 - .5 ASTM B88 Standard Specification for Seamless Copper Water Tube
 - .6 ASTM B251 Standard Specification for General Requirements for Wrought Seamless Copper and Copper-Alloy Tube
- .3 American Water Works Association (AWWA)
 - .1 AWWA C104 Cement-Mortar Lining for Ductile-Iron Pipe and Fittings.
 - .2 AWWA C110 Ductile-Iron and Gray-Iron Fittings
 - .3 AWWA C115 Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges
 - .4 AWWA C151 Ductile-Iron Pipe, Centrifugally Cast
 - .5 AWWA C153 Ductile-Iron Compact Fittings for Water Service
- .4 American Welding Society (AWS)
 - .1 AWA A5.8 Specification for Filler Metals for Brazing and Braze Welding
- .5 Factory Mutual (FM)

- .1 Approval Guide
- .6 National Building Code of Canada (NBC)
- .7 National Fire Protection Association (NFPA)
 - .1 NFPA 13 Installation of Sprinkler Systems
 - .2 NFPA 14 Installation of Standpipe and Hose Systems
 - .3 NFPA 20 Standard for the Installation of Stationary Pumps for Fire Protection
 - .4 NFPA 24 Standard for the Installation of Private Fire Service Mains and Their Appurtenances.
 - .5 NFPA 25 Inspection, Testing, and Maintenance of Water-based Fire Protection Systems
 - .6 NFPA 1963 Fire Hose Connections
- .8 Underwriters' Laboratories (UL)
 - .1 Certification Directory: Fire Protection Systems
- .9 Underwriters' Laboratories of Canada (ULC)
 - .1 CAN/ULC S524 Installation of Fire Alarm Systems

1.4 SYSTEM DESCRIPTIONS

- .1 Automatic Wet Type:
 - .1 This type has constantly available and pressurized water at the hose connections from the source, and/or fire department connection.
- .2 Automatic Dry Type:
 - .1 This system has a constantly available and pressurized water source upstream of a closed dry-pipe valve, with pressurized air or nitrogen between this valve and the hose connection(s). Opening the hose connection releases the flow of pressurized water from the source, and/or fire department connection.
- .3 Semi-Automatic Dry Type:
 - .1 This system has a constantly available and pressurized water source upstream of a closed deluge valve (or similar triggering mechanism), with air between this valve and the hose connection(s). A remote control device is required to releases the flow of water from the source, and/or fire department connection.
- .4 Combined Type:
 - .1 This system uses a standpipe to supply both hose connections and sprinklers.
- .5 Manual Type:
 - .1 This system, wet or dry, is not permanently attached to a water source and must rely on pressurized water pumped into it via the fire department connection.
 - .2 This type of system is not allowed.
- .6 Class I:

- .1 Hose connections: 2.5" (65 mm) diameter with 100-175 psig (690-1200 kPa) residual pressure at connection.
- .2 Pipe diameter: NPS 4 or greater; NPS 6 or greater if part of a combined system
- .7 Class II:
 - .1 Hose connections: 1.5" (38 mm) diameter with 65-100 psig (450-690 kPa) residual pressure at connection.
- .8 Class III:
 - .1 Hose connections: Both 2.5" (65 mm) diameter with 100-175 psig (690-1200 kPa) residual pressure at connection; and 1.5" (38 mm) diameter with 65-100 psig (450-690 kPa) residual pressure at connection.
 - .2 Pipe diameter: NPS 4 or greater; NPS 6 or greater if part of a combined system

1.5 CONTRACTOR RESPONSIBILITY

- .1 Supply and install a complete and working standpipe system.
- .2 Adhere to the Contractor Requirements in 21 05 00 Common Work Results for Fire Suppression.
- .3 The fire suppression Subcontractor shall obtain approval-in-principle of design from the local fire department authority prior to developing design drawings. This includes approval of type of system, class of system, hose size and length capability, nozzle types, connection types, and existing pumper truck capabilities.
- .4 If there is incomplete supply water data listed in this specification, it will be the requirement of the fire suppression Subcontractor to undertake tests as required to the obtain information necessary to design the standpipe system.

1.6 EXISTING SUPPLY WATER DATA

- .1 The following supply water information has been made available to aid in the standpipe design.
 - .1 Location and elevation of test hydrant/location: N/A
 - .2 Static pressure: N/A
 - .3 Residual pressure: N/A
 - .4 Flow volume: N/A
 - .5 Date and time of test: N/A
 - .6 Contact information of tester: N/A
- .2 Where system design requires water pressure exceeding what is naturally available, a fire pump shall be installed to NFPA 20 requirements to provide adequate supply water pressure.

1.7 SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 – Submittal Procedures

- .2 Listed products shall be submitted as Shop Drawings.
- .3 In addition to the submittals required in Section 21 05 00, submit the following design submittal to the authority having jurisdiction for approval. A copy will be included in the closeout submittal package per Section 01 78 00 – Closeout Submittals.
- .4 Design Submittal:
 - .1 For NFPA 14 applications, the fire suppression Subcontractor shall submit the following items stamped by their fire suppression Engineer.
 - .1 Detailed plans of the standpipe / hose connection layout
 - .2 System summary sheet
 - .3 Hydraulic calculation detail sheets for each standpipe
 - .4 Graph sheet
 - .5 Other supporting documentation as required
 - .2 Each item of the design submittal shall contain details and/or calculations per NFPA 14.

PART 2 - PRODUCTS

2.1 GENERAL INFORMATION

- .1 All products (components or assemblies) are required to be listed by a listing agency approved by the authority having jurisdiction (AHJ) with the following exceptions:
 - .1 Above ground copper or steel piping manufactured to standards designated in this specification
 - .2 Joints and fittings for copper and steel piping manufactured to standards designated in this specification
 - .3 Hangers and fasteners permitted not to be listed for fire protection piping per NFPA 13
 - .4 Components that do not affect system performance (i.e. drain piping, drain valves, and signage)
- .2 Unless otherwise allowed by the authority having jurisdiction, listed products shall be certified to a standard listed in the UL Certification Directory: Fire Protection Systems, or the FM Approval Guide.
- .3 Products used must be suitable for the installation environment and design conditions. Suitable listed products shall be selected in accordance with all conditions, requirements, and limitations of their listing.
- .4 All standpipe components shall be rated for a minimum 175 psig (1200 kPa) working pressure. Standpipes designated as “high pressure” shall have all components rated for 250 psig (1725 kPa) working pressure.

2.2 PIPE / TUBE (ABOVE GROUND)

- .1 For All Applications:
 - .1 Copper
 - .1 Manufactured to ASTM B75, ASTM B88, or ASTM B251
 - .2 Wall thickness of Type K, Type L, or Type M
 - .3 Marked with manufacturer's name, model designation, or schedule on every pipe over 2 feet (610 mm)
 - .2 Iron
 - .1 Manufactured to AWWA C115 or AWWA C151
 - .2 Lined in accordance with AWWA C104
 - .3 Marked with manufacturer's name, model designation, or schedule on every pipe over 2 feet (610 mm)
 - .3 Steel
 - .1 Manufactured to ASTM A795 or ASTM A53
 - .2 Wall thickness (if welded or roll-grooved):
 - .1 Schedule 10 for 5" (125 mm) pipe or smaller
 - .2 0.134" (3.4 mm) for 6" (150 mm) pipe
 - .3 0.188" (4.8 mm) for 8" (200 mm) and 10" (250 mm) pipe
 - .3 Wall thickness (if threaded or cut-grooved):
 - .1 Schedule 40 for pipe less than 8" (200 mm)
 - .2 Schedule 30 for 8" (200 mm) pipe or larger
 - .4 Marked with manufacturer's name, model designation, or schedule on every pipe over 2 feet (610 mm)
 - .4 Other Listed Pipe / Tube
 - .1 Manufactured and listed for standpipe use
 - .2 Suitable for the installation environment
 - .3 Pre-approved by the fire suppression design Engineer

2.3 FIRE PROTECTION / STANDPIPES (BURIED)

- .1 Fire protection piping downstream of the main building entry point shall not be buried unless specifically approved by the fire suppression Engineer and Authority Having Jurisdiction. If approved, all piping, joints, fittings, and couplings shall be specifically listed for buried fire protection piping applications.

2.4 JOINTS AND FITTINGS

- .1 Joints and fittings shall be pressure rated to exceed the maximum design water

pressure.

- .2 Joints and fittings shall be materially compatible with the pipe/tube, and shall be within the same category (i.e. ferrous metal, non-ferrous metal) as the pipe/tube. For example, copper (non-ferrous) fittings shall not be used with steel (ferrous) piping; or vice-versa.
- .3 Copper:
 - .1 Fittings shall be manufactured to ASME B16.18 or ASME B16.22 for pressure applications; or otherwise be listed by an approved agency for use in this application.
 - .2 Brazing material shall meet AWA A5.8, a copper-phosphorus alloy (BCuP) for general-duty brazing.
 - .3 Flanges and flanged fittings shall be Class 150 and manufactured to ASME B16.24.
 - .4 Threaded joints and fittings shall NOT be used unless prior approval is granted.
 - .1 Exception: Threaded hose connections are acceptable.
- .4 Steel:
 - .1 Fittings shall be manufactured to ASME B16.1, ASME B16.3, ASME B16.4, ASME B16.5, ASME B16.9, ASME B16.11, ASTM A234, AWWA C110, or AWWA C153; or otherwise be listed by an approved agency for use in this application.
 - .2 Listed fittings / couplings for grooved piping shall match with the listing of the gasket and groove characteristics.
 - .3 Fittings / couplings used for dry pipe, pre-action, or deluge systems shall be listed for dry pipe service. Galvanized fittings / couplings are not required unless the environment is such to require them.
- .5 Other Listed Fittings
 - .1 Manufactured and listed for fire protection standpipe use
 - .2 Suitable for the installation environment
 - .3 Pre-approved by the fire suppression design Engineer

2.5 VALVES AND SIGNAGE

- .1 All system performance valves shall be listed by an approved agency for use in each application.
- .2 Valves that do not affect system performance (i.e drain valves and test valves) are not required to be listed, but shall be suitable for the environment and conditions.
- .3 Control valves shall have the ability to be supervised per the design of the supervisory system.
- .4 All pressure-reducing valves shall include a listed pressure relief valve immediately downstream or integral to the pressure-reducing valve.
 - .1 Supervision/monitoring capability shall be included to warn of a high pressure situation.
- .5 All valves shall be identified by permanent, weatherproof, metal or plastic signage.

Signage shall be either a tag mounted at the valve via a chain, or permanently fixed in very close proximity to the valve such that there is no doubt which valve it refers to. Signage shall indicate the valve purpose, area it serves (if control valve), and reference to any other valves required to be operated / closed in order to perform work in each zone.

- .1 The signage at the water supply control valve serving automatic and semi-automatic standpipe systems shall also identify the basis of design (hydraulic calculation, or pipe schedule); the location, residual pressures, and flow rates for the two most remote hose connections hydraulically speaking; and the flow rates and residual pressures required by design at the valve, fire pump (if installed), and all fire department connections.

2.6 HANGERS AND SUPPORTS

- .1 Refer to Section 21 05 29 Hangers and Supports for Fire-Suppression Piping and Equipment for guidance and requirements.

2.7 HOSE STATIONS

- .1 Hose station locations shall be clearly indicated. Cabinets shall be marked to indicate the contents. Hose station shall be marked "Fire Hose for Use by Trained Personnel" and include operating instructions.
- .2 Cabinet:
 - .1 Door shall open fully and be out of the way, such that any means of egress where the cabinet is located are not affected.
- .3 Hose:
 - .1 Maximum 100 feet (30 m) of 1.5" (38 mm) hose, equipped ready for use.
 - .2 Hose and mounting rack shall be listed.
- .4 Nozzle:
 - .1 Nozzles for Class II service shall be listed.

2.8 HOSE CONNECTIONS

- .1 Hose connection valves shall be listed.
- .2 Threads of connections shall meet NFPA 1963 and be protected from damage, unless otherwise directed by the local fire department authority.

2.9 PRESSURE GAUGES

- .1 Gauges shall be listed.
- .2 Size:
 - .1 3.5" (90 mm) or 4.5" (115 mm) diameter indicator
- .3 Indicator:

- .1 Dial / needle type; digital or LED indicators are not accepted
- .2 Range shall be 0 - 300 psig (0 - 2070 kPa)
- .4 Labeling:
 - .1 Gauge shall be labeled with fluid type (water and/or air)
- .5 Accessories:
 - .1 Provision for draining
 - .2 Isolation valve

2.10 FIRE PUMPS (IF REQUIRED)

- .1 Fire pumps shall be listed and sized for system pressure and flow demand.

2.11 DRY TYPE SYSTEMS (IF REQUIRED)

- .1 Automatic Dry Type:
 - .1 An automatic air maintenance device is required and shall be listed by an approved agency for use in this application.
 - .1 Exception: If the required air compressor supply capacity is less than 5.5 cfm (156 L/min) at 10 psig (0.7 bar), then an automatic maintenance device is not required.

PART 3 - EXECUTION

3.1 INSTALLATION – GENERAL INFORMATION

- .1 Design piping and equipment flow rates to meet NFPA 14 at the required pressure.
- .2 Follow installation requirements found in the appropriate NFPA standards.
- .3 Follow any additional requirements specified in this specification.
- .4 Listed products shall be used in accordance with all conditions, requirements, and limitations of their listing. They must be suitable for the installation environment and design conditions.
- .5 Heat tracing as protection against fluid freezing is prohibited unless approved by the responsible fire suppression Engineer. If heat tracing is allowed, it shall be supervised.
- .6 Coordinate with the electrical/fire alarm Subcontractor for installation of supervised devices. Installation to meet CAN/ULC S524.

3.2 PIPE / TUBE (ABOVE GROUND)

- .1 Threading shall only be allowed in schedule 40 or thicker steel pipe.
- .2 Pipe bending is prohibited. Bending may be permitted only upon approval from the

responsible fire-suppression engineer.

- .3 Install a pressure gauge at the top of every standpipe.
- .4 Standpipe piping shall be installed with a means to drain and test.
 - .1 Standpipe auxiliary drains shall be designed to meet the requirements of NFPA 13.
 - .2 Standpipe test connections shall be located to permit flow tests of water supply connections.
 - .3 Main and auxiliary drains shall be sized as follows:
 - .1 For 2" (50 mm) and under standpipe: 3/4" (20 mm) drain or larger
 - .2 For 3.5" (90 mm) and under standpipe: 1 1/4" (32 mm) drain or larger
 - .3 For 4" (100 mm) and larger standpipe: 2" (50 mm)
 - .4 For NPS 3/4 drain connections, drain shall terminate indirectly above a 4" (100 mm) sanitary hub or funnel drain. For larger sized drain connections, drain shall terminate outdoors where water discharge will not cause a problem during flow tests. Coordinate with plumbing Subcontractor and Contractor to meet this requirement.
- .5 Drains and any other piping that terminate to the outdoors shall have at least 4 feet (1.2 m) of exposed pipe on the warm side of the exterior wall. No valves, specialties or accessories shall be in this length of pipe.
- .6 Affix applicable labels with directional arrows in accordance with Section 22 05 53 – Identification for Plumbing Piping and Equipment. Standpipes are considered "Fire Connections".

3.3 FIRE PROTECTION / STANDPIPES (BURIED)

- .1 Fire protection piping downstream of the main building entry point shall not be buried unless specifically approved by the fire suppression Engineer and Authority Having Jurisdiction. If approved, all piping, joints, fittings, and couplings shall be specifically listed and installed for buried fire protection piping applications per NFPA 24.

3.4 JOINTS AND FITTINGS

- .1 Threaded connections shall only be allowed in schedule 40 or thicker steel pipe.
- .2 Welded connections and procedures shall meet the requirements of NFPA 14. Buttwelding ends shall meet ASME B16.25.
- .3 Grooved pipe connections shall meet listing requirements of the fitting pertaining to the groove characteristics, gasket, and coupling.
- .4 Joints in copper piping shall be brazed. Brazing fluxes, if used, shall not be highly corrosive.
- .5 Changes in pipe size shall be accomplished by a one-piece reducing fitting.

3.5 VALVES AND SIGNAGE

- .1 All valves shall be visible or clearly located by signage, and accessible for operation and maintenance. It is the responsibility of the fire suppression Subcontractor to coordinate with other trades to allow for this accessibility.
- .2 Install an isolation valve on each riser to isolate that riser while the remaining standpipes and water supply are operational without interruption.
- .3 Install an indicating valve at the riser for each branch serving a hose station.
- .4 For combined systems, each connection from the standpipe to the sprinkler system shall include a control valve and check valve.
- .5 Control valves:
 - .1 Install a listed indicating valve to control all automatic sources of water supply, except fire department connections shall have no control valves apart from check valves.
 - .2 All controlling valves downstream of the building entry point and upstream of hose connections shall be supervised per NFPA 14.
- .6 Pressure-reducing valves:
 - .1 Install a pressure-reducing valve when required so that the maximum working pressures of all components at working temperature, or any hose connection pressure limits as indicated by class designation, are not exceeded. Supervision/monitoring of this valve shall warn of a high pressure situation.
 - .2 Install a normally closed, bypass around each pressure-reducing valve for isolation and repair.
 - .3 Pressure-reducing valves shall be accessible and installed no higher than 7.5 feet (2.3 m) above floor level.
 - .4 All pressure-reducing valves shall be located adjacent to a suitable drain riser/pipe sized to handle the full flow through the valve (not less than the outlet size of the valve, and not less than NPS 3).
 - .5 Where a pressure-reducing valve is required, install pressure gauges on both the inlet and outlet side of the valve.

3.6 HANGERS AND SUPPORTS

- .1 Refer to Section 21 05 29 Hangers and Supports for Fire-Suppression Piping and Equipment for guidance and requirements.

3.7 HOSE STATIONS

- .1 Hose stations shall be installed in buildings, or portions thereof, required to have standpipes, but are not sprinklered.
- .2 Hose stations shall be located within 5 m (16.5 feet) of exits, and other locations as required to provide coverage throughout. One hose station shall be located at each end of a horizontal exit, as defined in the NBC.

3.8 HOSE CONNECTIONS

- .1 Hose connections shall be at a height between 3-5 feet (1-1.5 m) above the floor.
- .2 Hose connections shall be located in exits. Locate per NFPA 14.
- .3 Clearance shall be such to allow the use of a standard fire department hose key.
- .4 The uppermost hose connection is allowed to have residual water pressure less than 100 psig (690 kPa) if:
 - .1 The building is sprinklered throughout,
 - .2 The design flow rate and pressure demand of the sprinkler system, including inside and outside hose allowances, can be met without the use of a fire pump, and
 - .3 The fire department can provide adequate pressure under full demand through the fire department connection such that the residual pressure at the uppermost hose connection is 100 psig (690 kPa).
- .5 Standpipes shall be Class I or Class III.
 - .1 Exception: Class II standpipes are allowed in buildings less than 25 m (82 feet) in height as measured from grade to the uppermost ceiling; and the building is not sprinklered. Class II standpipe use requires approval from the local fire department authority prior to design.

3.9 FIRE PUMPS (IF REQUIRED)

- .1 Fire pumps shall be installed per manufacturers and listing documentation.
- .2 Clearly visible signage shall indicate the minimum pressure and flow required at the discharge flange to meet system demand.

3.10 DRY TYPE SYSTEMS (IF REQUIRED)

- .1 Automatic Dry Type:
 - .1 The total system volume on the dry side shall not be more than 750 gal (2839 L) unless it can be shown that full pressure water delivery to the most remote hose connection is under three (3) minutes as measured by NFPA 14.
 - .2 Install listed pressure gauges on either side of the dry-pipe valve, at any air source (air pumps, receivers, air maintenance devices), and in any air piping from a remote air source to the dry side system.
 - .3 From the air supply source, install a relief valve (set to >10 psig (0.7 bar) above the system design pressure, but less than the valve rating pressure), then a renewable disc shutoff valve, then a check valve prior to the dry-pipe maintenance device.
 - .4 Do not install check valves or dry-pipe valves in unconditioned or freezing spaces.

- .5 Pressure test the dry-pipe system with air (40 psig (2.8 bar) for 24 hours). Correct any leakages and re-test until less than 1.5 psig (0.1 bar) is lost in 24 hours.
- .2 Semi-Automatic Dry Type:
 - .1 A listed remote control activation device shall be provided within 3 feet (1 m) of each hose connection in a location that is visible and clearly marked.
 - .2 Control devices shall be supervised per CAN/ULC S524.
 - .3 Install listed pressure gauges above and below the preaction valve, below a deluge valve, and any air supplies to preaction or deluge valves.
 - .4 The automatic water control valve shall be provided with operation means (hydraulic, pneumatic, or mechanical) that is independent of the remote control device.
 - .5 Do not install valves in unconditioned or freezing spaces.
 - .6 Semi-automatic dry type systems shall be either single interlocked, or double interlocked as defined by NFPA 14. Non-interlocked systems are not allowed.

3.11 PERFORMANCE VERIFICATION

- .1 All new systems shall be tested with test certificates completed and accepted prior to occupancy. Refer to NFPA 14 and NFPA 25 for further guidance.
- .2 Hydrostatic Testing:
 - .1 Hydrostatic test water shall be clean and have similar properties as the system water.
 - .2 Hydrostatically test all piping to at least 200 psig (13.8 bar), or 50 psig (3.5 bar) over the system working pressure, whichever is greater. Test pressure shall be available at the low elevation point of the system zone tested.
 - .3 Record the system pressure at the top of the system riser gauge(s).
 - .4 Hydrostatic test pressure shall be held for two (2) hours. No leakage is allowed unless permitted per NFPA 24.
 - .5 Additives to the test water are prohibited. This includes leak-stopping additives.
 - .6 If the pipe environment is below freezing and will likely cause the test water to freeze, an air pressure test is permitted and shall be conducted with the following requirements:
 - .1 Air test pressure shall be 40 psig (2.8 bar) for a duration of 24 hours.
 - .2 The system shall be acceptable if leakage is less than 1.5 psig (10.3 kPa) in 24 hours, otherwise correct any leaks and re-test.
- .3 Flow Testing:
 - .1 Testing shall be conducted by flowing water simultaneously at the outlet(s) indicated in the hydraulic calculations.
 - .2 Ensure pressure-reducing valves are functioning per design by recording static and residual inlet and outlet pressures, and flow rate on the test certificate.

- .3 Test the main drain valve by opening and waiting for the system pressure to stabilize. Record the static and residual pressure on the test certificate.
- .4 For dry and semi-automatic systems, test the flow at the most remote hose connection. Flow shall be 250 gpm (946 L/min) within three (3) minutes. Verify operation of each remote activation device per the manufacturer's documentation.
- .4 Dry and Semi-Automatic Air System Testing:
 - .1 Air test pressure shall be 40 psig (2.8 bar) for a duration of 24 hours.
 - .2 The system shall be acceptable if leakage is less than 1.5 psig (10.3 kPa) in 24 hours, otherwise correct any leaks and re-test.
- .5 Manual Valves:
 - .1 Operate all manual valves throughout their full range of motion and set to the finished position.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

- .1 All fire suppression work shall be considered a “Design-Build” component of this project. Work shall meet applicable code requirements, and also shall meet any additional requirements or instructions laid out in this specification that may deviate from, or go beyond minimum code requirements.
- .2 This section gives additional requirements for water-based fire suppression sprinkler systems, including wet-pipe, dry-pipe, preaction, deluge, and glycol (antifreeze) as required.
- .3 This section does not include protection of special hazards using high speed fixed spray, foam-water, water misting, or water as an additive.
- .4 This section does not include standpipes, or fire department connections.

1.2 RELATED SECTIONS

- .1 Section 01 33 00 – Submittal Procedures
- .2 Section 01 78 00 – Closeout Submittals
- .3 Section 07 84 00 – Firestopping
- .4 Section 09 91 00 – Interior Painting
- .5 Section 21 05 00 – Common Work Results for Fire Suppression
- .6 Section 21 05 29 – Hangers and Supports for Fire-Suppression Piping and Equipment
- .7 Section 22 05 53 – Identification for Plumbing Piping and Equipment

1.3 REFERENCES

- .1 American National Standards Institute (ANSI)/American Society of Mechanical Engineers International (ASME)
 - .1 ANSI/ASME B16.1 Cast Iron Pipe Flanges and Flanged Fittings
 - .2 ANSI/ASME B16.3 Malleable Iron Threaded Fittings
 - .3 ANSI/ASME B16.4 Cast Iron Threaded Fittings
 - .4 ANSI/ASME B16.5 Pipe Flanges and Flanged Fittings
 - .5 ANSI/ASME B16.9 Factory-Made Wrought Steel Butt-welding Fittings
 - .6 ANSI/ASME B16.18 Cast Copper Alloy Solder Joint Pressure Fittings
 - .7 ANSI/ASME B16.22 Wrought Copper and Copper Alloy Solder Joint Pressure Fittings

- .2 American Society for Testing and Materials (ASTM International)
 - .1 ASTM A53 Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
 - .2 ASTM A234 Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service
 - .3 ASTM A795 Standard Specification for Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use
 - .4 ASTM B32 Standard Specification for Solder Metal
 - .5 ASTM B75 Standard Specification for Seamless Copper Tube
 - .6 ASTM B88 Standard Specification for Seamless Copper Water Tube
 - .7 ASTM B251 Standard Specification for General Requirements for Wrought Seamless Copper and Copper-Alloy Tube
 - .8 ASTM B813 Standard Specification for Liquid and Paste Fluxes for Soldering of Copper and Copper Alloy Tube
 - .9 ASTM F438 Standard Specification for Socket-Type Chlorinated Poly(Vinyl Chloride) (CPVC) plastic Pipe Fittings, Schedule 40
 - .10 ASTM F439 Standard Specification for Socket-Type Chlorinated Poly(Vinyl Chloride) (CPVC) plastic Pipe Fittings, Schedule 80
 - .11 ASTM F442 Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe (SDR-PR)
- .3 National Fire Protection Association (NFPA)
 - .1 NFPA 13 Installation of Sprinkler Systems
 - .2 NFPA 13R Standard for the Installation of Sprinkler Systems in Residential Occupancies up to and Including Four Stories in Height
 - .3 NFPA 20 Standard for the Installation of Stationary Pumps for Fire Protection
 - .4 NFPA 25 Inspection, Testing, and Maintenance of Water-based Fire Protection Systems
- .4 Underwriters' Laboratories of Canada (ULC)
 - .1 CAN/ULC S102.2 Surface Burning Characteristics of Flooring, Floor Covering and Miscellaneous Materials
 - .2 CAN/ULC S524 Installation of Fire Alarm Systems

1.4 CONTRACTOR RESPONSIBILITY

- .1 Adhere to the Contractor Requirements in 21 05 00 Common Work Results for Fire Suppression.
- .2 The fire suppression Subcontractor and their hired fire suppression Engineer shall be aware of, and design for, any special hazards uniquely identified and addressed under NFPA 13 or other NFPA standards.
- .3 If there is incomplete supply water data listed in this specification, it will be the

requirement of the fire suppression Subcontractor to undertake tests as required to the obtain information necessary to design the sprinkler system.

1.5 EXISTING SUPPLY WATER DATA

- .1 The following supply water information has been made available to aid in the sprinkler design.
 - .1 Location and elevation of test hydrant/location: N/A
 - .2 Static pressure: N/A
 - .3 Residual pressure: N/A
 - .4 Flow volume: N/A
 - .5 Date and time of test: N/A
 - .6 Contact information of tester: N/A
- .2 Where system design requires water pressure exceeding what is naturally available, a fire pump shall be installed to NFPA 20 requirements to provide adequate supply water pressure.

1.6 SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 – Submittal Procedures
- .2 Listed products shall be submitted as Shop Drawings.
- .3 In addition to the submittals required in Section 21 05 00, submit the following design submittal to the authority having jurisdiction for approval. A copy will be included in the closeout submittal package per Section 01 78 00 – Closeout Submittals.
- .4 Design Submittal:
 - .1 For NFPA 13 applications, the fire suppression Subcontractor shall submit the following items stamped by their hired fire suppression Engineer.
 - .1 Detailed plans of the sprinkler and piping layout
 - .2 System summary sheet
 - .3 Hydraulic calculation detail sheets for the worst pressure zone and any special hazard areas (calculation detail sheets for all zones shall be available and included upon request)
 - .4 Graph sheet
 - .5 Other supporting documentation as required
 - .2 For NFPA 13R applications, the fire suppression Subcontractor shall submit the following items stamped by their hired fire suppression Engineer.
 - .1 Sprinkler and piping layout
 - .2 Other supporting documentation as required

PART 2 - PRODUCTS

2.1 GENERAL INFORMATION

- .1 All products (components or assemblies) are required to be listed by a listing agency approved by the authority having jurisdiction (AHJ) with the following exceptions:
 - .1 Above ground copper or steel piping manufactured to standards designated in this specification
 - .2 Joints and fittings for copper and steel piping manufactured to standards designated in this specification
 - .3 Hangers and fasteners permitted not to be listed per NFPA 13
 - .4 Components that do not affect system performance (i.e. drain piping, drain valves, and signage)
- .2 Products used must be suitable for the installation environment and design conditions. Suitable listed products shall be selected in accordance with all conditions, requirements, and limitations of their listing.

2.2 FIRE PROTECTION / SPRINKLER PIPING (ABOVE GROUND)

- .1 For Light Hazard Occupancies:
 - .1 Steel
 - .1 Manufactured to ASTM A795 or ASTM A53
 - .2 Wall thickness (if welded or roll-grooved):
 - .1 Schedule 10 for 5" (125 mm) pipe or smaller
 - .2 0.134" (3.4 mm) for 6" (150 mm) pipe
 - .3 0.188" (4.8 mm) for 8" (200 mm) and 10" (250 mm) pipe
 - .4 0.330" (8.4 mm) for 12" (300 mm) pipe
 - .3 Wall thickness (if threaded or cut-grooved):
 - .1 Schedule 40 for pipe less than 8" (200 mm)
 - .2 Schedule 30 for 8" (200 mm) pipe or larger
 - .4 Pipe used in dry-pipe or preaction systems shall be internally galvanized.
 - .5 Marked with manufacturer's name, model designation, or schedule on every pipe over 2 feet (610 mm)
- .2 For All Other Hazard Occupancies:
 - .1 Unless prior approval is granted by the authority having jurisdiction (AHJ) to use another listed pipe or tube, the piping shall be steel.
 - .1 Manufactured to ASTM A795 or ASTM A53
 - .2 Wall thickness (if welded or roll-grooved):

- .1 Schedule 10 for 5" (125 mm) pipe or smaller
- .2 0.134" (3.4 mm) for 6" (150 mm) pipe
- .3 0.188" (4.8 mm) for 8" (200 mm) and 10" (250 mm) pipe
- .4 0.330" (8.4 mm) for 12" (300 mm) pipe
- .3 Wall thickness (if threaded or cut-grooved):
 - .1 Schedule 40 for pipe less than 8" (200 mm)
 - .2 Schedule 30 for 8" (200 mm) pipe or larger
- .4 Pipe used in dry-pipe or preaction systems shall be internally galvanized.
- .5 Identifiably marked with manufacturer's name, model designation, or schedule on every pipe section over 2 feet (610 mm) in length.

2.3 FIRE PROTECTION / SPRINKLER PIPING (BURIED)

- .1 Fire protection piping downstream of the main building entry point shall not be buried unless specifically approved by the City of Winnipeg Representative and Authority Having Jurisdiction. If approved, all piping, joints, fittings, and couplings shall be specifically listed for buried fire protection piping applications.

2.4 JOINTS AND FITTINGS

- .1 Joints and fittings shall be materially compatible with the pipe/tube, and shall be within the same category (i.e. ferrous metal, non-ferrous metal, or plastic) as the pipe/tube. For example, CPVC (plastic) fittings shall not be used with steel (ferrous) piping; or copper (non-ferrous) fittings shall not be used with CPVC (plastic) piping.
- .2 Steel:
 - .1 Fittings shall be manufactured to ASME B16.1, ASME B16.3, ASME B16.4, ASME B16.5, ASME B16.9, or ASTM A234; or otherwise be listed by an approved agency for use in this application.
 - .2 Listed fittings / couplings for grooved piping shall match with the listing of the gasket and groove characteristics.
 - .3 Fittings / couplings used for dry pipe, pre-action, or deluge systems shall be listed for dry pipe service. Galvanized fittings / couplings are not required unless the environment is such to require them.

2.5 SPRINKLER HEADS

- .1 All sprinkler heads shall be listed by an approved agency for use in each application.
- .2 Sprinkler heads within conditioned space but within 10 feet (3 m) of an exterior opening (door, operable window, or ductless opening) shall be a freeze-protected type. This requirement extends beyond 10 feet (3 m) for environments where there is a reasonable possibility of the sprinkler head freezing.
- .3 A minimum of two (2) spare sprinkler heads of every type and temperature rating installed shall be included in a cabinet on site. The cabinet shall include a list per of

each type installed per NFPA 13. Include a suitable sprinkler head wrench within the cabinet. A minimum total number of replacement heads shall be stored on site in this cabinet as follows:

- .1 Minimum six (6) replacement heads for < 300 heads installed
- .2 Minimum twelve (12) replacement heads for 300 – 1000 heads installed
- .3 Minimum twenty-four (24) replacement heads for > 1000 heads installed

2.6 VALVES

- .1 All system performance valves shall be listed by an approved agency for use in each application.
- .2 Valves that do not affect system performance (i.e drain valves and test valves) are not required to be listed, but shall be suitable for the environment and conditions.
- .3 Control valves shall have the ability to be supervised per the design of the supervisory system.
- .4 A pressure relief valve rated at 175 psig (12.1 bar), or 10 psig (0.7 bar) over maximum system pressure (whichever is greater), shall be provided on wet pipe systems.
- .5 All valves shall be identified by permanent, weatherproof, metal or plastic signage. Signage shall be either a tag mounted at the valve via a chain, or permanently fixed in very close proximity to the valve such that there is no doubt which valve it refers to. Signage shall indicate the valve purpose, area it serves (if control valve), and reference to any other valves required to be operated / closed in order to perform work in each zone.

2.7 HANGERS AND SUPPORTS

- .1 Refer to Section 21 05 29 Hangers and Supports for Fire-Suppression Piping and Equipment for guidance and requirements.

2.8 DRY-PIPE SYSTEMS (IF REQUIRED)

- .1 Compressed air/nitrogen piping from the source to the dry pipe valve shall be no less than NPS 1/2.
- .2 Compressed nitrogen supply sources (if used) shall include a pressure regulator upstream of the dry-pipe air supply connection.
- .3 An automatic air maintenance device is required and shall be listed by an approved agency for use in this application.
 - .1 Exception: If the required air compressor supply capacity is less than 5.5 cfm (156 L/min) at 10 psig (0.7 bar), then an automatic maintenance device is not required.

2.9 OUTDOOR / UNCONDITIONED SPACE SPRINKLERS (IF REQUIRED)

- .1 Pipe and fittings outdoors or in any unconditioned space shall be corrosion resistant.

The type of corrosion resistance shall be approved by the fire protection Engineer prior product use and must be suitable for the pipe environment.

PART 3 - EXECUTION

3.1 INSTALLATION – GENERAL INFORMATION

- .1 Follow installation requirements found in the appropriate NFPA standards.
- .2 Follow any additional requirements specified in this specification.
- .3 Listed products shall be used in accordance with all conditions, requirements, and limitations of their listing. They must be suitable for the installation environment and design conditions.
- .4 Install listed pressure gauges in locations, and per instructions in NFPA 13.
- .5 Heat tracing as protection against fluid freezing is prohibited unless approved by the responsible fire suppression Engineer. If heat tracing is allowed, it shall be supervised.
- .6 Coordinate with the electrical/fire alarm Subcontractor for installation of supervised devices. Installation to meet CAN/ULC S524.

3.2 FIRE PROTECTION / SPRINKLER PIPING (ABOVE GROUND)

- .1 Threading shall only be allowed in schedule 40 or thicker steel pipe.
- .2 Pipe bending is prohibited. Bending may be permitted only upon approval from the responsible fire-suppression Engineer.
- .3 For NPS 3/4 drain connections, drain shall terminate indirectly above a 4" (100 mm) sanitary hub or funnel drain. For larger sized drain connections, drain shall terminate outdoors where water discharge will not cause a problem during flow tests. Coordinate with plumbing Subcontractor and Contractor to meet this requirement.
- .4 Drains and any other piping that terminate to the outdoors shall have at least 4 feet (1.2 m) of exposed pipe on the warm side of the exterior wall. No valves, specialties or accessories shall be in this length of pipe.
- .5 Affix applicable labels with directional arrows in accordance with Section 22 05 53 – Identification for Plumbing Piping and Equipment.

3.3 FIRE PROTECTION / SPRINKLER PIPING (BURIED)

- .1 Fire protection piping downstream of the main building entry point shall not be buried unless specifically approved by the fire suppression Engineer and Authority Having Jurisdiction. If approved, all piping, joints, fittings, and couplings shall be specifically listed and installed for buried fire protection piping applications.

3.4 JOINTS AND FITTINGS

- .1 Threaded connections shall only be allowed in schedule 40 or thicker steel pipe.
- .2 Welded connections and procedures shall meet the requirements of NFPA 13.
- .3 Grooved pipe connections shall meet listing requirements of the fitting pertaining to the groove characteristics, gasket, and coupling.
- .4 Solder connections shall meet the requirements of NFPA 13.

3.5 SPRINKLER HEADS

- .1 Install ordinary-, intermediate-, or high-temperature sprinkler heads as required by NFPA 13 to be within locations or distances from heat sources and potential heat sources.
- .2 Install freeze-protected sprinkler heads within conditioned space but within 10 feet (3 m) of an exterior opening (door, operable window, or ductless opening). This requirement extends beyond 10 feet (3 m) for environments where there is a reasonable possibility of the sprinkler head freezing.
- .3 The fire suppression Subcontractor and/or their hired fire suppression Engineer shall inquire from the City of Winnipeg and understand to a reasonable degree any storage areas that require sprinkler head clearances.

3.6 VALVES

- .1 All valves shall be visible or clearly located by signage, and accessible for operation and maintenance. It is the responsibility of the fire suppression Subcontractor to coordinate with other trades to allow for this accessibility.
- .2 Alarm, dry-pipe, preaction, and deluge valves shall be fitted with an alarm bypass test connection for an electric alarm switch located on the supply side of the valve.
 - .1 Exception: The alarm bypass test connection for alarm valves at the riser may be on the system side of the alarm valve.
- .3 Control valves:
 - .1 Install a listed indicating valve to control all automatic sources of water supply, except fire department connections shall have no control valves apart from check valves.
 - .2 All controlling valves on the water supply system downstream of the building entry point shall be supervised per NFPA 13.
- .4 Pressure-reducing valves:
 - .1 Where a pressure reducing valve is required to either limit a normal water supply to 175 psig (12.1 bar), or to reduce pressure for a listed device rated below 175 psig (12.1 bar), the following must be installed;
 - .1 Pressure gauges on both the inlet and outlet side of the pressure-reducing valve,
 - .2 A pressure relief valve set to 175 psig (12.1 bar) shall be installed at the outlet side of the pressure-reducing valve, and

- .3 A control valve (external or internal to the pressure-reducing valve) shall be located on the inlet side.
- .2 Means shall be provided downstream of pressure-reducing valves for flow tests at sprinkler system demand.

3.7 HANGERS AND SUPPORTS

- .1 Refer to Section 21 05 29 Hangers and Supports for Fire-Suppression Piping and Equipment for guidance and requirements.

3.8 DRY-PIPE SYSTEMS (IF REQUIRED)

- .1 Slope piping toward drain(s) at 1/2" per 10 feet (4 mm/m) for branch lines, and 1/4" per 10 feet (2 mm/m) for main lines.
- .2 Signage at the dry-pipe valve shall show number and location of dry-pipe drains.
- .3 Install a check valve between the intermediate chamber of the dry-pipe valve and the water flow alarm device to prevent flow from the bypass test connection entering the chamber.
- .4 Do not install check valves or dry-pipe valves in unconditioned or freezing spaces.

3.9 OUTDOOR / UNCONDITIONED SPACE SPRINKLERS (IF REQUIRED)

- .1 Outdoor sprinkler systems shall have an independent control valve.

3.10 PERFORMANCE VERIFICATION

- .1 Ensure all paint guards and protective caps are removed from sprinkler heads.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

- .1 This section gives guidance on the common work pertaining to plumbing.
- .2 All plumbing work shall be completed in conformance with, and subject to, the latest manufacturer, supplier and City of Winnipeg Representative documentation available (printed, electronic, or website), including installation and cautionary notes.
- .3 Refer to specific plumbing sections for further guidance.

1.2 RELATED SECTIONS

- .1 Section 01 33 00 – Submittal Procedures
- .2 Section 01 74 00 – Cleaning and Waste Management
- .3 Section 01 78 00 – Closeout Submittals

1.3 CONTRACTOR RESPONSIBILITY

- .1 It is the mechanical Subcontractor's responsibility to provide and install the necessary components for a complete and functional plumbing system.
- .2 The mechanical Subcontractor is responsible for paying for and obtaining all necessary permits and authorizations for work.
- .3 The mechanical Subcontractor is responsible for providing suitable submittals pertaining to this work.
- .4 Engineered drawings and specifications are designed based on particular, specified products that the City of Winnipeg Representative has chosen. If the mechanical Subcontractor wishes to use a different product than was specified, then:
 - .1 It is the mechanical Subcontractor's responsibility to ensure the supplier of the different product has obtained approval for the product to be used as either an equal or an alternate from the City of Winnipeg Representative. Mechanical Subcontractors should be aware that a product is granted equal status based on quality, capacity, and electrical load only. Alternates may be approved if there are deviations and modifications required that could still result in the intended design function.
 - .2 It is the mechanical Subcontractor's responsibility to modify any associated work if using the different product at no cost to the City of Winnipeg in such a way as it works as intended by the engineered drawings and specifications. This may include coordinating with other trades such as electrical to capture all the modifications required. It is at the discretion of the City of Winnipeg Representative if the design intent is maintained.

- .1 Example: A particular make and model of domestic hot water tank was specified. Another manufacturer's hot water tank with different dimensions was granted an equal status based on its quality, capacity, and electrical load being similar to the one specified. A mechanical Subcontractor who wants to use the equal product is responsible for ensuring the equal product fits in the space and is expected to modify the piping if required to accommodate the different tank.
- .5 It is the responsibility of the mechanical Subcontractor to coordinate with other trades such that all work can be accomplished in a suitable manner.
- .6 All coring, rough openings and penetrations greater than 6" (150 mm) diameter, and all patching, flashing and sealing shall be the responsibility of the Contractor.
- .7 The mechanical Subcontractor shall coordinate with the Contractor in arranging for, and being available during, inspections by the Authority Having Jurisdiction and City of Winnipeg Representative at:
 - .1 Rough work completion and prior to wall boarding, and
 - .2 Substantial completion for the purpose of obtaining final certification.

1.4 SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 – Submittal Procedures
- .2 Refer to specific sections for any additional submittal requirements.
- .3 Shop Drawings:
 - .1 The intent of shop drawings is to give confidence to the City of Winnipeg Representative that the mechanical Subcontractor is using the proper products and will be installed properly so the work is done as intended by the City of Winnipeg Representative. Generic catalog or sales information shall not be part of a shop drawing unless it specifically meets the intent.
 - .2 Shall clearly indicate job-specific products. If the manufacturer's cut sheet shows multiple products, indicate which one coincides with the appropriate tag on the drawing.
 - .3 Shall include a performance curve, sound data, a dimensioned drawing with required clearances and connection points, power requirements, and specified capacity required as applicable for each product.
 - .4 Shall indicate the supplier's name and contact information.
 - .5 Shall indicate compliance to applicable codes and standards.
 - .6 Mechanical Subcontractor shall submit a shop drawing for unique mounting arrangements or supports if required at the discretion of the City of Winnipeg Representative.
- .4 Closeout Submittals:
 - .1 Provide operation and maintenance data and incorporate into manual specified in Section 01 78 00 - Closeout Submittals.
 - .2 Approvals:

- .1 Submit two (2) copies of draft Operation and Maintenance Manual to City of Winnipeg's Representative for approval. Submission of individual data will not be accepted unless directed by City of Winnipeg's Representative.
- .2 Submit a copy of the As-Built drawings.
- .3 Make changes as required and re-submit as directed by City of Winnipeg's Representative.
- .3 Operation and maintenance manual approved by, and final copies deposited with, City of Winnipeg's Representative before final inspection.
- .4 Operation and Maintenance (O&M) Manual:
 - .1 Operation data to include:
 - .1 Control and or piping schematics for systems.
 - .2 Description of systems and their controls.
 - .3 Operation instruction for systems and components.
 - .4 Description of actions to be taken in event of equipment failure.
 - .2 Maintenance data to include:
 - .1 Servicing, maintenance, operation and troubleshooting instructions for each item of equipment. Instructions to include maintenance schedule and tools required.
 - .2 A parts list.
 - .3 Performance data to include:
 - .1 Equipment manufacturer's performance datasheets with point of operation as left after commissioning is complete
 - .2 Site reports (i.e. water test results)
 - .3 Equipment performance verification test results (i.e. balancing report)
 - .4 Authority Having Jurisdiction (AHJ) signed and approved inspection reports.
 - .5 Additional data:
 - .1 Prepare and insert into the O&M manual additional data when need for it becomes apparent during specified demonstrations and instructions.
 - .6 Site records:
 - .1 City of Winnipeg's Representative will provide one (1) set of reproducible mechanical drawings or AutoCAD files. Provide sets of white prints as required for each phase of work. Mark changes as work progresses and as changes occur.
 - .2 Use different color for each service.
 - .3 Make available for reference purposes and inspection.
 - .7 As-built drawings:

- .1 Identify each drawing in lower right hand corner in letters at least 12 mm high as follows: - "AS BUILT DRAWINGS: THIS DRAWING HAS BEEN REVISED TO SHOW MECHANICAL SYSTEMS AS INSTALLED" (Signature of Subcontractor) (Date).
- .2 Submit completed reproducible as-built drawings with Operating and Maintenance Manuals.

1.5 DELIVERY, STORAGE AND DISPOSAL

- .1 Per Section 01 74 00 – Cleaning and Waste Management
- .2 Packing, shipping, handling and unloading:
 - .1 Deliver and handle in accordance with manufacturer's written instructions.
 - .2 Deliver materials to site in original factory packaging, labeled with manufacturer's name, address.
- .3 Storage and Protection:
 - .1 Protect from weather and physical damage.
 - .2 Protect plastics from UV light.
 - .3 Store at temperatures and conditions required by manufacturer.
- .4 Waste Management and Disposal:
 - .1 Verify with City of Winnipeg on storage or disposal of existing City of Winnipeg equipment. Handle accordingly.
 - .2 Separate waste materials for reuse and recycling.
 - .3 Place excess or unused materials in designated containers.
 - .4 Divert unused metal materials from landfill to metal recycling facility approved by City of Winnipeg's Representative.
 - .5 Dispose of unused adhesive material at official hazardous material collections site approved by City of Winnipeg's Representative.

1.6 SCOPE OF WORK

- .1 Include in mechanical section, provision of labour, new materials, tools, transportation, services and facilities for a complete mechanical installation. The installation shall be left complete in all respects and ready for operation. Final installation shall be to the complete satisfaction of the City of Winnipeg Representative.
- .2 The successful mechanical Subcontractor shall be responsible for all sub-trades providing services to complete this project.
- .3 New Construction:
 - .1 Provide for the complete installation of plumbing systems as outlined herein and on the mechanical drawings, including but not limited to; incoming domestic water and fire protection water service with backflow prevention devices, domestic water meter assembly, sub-meter assembly and meter monitoring system, washroom plumbing fixtures (lavatories, water-closets, hardwired

infrared sensor operated faucets/valves, sinks) and trim; floor drains; emergency eye wash stations complete with thermostatic mixing valves; domestic hot water storage tanks; domestic hot water recirculating pumps; mop sinks; clothes washer supplies and DWV; refrigerated drinking fountains, domestic hot/cold /recirculation piping distribution systems; isolation and calibrated balancing valves; wall hydrants (non-freeze); control roof drains; sanitary drain/waste vent piping above and below ground within building; VRF fan coil and HVAC equipment condensate drainage piping; pipeline devices, gauges, thermometers and auxiliary components; coordination of equipment controls, monitoring and integration to the Building EMCS (and networked to the existing City of Winnipeg Building management System) with Division 25. Flush and disinfect dedicated incoming water service main.

1.7 GENERAL REQUIREMENTS

- .1 All drawings and all sections of the specifications apply to and form an integral part of this section.
- .2 Provide fully operational mechanical systems in complete accordance with applicable codes and bylaws.
- .3 Contract documents of this section are diagrammatic and approximate to scale. Do not scale from the drawings, for dimensions refer to architectural and structural drawings. The drawings and specifications establish scope for material and installation quality and are not detailed installation instructions. They establish scope, material and installation quality and are not detailed installation instructions showing every offset, fitting, valve or every difficulty encountered during execution of work and will not be used as an excuse for deficiencies or omissions. Follow manufacturers' recommendations for installation supplemented by contract documents, unless otherwise specified by the City of Winnipeg Representative.
- .4 Drawings and specifications are complementary each to the other, what is called for by one shall be binding as if called for by both.
- .5 Specification sections are not provided to define trade work scope. Trade work scope is the responsibility of the Contractor responsible for this project and covering the entire scope of work included in this project.
- .6 Should any discrepancy appear between the drawings and specifications, which leave the mechanical Subcontractor in doubt as to the true intent and meaning of the plans, and specifications, the mechanical Subcontractor shall obtain a ruling from the City of Winnipeg Representative. If this is not done it will be assumed that the most appropriate alternative has been allotted for. For any ruling to become binding, the City of Winnipeg representative must issue the new direction in a published form.
- .7 Examine all contract documents, including all drawings, specifications and work of other trades to ensure that work is co-ordinated and satisfactorily carried out without changes to the building or contract value.
- .8 In addition to all of the requirements in the contract documents, include recommended installation details and procedures for equipment as found in manufacturers' technical data.
- .9 As work progresses and before installing piping, ductwork, fixtures or equipment interfering with interior treatment and use of building, contact the City of Winnipeg

Representative for comment.

- .10 Install piping, etc., generally in the locations and routes shown on the drawings, close to the building structure to minimize furring and interference with other services or free space. Remove piping, wiring, ductwork, etc. that is not properly installed and replace to the satisfaction of the City of Winnipeg Representative at no cost to the City of Winnipeg.
- .11 Equipment, materials and work shall comply with the requirements of generally recognized agencies, including but not limited to CSA, ULC, CGA, NBFU, NFPA, TSSA, and the requirements of Authorities Having Jurisdiction.
- .12 Be completely responsible for the acceptable condition and operation of systems and equipment components forming part of the installation or associated with it. Promptly replace defective materials, parts and equipment and repair related damage.
- .13 The drawings are intended to convey the scope of work and indicate general arrangement and approximate location of apparatus and fixtures, and indicate the general location and route to be followed by pipes and ducts. Where required installations are not shown on plans or are only shown diagrammatically, install in such a way as to conserve headroom and interfere as little as possible with free use or space through which they pass, while there adequate space is allowed for service, maintenance, repair, or replacement for all equipment.
- .14 All serviceable items, such as valves, controls, bearings, filters and similar items, must be installed in such a manner as to be accessible for service, maintenance, repair and replacement without the removal of other material or equipment, and without the need for specialized equipment such as lifts, harnesses, or other safety items. All work to be installed to allow easy equipment isolation and servicing functions while all surrounding systems continue to operate.
- .15 Refer to architectural drawings for roof and other construction details. These shall relate to roof supports, piping penetrating roofs, etc. As indicated on mechanical detail sheets.
- .16 Misinterpretation of requirements of plans or specifications shall not relieve the mechanical Subcontractor of responsibility of properly completing work to approval of the City of Winnipeg Representative.
- .17 Confirm on the site the exact location and mounting elevation of outlets and fixtures as related to existing mechanical & electrical components as well as architectural & structural details.
- .18 Spaces reserved for equipment noted as future or allowances made for future extension to buildings, to be left clear so that future connections can be made. Provide adequate clear space for City of Winnipeg supplied equipment and connections for such equipment. Provide detailed layouts for checking and approval by City of Winnipeg Representative before commencing work.
- .19 Prepare interference and coordination drawings for all areas, wherever there is possible conflict and/or obstruction due to the positioning of mechanical equipment, piping, wiring, ductwork, or other work of this division relative to other trades.
- .20 Prepare drawings in conjunction with other trades.
- .21 Show all sleeves and openings for passage through structure, and all inserts, equipment bases, sumps, pits and supports, and relate these to suitable grid lines and elevation datum.
- .22 Submit drawings for acceptance by the City of Winnipeg Representative.

- .23 Drawings shall be to a scale sufficient to show the necessary details. Submit to the City of Winnipeg Representative for review and distribute drawings after review to trades concerned.
- .24 Prepare fully dimensioned detail drawings of shafts, pipe spaces. Show holes and sleeves, and include information pertaining to access, clearances, tapplings, drains and electrical connections.
- .25 Base information used to prepare drawings on certified shop drawings.
- .26 The cutting of openings not requiring lintels or other structural support will be the responsibility of the trade requiring the opening, the opening size will be the minimum required, and that patching will be the responsibility of the trades normally engaged in working with the finishing materials required to restore the opening to the original or specified conditions.
- .27 Where openings require lintels or other structural support, or roofing work, such openings will be specified under other divisions of this specification.
- .28 Protect equipment and materials in storage, on site, during and after installation until final acceptance. Leave factory covers in place and take special precautions to prevent entry of foreign material into working parts of piping systems.
- .29 Protect equipment with polyethylene covers and crates.
- .30 Operate, drain and flush out bearings and refill with new charge of lubricant, before final acceptance.
- .31 Thoroughly clean piping, ducts and equipment of dirt, cuttings and other foreign substances. Disconnect, clean and reconnect whenever necessary for purpose of locating and removing obstructions. Repair work damaged in course of removing obstructions.
- .32 Clean exposed surfaces of mechanical equipment, piping, etc., and polish plated work.
- .33 Protect bearings and shafts during installation. Grease shafts and sheaves to prevent corrosion. Supply and install extended nipples to outside of bearing enclosures for lubrication purposes.
- .34 Remove tools, surplus, and waste material from the building site upon completion of work. Clean grease, dirt, and excess material from walls, floors, ceilings, surfaces, and fixtures for which this Subcontractor was responsible, and leave the premises suitable for immediate use.
- .35 Verify that materials and equipment can be delivered to the place of the work and that sufficient space and access is available to permit installation thereof in locations shown on the drawings.
- .36 Check locations and inverts of service lines leaving and entering building to ensure their proper function prior to commencing work.
- .37 Verify location and elevation of existing services (water, electrical, sanitary, storm sewers, equipment, natural gas, voice and data cabling, ductwork and piping), which may affect the work of this division. Repair any damage to existing underground services caused by neglect to determine and mark out the location of such services prior to excavation work commencing.
- .38 Refer also to room finish schedules to determine finished, partially finished and unfinished areas of the building.

- .39 Visit site to determine access route for bringing equipment into the building.
- .40 Location routing and depth of sanitary sewers, water mains, natural gas, and other utilities shown on drawings are based on available information and are approximate only. Mechanical Subcontractor and his site services subtrades shall carry out following verification procedure prior to installing the site services:
 - .1 Reconfirm information noted on contract drawings, by comparing with the local utility's most current records.
 - .2 Referring to same benchmarks used by Subcontractor; take invert readings at nearest manholes and check for discrepancies with contract drawings.
 - .3 Prior to installation of piping, advise the City of Winnipeg Representative of any discrepancy found during above procedure. Revised drawings or instructions will be given to the Subcontractor.
 - .4 Avoid damaging or displacing existing services where exact position is not known. Should any damage occur, advise City of Winnipeg Representative in writing for remedial instructions.

PART 2 - PRODUCTS

2.1 QUALITY ASSURANCE

- .1 Specific sections may have additional requirements, or modifications to these requirements. In the case of contradiction, the requirement in the specific section is to be adhered to. In cases of no clear contradiction, these requirements shall be adhered to.
- .2 If any specification section includes the words "prior approval" or "unless otherwise approved", this is to mean a request must be made to the stamping City of Winnipeg Representative responsible for this design component of the project prior to any product being considered as acceptable. Upon acceptance by written confirmation, the Subcontractor may use it. Upon denial by written confirmation, the Subcontractor shall not use it. No other entity shall grant approval to the Subcontractor.
- .3 All products to be manufactured by companies with qualifications including:
 - .1 Ten (10) years of history providing this product (or applicably similar product) to the Canadian market. Reduction of this requirement is possible at the discretion of the City of Winnipeg Representative only.
 - .2 Engineering, design and application support available in a timely manner. This includes acknowledgement of an inquiry within 24 hours, and a suitable response to an inquiry within five (5) working days.
 - .3 Documented case studies of three (3) similar applications of the product showing similar usage and acceptable longevity of the product. Contact information for the City of Winnipeg/maintenance provider of each case study shall be available upon request.
 - .4 Wholly owned test facilities with access available upon request.

- .5 Provision of products meeting all applicable testing standards, ratings, and certifications for the Canadian market.
- .4 All products to be supplied by suppliers with qualifications including:
 - .1 Five (5) years of history providing this product (or applicably similar product) to the Canadian market.
 - .2 Manufacturer support including, being the manufacturer's designated representative of the product, being factory trained on the product, and having access to current engineering support from the manufacturer.
 - .3 Human on site availability (with any required security clearances or specific entry requirements up to date prior to visit) within 48 hours of initial contact for the purpose of commissioning the product or investigation of problems potentially involving the product. Suppliers shall provide a phone number that will be answered during regular working hours.

PART 3 - EXECUTION

3.1 INSTALLATION

- .1 All products to be installed by workers with qualifications including but not limited to:
 - .1 Five (5) years of experience installing the product (or applicably similar product).
 - .2 A comprehensive knowledge of the product manufacturer's installation requirements.
 - .3 An understanding as to the reasons why proper installation is required, and what problems occur with an improper installation.
- .2 Installation shall be the responsibility of a qualified journeyman licensed to perform the work required.
- .3 Installation shall be in accordance with the National Plumbing Code (NPC) and local codes.
- .4 Installation of service items (example: isolation valves, cleanouts, etc.) shall be coordinated with the Contractor and other Subtrades (example: wall boarding Subcontractor) so access to service items is easy and unencumbered. Ultimately, this is the responsibility of the mechanical Subcontractor.

3.2 PERFORMANCE VERIFICATION

- .1 Ensure fixtures are properly anchored, connected to system, effectively vented and tested.
- .2 The mechanical Subcontractor shall be available to accompany the Authority Having Jurisdiction and the City of Winnipeg Representative on site inspections. The mechanical Subcontractor shall have the ability to test all items during inspections.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

- .1 This section provides guidance on handling thermal expansion of plumbing piping systems.
- .2 This section does not include sprinkler piping.

1.2 RELATED SECTIONS

- .1 Section 22 05 00 – Common Work Results for Plumbing
- .2 Section 22 05 29 – Hangers and Supports for Plumbing Piping and Equipment
- .3 Section 22 11 16 – Domestic Water Piping
- .4 Section 22 13 16 – Sanitary Waste and Vent Piping

1.3 BASIC INFORMATION

- .1 Mechanical Subcontractor shall be aware that piping changes length when undergoing changes in temperature. Plastic piping like Polyethylene, PVC and CPVC change much more than copper or steel.
- .2 Physical allowances shall be made to handle pipe length changes due to thermal expansion/contraction in all cases, but special consideration shall be given to:
 - .1 Initial installation of piping systems in cold weather where the finished environment will be warmer, or vice-versa
 - .2 Piping that is located outdoors
 - .3 Piping that continues from one thermal zone to another (i.e. from conditioned space to an unconditioned attic space or garage)
 - .4 Piping that transfers fluids of different temperatures (i.e. hot water and cold water combination drains)
- .3 Common pipe materials and their respective changes in length [per 100 feet (30 m) of pipe] are listed for reference purposes:
 - .1 ABS:
 - .1 2.0" (50 mm) length change for every 40 F (22 C) temperature change
 - .2 4.9" (125 mm) length change for every 100 F (56 C) temperature change
 - .2 CPVC:
 - .1 1.8" (46 mm) length change for every 40 F (22 C) temperature change
 - .2 4.6" (117 mm) length change for every 100 F (56 C) temperature change

- .3 PVC:
 - .1 1.4" (36 mm) length change for every 40 F (22 C) temperature change
 - .2 3.6" (91 mm) length change for every 100 F (56 C) temperature change
- .4 Polyethylene:
 - .1 5.3" (135 mm) length change for every 40 F (22 C) temperature change
 - .2 13.3" (338 mm) length change for every 100 F (56 C) temperature change
- .5 Copper:
 - .1 0.4" (10 mm) length change for every 40 F (22 C) temperature change
 - .2 1.1" (28 mm) length change for every 100 F (56 C) temperature change
- .6 Steel:
 - .1 0.3" (8 mm) length change for every 40 F (22 C) temperature change
 - .2 0.7" (18 mm) length change for every 100 F (56 C) temperature change
- .7 Aluminum:
 - .1 0.6" (15 mm) length change for every 40 F (22 C) temperature change
 - .2 1.4" (36 mm) length change for every 100 F (56 C) temperature change

PART 2 - PRODUCTS

2.1 FLEXIBLE PIPE CONNECTORS

- .1 For steel pipe:
 - .1 Inner hose: carbon steel
 - .2 Outer sleeve: double braided stainless steel
 - .3 Pressure rating: 200 psi (13.8 bar)
 - .4 Temperature rating: 250 F (121 C)
 - .5 Connections: flanged
 - .6 Size: same as pipe
- .2 For copper pipe:
 - .1 Inner hose: bronze
 - .2 Outer sleeve: braided bronze
 - .3 Pressure rating: 125 psi (8.6 bar)
 - .4 Temperature rating: 250 F (121 C)
 - .5 Connections: flanged

.6 Size: same as pipe

2.2 EXPANSION JOINTS

- .1 For CPVC:
 - .1 Bellows type
- .2 For PVC drain, waste, and vent pipe (DWV):
 - .1 Telescoping tube-in-tube
 - .2 EPDM seals
 - .3 Useable in vertical or horizontal applications
- .3 For ABS:
 - .1 Telescoping tube-in-tube
 - .2 EPDM seals
 - .3 Vertical applications only

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION

- .1 The intent is to allow the mechanical Subcontractor some flexibility to implement appropriate expansion compensation techniques for piping systems. The Mechanical Subcontractor shall review the proposed piping layouts on site and install either a suitable expansion product or utilize a multi-elbow piping offset to allow for linear movement due to temperature changes.
- .2 Mechanical Subcontractor shall be aware of the temperature of the pipe and environment during installation, and account for thermal expansion/contraction that will occur before the work is complete and functioning as designed.
- .3 Telescoping tube-in-tube expansion joints require good linear alignment. Install an anchor at one end and an axial guide at the other end of the expansion joint, or otherwise ensure linear alignment during operation.
- .4 Utilize points of fixed movement where required to control expansion in a particular direction.

3.2 SPECIFIC APPLICATIONS

- .1 For plastic vertical supply risers, movement shall be restricted vertically by pipe clamps attached to structure at each floor level. At each floor level, install an unrestricted 'vee' offset using two 45 degree fittings and a 90 degree fitting with 12" (300 mm) legs in the bottom third of the riser, or install a bellows type expansion device just above each pipe clamp, or install per manufacturers instructions.

- .2 In the absence of other thermal expansion/contraction methods, provide the following for every 100 feet (30 m) of piping:
 - .1 For any application where potential temperature changes are <40 F (22 C):
 - .1 CPVC: 4-elbow 'U' joint with 4 foot (1220 mm) legs and 2 foot (610 mm) base
 - .2 PVC: 4-elbow 'U' joint with 4 foot (1220 mm) legs and 2 foot (610 mm) base
 - .3 ABS: 4-elbow 'U' joint with 4 foot (1220 mm) legs and 2 foot (610 mm) base
 - .4 Copper: 4-elbow 'U' joint with 12" (300 mm) legs and 12" (300 mm) base
 - .5 Aluminum: 4-elbow 'U' joint with 24" (610 mm) legs and 12" (300 mm) base
 - .6 Steel: 4-elbow 'U' joint with 24" (610 mm) legs and 12" (300 mm) base
 - .7 Polyethylene: flexible bends between anchor points
 - .2 For all outdoor piping, unconditioned attic piping, unconditioned crawlspace piping, all domestic hot water piping, or any application where potential temperature changes are <100 F (<56 C):
 - .1 CPVC: 4-elbow 'U' joint with 6 foot (1830 mm) legs and 3 foot (914 mm) base
 - .2 PVC: 4-elbow 'U' joint with 6 foot (1830 mm) legs and 3 foot (914 mm) base
 - .3 ABS: 4-elbow 'U' joint with 6 foot (1830 mm) legs and 3 foot (914 mm) base
 - .4 Copper: 4-elbow 'U' joint with 24" (610 mm) legs and 12" (300 mm) base
 - .5 Aluminum: 4-elbow 'U' joint with 24" (610 mm) legs and 12" (300 mm) base
 - .6 Steel: 4-elbow 'U' joint with 24" (610 mm) legs and 12" (300 mm) base
 - .7 Polyethylene: flexible bends between anchor points

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

- .1 This section gives guidance on meters and gauges used in plumbing piping and includes:
 - .1 Pressure gauges
 - .2 Thermometers
 - .3 Water meters
- .2 This section does not include guidance on:
 - .1 Compressed air meters or gauges
 - .2 Fire Protection meters or gauges

1.2 RELATED SECTIONS

- .1 Section 01 33 00 – Submittal Procedures
- .2 Section 01 78 00 – Closeout Submittals
- .3 Section 01 91 13 – General Commissioning Requirements
- .4 Section 22 05 00 – Common Work Results for Plumbing

1.3 REFERENCES

- .1 American Society of Mechanical Engineers International (ASME)
 - .1 ASME B40.100 Pressure Gauges and Gauge Attachments
 - .2 ASME B40.200 Thermometers, Direct Reading and Remote Reading
- .2 American Water Works Association (AWWA)
 - .1 AWWA C700 Standard for Cold Water Meters-Displacement Type, Bronze Main Case

1.4 SUBMITTALS

- .1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Upon request, provide manufacturer's printed product datasheets, indicating models and options specific to this work. Datasheets submitted shall include designations of rating compliance (i.e. AWWA).
- .3 Closeout submittals in accordance with Section 01 78 00 – Closeout Submittals
- .4 Operation and Maintenance (O&M) Manual Data:

- .1 For tank fluid level gauge applications, provide a copy of the set-up and calibration settings based on site-specific inputs.

PART 2 - PRODUCTS

2.1 PRESSURE GAUGES

- .1 Meets ASME B40.100
- .2 Gauge shall have a bottom entry, lead free brass NPT connection.
- .3 Gauge shall be in dual units and range from 0 to 11 bar (160 psi).
- .4 Gauge shall have a minimum 63 mm (2.5") diameter display.

2.2 THERMOMETERS

- .1 Meets ASME B40.200
- .2 Thermowell shall be lead free brass.
- .3 Thermometer shall be a scale type with red liquid in glass.
- .4 Readout shall be in dual units and range shall be at least from 4 C (40 F) to 100 C (212 F).

2.3 WATER METERS (IF NOT SUPPLIED BY THE REGULATING AGENCY / UTILITY COMPANY)

- .1 Equipment Sub-Meters:
 - .1 Standard: AWWA C715, NSF/ANSI 61
 - .2 Pressure Rating: 150-psig (1035-kPa) working pressure.
 - .3 Operating Water Temperature Rating: 33 to 122F (0.5 to 50C).
 - .4 Measurement: ultrasonic, solid state metrology
 - .5 Registration: In gallons (liters) or cubic feet (cubic meters) as required.
 - .6 Case: Lead-free and corrosion resistant.
 - .7 Connections: flanged.
 - .8 Accessories:
 - .1 Remote reader with interface for compatibility with the BMS for monitoring and recording purposes.
 - .9 Acceptance: Neptune Mach 10 or equal.

PART 3 - EXECUTION

3.1 INSTALLATION – GENERAL

- .1 Meters and gauges shall be installed such that they can be read from a reasonable and logical location within the room without the need for ladders, or bending or twisting.

3.2 INSTALLATION – PRESSURE GAUGES

- .1 Install where indicated on the design documents and downstream of every pressure reducing valve.

3.3 INSTALLATION – THERMOMETERS

- .1 Install where indicated on the design documents and downstream of every mixing valve.

3.4 INSTALLATION – WATER METERS

- .1 Meter shall be protected against hot water [>80 F (27 C)] intrusion.
- .2 Coordinate with Division 25 for connection of encoder, setup and readout location.
- .3 For incoming service meters, no branch or connection shall be upstream of the meter within the building.
 - .1 Exception: for 2" (50 mm) or greater incoming water services, a meter isolation by-pass branch shall be installed. The by-pass branch shall be normally closed and sealed.

3.5 FIELD QUALITY CONTROL

- .1 Perform the following tests and inspections:
 - .1 Fill each tank with containing a level gauge from empty to alarm/cut-out level to verify correct operation. Empty tank and repeat.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

- .1 This section gives guidance on general duty plumbing valves and includes:
 - .1 Isolation valves
 - .2 Single check valves
- .2 This section does not include:
 - .1 Compressed air valves
 - .2 Fire service valves
 - .3 Medical gas or vacuum valves

1.2 RELATED SECTIONS

- .1 Section 01 33 00 – Submittal Procedures
- .2 Section 01 78 00 – Closeout Submittals
- .3 Section 22 05 00 – Common Work Results for Plumbing
- .4 Section 22 05 29 – Hangers and Supports for Plumbing Piping and Equipment
- .5 Section 22 05 53 – Identification for Plumbing Piping and Equipment
- .6 Section 22 11 16 – Domestic Water Piping

1.3 REFERENCES

- .1 American Water Works Association (AWWA)
 - .1 AWWA C508 Swing-Check Valves for Waterworks Service
- .2 American Society for Testing and Materials International (ASTM)
 - .1 ASTM A126 Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings
 - .2 ASTM A536 Standard Specification for Ductile Iron Castings

1.4 SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Upon request, provide manufacturer's printed product datasheets for valves, indicating models and options specific to this work. Datasheets submitted shall include designations of rating compliance (i.e. AWWA or ASTM).

- .3 Closeout Submittals:
 - .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
 - .2 Provide valve information per the requirements of Section 22 05 53 – Identification for Plumbing Piping and Equipment.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

- .1 Minimum Working Pressure: 125 psig (860 kPa) unless otherwise indicated.
- .2 Choose “lead-free” products (<0.25% lead by weight on wetted surfaces).

2.2 ISOLATION VALVES

- .1 Up to, and including, 2” (50 mm) diameter:
 - .1 Ball Valves:
 - .1 Full port
 - .2 Pressure Rating: 150 psi (10.3 bar)
 - .3 Body and Ball: Brass (may be chrome plated), or Stainless steel
 - .4 Packing and Seats: PTFE
 - .5 Handle: Zinc plated steel (fixture isolation valves may be other metal)
 - .6 End Connections: Threaded
 - .2 Over 2” (50 mm) diameter:
 - .1 Gate Valves:
 - .1 Body: Manufacturer applied epoxy coated iron inside and out
 - .2 Pressure Rating: 200 psi (13.8 bar)
 - .3 Disc: Cast iron and Buna-N rubber (wedge type)
 - .4 End Connections: Flanged to ASTM A126, or Grooved to ASTM A536
 - .2 Ball Valves:
 - .1 Full port, two piece construction
 - .2 Pressure Rating: 400 psi (27.5 bar)
 - .3 Body and Ball: Brass (may be chrome plated), or Stainless steel
 - .4 Packing and Seats: PTFE
 - .5 Handle: Zinc plated steel

- .6 End Connections: Threaded

2.3 SINGLE CHECK VALVES

- .1 Up to, and including, 2" (50 mm) diameter:
 - .1 'Tee' or "Wye" pattern
 - .2 Pressure Rating: 200 psi (13.8 bar)
 - .3 Body: Bronze
 - .4 Disc: Bronze
 - .5 End Connections: Threaded
- .2 Over 2" (50 mm) diameter:
 - .1 Meets requirements of AWWA C508
 - .2 Pressure Rating: 250 psi (17.2 bar)
 - .3 Body: Manufacturer applied epoxy coated iron inside and out
 - .4 Disc: Buna-N or EPDM encapsulated steel
 - .5 End Connections: Flanged

PART 3 - EXECUTION

3.1 INSTALLATION – GENERAL

- .1 Valves shall be compatible with the plumbing piping connected.
- .2 Valves attached in plumbing piping shall be supported such that the installation does not cause excessive force or torque on the piping.
- .3 Coordinate with other trades including wall and ceiling finisher to allow for access doors to be located in a suitable location adjacent to each valve.

3.2 INSTALLATION – ISOLATION VALVES

- .1 Install isolation valves on water piping to every fixture.
- .2 Install isolation valves at every branch off a vertical water-filled riser.
- .3 Do not install a valve within 30" (760 mm) of a heat generating source (i.e. hot water tank).

3.3 INSTALLATION – SINGLE CHECK VALVES

- .1 Ensure valve is installed in proper orientation.

- .2 Clean and ensure the valve disc moves freely and seals completely before and after installation.

3.4 QUALITY CONTROL

- .1 Valves shall be labeled and set to their working position.
- .2 Valves shall be operated opened and closed after the system is filled with liquid and water hammer effect shall be noted. Install water hammer arrestors upstream of valves that cause water hammer as per Section 22 11 19 – Domestic Water Piping Specialties.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

- .1 This section includes (as applicable) guidance on hanging or supporting domestic water supply piping, sanitary waste piping, rain water leaders, sump pump discharge piping, vent piping, medical gas piping, compressed air piping, and plumbing equipment.
- .2 This section does not include sprinkler piping.
- .3 This section gives guidance on hanging and supporting plumbing piping and equipment and includes:
 - .1 Pipe Hangers and Supports
 - .2 Hanger Rods
 - .3 Inserts
 - .4 Flashing
 - .5 Sleeves and Seals
 - .6 Formed Steel Channel
 - .7 Equipment Bases and Supports
 - .8 Metal Framing Systems
 - .9 Fasteners
 - .10 Pipe Positioning Systems
- .4 The Mechanical Subcontractor responsible for the work of this section shall be familiar with MSS SP-58, industry recognized installation guides and have a minimum of five (5) years experience installing as per such guides.

1.2 RELATED SECTIONS

- .1 Section 01 33 00 – Submittal Procedures
- .2 Section 05 50 00 – Metal Fabrications
- .3 Section 07 84 00 – Firestopping
- .4 Section 09 91 00 – Interior Painting
- .5 Section 22 05 00 – Common Work Results for Plumbing
- .6 Section 22 05 16 – Expansion Fittings and Loops for Plumbing Piping
- .7 Section 22 07 19 – Plumbing Piping Insulation
- .8 Section 22 11 16 – Domestic Water Piping
- .9 Section 22 13 16 – Sanitary Waste and Vent Piping

- .10 Section 22 14 16 – Rainwater Leaders

1.3 REFERENCES

- .1 International Association of Plumbing and Mechanical Officials (IAPMO)
 - .1 IAPMO PS 42 Pipe Alignment and Secondary Support Systems
- .2 Manufacturers Standardization Society of the Valve and Fittings Industry (MSS)
 - .1 MSS SP-58 Pipe Hangers and Supports – Materials, Design, Manufacture, Selection, Application and Installation
 - .2 MSS SP-127 Bracing for Piping Systems: Seismic – Wind – Dynamic Design, Selection and Application

1.4 SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Shop Drawings:
 - .1 All trapeze pipe hangers, metal framing systems, and fabricated equipment support designs require a detailed, job-specific drawing submittal labeled with equipment weights to the City of Winnipeg Representative for approval.

PART 2 - PRODUCTS

2.1 PIPE HANGERS AND SUPPORTS

- .1 All hangers and supports must meet MSS SP-58. Refer to Part 3, “Hanger and Support Applications” for pipe hanger and support suitability.
- .2 Insulated pipe shall be supported with a hanger or support with a supporting diameter the same as the fully insulated pipe diameter with an included rigid insulation shield. The insulation shall not be compressed or otherwise have a reduction in insulating ability as a result of hanging or supporting the pipe.
- .3 Pipe containing steam or liquid greater than 160 F (71 C) that is supported from below the pipe shall be on roller supports.
- .4 Pipe located in areas or adjacent to areas where noise and vibration are concerns shall use PVC coated hanger and support products.
- .5 Copper pipe shall be hung or supported with PVC coated or felt lined products to prevent electrolysis between the pipe and the hanger or support.

2.2 HANGER RODS

- .1 Unless otherwise indicated, hanger rods shall be zinc-plated steel, fully threaded rod.

2.3 CONCRETE INSERTS

- .1 Inserts shall be malleable iron case with a galvanized steel shell and expander plug for threaded connection. Inserts shall have capability for lateral adjustment, a top slot for reinforcing rods, and lugs for attaching to forms. Insert internal threads to match hanger rod threads.

2.4 FLASHING

- .1 Metal flashing shall be 26 gage galvanized steel.
- .2 Metal counterflashing shall be 22 gage galvanized steel.
- .3 Caps shall be 22 gage steel for non-fire resistance rated separations and 16 gage steel for fire resistance rated separations.

2.5 SLEEVES AND SEALS

- .1 Exterior, underground wall penetrations:
 - .1 Schedule 40 steel pipe with welded wall collar embedded in concrete. Pipe and collar bituminous coated and lined.
 - .2 Hydrostatic pipe closure, "Link-Seal" or approved equal.
- .2 Exterior, aboveground wall penetrations:
 - .1 Concrete wall: Schedule 40 steel pipe with welded wall collar embedded in concrete. Pipe and collar bituminous coated and lined. Wall attached pipe clamp attached to interior face of exterior wall. Expanding foam between pipe and sleeve. Thermally broken and caulked escutcheons on exterior and interior face.
 - .2 Framed wall: 18 gage galvanized steel. Wall attached pipe clamp attached to interior face of exterior wall. Expanding foam between pipe and sleeve. Thermally broken and caulked escutcheons on exterior and interior face.
- .3 Interior, fire rated wall penetration:
 - .1 Concrete wall: Schedule 40 steel pipe with welded wall collar embedded in concrete. Pipe and collar bituminous coated and lined. Firestopping material as per section 07 84 00 between pipe and sleeve. 16 gage steel escutcheons on exposed faces of wall.
 - .2 Framed wall: 18 gage galvanized steel. Firestopping material as per section 07 84 00 between pipe and sleeve. 16 gage steel escutcheons on exposed faces of wall.
- .4 Interior, non-rated wall penetration:
 - .1 Concrete wall: Schedule 40 steel pipe with welded wall collar embedded in concrete. Pipe and collar bituminous coated and lined. Closed cell foam spray between pipe and sleeve. 16 gage steel escutcheons on exposed faces of wall.
 - .2 Framed wall: No sleeve required. 16 gage steel escutcheons on exposed faces of wall.

- .5 Floor penetration:
 - .1 Cored or drilled hole to be coordinated with structural City of Winnipeg Representative for reinforcement requirements. Firestopping material as per section 07 84 00. 2" (50 mm) high oversized schedule 40 steel pipe curb secured and caulked on finished floor. Riser clamp rests on curb. Material deviations may be accepted upon prior approval from the City of Winnipeg representative. Submit in accordance with Section 01 33 00 – Submittal Procedures.

2.6 FORMED STEEL CHANNEL

- .1 Shall be manufactured by a member company of the Metal Framing Manufacturers Association.

2.7 EQUIPMENT BASES AND SUPPORTS

- .1 Structural carbon steel shapes, coated with corrosion prevention primer.
- .2 Material deviations may be accepted upon prior approval from the City of Winnipeg representative. Submit in accordance with Section 01 33 00 – Submittal Procedures.

2.8 METAL FRAMING SYSTEMS

- .1 Shall be manufactured by a member company of the Metal Framing Manufacturers Association.

2.9 FASTENERS

- .1 Powder Actuated Fasteners:
 - .1 Threaded steel stud with pull out, tension and shear capacities appropriate for supported load and building structure material.
- .2 Mechanical Expansion Anchors:
 - .1 Insert wedge type, stainless steel anchors with pull out, tension and shear capacities appropriate for supported load and building structure material.
 - .2 Underwriters Laboratory (UL) listed

2.10 PIPE POSITIONING SYSTEMS

- .1 Shall be manufactured to IAPMO PS 42.

PART 3 - EXECUTION

3.1 QUALITY ASSURANCE

- .1 Installer qualified in performing work in this section shall have at least five (5) years successful experience in similar installations.
- .2 Fabricated trapeze hangers, metal framing systems, and equipment support designs are to be submitted to the City of Winnipeg representative for approval.

3.2 GENERAL INSTALLATION

- .1 Refer to Part 2 – Products for additional guidance on installing a product or an assembly of products for a particular application.
- .2 All hangers and supports must meet MSS SP-58. Refer to Part 3, “Hanger and Support Applications” for pipe hanger and support suitability.
- .3 Install supports to secure equipment in place, prevent vibration, maintain grade and allow for expansion and contraction.
- .4 Wire or perforated strap is not acceptable to use for hanging pipes or equipment.
- .5 Include expansion fittings and offsets as per Section 22 05 16 – Expansion Fittings and Loops for Plumbing Piping.
- .6 Vertical risers shall be supported at every floor level and every 12’ (3.6 M) by riser clamps.
- .7 Vertical piping (other than cast iron) may be affixed in position by formed steel channel clamps. For plastic and copper piping, use a PVC or rubber isolator between the clamp and bare pipe. For cast iron piping, use pipe clamps attached to building structure.
- .8 Fasten supports to building structural steel system or to cast-in-place inserts in concrete construction for new construction. Concrete fasteners are acceptable when holding strength of finished concrete has been established.
- .9 Insulated pipe shall be supported with a hanger or support with a supporting diameter the same as the fully insulated pipe diameter with an included rigid insulation shield. The insulation shall not be compressed or otherwise have a reduction in insulating ability as a result of hanging or supporting the pipe.
- .10 Locate support adjacent to equipment. Prevent excessive stresses on piping and equipment connections.
- .11 Do not support piping or equipment from other piping or from equipment.
- .12 For horizontally hung multiple pipe runs, use a trapeze support assembly.
- .13 On multiple pipe runs, allow minimum 1” (25 mm) clearance between finished (including insulation) pipes.
- .14 Install hangers within 12” (300 mm) on either side of a horizontal fitting.

3.3 SPECIFIC INSTALLATION – PLASTIC PIPE

- .1 When hanging horizontal plastic pipe sized 4" (100 mm) diameter and under, and that conveys liquid greater than 80 F (27 C), supports shall be:
 - .1 Continuous support channel under pipe to prevent sagging, or
 - .2 Vee bottom clevis type hangers that shall include 18 gage channel support to prevent sagging.
- .2 Plastic pipe sized 2" (50 mm) diameter and under may be supported using rigid PVC or PVC coated steel conduit fittings.
- .3 Ensure pipe will not be subject to abrasion by supports during expansion and contraction.

3.4 HORIZONTAL PIPE SUPPORT SPACING

- .1 Support horizontal straight sections of piping as follows:

Nominal Pipe Size	Maximum Distance Between Supports					
	<i>Steel (liquid)</i>	<i>Steel (steam or comp.air)</i>	<i>Copper (liquid or vent)</i>	<i>Plastic (liquid)</i>	<i>Plastic (vent)</i>	<i>Aluminum (comp.air)</i>
½" (12mm)	7' (2.1m)	8' (2.4m)	5' (1.5m)	4' (1.2m)	-	5' (1.5m)
¾" (19mm)	7' (2.1m)	8' (2.4m)	6' (1.8m)	4' (1.2m)	-	5' (1.5m)
1" (25mm)	7' (2.1m)	9' (2.7m)	8' (2.4m)	4' (1.2m)	6' (1.8m)	5' (1.5m)
1¼" (32mm)	7' (2.1m)	9' (2.7m)	10' (3.0m)	4' (1.2m)	6' (1.8m)	5' (1.5m)
1½" (39mm)	9' (2.7m)	12' (3.6m)	10' (3.0m)	5' (1.5m)	6' (1.8m)	5' (1.5m)
2" (50mm)	10' (3.0m)	13' (4.0m)	10' (3.0m)	5' (1.5m)	6' (1.8m)	8' (2.4m)
2½" (64mm)	10' (3.0m)	14' (4.3m)	10' (3.0m)	5' (1.5m)	6' (1.8m)	8' (2.4m)
3" (75mm)	10' (3.0m)	15' (4.6m)	10' (3.0m)	6' (1.8m)	8' (2.4m)	8' (2.4m)
4" (100mm)	10' (3.0m)	16' (4.9m)	10' (3.0m)	6' (1.8m)	8' (2.4m)	8' (2.4m)
6" (150mm)	10' (3.0m)	16' (4.9m)	10' (3.0m)	7' (2.1m)	8' (2.4m)	5' (1.5m)
8" (200mm)	10' (3.0m)	-	10' (3.0m)	7' (2.1m)	-	-

- .2 Provide additional supports for concentrated loads such as valves, specialties and pipe fittings and every change in direction.

3.5 EQUIPMENT SUPPORTS

- .1 Generally, install as per manufacturer's requirements.
- .2 Generally, mount equipment such that movement during start and stop is less than ¼" (6 mm). The intent is to reduce stresses applied to the equipment attachments (i.e. piping) to within a safe working range thereby eliminating potential damage.
- .3 Equipment support springs shall be statically loaded to 50% compression by weight of equipment. Include a ¼" (6 mm) neoprene acoustic pad under each spring support.
- .4 Coordinate concrete base or inertia concrete block requirements for each piece of equipment with Contractor prior to installation. Concrete work and any associated

structural reinforcement is by Contractor; vibration and acoustic isolation of equipment support is by mechanical Subcontractor.

3.6 PERFORMANCE VERIFICATION

- .1 Upon completion of piping installation, and before system operation, examine all fasteners, inserts and attachments for looseness, movement, or other factors that would reduce their ability to act at their rated capacity.
- .2 Examine all pipe hangers for movement before and after system operation. Reinforce any area of hanger movement.
- .3 Prior to system operation, examine spring supports for available movement. Loaded springs shall rest in a 50% compressed state.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

- .1 This section includes guidance on identifying plumbing related piping systems and equipment.
- .2 This section does not include identification of HVAC piping and equipment.
- .3 If an existing identification system with color codes are already in place and this work is being added to the existing systems, use the existing identification system. Otherwise, use the color codes and materials specified in this section.

1.2 RELATED SECTIONS

- .1 Section 01 33 00 – Submittal Procedures
- .2 Section 01 78 00 – Closeout Submittals
- .3 Section 09 91 00 – Painting
- .4 Section 22 05 00 – Common Work Results for Plumbing
- .5 Section 22 05 23 – General Duty Valves for Plumbing Piping
- .6 Section 22 07 19 – Plumbing Piping Insulation
- .7 Section 22 11 16 – Domestic Water Piping
- .8 Section 22 11 19 – Domestic Water Piping Specialties
- .9 Section 22 13 16 – Sanitary Waste and Vent Piping
- .10 Section 22 13 19 – Sanitary Waste Piping Specialties
- .11 Section 22 14 16 – Rainwater Leaders
- .12 Section 22 14 19 – Sump Pump Discharge Piping

1.3 REFERENCES

- .1 American Society of Mechanical Engineers (ASME)
 - .1 ANSI/ASME A13.1 Scheme for the Identification of Piping Systems

1.4 SUBMITTALS

- .1 Compile a list of labelled items (equipment, valves, piping specialties) listed in PART-2 PRODUCTS with the following information
 - .1 Tag (i.e. V-1)
 - .2 Description (i.e. Domestic Cold Water Isolation Valve)

- .3 Location (i.e. Room 305 Ceiling Space)
- .4 Manufacturer of item
- .5 Model number of item
- .2 Include a copy of this compiled list in the Operations and Maintenance (O&M) Manual required in the close-out submittal package. Also, include a laminated copy for permanent mounting in the appropriate maintenance room.
- .3 Mark labelled items on the as-built drawings.
- .4 For items located within a mechanical room, create a laminated, schematic drawing with items labelled for permanent mounting in the mechanical room.

PART 2 - PRODUCTS

2.1 PIPING IDENTIFICATION – GENERAL SIZING OF LABELS

- .1 For ¾" to 1¼" (19 mm to 32 mm) outer diameter pipe or insulation
 - .1 Color coding shall be 8" (200 mm) long
 - .2 Lettering shall be ½" (13 mm) high
- .2 For 1½" to 2" (32 mm to 50 mm) outer diameter pipe or insulation
 - .1 Color coding shall be 8" (200 mm) long
 - .2 Lettering shall be ¾" (19 mm) high
- .3 For 2½" to 6" (64 mm to 150 mm) outer diameter pipe or insulation
 - .1 Color coding shall be 12" (300 mm) long
 - .2 Lettering shall be 1¼" (32 mm) high
- .4 For 8" to 10" (200 mm to 250 mm) outer diameter pipe or insulation
 - .1 Color coding shall be 24" (600 mm) long
 - .2 Lettering shall be 2½" (64 mm) high
- .5 For over 10" (250 mm) outer diameter pipe or insulation
 - .1 Color coding shall be 32" (813 mm) long
 - .2 Lettering shall be 3½" (90 mm) high

2.2 PIPING IDENTIFICATION – GENERAL COLOR CODING

- .1 Refer to the table in this section for specific fluid/gas service piping. If a particular fluid/gas is not listed:
 - .1 For fire quenching fluid/gas, use white lettering on a red background

- .2 For toxic or corrosive fluid/gas, use black lettering on an orange background
- .3 For flammable fluid/gas with a flash point under 37.8 C (100 F), use black lettering on a yellow background
- .4 For combustible fluid/gas with a flash point between 37.8 C (100 F) and 93.3 C (200 F), use white lettering on a brown background
- .5 For chemicals or mixtures with a flash point above 93.3 C (200 F), use white lettering on an purple background unless otherwise specified
- .6 For compressed air, use white lettering on a blue background
- .7 For gray water applications, use white lettering on a gray background
- .8 For sanitary waste water, use white lettering on a black background

2.3 PIPING IDENTIFICATION – GENERAL LABELLING CONTENT

- .1 Include:
 - .1 Descriptive name of fluid/gas in pipe
 - .2 Direction of flow arrow
 - .3 Temperature (required for different temperatures for same named fluid/gas)
 - .4 Pressure (required for different pressures for same named fluid/gas)
 - .5 Any unique identifier within same named fluid/gas (i.e. Breathing Compressed Air versus Non-Breathing Compressed Air)

2.4 PIPING IDENTIFICATION – SPECIFIC FLUID/GAS

<u>Fluid/Gas</u>	<u>Background Color</u>	<u>Lettering Color</u>	<u>Unique Identifier</u>
SPRINKLER	Red	White	DRY, WET, or GLYCOL
FIRE CONNECTION	Red	White	
DOMESTIC COLD WATER	Green	White	
DOMESTIC HOT WATER	Green	White	Add temperature if multiple
DOMESTIC HW RECIRC	Green	White	
RAIN WATER LEADER	Gray	White	
STORM WATER	Gray	White	
PUMPED SANITARY	Black	White	
SANITARY	Black	White	
VENT	White	Black	

2.5 EQUIPMENT, VALVES AND PIPING SPECIALTIES LABELLING

- .1 The intent is for any item that is required to be maintained, or be used in the course of maintenance, adjustment or repair in the system, shall be labelled in such a way that it is useful and visible.
- .2 The following plumbing equipment shall be labelled
 - .1 Pumps and their respective controller
- .3 The following plumbing valves and specialties shall be labelled
 - .1 Backflow preventers
 - .2 Pressure reducing valves
 - .3 Isolation valves for mains and branch lines
 - .4 Balancing valves
 - .5 Strainers
 - .6 Trap primer systems
 - .7 Backwater valves
- .4 Suitable labelling material shall be:
 - .1 For equipment:
 - .1 Lamacoids with minimum 1/16" (2 mm) thick plastic and engraved lettering. Sizes shall be determined based of each piece of equipment with the intent that the lamacoid can be easily read from up to 3 m (10 feet) away. Color shall generally be white background and black lettering unless otherwise indicated.
 - .2 For valves and specialties:
 - .1 Brass tags shall be 1½" (38 mm) diameter with stamped identification data filled with black paint.
 - .2 Plastic tags shall be 1¾" (44 mm) diameter with recessed identification data. Background and lettering colors to match associated piping labels.

2.6 MANUFACTURERS NAMEPLATES

- .1 Nameplates stamped or installed permanently by the manufacturer shall at least designate the make, model number, and applicable standards it adheres to (i.e ULC, CSA). Additional information is acceptable.

2.7 LANGUAGE

- .1 Identification to be in English.

PART 3 - EXECUTION

3.1 INTENT

- .1 The intent is to label items and leave behind suitably detailed information for future maintenance staff. Installation shall be done with this in mind.

3.2 INSTALLATION

- .1 Install per manufacturer's written installation instructions.
- .2 For piping labels, install one label:
 - .1 At every valve and flange connection
 - .2 On either side of a wall or floor penetration
 - .3 At every access panel if piping is concealed
 - .4 At every change of direction
 - .5 Every 15 M (50 feet) of straight pipe
- .3 For lamacoids, install with supplier applied adhesive.
- .4 For tags, install with a closing chain so the tag cannot come off the item and it does not hamper the normal operation of the item.
- .5 All labelling shall be visible from the floor and the most logical direction of approach to the item.

3.3 TIMING

- .1 Provide identification only after all painting specified in Section 09 91 00 - Interior Painting has been completed.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

- .1 This section includes guidance on thermal insulation for plumbing piping and piping accessories.
- .2 This section does not include sprinkler piping or HVAC equipment piping.

1.2 RELATED SECTIONS

- .1 Section 01 33 00 – Submittal Procedures
- .2 Section 07 84 00 – Firestopping
- .3 Section 22 05 00 – Common Work Results for Plumbing
- .4 Section 22 05 29 – Hangers and Supports for Plumbing Piping and Equipment
- .5 Section 22 05 33 – Heat Tracing for Plumbing Piping
- .6 Section 22 05 53 – Identification of Plumbing Piping and Equipment
- .7 Section 22 11 16 – Domestic Water Piping
- .8 Section 22 13 16 – Sanitary Waste and Vent Piping
- .9 Section 22 14 16 – Rainwater Leaders

1.3 REFERENCES

- .1 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)
 - .1 ASHRAE Standard 90.1 Energy Efficient Design of New Buildings Except Low-Rise Residential Buildings (Including all Addenda)
- .2 American Society for Testing and Materials (ASTM)
 - .1 ASTM C335 Standard Test Method for Steady State Heat Transfer Properties of Horizontal Pipe Insulation
 - .2 ASTM C547 Standard Specification for Mineral Fiber Pipe Insulation
 - .3 ASTM C795 Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel
 - .4 ASTM C921 Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation
- .3 Canadian General Standards Board (CGSB)
 - .1 CGSB 51-GP-52Ma Vapour Barrier, Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation

- .2 CAN/CGSB-51.53 Poly (Vinyl Chloride) Jacketing Sheet, for Insulated Pipes, Vessels and Round Ducts
- .4 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets
- .5 Thermal Insulation Association of Canada (TIAC)
 - .1 Best Practices Guide
- .6 Underwriters' Laboratories of Canada (ULC)
 - .1 CAN/ULC S102 Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies
 - .2 CAN/ULC S102.2 Standard Method of Test for Surface Burning Characteristics of Flooring, Floor Coverings, and Miscellaneous Materials and Assemblies
 - .3 CAN/ULC S701 Thermal Insulation, Polystyrene, Boards and Pipe Covering
- .7 National Energy Code of Canada for Buildings (NECB)

1.4 DEFINITIONS

- .1 For purposes of this section:
 - .1 "CONCEALED" - insulated mechanical services in suspended ceilings and non-accessible chases and furred-in spaces.
 - .2 "EXPOSED" - will mean "not concealed" as defined herein.

1.5 SUBMITTALS

- .1 Submit product data in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Upon request, submit two copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS).
- .3 Shop Drawings:
 - .1 Upon request, submit manufacturer's printed product datasheet. Clearly identify products used on this job. Include product characteristics, performance criteria, and limitations.
- .4 Quality Assurance:
 - .1 Upon request, submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

1.6 QUALITY ASSURANCE

- .1 Qualifications:
 - .1 Installer:

- .1 Has current certifications required in performing work of this Section
 - .2 Has at least five (5) years successful experience in this size and type of project
 - .3 Is qualified to understand, and experienced with, the TIAC Best Practices Guide.
- .2 Supplier:
- .1 Has at least five (5) years successful experience in this size and type of project
 - .2 Must be a company specializing in work of this Section.
 - .3 Must be available and competent to give installation support to the installer.
- .3 Manufacturer:
- .1 Must be a company specializing in work of this Section.
 - .2 Must be listed in the relevant section of the TIAC Best Practices Guide.

PART 2 - PRODUCTS

2.1 FOR HOT WATER [60 F – 220 F (15 C – 105 C)]

- .1 Flame spread / smoke developed rating: 25/50 as per CAN/ULC S102 or CAN/ULC S102.2
- .2 For conditioned space
 - .1 Thermal conductivity factor 'k': 0.035-0.040 W/m*C @ 38 C
 - .2 For concealed space
 - .1 Preformed mineral fiber (low and medium temperature) pipe insulation with a factory applied jacket, or
 - .2 Preformed glass fiber pipe insulation with a factory applied jacket, or
 - .3 Closed cell foam elastomeric pipe insulation.
 - .3 For exposed space
 - .1 Preformed mineral fiber (low and medium temperature) pipe insulation with PVC jacket, or
 - .2 Preformed glass fiber pipe insulation with a factory applied jacket with PVC jacket
- .4 Insulation thickness
 - .1 Up to 2 NPS: 1" (25 mm)
 - .2 2½ NPS and up: 1½" (38 mm)

- .3 For unconditioned space
 - .1 Thermal conductivity factor 'k': 0.046-0.049 W/m°C @ 38 C
 - .2 For concealed space
 - .1 Preformed mineral fiber (low and medium temperature) pipe insulation with a factory applied jacket, or
 - .2 Preformed glass fiber pipe insulation with a factory applied jacket, or
 - .3 Closed cell foam elastomeric pipe insulation (not acceptable if heat traced).
 - .3 For exposed space
 - .1 Preformed mineral fiber (low and medium temperature) pipe insulation with PVC jacket, or
 - .2 Preformed glass fiber pipe insulation with a factory applied jacket with PVC jacket
 - .4 Insulation thickness
 - .1 Up to 2 NPS: 2½" (64 mm)
 - .2 2½ NPS to 4 NPS: 3" (76 mm)
 - .3 5 NPS and up: 3½" (89 mm)
- .4 For outdoor applications
 - .1 Thermal conductivity factor 'k': 0.046-0.049 W/m°C @ 38 C
 - .2 Preformed mineral fiber (low and medium temperature) pipe insulation with stainless steel jacket, or
 - .3 Preformed glass fiber pipe insulation with a factory applied jacket with stainless steel jacket
 - .4 Insulation thickness
 - .1 Up to 2 NPS: 2½" (64 mm)
 - .2 2½ NPS to 4 NPS: 3" (76 mm)
 - .3 5 NPS and up: 3½" (89 mm)

2.2 FOR COLD WATER [32 F – 60 F (0 C – 15 C)]

- .1 Flame spread / smoke developed rating: 25/50 as per CAN/ULC S102 or CAN/ULC S102.2
- .2 Vapor retarder permeance: 0.02 Perms or less
- .3 For conditioned space
 - .1 For concealed space
 - .1 Preformed mineral fiber (low and medium temperature) pipe insulation with a factory applied jacket, or
 - .2 Preformed glass fiber pipe insulation with a factory applied jacket, or

- .3 Closed cell foam elastomeric pipe insulation, or
- .4 Cellular glass pipe insulation
- .2 For exposed space
 - .1 Preformed mineral fiber (low and medium temperature) pipe insulation with PVC jacket, or
 - .2 Preformed glass fiber pipe insulation with a factory applied jacket with PVC jacket
- .3 Insulation thickness
 - .1 Up to 2 NPS: 1" (25 mm)
 - .2 2½ NPS and up: 1½" (38 mm)
- .4 For unconditioned space (pipe heat trace required)
 - .1 For concealed space
 - .1 Preformed mineral fiber (low and medium temperature) pipe insulation with a factory applied jacket, or
 - .2 Preformed glass fiber pipe insulation with a factory applied jacket, or
 - .3 Cellular glass pipe insulation
 - .2 For exposed space
 - .1 Preformed mineral fiber (low and medium temperature) pipe insulation with PVC jacket, or
 - .2 Preformed glass fiber pipe insulation with a factory applied jacket with PVC jacket
 - .3 Insulation thickness
 - .1 Up to 2 NPS: 2½" (64 mm)
 - .2 2½ NPS to 4 NPS: 3" (76 mm)
 - .3 5 NPS and up: 3½" (89 mm)

2.3 FOR VENT, RAIN WATER LEADER, AND SANITARY PIPING

- .1 Flame spread / smoke developed rating: 25/50 as per CAN/ULC S102 or CAN/ULC S102.2
- .2 Vapor retarder permeance: 0.02 Perms or less
- .3 For conditioned space
 - .1 Insulate a minimum 10 feet (3 m) prior to exterior (unconditioned) penetration point (or more if additional is indicated on the drawings).
 - .2 For concealed space
 - .1 Preformed mineral fiber (low and medium temperature) pipe insulation with a factory applied jacket, or
 - .2 Preformed glass fiber pipe insulation with a factory applied jacket, or

- .3 Closed cell foam elastomeric pipe insulation, or
- .4 Cellular glass pipe insulation
- .3 For exposed space
 - .1 Preformed mineral fiber (low and medium temperature) pipe insulation with PVC jacket, or
 - .2 Preformed glass fiber pipe insulation with a factory applied jacket with PVC jacket
- .4 Insulation thickness
 - .1 All pipe sizes: 1" (25 mm)
- .4 For unconditioned space (heat trace required in traps and locations completely filled with liquid)
 - .1 Insulate pipe completely
 - .2 For concealed space
 - .1 Preformed mineral fiber (low and medium temperature) pipe insulation with a factory applied jacket, or
 - .2 Preformed glass fiber pipe insulation with a factory applied jacket, or
 - .3 Closed cell foam elastomeric pipe insulation, or
 - .4 Cellular glass pipe insulation
 - .3 For exposed space
 - .1 Preformed mineral fiber (low and medium temperature) pipe insulation with PVC jacket, or
 - .2 Preformed glass fiber pipe insulation with a factory applied jacket with PVC jacket
 - .4 Insulation thickness
 - .1 All pipe sizes: 1" (25 mm)

2.4 INSULATION SECUREMENT

- .1 Joint connections, vapor retarder completion, jacket attachment and associated materials otherwise required for installation to the insulation manufacturer's instructions shall be provided by the insulation manufacturer.

2.5 JACKETS

- .1 Polyvinyl Chloride (PVC):
 - .1 Moulded type to CAN/CGSB-51.53 with pre-formed shapes as required.
 - .2 Minimum service temperatures: -4 F (-20°C).
 - .3 Moisture vapour transmission: 0.02 perm.

- .4 Labels: As per Section 22 05 53 – Identification of Plumbing Piping and Equipment
- .5 Apply in all wet or humid environments.

PART 3 - EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 PRE- INSTALLATION REQUIREMENT

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

3.3 INSTALLATION - GENERAL

- .1 Install in accordance with TIAC Best Practices Guide.
- .2 Apply materials in accordance with manufacturer's instructions.
- .3 Closed cell elastomeric insulation shall not be used on externally heat traced piping.
- .4 Maintain uninterrupted continuity and integrity of vapor retarder jacket and finishes.
 - .1 Install hangers, supports outside vapor retarder jacket.

3.4 RUNOUTS

- .1 Run-outs to individual units and equipment not exceeding 13' (4000 mm) long.
- .2 Do not insulate exposed runouts to plumbing fixtures, fixture risers, valves, or fittings located within the same room as the fixture.
 - .1 Exception: Barrier-free fixtures may require insulation and PVC jacketing for burn protection.

3.5 INSTALLATION OF ELASTOMERIC INSULATION

- .1 Insulation to remain dry. Overlaps shall be installed to manufacturer's instructions. Ensure tight joints.
- .2 Provide vapor retarder to joints as recommended by manufacturer.

3.6 INSTALLATION - FOR HOT WATER [60 F – 220 F (15 C – 105 C)]

- .1 TIAC Code: 1501-H.
 - .1 Insulation and jackets shall be attached as per manufacturer's installation documentation.
 - .2 Valves, bonnets, strainers, P-T ports, and gauges are not to be insulated unless in unconditioned or outdoor spaces.
- .2 For concealed spaces
 - .1 Finish shall be TIAC code: CPF/2
 - .2 Valves, bonnets, strainers, P-T ports, and gauges are not to be finished unless in unconditioned or outdoor spaces.
- .3 For exposed spaces (not outdoors)
 - .1 Finish shall be TIAC code: CPF/4
 - .2 Valves, bonnets, strainers, P-T ports, and gauges are not to be finished unless in unconditioned or outdoor spaces.
- .4 For outdoor applications
 - .1 Finish shall be TIAC code: CPF/3

3.7 INSTALLATION - FOR COLD WATER [32 F – 60 F (0 C – 15 C)]

- .1 TIAC Code: 1501-C.
 - .1 Insulation and jackets shall be attached as per manufacturer's installation documentation.
- .2 For concealed spaces
 - .1 Finish shall be TIAC code: CPF/2
 - .2 P-T ports, and gauges are not to be finished unless in unconditioned or outdoor spaces.
- .3 For exposed spaces (not outdoors)
 - .1 Finish shall be TIAC code: CPF/4
 - .2 P-T ports, and gauges are not to be finished unless in unconditioned or outdoor spaces.
- .4 For outdoor applications
 - .1 Finish shall be TIAC code: CPF/3

3.8 INSTALLATION - FOR VENT, RAIN WATER LEADER, AND SANITARY PIPING

- .1 TIAC Code: 1501-C.
 - .1 Insulation and jackets shall be attached as per manufacturer's installation documentation.

- .2 Coordinate heat tracing of traps and other areas of completely filled with liquid prior to insulation installation.
- .2 For concealed spaces
 - .1 Finish shall be TIAC code: CPF/2
 - .2 Backwater valves and other accessories shall not be insulated unless within 10 feet (3 m) of an exterior (unconditioned) penetration point.
- .3 For exposed spaces (not outdoors)
 - .1 Finish shall be TIAC code: CPF/4
 - .2 Backwater valves and other accessories shall not be insulated unless within 10 feet (3 m) of an exterior (unconditioned) penetration point.
- .4 For outdoor applications
 - .1 Finish shall be TIAC code: CPF/3

3.9 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

PART 1 - GENERAL

1.1 SUMMARY

- .1 This section includes the requirements for domestic potable water piping.
- .2 The intent of the design is to have a complete, working domestic potable water system that will function under all reasonable conditions. Installation shall meet this intent.

1.2 RELATED SECTIONS

- .1 Section 01 33 00 – Submittal Procedures
- .2 Section 01 78 00 – Closeout Submittals
- .3 Section 07 85 00 – Firestopping
- .4 Section 22 05 00 – Common Work Results for Plumbing
- .5 Section 22 05 16 – Expansion Fittings and Loops for Plumbing Piping
- .6 Section 22 05 29 – Hangers and Supports for Plumbing Piping and Equipment
- .7 Section 22 05 53 – Identification for Plumbing Piping and Equipment
- .8 Section 22 07 19 – Plumbing Piping Insulation

1.3 REFERENCES

- .1 American National Standards Institute (ANSI)/American Society of Mechanical Engineers International (ASME)
 - .1 ANSI/ASME B16.15 Cast Bronze Threaded Fittings, Classes 125 and 250
 - .2 ANSI/ASME B16.18 Cast Copper Alloy Solder Joint Pressure Fittings
 - .3 ANSI/ASME B16.22 Wrought Copper and Copper Alloy Solder Joint Pressure Fittings
- .2 American National Standards Institute/National Sanitation Foundation (ANSI/NSF)
 - .1 ANSI/NSF 61, Drinking Water System Components
- .3 American Society for Testing and Materials International (ASTM)
 - .1 ASTM B88M Standard Specification for Seamless Copper Water Tube (Metric)
 - .2 ASTM F493 Standard Specification for Solvent Cements for Chlorinated Polyvinyl Chloride (CPVC) Plastic Pipe and Fittings
 - .3 ASTM F877 Standard Specification for Crosslinked Polyethylene (PEX) Plastic Hot- and Cold-Water Distribution Systems
 - .4 ASTM F2080 Standard Specification for Cold-Expansion Fittings with Metal Compression-Sleeves for Crosslinked Polyethylene (PEX) Pipe

- .4 American Water Works Association (AWWA)
 - .1 AWWA C904-06 - Crosslinked Polyethylene (PEX) Pressure Pipe, 1/2 In.(12 mm) Through 3 In. (76 mm), for Water Service
- .5 Canadian Standards Association (CSA International).
 - .1 CSA B137.5 Crosslinked Polyethylene (PEX) Tubing Systems for Pressure Applications
 - .2 CSA B137.6 Chlorinated Polyvinylchloride (CPVC) Pipe, Tubing, and Fittings for Hot and Cold Water Distribution Systems
- .6 Underwriters' Laboratories of Canada (ULC)
 - .1 CAN/ULc S101 PEX Pipe through Fire Rated Assemblies
 - .2 CAN/ULc S102.2 Surface Burning Characteristics of Flooring, Floor Covering and Miscellaneous Materials
- .7 National Research Council (NRC)/Institute for Research in Construction
 - .1 National Plumbing Code of Canada (NPC)

1.4 SUBMITTALS

- .1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Upon request, provide manufacturer's printed product datasheets for piping and adhesives, indicating models and options specific to this work. Datasheets submitted shall include designations of rating compliance (i.e. CSA, ASTM, ULC, etc.).
- .3 Include in Operation and Maintenance (O&M) Manual per 01 78 00 – Closeout Submittals:
 - .1 Reports:
 - .1 Include certificate of water flow and pressure tests conducted on incoming water service, demonstrating adequacy of flow and pressure.
 - .2 Include water quality sample analysis.

1.5 QUALITY ASSURANCE

- .1 Manufacturer: Must be a company specializing in the Work of this Section with a minimum of ten (10) years documented experience.
- .2 All piping and fittings of a particular material shall be supplied by one manufacturer.
- .3 Supplier: Must be a company specializing in the Work of this Section with a minimum of five (5) years documented experience.

PART 2 - PRODUCTS

2.1 PIPING

- .1 Domestic hot, cold and recirculation systems, within building.
 - .1 Copper:
 - .1 Above ground: copper tube, hard drawn, type L: to ASTM B88M.
 - .2 Buried or embedded: copper tube, soft annealed, type K: to ASTM B88M, in long lengths and with no buried joints.
 - .3 Copper shall be used at all hot water heater connections, and installed 10'-0" upstream and downstream of the heater.
 - .2 CPVC:
 - .1 Above ground use only: to CSA B137.6
 - .2 Pipe shall be rated for continuous operation of 100 psi gauge pressure at 180°F temperature (690 kPa @ 82°C).
 - .3 Pipe to have a Flame Spread Index of less than 25, and a Smoke Developed Index of less than 50 when tested in accordance with CAN/ULC S102.2.

2.2 FITTINGS

- .1 Copper:
 - .1 Cast bronze threaded fittings, Class 125 and 250: to ANSI/ASME B16.15.
 - .2 Cast copper, solder type: to ANSI/ASME B16.18.
 - .3 Wrought copper and copper alloy, solder type: to ANSI/ASME B16.22.
 - .4 NPS 1½ and under: Cast copper, ANSI/ASME B16.18 or wrought copper, ANSI/ASME B16.22; with 301 stainless steel internal components, EPDM seal, and push-to-connect joints.
- .2 CPVC:
 - .1 Fittings are to be the same material as the pipe and provided by the pipe manufacturer.

2.3 JOINTS

- .1 Copper:
 - .1 Solder: 95/5 tin copper alloy lead free.
 - .2 Teflon tape: for threaded joints.
 - .3 Dielectric connections between dissimilar metals.
- .2 CPVC:

- .1 Solvent cement to CSA B137.6, ASTM F493 and ANSI/NSF 61.
- .2 Two part CPVC cement with primer (Low VOC).

PART 3 - EXECUTION

3.1 ACCEPTABLE INSTALLERS

- .1 The responsible installer shall be licensed in the jurisdiction of the installation.
- .2 For Copper:
 - .1 Installation by qualified journeyman with at least five (5) years experience in copper joining work.
- .3 For CPVC:
 - .1 Under direct supervision of, or conducted by a qualified journeyman.

3.2 PREPARATION

- .1 Coordinate installation with trades whose installations are close by, or in potential conflict.
- .2 Prepare the layout based on manufacturer's recommendations for proper installation.

3.3 INSTALLATION (GENERAL)

- .1 Install in accordance with:
 - .1 Canadian National Plumbing Code (NPC)
 - .2 Local Authority Having Jurisdiction (AHJ).
 - .3 Manufacturer's Instructions
- .2 For Copper:
 - .1 Solder connections: Clean and score, de-burr and apply flux. Protect against flame damage. Remove excess solder and flux after joining.
- .3 For CPVC:
 - .1 Straight cut, de-burr and clean. Apply primer and two part cement as per manufacturer's requirements.
- .4 Maintain 6" (150 mm) between cold water and hot water piping.
- .5 Connect to fixtures and equipment in accordance with manufacturer's written instructions unless otherwise indicated.

3.4 INSTALLATION (SPECIFIC AREAS)

- .1 For vertical shafts that do not have fire separations at each floor level, only copper pipe is acceptable. Copper shall be used for pipe entering and leaving the shaft and entirely in the shaft.

3.5 PRE-STARTUP INSPECTION

- .1 Verify that system can be completely drained.
- .2 Ensure that pressure booster systems (if applicable) are installed properly.
- .3 Ensure that air chambers, expansion compensators are installed properly.
- .4 Ensure Pex piping can be isolated from piping of other material.

3.6 STARTUP PROCESS

- .1 Consult local authority having jurisdiction (AHJ) inspector prior to startup process regarding process deviation, inspection and witnessing requirements.
- .2 Disconnect/isolate any water treatment and softening devices.
- .3 Disconnect/isolate gas or power to water heaters. Maintain water flow through units.
- .4 Pressure Test System
 - .1 Pressurize system with air prior to covering with drywall. Maintain pressure for 24 hours.
 - .2 Test pressure: greater of 1½ times maximum system operating pressure or 125 psi (860 kPa).
 - .3 Submit pressure test report upon request.
- .5 Flush all piping with water for three (3) hours.
- .6 Disinfect copper and CPVC pipes.
 - .1 Disinfection process may be modified by the authority having jurisdiction (AHJ) at their discretion. Mechanical Subcontractor shall follow AHJ direction.
 - .2 Coordinate disinfection process with incoming water service work done by site services Subcontractor.
 - .3 Drain water from system.
 - .4 Fill system with water containing 50 ppm (50mg/L) of chlorine.
 - .5 Let stand in piping system for 24 hours.
 - .6 Drain piping.
- .7 Flush copper and CPVC pipes for three (3) hours, or until chlorine smell is gone, whichever is longer.
- .8 Connect/open valves to Pex piping, water treatment devices.
- .9 Connect/open valve for gas or electricity for water heating devices. Bring temperature up slowly.

- .10 Monitor pipe expansion.
- .11 Purge air from system.

3.7 POST-STARTUP INSPECTION

- .1 Inspect air vents, pressure reducing valves and pressure relief valves for leaks.
- .2 Inspect pipe expansion compensation locations for leaks.
- .3 Clean faucet diffusers/strainers.
- .4 Rectify start-up deficiencies.

3.8 PERFORMANCE VERIFICATION

- .1 Record incoming water pressure and flow rate.
- .2 Take water sample from faucet at high point in system. Submit to an accredited laboratory to produce a water quality report.
- .3 Verify performance of temperature controls. Adjust as required.
- .4 Verify compliance with safety and health requirements.
- .5 Check for proper operation of water hammer arrestors. Run one outlet for 10 seconds then, shut off water immediately. If water hammer occurs, replace water hammer arrestor or re-charge air chambers. Repeat for outlets and flush valves.
- .6 Reports:
 - .1 Include certificate of water flow and pressure tests conducted on incoming water service, demonstrating adequacy of flow and pressure.
 - .2 Include water quality sample analysis.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

- .1 This section gives guidance on domestic water piping specialties and includes:
 - .1 General Requirements
 - .2 Vacuum breakers
 - .3 Backflow preventers
 - .4 Water pressure-reducing valves
 - .5 Balancing valves
 - .6 Temperature control water mixing valves
 - .7 Strainers
 - .8 Outlet boxes
 - .9 Hose bibbs (Interior)
 - .10 Wall hydrants (Exterior)
 - .11 Drain valves
 - .12 Water-hammer arresters
 - .13 Trap primer systems
 - .14 Flexible connectors

1.2 RELATED SECTIONS

- .1 Section 01 33 00 – Submittal Procedures
- .2 Section 01 78 00 – Closeout Submittals
- .3 Section 01 91 13 – General Commissioning Requirements
- .4 Section 22 05 00 – Common Work Results for Plumbing
- .5 Section 22 05 29 – Hangers and Supports for Plumbing Piping and Equipment
- .6 Section 22 05 53 – Identification for Plumbing Piping and Equipment
- .7 Section 22 07 19 – Plumbing Piping Insulation
- .8 Section 22 11 16 – Domestic Water Piping

1.3 REFERENCES

- .1 Listed under individual specialties

1.4 SUBMITTALS

- .1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Provide manufacturer's printed product datasheets for each specialty, indicating models and options specific to this work. Datasheets submitted shall include designations of rating compliance (i.e. CSA, ASTM, ULc, etc.).
- .3 Closeout Submittals:
 - .1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.
 - .2 Provide Performance Verification Reports.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

- .1 Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig (860 kPa) unless otherwise indicated.
- .2 Choose "lead-free" products (<0.25% lead by weight on wetted surfaces).
- .3 Include isolation valves before and after every specialty or group of specialties requiring maintenance.

2.2 VACUUM BREAKERS

- .1 Pipe-Applied, Atmospheric-Type Vacuum Breakers (AVB)
 - .1 Construction Standard: ASSE 1001.
 - .2 Application Standard: CAN/CSA B64.1.1
 - .3 Size: As required to match connected piping.
 - .4 Inlet and Outlet Connections: Threaded.
- .2 Hose-Connection Vacuum Breakers (HVB or HCVB)
 - .1 Standard: ASSE 1011.
 - .2 Application Standard: CAN/CSA B64.2
 - .3 Outlet Connection: Garden-hose threaded complying with ASME B1.20.7.
- .3 Pressure Vacuum Breakers (PVB)
 - .1 Standard: ASSE 1020.
 - .2 Application Standard: CAN/CSA B64.1.2

- .3 Size: As required to match connected piping.
- .4 Accessories:
 - .1 Valves: Ball type, on inlet and outlet.
- .4 Laboratory-Faucet Vacuum Breakers (LFVB)
 - .1 Unit consists of two (2) independent check valves with intermediate vacuum breaker and relief vent.
 - .2 Standard: ASSE 1035.
 - .3 Application Standard: CAN/CSA B64.7
 - .4 Size: As required to match faucet size.
 - .5 End Connections: Threaded.
 - .6 Finish: Chrome plated.
- .5 Spill-Resistant Vacuum Breakers (SVB or SRPVB)
 - .1 Standard: ASSE 1056.
 - .2 Application Standard: CAN/CSA B64.1.3
 - .3 Size: As required to match connected piping.
 - .4 Accessories:
 - .1 Valves: Ball type, on inlet and outlet.

2.3 BACKFLOW PREVENTION

- .1 Intermediate Atmospheric-Vent Backflow Preventers (DuCV or DC with vent)
 - .1 Standard: ASSE 1012.
 - .2 Application Standard: CAN/CSA B64.8
 - .3 Size: As required to match connected piping.
 - .4 End Connections: Union joint.
- .2 Reduced-Pressure-Principle Backflow Preventers (RP or RPZ)
 - .1 Standard: ASSE 1013.
 - .2 Application Standard: CAN/CSA B64.4
 - .3 Body: Bronze for NPS 2 (DN 50) and smaller; Cast iron with interior lining that complies with AWWA C550 for NPS 2 1/2 (DN 65) and larger.
 - .4 End Connections: Threaded for NPS 2 (DN 50) and smaller; flanged for NPS 2 1/2 (DN 65) and larger.
 - .5 Accessories:
 - .1 Valves NPS 2 (DN 50) and Smaller: Ball type with threaded ends on inlet and outlet.
 - .2 Valves NPS 2 1/2 (DN 65) and Larger: Outside-screw and yoke-gate type with flanged ends on inlet and outlet.

- .3 Air-Gap Fitting: ASME A112.1.2, matching backflow-preventer connection.
- .3 Double-Check, Backflow-Prevention Assemblies (DCVA)
 - .1 Standard: ASSE 1015.
 - .2 Application Standard: CAN/CSA B64.5
 - .3 Body: Bronze for NPS 2 (DN 50) and smaller; cast iron with interior lining that complies with AWWA C550 or that is FDA approved for NPS 2 1/2 (DN 65) and larger.
 - .4 End Connections: Threaded for NPS 2 (DN 50) and smaller; flanged for NPS 2 1/2 (DN 65) and larger.
 - .5 Configuration: Designed for horizontal, straight-through flow.
 - .6 Accessories:
 - .1 Valves NPS 2 (DN 50) and smaller: Ball type with threaded ends on inlet and outlet.
 - .2 Valves NPS 2 1/2 (DN 65) and larger: Outside-screw and yoke-gate type with flanged ends on inlet and outlet.
- .4 Dual-Check-Valve Backflow Preventers (DC or DuC)
 - .1 Standard: ASSE 1024.
 - .2 Application Standard: CAN/CSA B64.6
 - .3 Body: Bronze with union inlet.
- .5 Reduced-Pressure-Detector, Fire-Protection, Backflow-Preventer Assemblies (RPF or RPDA)
 - .1 Standard: ASSE 1047 and is FM Global approved or UL listed.
 - .2 Application Standard: CAN/CSA B64.4.1
 - .3 Body: Cast iron with interior lining that complies with AWWA C550 or that is FDA approved
 - .4 End Connections: Flanged.
 - .5 Accessories:
 - .1 Valves: Outside-screw and yoke-gate type with flanged ends on inlet and outlet.
 - .2 Air-Gap Fitting: ASME A112.1.2, matching backflow-preventer connection.
- .6 Double-Check, Detector-Assembly , Fire Protection, Backflow Preventers (DCDA or DCVAF)
 - .1 Standard: ASSE 1048 and is FM Global approved or UL listed.
 - .2 Application Standard: CAN/CSA B64.5.1
 - .3 Body: Cast iron with interior lining that complies with AWWA C550.
 - .4 End Connections: Flanged.
 - .5 Accessories:

- .1 Valves: Outside-screw and yoke-gate type with flanged ends on inlet and outlet.

2.4 WATER PRESSURE-REDUCING VALVES

- .1 Pressure Regulators
 - .1 Working Pressure Rating: Initial working pressure of 300 psig (21 bar).
 - .2 Reduced Pressure: Adjustable to meet the requirements of the attached equipment.
 - .3 Material:
 - .1 Body: Bronze or Brass
 - .2 Diaphragm: Reinforced Buna-N
 - .3 Disc: Buna-N – Stainless Steel
- .2 Pressure Reducers
 - .1 Standard: ASSE 1003
 - .2 Working Pressure Rating: Initial working pressure of 200 psig (1380 kPa) minimum
 - .3 Reduced Pressure: Adjustable between 10 – 30 psig (69 – 207 kPa)
 - .4 Include integral stainless steel strainer.
 - .5 Material:
 - .1 Body: cast copper-silicone alloy
 - .2 Seat: Stainless steel
 - .3 Diaphragm: Reinforced EPDM
 - .4 Valve Disc: EPDM

2.5 BALANCING VALVES

- .1 Memory-Stop Balancing Valves
 - .1 Pressure Rating: 125 psig (862 kPa) minimum.
 - .2 Size: NPS 2 (DN 50) or smaller.
 - .3 Material:
 - .1 Body: Brass
 - .2 Port: Brass
 - .3 Ball: Chrome-plated brass
 - .4 Seats: PTFE
 - .4 Accessories: Checked metering ports

2.6 TEMPERATURE CONTROL WATER MIXING VALVES

- .1 "Point-of-Use" Water Temperature Limiting Devices: 3/8" (10 mm) to 1" (25 mm) connections
 - .1 Standard: ASSE 1070.
 - .2 Pressure Rating: 150 psig (10.3 bar) minimum.
 - .3 Flow Rating: Accurate at 0.5 gpm (2.2 l/min) and higher
 - .4 Leaving Temperature: 80 - 120 F (27 - 49 C) – Manually adjustable.
 - .5 Material:
 - .1 Body: Brass or Copper-silicon alloy
 - .2 Disc: Buna-N or Stainless steel
 - .3 Thermostat: Copper
 - .4 Spring: Stainless steel
 - .6 Accessories:
 - .1 Check valves to prevent temperature migration
 - .2 40 mesh stainless steel screens on hot and cold water supplies to valve.
- .2 Primary, Thermostatic Water Mixing Valves: 3/4" (19 mm) to 2" (50 mm) connections
 - .1 Standard: ASSE 1017.
 - .2 Pressure Rating: 125 psig (860 kPa) minimum.
 - .3 Flow Rating: As per ASSE 1017
 - .4 Leaving Temperature: 90 - 180 F (32 - 82 C) – Manually adjustable.
 - .5 Material:
 - .1 Body: Brass
 - .2 Thermostat actuator: Paraffin based
 - .6 Accessories:
 - .1 Check valves to prevent temperature migration

2.7 STRAINERS

- .1 Wye-Pattern Strainers: 1/4" (8 mm) to 4" (100 mm)
 - .1 Pressure Rating: 300 psig (20.7 bar) minimum at 210 F (99 C).
 - .2 Material:
 - .1 Body: Copper-silicon alloy
 - .2 Strainer: 304 Stainless steel
 - .1 #20 mesh for 1/4" (8 mm) to 2 1/2" (65 mm) pipe
 - .2 3/64" mesh for 3" (75 mm) pipe

- .3 1/8" mesh for 4" (100 mm) pipe

2.8 LAUNDRY BOXES

- .1 Clothes Washer Outlet Boxes
 - .1 Standards:
 - .1 Valves: ASME A112.18.1
 - .2 Hose Outlets: ASME B1.20.7
 - .2 Mounting: Recessed in wall.
 - .3 Material and Finish:
 - .1 Box: Enameled-steel, epoxy-painted-steel, or rigid plastic.
 - .2 Hose bibbs: Brass with water hammer arrestors.
 - .4 Drain: Box shall have sealed connection to standpipe and P-trap to receive washer waste hose.

2.9 HOSE BIBBS (INTERIOR)

- .1 Hose Bibbs (Exposed)
 - .1 Standards:
 - .1 Hose Outlet: ASME B1.20.7
 - .2 Vacuum Breaker: ASSE 1011
 - .2 Material:
 - .1 Body: Bronze.
 - .2 Seat: Bronze, replaceable.
 - .3 Pressure Rating: 125 psig (860 kPa).
 - .4 Accessories:
 - .1 Vacuum Breaker: non-removable, tamper-proof.

2.10 WALL HYDRANTS (EXTERIOR)

- .1 Non-freeze Wall Hydrants
 - .1 Standard: ASSE 1053
 - .2 Pressure Rating: 125 psig (860 kPa).
 - .3 Material:
 - .1 Body and Pipe: Brass
 - .2 Box: Brass
 - .4 Operation: Quarter-turn key.

- .5 Pipe to be length required to match wall thickness including box. Include wall clamp.
- .6 Must be automatic draining.
- .7 Inlet size: NPS 3/4 (DN 20).
- .8 Outlet: Integral dual check valve and garden-hose thread.
- .9 Accessories:
 - .1 Dual check valve
 - .2 Flush mount box with weep hole to enclose hydrant

2.11 DRAIN VALVES

- .1 Ball-Valve-Type, Hose-End Drain Valves
 - .1 Standard: MSS SP-110 for standard-port, two-piece ball valves.
 - .2 Pressure Rating: Class 125.
 - .3 Size: NPS 3/4 (DN 20).
 - .4 Body: Copper alloy.
 - .5 Ball: Chrome-plated brass.
 - .6 Seats and Seals: Replaceable.
 - .7 Handle: Vinyl-covered steel.
 - .8 Inlet: Threaded or solder joint.
 - .9 Outlet: Threaded, short nipple with garden-hose thread complying with ASME B1.20.7 and cap with brass chain.
- .2 Gate-Valve-Type, Hose-End Drain Valves
 - .1 Standard: MSS SP-80 for gate valves.
 - .2 Pressure Rating: Class 125.
 - .3 Size: NPS 3/4 (DN 20).
 - .4 Body: ASTM B 62 bronze.
 - .5 Inlet: NPS 3/4 (DN 20) threaded or solder joint.
 - .6 Outlet: Garden-hose thread complying with ASME B1.20.7 and cap with brass chain.
- .3 Stop-and-Waste Drain Valves
 - .1 Combination stop and drain valves are not permitted unless specifically authorized. Use separate isolation and drain valves.

2.12 WATER HAMMER ARRESTERS

- .1 Water-Hammer Arresters

- .1 Standard: ASSE 1010 and ANSI A112.26.1M.
- .2 Pressure Rating:
 - .1 Working range up to 350 psig (24 bar)
 - .2 Surge protection to 1500 psig (103.4 bar)
- .3 Temperature Rating: Up to 250 F (121 C)
- .4 Size: A through F, as required by number of fixtures.

2.13 TRAP PRIMER DEVICES

- .1 Pressure Drop Primer Device
 - .1 Standard: ASSE 1018.
 - .2 Pressure Rating:
 - .1 20 psig (138 kPa) to 125 psig (860 kPa) supply water pressure.
 - .2 3 psi (21 kPa) pressure drop activation.
 - .3 Body: Bronze or Brass
 - .4 Inlet and Outlet Connections: NPS 1/2 (DN 15) threaded.
 - .5 Accessories: Air gap fitting.
- .2 Electronic Trap Primer Systems (Single Manufacturer Package)
 - .1 Standard: ASSE 1044.
 - .2 Pressure Rating: to 100 psig (690 kPa) supply water pressure.
 - .3 Inlet and Outlet Connections: NPS 1/2 (DN 15).
 - .4 Cabinet: 16 gage epoxy coated steel.
 - .5 Power connection: Single point 120 VAC or 24 VDC
 - .6 Electric Controls: 24-hour timer, solenoid valve, and manual override switch.
 - .7 Accessories:
 - .1 Manifold to serve up to five (5) traps.
 - .2 Air gap fitting

2.14 FLEXIBLE CONNECTORS

- .1 Braided Stainless Steel Flexible Connectors
 - .1 Material:
 - .1 Hose: PVC
 - .2 Jacket: Braided stainless steel
 - .3 Connections: Lead-free brass
 - .2 Working Pressure Rating: Minimum 125 psig (860 kPa)

- .3 Working Temperature Rating: 180 F (82 C)

PART 3 - EXECUTION

3.1 INSTALLATION – GENERAL

- .1 Specialty items shall be compatible with the plumbing piping connected.
- .2 Specialty items attached in plumbing piping shall be supported such that the installation does not cause excessive force or torque on the piping.
- .3 Coordinate with other trades including wall and ceiling finisher to allow for access doors to be located in a suitable location adjacent to the specialty device.
- .4 Attached piping shall be clean of oil, cutting fluid and burrs prior to installation of specialty device. Many piping specialties will not function properly if oil or debris is allowed to enter.

3.2 INSTALLATION – VACUUM BREAKERS AND BACKFLOW PREVENTERS

- .1 Install air gaps, vacuum breakers, or backflow preventers as required by the particular application in each water supply that serves fixtures, tanks, devices or other systems that may be sources of contamination. Comply with:
 - .1 Authorities Having Jurisdiction (AHJ)
 - .2 CAN/CSA B64.10-11 - Selection and Installation of Backflow Preventers
 - .3 Canadian National Plumbing Code (NPC)
- .2 If a specific type of contamination or backflow prevention is specified on the drawings or elsewhere in the specification, that type must be used, even if an optional type is allowed when complying with 3.2.1 above.
- .3 Locate backflow preventers in same room as connected equipment or system.
- .4 Backflow preventers with atmospheric-vent or port drain connection shall terminate above a floor hub drain with an air gap.
- .5 Do not install bypass piping around backflow preventers.

3.3 INSTALLATION – WATER PRESSURE-REDUCING VALVES

- .1 Install pressure gages on inlet and outlet.

3.4 INSTALLATION – BALANCING VALVES

- .1 Install balancing valves in locations where they can easily be adjusted.

3.5 INSTALLATION – TEMPERATURE CONTROL WATER MIXING VALVES

- .1 Install “point-of-use” water temperature control devices at each fixture, or closely grouped fixtures, as indicated on the drawings or designated as requiring anti-scald protection.
- .2 Primary water temperature control devices are not to be used to provide anti-scald protection to fixtures.
- .3 Install temperature control water mixing valves in locations where they can easily be adjusted.
- .4 Install so valves are independently attached to structure. Do not rely on connected piping for support.

3.6 INSTALLATION - STRAINERS

- .1 Unless integral to the valve, install a wye-pattern strainer for water on each supply side connection to each pressure-reducing valve, balancing valve, or temperature control mixing valve.
- .2 Install a wye-pattern strainer for water on each supply side connection to each pump.

3.7 INSTALLATION – OUTLET BOXES

- .1 Install outlet boxes recessed in wall, or upon approval only, surface mounted to wall. Install wood blocking wall reinforcement between studs to rigidly attach box to structure.

3.8 INSTALLATION – HOSE BIBBS (INTERIOR)

- .1 Install hose bibbs rigidly to structure with wood blocking as required.

3.9 INSTALLATION – WALL HYDRANTS (EXTERIOR)

- .1 Coordinate with exterior wall finishing Subcontractor and wall structural Subcontractor to accept hydrant mounting.
- .2 Use spray foam insulation to fill voids after installation. Maintain thermal and vapor barriers.

3.10 INSTALLATION – DRAIN VALVES

- .1 Drain valve to be located at low point of systems to allow for complete drainage.
- .2 For incoming domestic water service to a building, the order of installation shall be point of entry, water meter, backflow preventer, stop cock, then drain valve. All fixtures and branches shall be downstream of the drain valve.
- .3 Drain valves for hot water applications shall be a gate valve type.

3.11 INSTALLATION – WATER HAMMER ARRESTERS

- .1 Locate as close as possible to quick closing valves.
- .2 Generally for groups of fixtures, install on both cold and hot water supply lines between last and second last fixture; sized for total connected fixture units.
- .3 Refer to manufacturer's documents for sizing and placement data.

3.12 INSTALLATION – TRAP PRIMERS

- .1 For pressure drop primers:
 - .1 Primer branch pipe shall tee off the top of supply water piping. Install union prior to primer device.
 - .2 Clean and flush supply water piping prior to installation. Debris will hamper proper primer operation.
 - .3 Connect rigid pipe from outlet of air gap fitting to trap connection with a minimum 1% slope towards the trap.
 - .4 Mount the primer device 12" (300 mm) above the trap for every 20 feet (6 m) of outlet pipe.
 - .5 Use only Teflon tape for threaded pipe connections.
- .2 For electronic primers:
 - .1 Coordinate with electrical contractor to provide line voltage (120 VAC units only).
 - .2 Provide 24 VDC power to the unit (24 VDC units only). Mechanical contractor is responsible for line to low voltage transformer if required.
 - .3 Primer system to be mounted within a cabinet.
 - .4 Primer branch pipe shall tee off the top of supply water piping.
 - .5 Clean and flush supply water piping prior to installation. Debris will hamper proper primer operation.
 - .6 Connect rigid pipe(s) from outlet of manifold to each trap connection with a minimum 1% slope towards the trap.

3.13 INSTALLATION – FLEXIBLE CONNECTORS

- .1 Use when connecting domestic water supply to sinks, lavatories, toilet tanks, and any equipment or fixture that may not be rigidly attached to structure or may move relative to the attached piping.
- .2 Flexible connectors shall not be excessively long or short. The intent is to allow for reasonable fixture, equipment or piping movement relative to each other while maintaining a good connection and flow.
- .3 Do not install flexible connectors within 3 feet (1 m) of a hot water generator, hot water tank, or associated flue venting. When flexible connectors are required for these applications, flexible connectors shall be attached only to the horizontal sections of branch piping to the unit.

3.14 FIELD QUALITY CONTROL

- .1 Perform the following tests and inspections:
 - .1 Test each backflow preventer according to authorities having jurisdiction and the device's reference standard.
 - .2 Inspect and clean strainers after initial water flushing and again just prior to project completion.
- .2 Domestic water piping specialties will be considered defective if they do not pass tests and inspections.
- .3 Prepare test and inspection reports.

3.15 ADJUSTING

- .1 Set field-adjustable pressure set points of water pressure-reducing valves.
- .2 Set field-adjustable flow set points of balancing valves.
- .3 Set field-adjustable temperature set points of temperature-actuated, water mixing valves.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

- .1 This section includes the requirements of drainage, waste, and vent (DWV) piping for a sanitary application.
- .2 The intent of the design is to have a complete, working sanitary waste and vent system that will function under all reasonable conditions. Installation shall meet this intent.

1.2 RELATED SECTIONS

- .1 Section 01 33 00 – Submittal Procedures
- .2 Section 07 84 00 – Firestopping
- .3 Section 22 05 00 – Common Work Results for Plumbing
- .4 Section 22 05 29 – Hangers and Supports for Plumbing Piping and Equipment
- .5 Section 22 05 53 – Identification of Plumbing Piping and Equipment
- .6 Section 22 07 19 – Plumbing Piping Insulation

1.3 REFERENCES

- .1 American Society of Mechanical Engineers (ASME)
 - .1 ASME A112.3.1 Stainless Steel Drainage Systems for Sanitary DWV, Storm, and Vacuum Applications, Above- and Below-Ground.
 - .2 ASME B16.12 Cast Iron Threaded Drainage Fittings
 - .3 ASME/ANSI B16.23 Cast Copper Alloy Solder Joint Drainage Fittings (DWV)
 - .4 ASME/ANSI B16.29 Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings (DWV)
- .2 American Society for Testing and Materials (ASTM)
 - .1 ASTM A53 Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
 - .2 ASTM A312 Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes
 - .3 ASTM A536 Standard Specification for Ductile Iron Castings
 - .4 ASTM B32 Specification for Solder Metal
 - .5 ASTM B88 Specification for Seamless Copper Water Tube
 - .6 ASTM B306 Specification for Copper Drainage Tube (DWV)

- .7 ASTM D2235 Specification for Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings
- .8 ASTM D2564 Specification for Solvent Cements for Poly(Vinyl-Chloride) (PVC) Plastic Piping Systems
- .9 ASTM F628 Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Schedule 40 Plastic Drain, Waste, and Vent Pipe with a Cellular Core
- .3 Canadian Standards Association (CSA)
 - .1 CSA B70 Cast Iron Soil Pipe, Fittings and Means of Joining
 - .2 CSA B181.1 Acrylonitrile-Butadiene-Styrene (ABS) Drain, Waste and Vent Pipe and Pipe Fittings
 - .3 CSA B181.2 PVC Drain, Waste and Vent Pipe and Pipe Fittings
 - .4 CSA B182.1 Plastic Drain and Sewer Pipe and Pipe Fittings
- .4 Underwriters Laboratory of Canada (ULC)
 - .1 CAN/ULC S102.2 Method of Test for Surface Burning Characteristics of Flooring, Floor Coverings, and Miscellaneous Materials and Assemblies
- .5 National Research Council (NRC)/Institute for Research in Construction
 - .1 National Plumbing Code of Canada (NPC)

1.4 SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Upon request, provide manufacturer's printed product datasheets for piping and adhesives, indicating models and options specific to this work. Datasheets submitted shall include designations of rating compliance (i.e. CSA, ASTM, ULc, etc.).

PART 2 - PRODUCTS

2.1 PIPING AND FITTINGS

- .1 For underground DWV applications:
 - .1 PVC meeting CSA B181.2
 - .2 Stainless steel type 316L meeting ASTM A312
 - .3 Cast iron meeting CSA B70
 - .1 Hub and Spigot connections, thrust blocks at turns
- .2 For aboveground DWV applications (in combustible construction):

- .1 PVC meeting CSA B181.2
- .2 Copper tube: 'K' or 'L' hard temper meeting ASTM B88, or 'DWV' meeting ASTM B306
 - .1 EXCEPTION: Copper tube is not allowed for the fixture drain or vent located below the flood level of urinals.
 - .2 Fittings:
 - .1 Wrought copper alloy meeting ASME B16.29
 - .2 Cast copper alloy meeting ASME B16.23
 - .3 Stainless steel type 316L meeting ASTM A312
 - .4 Cast iron meeting CSA B70
- .3 For aboveground DWV applications (in non-combustible construction):
 - .1 Flame spread rating less than 25.
 - .2 PVC meeting CSA B181.2 and CAN/ULC S102.2
 - .3 Copper tube: 'K' or 'L' hard temper meeting ASTM B88, or 'DWV' meeting ASTM B306
 - .1 EXCEPTION: Copper tube is not allowed for the fixture drain or vent located below the flood level of urinals.
 - .2 Fittings:
 - .1 Wrought copper alloy meeting ASME B16.29
 - .2 Cast copper alloy meeting ASME B16.23
 - .4 Stainless steel type 316L meeting ASTM A312
 - .5 Cast iron meeting CSA B70
 - .4 For DWV applications within air plenums:
 - .1 Flame spread rating less than 25 and smoke developed classification less than 50.
 - .2 PVC meeting CSA B181.2 and CAN/ULC S102.2
 - .3 Copper tube: 'K' or 'L' hard temper meeting ASTM B88, or 'DWV' meeting ASTM B306
 - .1 Fittings:
 - .1 Wrought copper alloy meeting ASME B16.29
 - .2 Cast copper alloy meeting ASME B16.23
 - .4 Stainless steel type 316L meeting ASTM A312
 - .5 Cast iron meeting CSA B70
 - .4 Stainless steel type 316L meeting ASTM A312
 - .5 Cast iron meeting CSA B70
 - .5 For DWV applications in high-rise buildings:
 - .1 Flame spread rating less than 25 and smoke developed classification less than 50.

- .2 PVC meeting CSA B181.2 and CAN/ULC S102.2
 - .1 Note: PVC is not allowed below a point located 20 vertical feet (6 m) above the base horizontal elbow of a vertical riser, and
 - .2 Note: PVC is not allowed below the horizontal plane of the exterior grade level.
- .3 Copper tube: 'K' or 'L' hard temper meeting ASTM B88, or 'DWV' meeting ASTM B306
 - .1 EXCEPTION: Copper tube is not allowed for the fixture drain or vent located below the flood level of urinals.
 - .2 Fittings:
 - .1 Wrought copper alloy meeting ASME B16.29
 - .2 Cast copper alloy meeting ASME B16.23
 - .4 Stainless steel type 316L meeting ASTM A312
 - .5 Cast iron meeting CSA B70
- .6 For DWV applications in vertical shafts (including entry and exit from shaft):
 - .1 Copper tube: 'K' or 'L' hard temper meeting ASTM B88, or 'DWV' meeting ASTM B306
 - .1 Fittings:
 - .1 Wrought copper alloy meeting ASME B16.29
 - .2 Cast copper alloy meeting ASME B16.23
 - .2 Stainless steel type 316L meeting ASTM A312
 - .3 Cast iron meeting CSA B70

2.2 JOINTS

- .1 'MJ' Mechanical joints/couplings (clamped sleeves) are not acceptable joints for any piping.
- .2 PVC solvent weld: to ASTM D2564
 - .1 Sizes 1½ to 6: one step cement (Low VOC)
 - .2 Sizes 8 and above: two step cement, plus low VOC primer
- .3 Copper solder: to ASTM B32
- .4 Stainless steel: threaded (schedule 40 or thicker pipe and fittings only), or groove-type fittings and couplings meeting ASTM A536
- .5 Cast iron: threaded to ASME B16.12 (except underground), or hub and spigot to CSA B70

PART 3 - EXECUTION

3.1 INSTALLATION

- .1 Installation by a qualified journeyman.
- .2 Install in accordance with Canadian Plumbing Code and local authority having jurisdiction.
- .3 Cleanouts and other service items must be accessible.
- .4 Penetrations through structure shall be such that structural loads are not transferred to pipes.
- .5 For pumped discharge piping, ensure piping is braced to structure to avoid excessive movement.

3.2 TESTING

- .1 Pressure test underground systems before backfilling in accordance with Canadian Plumbing Code.
 - .1 As per piping manufacturer's instructions.
 - .2 Air test: Maintain 35 kPa (5 Psi) for 15 minutes.
- .2 Pressure test above ground systems in accordance with Canadian Plumbing Code.
 - .1 As per piping manufacturer's instructions.
 - .2 Air test: Maintain 35 kPa (5 Psi) for 15 minutes.
 - .3 Water test: Maintain 3m (10 feet) of water column for 15 minutes.

3.3 PERFORMANCE VERIFICATION

- .1 Open cleanouts, apply linseed oil to threads and re-seal.
- .2 Ensure traps are fully and permanently primed.
- .3 Ensure fixtures are properly anchored, connected to system and effectively vented.
- .4 Affix applicable label (sanitary or vent) with directional arrows in accordance with Section 22 05 53 – Identification for Plumbing Piping and Equipment.
- .5 Provide copies of test reports for Commissioning Manuals.
- .6 Provide copies of Inspection Reports from the local authority having jurisdiction.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

- .1 This section gives guidance on sanitary waste piping specialties and includes:
 - .1 Trap Seals
 - .2 Trap Primer Connections
 - .3 Cleanouts
 - .4 Backwater Valves

1.2 RELATED SECTIONS

- .1 Section 01 33 00 – Submittal Procedures
- .2 Section 01 78 00 – Closeout Submittals
- .3 Section 22 05 00 – Common Work Results for Plumbing
- .4 Section 22 05 29 – Hangers and Supports for Plumbing Piping and Equipment
- .5 Section 22 05 53 – Identification for Plumbing Piping and Equipment
- .6 Section 22 07 19 – Plumbing Piping Insulation
- .7 Section 22 13 16 – Sanitary Waste and Vent Piping

1.3 REFERENCES

- .1 Listed under individual specialties

1.4 SUBMITTALS

- .1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Upon request, provide manufacturer's printed product datasheets for specialties, indicating models and options specific to this work. Datasheets submitted shall include designations of rating compliance (i.e. CSA, ASTM, ULc, etc.).
- .3 Closeout Submittals:
 - .1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.
 - .2 Provide chemical supplier's printed data sheet for condensate neutralization media.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

- .1 Specialties shall be suitable for the environment they are placed in.
- .2 Specialties shall be constructed of similar material as the attached piping.
- .3 Do not reduce or increase piping at specialties unless specifically designed by the City of Winnipeg Representative.
- .4 If any sanitary waste piping specialty is not easily accessible, the mechanical Subcontractor is responsible for supplying and installing a suitably sized metal access panel, and coordinating installation with other Subtrades so the specialty can be easily accessed.

2.2 TRAP SEALS

- .1 Floor Drain Push-to-Fit Seal
 - .1 Material: ABS plastic with elastomeric EPDM
 - .2 Sizes: 2" (50 mm) to 4" (100 mm)

2.3 TRAP PRIMER CONNECTIONS

- .1 For cast iron:
 - .1 Epoxy coated cast iron adapter piece.
 - .2 1/2" (13 mm) IPS tapping within extra material part of adapter.
- .2 For PVC:
 - .1 Schedule 40 adapter piece.
 - .2 1/2" (13 mm) FIPT tapping within extra material part of adapter.

2.4 CLEANOUTS

- .1 Floor locations:
 - .1 Cast iron or PVC body (same material and ratings as pipe).
 - .2 Plug diameter to be 3" (75 mm) or greater.
 - .3 Adjustable to floor height.
 - .4 Top exposed cover:
 - .1 Nickel bronze material.
 - .2 Square for straight line floor patterns (tile, wood).
 - .3 Round for other (carpet, vinyl, concrete).
 - .5 Include flashing clamp and flange for sealed floor applications.

- .6 'Heavy-duty' rated when potentially subject to vehicle traffic.
- .2 Wall locations:
 - .1 Cast iron, PVC, ABS, or copper alloy body (same material and ratings as pipe).
 - .2 Tapered thread plug with machine screw center tapping
 - .3 Stainless steel access cover with center machine screw.
- .3 Exposed locations:
 - .1 PVC or ABS body (same material and ratings as pipe).

2.5 BACKWATER VALVES

- .1 Main sanitary leaving building:
 - .1 Cast iron or PVC body (same material and ratings as pipe).
 - .2 No mechanical joint connections.
 - .3 Shall be able to be visually inspected for proper working function.
 - .4 Full port design.
- .2 Branch lines or pumped discharge lines:
 - .1 Cast iron, PVC, ABS, or copper alloy body (same material and ratings as pipe).
 - .2 No mechanical joint connections.

PART 3 - EXECUTION

3.1 INSTALLATION – GENERAL

- .1 Install in locations that are accessible for maintenance.

3.2 INSTALLATION – TRAP SEALS

- .1 For floor drain applications, remove strainer and insert at drain outlet before trap.
- .2 Ensure traps are filled with water.

3.3 INSTALLATION – TRAP PRIMER CONNECTIONS

- .1 Install in vertical pipe immediately upstream of trap.

3.4 INSTALLATION – CLEANOUTS

- .1 Install every 50' (15 m) in straight runs of piping.
- .2 Install at every 90 degree change of direction.

- .3 Install at locations shown elsewhere on the drawings.
- .4 Open cleanouts, apply linseed oil to threads and re-seal.

3.5 INSTALLATION – BACKWATER VALVES

- .1 Install backwater valves so the flapper can be visually inspected.
- .2 All piping downstream of the flapper can be considered a 'high pressure' zone. No mechanical joints are allowed. Use solvent weld or threaded joints within the building envelope downstream of the backwater valve.
- .3 Provide thrust block at the backwater valve for the main sanitary leaving the building and all changes of direction between the backwater valve and the building exit point.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

- .1 This section provides the requirements of rainwater leader piping for inside a building application.
- .2 The intent of the design is to have a complete, working rainwater leader system that will function under all reasonable conditions. Installation shall meet this intent.

1.2 RELATED SECTIONS

- .1 Section 01 33 00 – Submittal Procedures
- .2 Section 07 84 00 – Firestopping
- .3 Section 09 91 00 – Interior Painting
- .4 Section 22 05 00 – Common Work Results for Plumbing
- .5 Section 22 05 29 – Hangers and Supports for Plumbing Piping and Equipment
- .6 Section 22 05 53 – Identification for Plumbing Piping and Equipment
- .7 Section 22 07 19 – Plumbing Piping Insulation

1.3 REFERENCES

- .1 American National Standards Institute (ANSI)
 - .1 ASME/ANSI B16.23 Cast Copper Alloy Solder Joint Drainage Fittings (DWV)
 - .2 ASME/ANSI B16.29 Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings (DWV)
- .2 American Society for Testing and Materials (ASTM)
 - .1 ASTM B32 Specification for Solder Metal
 - .2 ASTM B306 Specification for Copper Drainage Tube (DWV)
 - .3 ASTM D2235 Specification for Solvent Cement for Acrylonitrille-Butadiene-Styrene (ABS) Plastic Pipe and Fittings
 - .4 ASTM D2564 Specification for Solvent Cements for Poly(Vinyl-Chloride) (PVC) Plastic Piping Systems
- .3 Canadian Standards Association (CSA)
 - .1 CSA B70 Cast Iron Soil Pipe, Fittings and Means of Joining
 - .2 CSA B1800 Series ABS Drain, Waste and Vent Pipe and Pipe Fittings
 - .3 CSA B181.2 PVC Drain, Waste and Vent Pipe and Pipe Fittings

- .4 CSA B182.1 Plastic Drain and Sewer Pipe and Pipe Fittings
- .4 Underwriters Laboratory of Canada (ULC)
 - .1 CAN/ULc S102.2 Method of Test for Surface Burning Characteristics of Flooring, Floor Coverings, and Miscellaneous Materials and Assemblies
- .5 National Research Council (NRC)/Institute for Research in Construction
 - .1 National Plumbing Code of Canada (NPC)

1.4 SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Upon request, provide manufacturer's printed product datasheets for piping and adhesives, indicating models and options specific to this work. Datasheets submitted shall include designations of rating compliance (i.e. CSA, ASTM, ULc, etc.).

PART 2 - PRODUCTS

2.1 PIPING AND FITTINGS

- .1 For underground rainwater leaders within buildings:
 - .1 PVC meeting CSA B181.2
 - .2 Cast Iron meeting CSA B70
 - .1 Hub and Spigot connections, thrust blocks at turns
- .2 For aboveground rainwater leader applications (combustible construction):
 - .1 PVC meeting CSA B181.2
- .3 For aboveground rainwater leader applications (non-combustible construction):
 - .1 Flame spread rating less than 25.
 - .2 PVC meeting CSA B181.2, CAN/ULc S102.2
- .4 For rainwater leader applications within air plenums:
 - .1 Flame spread rating less than 25 and smoke developed classification less than 50.
 - .2 PVC meeting CSA B181.2, CAN/ULc S102.2
- .5 For rainwater leader applications in high-rise buildings:
 - .1 Flame spread rating less than 25 and smoke developed classification less than 50.
 - .2 PVC meeting CSA B181.2, CAN/ULc S102.2

- .6 For rainwater leader applications in vertical shafts (including entry and exit from shaft):
 - .1 Copper DWV meeting ASTM B306
 - .2 Cast Iron meeting CSA B70
 - .1 Hub and Spigot connections: Thrust support at base in both directions and weight supported at every floor level.

2.2 JOINTS

- .1 PVC solvent weld: to ASTM D2564.
 - .1 Sizes 1½ to 6: one step cement (Low VOC)
 - .2 Sizes 8 and above: two step cement, plus low VOC primer.
- .2 Cast Iron: Hub and Spigot to CSA B70
- .3 Copper solder: to ASTM B32

PART 3 - EXECUTION

3.1 INSTALLATION

- .1 Installation by a qualified journey person.
- .2 Install in accordance with Canadian Plumbing Code and local authority having jurisdiction.
- .3 Cleanouts and other service items must be accessible.
- .4 Do not use 90 degree elbows on horizontal runs. 90 degree changes of direction shall be accomplished by two (2) 45 degree fittings with a short (8"-12") straight section between.
- .5 Penetrations through structure shall be such that structural loads are not transferred to pipes. Pipe shall be braced to concrete structure where available to restrict horizontal movement.

3.2 TESTING

- .1 Pressure test underground systems before backfilling in accordance with Canadian Plumbing Code.
 - .1 As per piping manufacturer's instructions.
 - .2 Air test: Maintain 35 kPa (5 Psi) for 15 minutes.
- .2 Pressure test above ground systems in accordance with Canadian Plumbing Code.
 - .1 As per piping manufacturer's instructions.
 - .2 Air test: Maintain 35 kPa (5 Psi) for 15 minutes.

- .3 Water test: Maintain 3m (10 feet) of water column for 15 minutes.

3.3 PERFORMANCE VERIFICATION

- .1 Open cleanouts, apply linseed oil to threads and re-seal.
- .2 Ensure traps are fully and permanently primed.
- .3 Ensure fixtures are properly anchored, connected to system and effectively vented.
- .4 Affix applicable label (rainwater) with directional arrows in accordance with Section 22 05 53 – Identification for Plumbing Piping and Equipment.
- .5 Provide copies of test reports for Commissioning Manuals.
- .6 Provide copies of Inspection Reports from the local authority having jurisdiction.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

- .1 This section gives guidance on the common work pertaining to HVAC.
- .2 All HVAC work shall be completed in conformance with, and subject to, the latest manufacturer, supplier and City of Winnipeg Representative documentation available (printed, electronic, or website), including installation and cautionary notes.
- .3 Refer to specific HVAC sections for further guidance.

1.2 RELATED SECTIONS

- .1 Section 01 33 00 – Submittal Procedures
- .2 Section 01 74 00 – Cleaning
- .3 Section 01 74 19 - Waste Management and Disposal
- .4 Section 01 78 00 – Closeout Submittals

1.3 CONTRACTOR RESPONSIBILITY

- .1 It is the mechanical Subcontractor's responsibility to provide and install the necessary components for complete and functional systems.
- .2 The mechanical Subcontractor is responsible for paying for and obtaining all necessary permits and authorizations required for the work.
- .3 The mechanical Subcontractor is responsible for providing suitable submittals pertaining to this work.
- .4 Engineered drawings and specifications are designed based on particular, specified products that the City of Winnipeg Representative has chosen. If the mechanical Subcontractor wishes to use a different product than was specified, then:
 - .1 It is the mechanical Subcontractor's responsibility to ensure the supplier of the different product has obtained approval for the product to be used as either an equal or an alternate from the City of Winnipeg Representative. Subcontractors should be aware that a product is granted equal status based on quality, capacity, and electrical load only. Alternates may be approved if there are deviations and modifications required that could still result in the intended design function.
 - .2 It is the mechanical Subcontractor's responsibility to modify any associated work if using the different product at no cost to the City of Winnipeg in such a way as it works as intended by the engineered drawings and specifications. This may include coordinating with other trades such as electrical to capture all the modifications required. It is at the discretion of the City of Winnipeg Representative if the design intent is maintained.

- .1 Example: A particular make and model of air handling unit was specified. Another manufacturer's air handling unit with different dimensions was granted an equal status based on its quality, capacity, and electrical load being similar to the one specified. A Subcontractor who wants to use the equal product is responsible for ensuring the equal product fits in the space and is expected to modify the ductwork if required to accommodate different connection points.
- .5 It is the responsibility of the mechanical Subcontractor to coordinate with other trades such that all work can be accomplished in a suitable manner.
- .6 All coring, rough openings and penetrations greater than 6" (150 mm) diameter, and all patching, flashing and sealing shall be the responsibility of the Contractor.
- .7 The mechanical Subcontractor shall coordinate with the Contractor in arranging for, and being available during, inspections by the Authority Having Jurisdiction and City of Winnipeg representative at:
 - .1 Rough work completion and prior to wall boarding, and
 - .2 Substantial completion for the purpose of obtaining final certification.
- .8 Mechanical trade and subtrades shall allow for additional personnel and coordination time as required to assist the Integrated Testing Coordinator in functional testing and reporting of fire protection and life safety systems for compliance with CAN/ULC S-1001 - Integrated Systems Testing of Fire Protection Systems and Life Safety Systems. Mechanical equipment affected by the integrated testing includes but is not limited to, combination fire/smoke dampers, equipment interlocks and shutdown.

1.4 SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 – Submittal Procedures
- .2 Refer to specific sections for any additional submittal requirements.
- .3 Shop Drawings:
 - .1 The intent of shop drawings is to give confidence to the City of Winnipeg Representative that the mechanical Subcontractor is using the proper products and will be installed properly so the work is done as intended by the City of Winnipeg Representative. Generic catalog or sales information shall not be part of a shop drawing unless it specifically meets the intent.
 - .2 Shall clearly indicate job-specific products. If the manufacturer's cut sheet shows multiple products, indicate which one coincides with the appropriate tag on the drawing.
 - .3 Shall include a performance curve, sound data, a dimensioned drawing with required clearances and connection points, power requirements, and specified capacity required as applicable for each product.
 - .4 Shall indicate the supplier's name and contact information.
 - .5 Shall indicate compliance to applicable codes and standards.
 - .6 Mechanical Subcontractor shall submit a shop drawing for unique mounting arrangements or supports if required at the discretion of the City of Winnipeg Representative.

- .4 Closeout Submittals:
 - .1 Provide operation and maintenance data and incorporate into manual specified in Section 01 78 00 - Closeout Submittals.
 - .2 Approvals:
 - .1 Submit two (2) copies of draft Operation and Maintenance Manual to City of Winnipeg's Representative for approval. Submission of individual data will not be accepted unless directed by City of Winnipeg's Representative.
 - .2 Submit a copy of the As-Built drawings.
 - .3 Make changes as required and re-submit as directed by City of Winnipeg's Representative.
 - .3 Operation and maintenance manual approved by, and final copies deposited with, City of Winnipeg's Representative before final inspection.
 - .4 Operation and Maintenance (O&M) Manual:
 - .1 Operation data to include:
 - .1 Control wiring and piping/ducting schematics for systems.
 - .2 Description of systems and their controls.
 - .3 Operation instruction for systems and components.
 - .4 Description of actions to be taken in event of equipment failure.
 - .2 Maintenance data to include:
 - .1 Servicing, maintenance, operation and troubleshooting instructions for each item of equipment. Instructions to include maintenance schedule and tools required.
 - .2 A parts list.
 - .3 Performance data to include:
 - .1 Equipment manufacturer's performance datasheets with point of operation as left after commissioning is complete
 - .2 Site reports (i.e. hydronic system water quality results)
 - .3 Equipment performance verification test results (i.e. air balance report)
 - .4 Authority Having Jurisdiction (AHJ) signed and approved inspection reports.
 - .5 Additional data:
 - .1 Prepare and insert into the O&M manual additional data when need for it becomes apparent during specified demonstrations and instructions.
 - .6 Site records:
 - .1 City of Winnipeg's Representative will provide one (1) set of reproducible mechanical drawings or AutoCAD files. Provide sets of white prints as required for each phase of work. Mark changes as work progresses and as changes occur.

- .2 Use different color for each service.
- .3 Make available for reference purposes and inspection.
- .7 As-built drawings:
 - .1 Identify each drawing in lower right hand corner in letters at least 12 mm high as follows: - "AS BUILT DRAWINGS: THIS DRAWING HAS BEEN REVISED TO SHOW MECHANICAL SYSTEMS AS INSTALLED" (Signature of Subcontractor) (Date).
 - .2 Submit completed reproducible as-built drawings with Operating and Maintenance Manuals.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Packing, shipping, handling and unloading:
 - .1 Deliver and handle in accordance with manufacturer's written instructions.
 - .2 Deliver materials to site in original factory packaging, labeled with manufacturer's name, address.
- .2 Storage and Protection:
 - .1 Protect from weather and physical damage.
 - .2 Protect plastics from UV light.
 - .3 Store at temperatures and conditions required by manufacturer.
- .3 Waste Management and Disposal:
 - .1 Verify with City of Winnipeg on storage or disposal of existing City of Winnipeg equipment. Handle accordingly.
 - .2 Separate waste materials for reuse and recycling.
 - .3 Place excess or unused materials in designated containers.
 - .4 Divert unused metal materials from landfill to metal recycling facility approved by City of Winnipeg's Representative.
 - .5 Dispose of unused adhesive material at official hazardous material collections site approved by City of Winnipeg's Representative.

1.6 SCOPE OF WORK

- .1 Include in mechanical section, provision of labour, new materials, tools, transportation, services and facilities for a complete mechanical installation. The installation shall be left complete in all respects and ready for operation. Final installation shall be to the complete satisfaction of the City of Winnipeg Representative.
- .2 The successful mechanical Subcontractor shall be responsible for all sub-trades providing services to complete this project.
- .3 New Construction:
 - .1 Provide for the complete installation of new heating, ventilation, and air conditioning (HVAC) systems, as outlined herein and on the mechanical

drawings, including but not limited to; electric makeup air handling units for the Washbay area; indoor air handling units with outdoor air cooled condensing unit; reverse-flow energy recovery ventilators and associated DX cooling equipment; air source variable refrigerant flow (VRF) heat pumps and associated indoor fan coils, branch circuit controllers, refrigeration piping and auxiliaries, wall mount zone temperature controllers, system controls; combination fire/smoke dampers; testing, adjusting and balancing of all ventilation distribution systems; galvanized steel duct air distribution and fittings; grilles, louvers, registers and diffusers; communication room and electrical room air conditioning units, outdoor air cooled condensing units; electric-to-steam humidifiers and duct mount dispersion manifold; coordination of all HVAC equipment controls, monitoring and integration to the Building EMCS, and to interface with the existing City of Winnipeg Extended Application and Data Server (ADX), with Division 25.

- .2 All heating, ventilation, air conditioning, and plumbing equipment and installation shall meet or exceed the energy performance criteria in compliance with Manitoba Energy Code and LEED design requirements.
- .3 Coordinate with Electrical Subcontractor all electrical lockout relays required to prevent simultaneous heating and cooling in temperature controlled zones where fan coils also utilize electric heaters.

1.7 GENERAL REQUIREMENTS

- .1 All drawings and all sections of the specifications apply to and form an integral part of this section.
- .2 Provide fully operational mechanical systems in complete accordance with applicable codes and bylaws.
- .3 Contract documents of this section are diagrammatic and approximate to scale. Do not scale from the drawings, for dimensions refer to architectural and structural drawings. The drawings and specifications establish scope for material and installation quality and are not detailed installation instructions. Follow manufacturers' recommendations for installation supplemented by contract documents, unless otherwise specified by the City of Winnipeg Representative.
- .4 Drawings and specifications are complementary each to the other, what is called for by one shall be binding as if called for by both.
- .5 Specification sections are not provided to define trade work scope. Trade work scope is the responsibility of the Contractor responsible for this project and covering the entire scope of work included in this project.
- .6 Should any discrepancy appear between the drawings and specifications, which leave the mechanical Subcontractor in doubt as to the true intent and meaning of the plans, and specifications, the mechanical Subcontractor shall obtain a ruling from the City of Winnipeg Representative. If this is not done it will be assumed that the most appropriate alternative has been allotted for. For any ruling to become binding, the City of Winnipeg Representative must issue the new direction in a published form.
- .7 Examine all contract documents, including all drawings, specifications and work of other trades to ensure that work is coordinated and satisfactorily carried out without changes to the building or contract value.

- .8 In addition to all of the requirements in the contract documents, include recommended installation details and procedures for equipment as found in manufacturers' technical data.
- .9 As work progresses and before installing piping, ductwork, fixtures or equipment interfering with interior treatment and use of building, contact the City of Winnipeg Representative for comment. If the mechanical Subcontractor fails to perform above checking and fails to inform the City of Winnipeg Representative of such interference, the mechanical Subcontractor to bear all subsequent expense to make good the installation.
- .10 Install piping, ductwork, etc., generally in the locations and routes shown on the drawings, close to the building structure to minimize furring and interference with other services or free space. Remove piping, wiring, ductwork, etc. that is not properly installed and replace to the satisfaction of the City of Winnipeg Representative at no cost to the City of Winnipeg.
- .11 Equipment, materials and work shall comply with the requirements of generally recognized agencies, including but not limited to CSA, ULC, CGA, NBFU, NFPA, TSSA, and the requirements of Authorities Having Jurisdiction.
- .12 Be completely responsible for the acceptable condition and operation of systems and equipment components forming part of the installation or associated with it. Promptly replace defective materials, parts and equipment and repair related damage.
- .13 The drawings are intended to convey the scope of work and indicate general arrangement and approximate location of apparatus and fixtures, and indicate the general location and route to be followed by pipes and ducts. Where required installations are not shown on plans or are only shown diagrammatically, install in such a way as to conserve headroom and interfere as little as possible with free use or space through which they pass, while there adequate space is allowed for service, maintenance, repair, or replacement for all equipment.
- .14 All serviceable items, such as valves, controls, bearings, filters and similar items, must be installed in such a manner as to be accessible for service, maintenance, repair and replacement without the removal of other material or equipment, and without the need for specialized equipment such as lifts, harnesses, or other safety items. All work to be installed to allow easy equipment isolation and servicing functions while all surrounding systems continue to operate.
- .15 Refer to architectural drawings for roof and other construction details. These shall relate to roof supports, piping penetrating roofs, etc. As indicated on mechanical detail sheets.
- .16 Misinterpretation of requirements of plans or specifications shall not relieve mechanical Subcontractor of responsibility of properly completing work to approval of the City of Winnipeg Representative.
- .17 Confirm on the site the exact location and mounting elevation of outlets and fixtures as related to existing mechanical & electrical components as well as architectural & structural details.
- .18 As work progresses and before installing piping, ductwork, wiring, fixtures and equipment interfering with interior treatment and use of building, consult the City of Winnipeg Representative for appropriate action before proceeding. This applies to all levels and proper grading of piping. If mechanical Subcontractor fails to perform above checking and fails to inform the City of Winnipeg Representative of such interference, mechanical Subcontractor to bear all subsequent expense to make good the installation.

- .19 Spaces reserved for equipment noted as future or allowances made for future extension to buildings, to be left clear so that future connections can be made. Provide adequate clear space for City of Winnipeg supplied equipment and connections for such equipment. Provide detailed layouts for checking and approval by the City of Winnipeg Representative before commencing work.
- .20 Install ceiling mounted or exposed components (e.g. Diffusers, sprinkler heads, grilles) in accordance with reflected ceiling drawings or floor plans.
- .21 Prepare interference and coordination drawings for all areas, wherever there is possible conflict and/or obstruction due to the positioning of mechanical equipment, piping, wiring, ductwork, or other work of this division relative to other trades.
- .22 Prepare drawings in conjunction with other trades.
- .23 Drawings shall be to a scale sufficient to show the necessary details. Submit to the City of Winnipeg Representative for review and distribute drawings after review to trades concerned.
- .24 Prepare fully dimensioned detail drawings of shafts, duct spaces, pipe spaces and tunnels. Show holes and sleeves, and include information pertaining to access, clearances, tappings, drains and electrical connections.
- .25 Base information used to prepare drawings on certified shop drawings.
- .26 Prepare, and submit for review, scale drawings of equipment bases, anchors and their relationship to structure, inertia slabs, floor and roof curbs, which pertain to Division 21, 22, 23, 25 work and which are not shown on architectural or structural drawings.
- .27 The cutting of openings not requiring lintels or other structural support will be the responsibility of the trade requiring the opening, the opening size will be the minimum required, and that patching will be the responsibility of the trades normally engaged in working with the finishing materials required to restore the opening to the original or specified conditions.
- .28 Where openings require lintels or other structural support, or roofing work, such openings will be specified under other divisions of this specification.
- .29 Protect equipment and materials in storage, on site, during and after installation until final acceptance. Leave factory covers in place and take special precautions to prevent entry of foreign material into working parts of piping and duct systems.
- .30 Protect equipment with polyethylene covers and crates.
- .31 Operate, drain and flush out bearings and refill with new charge of lubricant, before final acceptance.
- .32 Thoroughly clean piping, ducts and equipment of dirt, cuttings and other foreign substances. Disconnect, clean and reconnect whenever necessary for purpose of locating and removing obstructions. Repair work damaged in course of removing obstructions.
- .33 Vacuum clean and remove debris from the inside of air handling systems, fans, heat pumps, ducts, coils, terminal units, etc.
- .34 Clean exposed surfaces of mechanical equipment, ductwork, piping, etc., and polish plated work.
- .35 Comb all bent fins to proper configuration on all coils in ductwork, air handling units, fan

coil units, heat pumps, entrance heaters, finned radiation elements, and other heating and cooling equipment.

- .36 Protect bearings and shafts during installation. Grease shafts and sheaves to prevent corrosion. Supply and install extended nipples to outside of bearing enclosures for lubrication purposes.
- .37 Remove tools, surplus, and waste material from the building site upon completion of work. Clean grease, dirt, and excess material from walls, floors, ceilings, surfaces, and fixtures for which this mechanical Subcontractor was responsible, and leave the premises suitable for immediate use.
- .38 Verify that materials and equipment can be delivered to the place of the work and that sufficient space and access is available to permit installation thereof in locations shown on the drawings.
- .39 Check locations and inverts of service lines leaving and entering building to ensure their proper function prior to commencing work.
- .40 Refer also to room finish schedules to determine finished, partially finished and unfinished areas of the building.
- .41 Visit site to determine access route for bringing equipment into the building.
- .42 Location routing and depth of sanitary sewers, water mains, natural gas, and other utilities shown on drawings are based on available information and are approximate only. Mechanical Subcontractor and his site services subtrades shall carry out following verification procedure prior to installing the site services:
 - .1 Reconfirm information noted on contract drawings, by comparing with the local utility's most current records.
 - .2 Referring to same benchmarks used by mechanical Subcontractor; take invert readings at nearest manholes and check for discrepancies with contract drawings.
 - .3 Prior to installation of piping, advise the City of Winnipeg Representative of any discrepancy found during above procedure. Revised drawings or instructions will be given to mechanical Subcontractor.
 - .4 Avoid damaging or displacing existing services where exact position is not known. Should any damage occur, advise the City of Winnipeg Representative in writing for remedial instructions.
- .43 Permanent HVAC systems and/or equipment shall not be used during construction period.

PART 2 - PRODUCTS

2.1 QUALITY ASSURANCE

- .1 Specific sections may have additional requirements, or modifications to these requirements. In the case of contradiction, the requirement in the specific section is to be adhered to. In cases of no clear contradiction, these requirements shall be adhered

- to.
- .2 If any specification section includes the words “prior approval” or “unless otherwise approved”, this is to mean a request must be made to the stamping City of Winnipeg Representative responsible for this design component of the project prior to any product being considered as acceptable. Upon acceptance by written confirmation, the mechanical Subcontractor may use it. Upon denial by written confirmation, the mechanical Subcontractor shall not use it. No other entity shall grant approval to the mechanical Subcontractor.
 - .3 All products to be manufactured by companies with qualifications including:
 - .1 Ten (10) years of history providing this product (or applicably similar product) to the Canadian market. Reduction of this requirement is possible at the discretion of the City of Winnipeg Representative only.
 - .2 Engineering, design and application support available in a timely manner. This includes acknowledgement of an inquiry within 24 hours, and a suitable response to an inquiry within five (5) working days.
 - .3 Documented case studies of three (3) similar applications of the product showing similar usage and acceptable longevity of the product. Contact information for the City of Winnipeg/maintenance provider of each case study shall be available upon request.
 - .4 Wholly owned test facilities with access available upon request.
 - .5 Provision of products meeting all applicable testing standards, ratings, and certifications for the Canadian market.
 - .4 All products to be supplied by suppliers with qualifications including:
 - .1 Five (5) years of history providing this product (or applicably similar product) to the Canadian market.
 - .2 Manufacturer support including, being the manufacturer’s designated representative of the product, being factory trained on the product, and having access to current engineering support from the manufacturer.
 - .3 Human on site availability (with any required security clearances or specific entry requirements up to date prior to visit) within 48 hours of initial contact for the purpose of commissioning the product or investigation of problems potentially involving the product. Suppliers shall provide a phone number that will be answered during regular working hours.

PART 3 - EXECUTION

3.1 INSTALLATION

- .1 All products to be installed by workers with qualifications including:
 - .1 Five (5) years of experience installing the product (or applicably similar product).
 - .2 A comprehensive knowledge of the product manufacturer’s installation requirements.

- .3 An understanding as to the reasons why proper installation is required, and what problems occur with an improper installation.
- .2 Installation shall be the responsibility of a qualified journeyman licensed to perform the work required.
- .3 Installation shall be in accordance with the National Building Code (NBC), American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE), Sheet Metal and Air Conditioning Contractors' National Association (SMACNA), and local codes.
- .4 Installation of service items (example: balancing valves, dampers, etc.) shall be coordinated with the Contractor and other trades (example: wall boarding Subcontractor) so access to service items is easy and unencumbered. Ultimately, this is the responsibility of the mechanical Subcontractor.

3.2 PERFORMANCE VERIFICATION

- .1 Retain a certified air balancer to balance the HVAC systems and if applicable, the hydronic systems. Work with the balancer to remediate any differences between design expectations and as-constructed installations (i.e. changing pulleys, modifying frequency drive settings, etc.). Ensure ventilation air dampers are set correctly.
- .2 Operate systems and remediate areas of excessive noise and vibration.
- .3 Install new air filters after all construction is complete and just prior to turning over the building to the City of Winnipeg.
- .4 The mechanical Subcontractor shall be available to accompany the Authority Having Jurisdiction and the City of Winnipeg Representative on site inspections and tests. The mechanical contractor shall have the ability to test all items during inspections.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

- .1 This section includes common requirements for mechanical HVAC electric motors.

1.2 RELATED SECTIONS

- .1 Section 01 33 00 – Submittal Procedures
- .2 Section 01 78 00 – Closeout Submittals
- .3 Section 23 05 00 – Common Work Results for HVAC

1.3 REFERENCES

- .1 Canadian Standards Association (CAN/CSA)
 - .1 CAN/CSA C22.1 Canadian Electrical Code Part 1
- .2 National Electrical Manufacturers Association (NEMA)
 - .1 NEMA MG 1 Motors and Generators

1.4 CONTRACTOR RESPONSIBILITY

- .1 The mechanical Subcontractor is ultimately responsible for complete and functional HVAC systems. As required, components of this work shall be directed by the mechanical Subcontractor but undertaken by qualified subtrades as follows:
 - .1 All power conductor wiring and grounding:
 - .1 A certified electrical Subcontractor
 - .2 Supply and installation of magnetic starters:
 - .1 A certified electrical Subcontractor
 - .3 Supply and programming of variable frequency drives:
 - .1 A mechanical Subcontractor, or
 - .2 A controls Subcontractor
 - .4 Low voltage wiring (including supply of line-to-low voltage transformers):
 - .1 A mechanical Subcontractor, or
 - .2 A controls Subcontractor

1.5 SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 – Submittal Procedures

- .2 Shop Drawings:
 - .1 Motor information may be included within the shop drawing for mechanical equipment.
 - .2 Include motor type, voltage, full load current rating (FLA), power consumption, and rpm.
 - .3 Upon request, provide any information found on the motor nameplate per NEMA MG-1.
 - .4 Subcontractor shall submit a shop drawing for unique mounting arrangements or supports if required at the discretion of the City of Winnipeg Representative.
- .3 Closeout Submittals:
 - .1 Provide operation and maintenance data and incorporate into manual specified in Section 01 78 00 - Closeout Submittals.
 - .2 Operation and Maintenance (O&M) Manual:
 - .1 Operation data to include:
 - .1 Tag #, function description, and nameplate information.

PART 2 - PRODUCTS

2.1 AC INDUCTION MOTORS

- .1 Unless otherwise specified, or explicitly allowed by the City of Winnipeg Representative via a written document, all AC motors used for HVAC applications shall be:
 - .1 In accordance with NEMA MG 1
 - .2 "Premium" efficiency rated
 - .3 Class B temperature tolerance
 - .4 1800 rpm
 - .5 Continuous duty
 - .6 Open Drip-Proof (ODP), or Totally-Enclosed Fan Cooled (TEFC)
 - .7 Constructed with phase insulation paper
- .2 Any AC motor controlled via a variable-frequency drive (VFD) shall meet NEMA MG 1 Part 31, and include a shaft grounding ring.

2.2 ECM MOTORS

- .1 Unless otherwise specified, or explicitly allowed by the City of Winnipeg Representative via a written document, all ECM motors used for HVAC applications shall be:
 - .1 AC input, electronically commutated to DC motor drive

- .2 On board potentiometer dial, and 0-10V analog input for remote speed control
- .3 Internal overload protection
- .4 Internal locked rotor protection
- .5 Internal thermal protection

PART 3 - EXECUTION

3.1 INSTALLATION

- .1 Motors that are factory installed in mechanical units shall be checked for mounting bolt tightness and proper vibration isolation.
- .2 Field installed motors shall be installed per manufacturer's documentation.
- .3 Electrical connection and grounding shall be by an electrical Subcontractor and conform to CAN/CSA C22.1.
- .4 Conductors shall be flexible and allow for motor movement.

3.2 PERFORMANCE VERIFICATION

- .1 Verify mounting tightness and suitable vibration isolation.
- .2 Verify correct shaft rotation.
- .3 Check running load on motor to ensure it is operating within its design range.
- .4 Operate systems and remediate areas of excessive noise and vibration.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

- .1 This section gives guidance on meters and gauges used in liquid HVAC piping and includes:
 - .1 Pressure gauges
 - .2 Thermometers
 - .3 Sight glasses
 - .4 Pressure-Temperature (P-T) ports
- .2 This section does not include meters and gauges for steam applications.

1.2 RELATED SECTIONS

- .1 Section 01 33 00 – Submittal Procedures
- .2 Section 01 78 00 – Closeout Submittals
- .3 Section 01 91 13 – General Commissioning Requirements
- .4 Section 23 05 00 – Common Work Results for HVAC

1.3 REFERENCES

- .1 American Society of Mechanical Engineers International (ASME)
 - .1 ASME B40.100 Pressure Gauges and Gauge Attachments
 - .2 ASME B40.200 Thermometers, Direct Reading and Remote Reading

1.4 SUBMITTALS

- .1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Upon request, provide manufacturer's printed product datasheets, indicating models and options specific to this work. Datasheets submitted shall include designations of rating compliance (i.e. ASME).
- .3 Closeout submittals in accordance with Section 01 78 00 – Closeout Submittals
- .4 Operation and Maintenance (O&M) Manual Data:
 - .1 For tank fluid level gauge applications, provide a copy of the set-up and calibration settings based on site-specific inputs.

PART 2 - PRODUCTS

2.1 PRESSURE GAUGES

- .1 Meets ASME B40.100
- .2 Housing shall be metal.
- .3 Gauge shall have a bottom entry, brass NPT connection.
- .4 Generally speaking, gauge shall be in dual units and range from 0 to 4.2 bar (60 psi).
 - .1 Exception: The Subcontractor shall confirm the maximum working pressure seen in the system piping and provide a gauge capable of indicating a range between 150% and 200% of the maximum system pressure by design.
- .5 Gauge shall have a minimum 63 mm (2.5") diameter display.

2.2 THERMOMETERS

- .1 Meets ASME B40.200
- .2 Thermowell or sensing tube shall be brass and register the center of the fluid flow.
- .3 Thermometer indication shall be:
 - .1 A linear scale type with red liquid in glass, or
 - .2 A dial scale type with glass lens and needle indicator, or
 - .3 A digital or LED display
- .4 Readout shall be in dual units and the range shall be at least, and reasonable close to 4 C (40 F) to 120 C (248 F).

2.3 PRESSURE-TEMPERATURE PORTS (P-T PORTS)

- .1 Dual EPDM seals
- .2 Compatible with water, and ethylene or propylene glycol mixtures
- .3 1/4" NPT male pipe connection and 1/8" flared thread ports for measuring equipment connection.

PART 3 - EXECUTION

3.1 INSTALLATION – GENERAL

- .1 Meters and gauges shall be installed such that they can be read from a reasonable and logical location within the room without the need for ladders, or bending or twisting.

- .2 Meters and gauges shall be located in conditioned spaces, unless otherwise indicated.

3.2 INSTALLATION – PRESSURE GAUGES

- .1 Install where indicated on the design documents, and
 - .1 Downstream of every pressure reducing valve,
 - .2 On either side of every hydronic loop pump,
 - .3 At each expansion tank (fluid side), and
 - .4 The highest elevation point in each hydronic system.

3.3 INSTALLATION – THERMOMETERS

- .1 Install where indicated on the design documents, and
 - .1 On each leg of a heat exchanger,
 - .2 Downstream of every mixing valve, and
 - .3 On the supply and return piping to each boiler, fluid cooler, or chiller.

3.4 INSTALLATION – PRESSURE-TEMPERATURE PORTS (P-T PORTS)

- .1 Install where indicated on the design documents, and
 - .1 On the supply and return piping to each hydronic coil,
 - .2 On the supply and return piping to each heat pump, and
 - .3 On the conditioned side of every hydronic pipe entering or leaving the building (i.e. to and from a geothermal field).

3.5 FIELD QUALITY CONTROL

- .1 Perform the following tests and inspections:
 - .1 Fill each tank with containing a level gauge from empty to alarm/cut-out level to verify correct operation. Empty tank and repeat.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

- .1 This section includes (as applicable) guidance on hanging or supporting hydronic piping, fuel oil piping, natural gas piping, refrigerant piping, HVAC ducting and HVAC equipment.
- .2 This section does not include plumbing related piping.
- .3 This section gives guidance on hanging and supporting piping, ducting and equipment and includes:
 - .1 Pipe Hangers and Supports
 - .2 Round Duct Suspension Rings
 - .3 Hanger Rods
 - .4 Inserts
 - .5 Flashing
 - .6 Sleeves and Seals
 - .7 Formed Steel Channel
 - .8 Equipment Bases and Supports
 - .9 Metal Framing Systems
 - .10 Fasteners
 - .11 Pipe Positioning Systems

1.2 RELATED SECTIONS

- .1 Section 01 33 00 – Submittal Procedures
- .2 Section 05 50 00 – Metal Fabrications
- .3 Section 07 84 00 – Firestopping
- .4 Section 09 91 23 – Interior Painting
- .5 Section 23 05 00 – Common Work Results for HVAC
- .6 Section 23 07 19 – HVAC Piping Insulation
- .7 Section 23 23 00 – Refrigerant Piping
- .8 Section 23 31 13 – Metal Ducts

1.3 REFERENCES

- .1 International Association of Plumbing and Mechanical Officials (IAPMO)

- .1 IAPMO PS 42 Pipe Alignment and Secondary Support Systems
- .2 Manufacturers Standardization Society of the Valve and Fittings Industry (MSS)
 - .1 MSS SP-58 Pipe Hangers and Supports – Materials, Design, Manufacture, Selection, Application and Installation
 - .2 MSS SP-127 Bracing for Piping Systems: Seismic – Wind – Dynamic Design, Selection and Application
- .3 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)
 - .1 HVAC Duct Construction Standards – Metal and Flexible

1.4 SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Shop Drawings:
 - .1 All trapeze pipe hangers, metal framing systems, and fabricated equipment support designs require a detailed, job-specific drawing submittal labeled with equipment weights to the Structural Engineer for approval.

PART 2 - PRODUCTS

2.1 PIPE HANGERS AND SUPPORTS

- .1 All hangers and supports must meet MSS SP-58. Refer to Part 3, “Hanger and Support Applications” for pipe hanger and support suitability.
- .2 Insulated pipe shall be supported with a hanger or support with a supporting diameter the same as the fully insulated pipe diameter with an included rigid insulation shield. The insulation shall not be compressed or otherwise have a reduction in insulating ability as a result of hanging or supporting the pipe.
- .3 Pipe containing steam or liquid greater than 160 F (71 C) that is supported from below the pipe shall be on roller supports.
- .4 Pipe located in areas or adjacent to areas where noise and vibration are concerns shall use PVC coated hanger and support products.
- .5 Copper pipe shall be hung or supported with PVC coated or felt lined products to prevent electrolysis between the pipe and the hanger or support.
- .6 Natural Gas and other similar piping on flat roofs shall use manufactured, UV resistant, rubberized bases for pipe supports. Pipe clamps shall be one pipe size larger to allow for minor movement.

2.2 ROUND DUCT SUSPENSION RINGS

- .1 Suspension rings shall be full or half diameter.
 - .1 Suspension rings shall be 16 ga (1.5 mm) for diameters up to 12” (300 mm)

- .2 Suspension rings shall be 12 ga (2.7 mm) for diameters up to 24" (600 mm)
- .3 Suspension rings shall be 10 ga (3.4 mm) for diameters up to 48" (1200 mm)

2.3 HANGER RODS

- .1 Unless otherwise indicated, hanger rods shall be zinc-plated steel, fully threaded rod.

2.4 CONCRETE INSERTS

- .1 Inserts shall be malleable iron case with a galvanized steel shell and expander plug for threaded connection. Inserts shall have capability for lateral adjustment, a top slot for reinforcing rods, and lugs for attaching to forms. Insert internal threads to match hanger rod threads.

2.5 FLASHING

- .1 Metal flashing shall be 26 gage galvanized steel.
- .2 Metal counterflashing shall be 22 gage galvanized steel.
- .3 Caps shall be 22 gage steel for non-fire resistance rated separations and 16 gage steel for fire resistance rated separations.

2.6 SLEEVES AND SEALS

- .1 Exterior, underground wall penetrations:
 - .1 Schedule 40 steel pipe with welded wall collar embedded in concrete. Pipe and collar bituminous coated and lined.
 - .2 Hydrostatic pipe closure, "Link-Seal" or approved equal.
- .2 Exterior, aboveground wall penetrations:
 - .1 Concrete wall: Schedule 40 steel pipe with welded wall collar embedded in concrete. Pipe and collar bituminous coated and lined. Wall attached pipe clamp attached to interior face of exterior wall. Expanding foam between pipe and sleeve. Thermally broken and caulked escutcheons on exterior and interior face.
 - .2 Framed wall: 18 gage galvanized steel. Wall attached pipe clamp attached to interior face of exterior wall. Expanding foam between pipe and sleeve. Thermally broken and caulked escutcheons on exterior and interior face.
- .3 Interior, fire rated wall penetration:
 - .1 No sleeve required. Sealing to be firestopping material as per section 07 84 00. Installation as per the firestop manufacturer's product guide for the specific type of pipe and wall type applicable.
- .4 Interior, non-rated wall penetration:

- .1 Concrete wall: Schedule 40 steel pipe with welded wall collar embedded in concrete. Pipe and collar bituminous coated and lined. Closed cell foam spray between pipe and sleeve. 16 gage steel escutcheons on exposed faces of wall.
- .2 Framed wall: No sleeve required. 16 gage steel escutcheons on exposed faces of wall.
- .5 Floor penetration:
 - .1 Cored or drilled hole to be coordinated with structural consultant for reinforcement requirements. Firestopping material as per section 07 84 00. 2" (50 mm) high oversized schedule 40 steel pipe curb secured and caulked on finished floor. Riser clamp rests on curb. Material deviations may be accepted upon prior approval from the mechanical engineer. Submit in accordance with Section 01 33 00 – Submittal Procedures.

2.7 FORMED STEEL CHANNEL

- .1 Shall be manufactured by a member company of the Metal Framing Manufacturers Association.

2.8 EQUIPMENT BASES AND SUPPORTS

- .1 Structural carbon steel shapes, coated with corrosion prevention primer.
- .2 Material deviations may be accepted upon prior approval from the mechanical engineer. Submit in accordance with Section 01 33 00 – Submittal Procedures.

2.9 METAL FRAMING SYSTEMS

- .1 Shall be manufactured by a member company of the Metal Framing Manufacturers Association, or approved equal.

2.10 FASTENERS

- .1 Powder Actuated Fasteners:
 - .1 Threaded steel stud with pull out, tension and shear capacities appropriate for supported load and building structure material.
- .2 Mechanical Expansion Anchors:
 - .1 Insert wedge type, stainless steel anchors with pull out, tension and shear capacities appropriate for supported load and building structure material.
 - .2 Underwriters Laboratory (UL) listed

2.11 PIPE POSITIONING SYSTEMS

- .1 Shall be manufactured to IAPMO PS 42.

PART 3 - EXECUTION

3.1 QUALITY ASSURANCE

- .1 Installer qualified in performing work in this section shall have at least five (5) years successful experience in similar installations.
- .2 Ductwork installers must be current members of SMACNA, have received adequate training, and are proven competent in understanding the ductwork support methods described in the HVAC Duct Construction Standards: Hangers and Supports (SMACNA).
- .3 Fabricated trapeze hangers, metal framing systems, and equipment support designs are to be submitted to the Structural Engineer for approval.

3.2 GENERAL INSTALLATION

- .1 Refer to Part 2 – Products for additional guidance on installing a product or an assembly of products for a particular application.
- .2 All pipe hangers and supports must meet MSS SP-58. Refer to Part 3, “Hanger and Support Applications” for individual pipe hanger and support suitability.
- .3 Install supports to secure equipment in place, prevent vibration, maintain grade and allow for expansion and contraction.
- .4 Wire or perforated strap is not acceptable to use for hanging pipes, ducts, or equipment.
- .5 Vertical risers shall be supported at its base, at every floor level, and every 12’ (3.6 M).
- .6 Vertical piping (other than steel) may be affixed in position by formed steel channel clamps. For plastic and copper piping, use a PVC or rubber isolator between the clamp and bare pipe. For steel piping, use pipe clamps attached to building structure.
- .7 Fasten supports to building structural steel system or to cast-in-place inserts in concrete construction for new construction. Concrete fasteners are acceptable when holding strength of finished concrete has been established.
- .8 Insulated pipe shall be supported with a hanger or support with a supporting diameter the same as the fully insulated pipe diameter with an included rigid insulation shield. The insulation shall not be compressed or otherwise have a reduction in insulating ability as a result of hanging or supporting the pipe.
- .9 Insulated round ductwork shall be supported with a hanger or support outside the fully insulated duct with rigid insulation supports, or shall be supported with a suspension ring with a supporting diameter the same as the un-insulated duct with appropriate sealing around the hanger penetration point through the insulation. The insulation shall not be compressed or otherwise have a reduction in insulating ability as a result of hanging or supporting the ductwork.
- .10 Locate support adjacent to equipment. Prevent excessive stresses on piping and equipment connections.
- .11 Do not support piping or equipment from other piping or from equipment.
- .12 For horizontally hung multiple pipe runs, use a trapeze support assembly.

- .13 On multiple pipe runs, allow minimum 1" (25 mm) clearance between finished (including insulation) pipes.
- .14 Install hangers within 12" (300 mm) on either side of a horizontal fitting.

3.3 SPECIFIC INSTALLATION – PLASTIC PIPE

- .1 When hanging horizontal plastic pipe sized 4" (100 mm) diameter and under, and that conveys liquid greater than 80 F (27 C), supports shall be...
 - .1 Continuous support channel under pipe to prevent sagging, or
 - .2 Vee bottom clevis type hangers that shall include 18 gage channel support to prevent sagging.
- .2 Plastic pipe sized 2" (50 mm) diameter and under may be supported using rigid PVC or PVC coated steel conduit fittings.
- .3 Ensure pipe will not be subject to abrasion by supports during expansion and contraction.

3.4 HORIZONTAL PIPE SUPPORT SPACING

- .1 Support horizontal straight sections of piping as follows:

Nominal Pipe Size	Maximum Distance Between Supports				
	<i>Steel (liquid)</i>	<i>Steel (steam or gas)</i>	<i>Copper (liquid or air)</i>	<i>Plastic (liquid)</i>	<i>Plastic (air)</i>
1/2" (12mm)	6' (1.8m)	6' (1.8m)	5' (1.5m)	3' (0.9m)	4' (1.2m)
3/4" (19mm)	7' (2.1m)	8' (2.4m)	6' (1.8m)	3' (0.9m)	4' (1.2m)
1" (25mm)	7' (2.1m)	8' (2.4m)	8' (2.4m)	3' (0.9m)	4' (1.2m)
1 1/4" (32mm)	7' (2.1m)	9' (2.7m)	10' (3.0m)	3' (0.9m)	4' (1.2m)
1 1/2" (39mm)	8' (2.4m)	10' (3.0m)	10' (3.0m)	3' (0.9m)	5' (1.5m)
2" (50mm)	8' (2.4m)	10' (3.0m)	10' (3.0m)	3' (0.9m)	5' (1.5m)
2 1/2" (64mm)	8' (2.4m)	10' (3.0m)	10' (3.0m)	3' (0.9m)	5' (1.5m)
3" (75mm)	8' (2.4m)	15' (4.6m)	10' (3.0m)	3' (0.9m)	6' (1.8m)
4" (100mm)	8' (2.4m)	15' (4.6m)	10' (3.0m)	3' (0.9m)	6' (1.8m)
6" (150mm)	8' (2.4m)	16' (4.9m)	10' (3.0m)	3' (0.9m)	7' (2.1m)
8" (200mm)	10' (3.0m)	-	10' (3.0m)	3' (0.9m)	7' (2.1m)

- .2 Exception: Natural gas piping less than 1" (25 mm) diameter on a rooftop shall be supported every 4' (1.2 m).
- .3 Provide additional supports for concentrated loads such as valves, specialties and pipe fittings and every change in direction.

3.5 DUCTWORK SUPPORT

- .1 For rectangular ductwork, installation shall be within the parameters of HVAC Duct Construction Standards: Hangers and Supports (SMACNA).

- .2 For round ductwork, use suspension rings, rigid metal supports, or brackets.
- .3 Wire, perforated strap, or metal less than 16 ga (1.5 mm) thick is not acceptable to support ducts.
- .4 Hangers and supports shall not interfere with the integrity and function of insulation or vapor barrier.
- .5 For ducts that convey particulate solids, supports shall be designed to carry the weight of the ductwork half filled with the solid particulate matter.

3.6 EQUIPMENT SUPPORTS

- .1 Generally, install as per manufacturer's requirements.
- .2 Generally, mount equipment such that movement during start and stop is less than ¼" (6 mm). The intent is to reduce stresses applied to the equipment attachments (i.e. piping) to within a safe working range thereby eliminating potential damage.
- .3 Equipment support springs shall be statically loaded to 50% compression by weight of equipment. Include a ¼" (6 mm) neoprene acoustic pad under each spring support.
- .4 Coordinate concrete base or inertia concrete block requirements for each piece of equipment with general contractor prior to installation. Concrete work and any associated structural reinforcement is by general contractor; vibration and acoustic isolation of equipment support is by mechanical contractor.

3.7 PERFORMANCE VERIFICATION

- .1 Upon completion of piping installation, and before system operation, examine all fasteners, inserts and attachments for looseness, movement, or other factors that would reduce their ability to act at their rated capacity.
- .2 Examine all pipe hangers for movement before and after system operation. Reinforce any area of hanger movement.
- .3 Prior to system operation, examine spring supports for available movement. Loaded springs shall rest in a 50% compressed state.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

- .1 This section includes guidance on identifying HVAC related piping systems and equipment.
- .2 This section does not include identification of plumbing piping and equipment.
- .3 If an existing identification system with color codes are already in place and this work is being added to the existing systems, use the existing identification system. Otherwise, use the color codes and materials specified in this section.

1.2 RELATED SECTIONS

- .1 Section 01 33 00 – Submittal Procedures
- .2 Section 01 78 00 – Closeout Submittals
- .3 Section 09 91 00 – Interior Painting
- .4 Section 23 05 00 – Common Work Results for HVAC
- .5 Section 23 07 19 – HVAC Piping Insulation
- .6 Section 23 11 23 – Facility Natural-Gas Piping
- .7 Section 23 31 13 – Metal Ducts

1.3 REFERENCES

- .1 American Society of Mechanical Engineers (ASME)
 - .1 ANSI/ASME A13.1 Scheme for the Identification of Piping Systems

1.4 SUBMITTALS

- .1 Compile a list of labelled items (equipment, valves, piping specialties) listed in PART-2 PRODUCTS with the following information
 - .1 Tag (i.e. V-1)
 - .2 Description (i.e. Coil #1 Hot Water Balancing Valve)
 - .3 Location (i.e. Room 305 Ceiling Space)
 - .4 Manufacturer of item
 - .5 Model number of item
- .2 Include a copy of this compiled list in the Operations and Maintenance Manual required in the close-out submittal package. Also, include a laminated copy for permanent mounting in the appropriate maintenance room.

- .3 Mark labelled items on the as-built drawings.
- .4 For items located within a mechanical room, create a laminated, schematic drawing with items labelled for permanent mounting in the mechanical room.

PART 2 - PRODUCTS

2.1 DUCTWORK IDENTIFICATION

- .1 A label or paint with white background and black lettering at least 3.5" (90 mm) high.
- .2 Include arrow indicating direction of air flow.
- .3 Include type (i.e. Supply, or Smoke Exhaust).
- .4 Include the air moving unit it serves.

2.2 PIPING IDENTIFICATION – GENERAL SIZING OF LABELS

- .1 For ¾" to 1¼" (19 mm to 32 mm) outer diameter pipe or insulation
 - .1 Color coding shall be 8" (200 mm) long
 - .2 Lettering shall be ½" (13 mm) high
- .2 For 1½" to 2" (32 mm to 50 mm) outer diameter pipe or insulation
 - .1 Color coding shall be 8" (200 mm) long
 - .2 Lettering shall be ¾" (19 mm) high
- .3 For 2½" to 6" (64 mm to 150 mm) outer diameter pipe or insulation
 - .1 Color coding shall be 12" (300 mm) long
 - .2 Lettering shall be 1¼" (32 mm) high
- .4 For 8" to 10" (200 mm to 250 mm) outer diameter pipe or insulation
 - .1 Color coding shall be 24" (600 mm) long
 - .2 Lettering shall be 2½" (64 mm) high
- .5 For over 10" (250 mm) outer diameter pipe or insulation
 - .1 Color coding shall be 32" (813 mm) long
 - .2 Lettering shall be 3½" (90 mm) high

2.3 PIPING IDENTIFICATION – GENERAL COLOR CODING

- .1 Refer to the table in this section for specific fluid/gas service piping. If a particular fluid/gas is not listed:
 - .1 For fire quenching fluid/gas, use white lettering on a red background

- .2 For toxic or corrosive fluid/gas, use black lettering on an orange background
- .3 For flammable fluid/gas with a flash point under 37.8 C (100 F), use black lettering on a yellow background
- .4 For combustible fluid/gas with a flash point between 37.8 C (100 F) and 93.3 C (200 F), use white lettering on a brown background
- .5 For chemicals or mixtures with a flash point above 93.3 C (200 F), use white lettering on an purple background unless otherwise specified
- .6 For any hydronic water system, use white lettering on a green background
- .7 For glycol/water mixture applications, use white lettering on a purple background

2.4 PIPING IDENTIFICATION – GENERAL LABELLING CONTENT

- .1 Include:
 - .1 Descriptive name of fluid/gas in pipe
 - .2 Direction of flow arrow
 - .3 Temperature (required for different temperatures for same named fluid/gas)
 - .4 Pressure (required for different pressures for same named fluid/gas)
 - .5 Any unique identifier within same named fluid/gas (i.e. Refrigerant Liquid versus Refrigerant Vapor)

2.5 PIPING IDENTIFICATION – SPECIFIC FLUID/GAS

<u>Fluid/Gas</u>	<u>Background Color</u>	<u>Lettering Color</u>	<u>Unique Identifier</u>
STEAM	Blue	White	Add pressure if multiple
STEAM CONDENSATE	Green	White	
REFRIGERANT	Purple	White	Add type (i.e. R410a)
REFRIGERANT COIL CONDENSATE	Gray	White	

2.6 EQUIPMENT, VALVES AND PIPING SPECIALTIES LABELLING

- .1 The intent is for any item that is required to be maintained, or be used in the course of maintenance, adjustment or repair in the system, shall be labelled in such a way that it is useful and visible.
- .2 The following HVAC equipment shall be labelled
 - .1 Air handlers and their respective controller
 - .2 Fans and their respective controller
 - .3 Pumps and their respective controller

- .4 AC Condensers
- .5 Motorized dampers
- .6 Thermostats (label says what it controls)
- .7 VRF equipment
- .8 humidifiers
- .3 Suitable labelling material shall be:
 - .1 For equipment:
 - .1 Lamacoids with minimum 1/16" (2 mm) thick plastic and engraved lettering. Sizes shall be determined based of each piece of equipment with the intent that the lamacoid can be easily read from up to 3 m (10 feet) away. Color shall generally be white background and black lettering unless otherwise indicated.
 - .2 For valves and specialties:
 - .1 Brass tags shall be 1½" (38 mm) diameter with stamped identification data filled with black paint.
 - .2 Plastic tags shall be 1¾" (44 mm) diameter with recessed identification data. Background and lettering colors to match associated piping labels.

2.7 MANUFACTURERS NAMEPLATES

- .1 Nameplates stamped or installed permanently by the manufacturer shall at least designate the make, model number, and applicable standards it adheres to (i.e ULc, CSA). Additional information is acceptable.

2.8 LANGUAGE

- .1 Identification to be in English.

PART 3 - EXECUTION

3.1 INTENT

- .1 Some of this work is subjective. The intent is label items and leave behind suitably detailed information for future maintenance staff. Installation shall be done with this in mind.

3.2 INSTALLATION

- .1 Install per manufacturer's written installation instructions.
- .2 For ductwork, install labels:

- .1 On either side of a wall or floor penetration for any non-HVAC ductwork (i.e. smoke exhaust, or fume extraction)
- .2 Within six (6) feet (2 meters) of an inline component (i.e. HEPA filter, or duct heater coil)
- .3 For piping labels, install one label:
 - .1 At every valve and unit connection
 - .2 On either side of a wall or floor penetration
 - .3 At every access panel if piping is concealed
 - .4 At every change of direction
 - .5 Every 15 M (50 feet) of straight pipe
- .4 For lamacoids, install with supplier applied adhesive.
- .5 For tags, install with a closing chain so the tag cannot come off the item and it does not hamper the normal operation of the item.
- .6 All labelling shall be visible from the floor and the most logical direction of approach to the item.
- .7 Do not paint, insulate or cover in any way.

3.3 TIMING

- .1 Provide identification only after all painting specified in Section 09 91 00 - Interior Painting has been completed.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

- .1 This section includes requirements for testing, adjusting, and balancing (TAB):
 - .1 Air systems,
 - .2 Hydronic/Water systems

1.2 RELATED SECTIONS

- .1 Section 01 33 00 – Submittal Procedures
- .2 Section 01 78 00 – Closeout Submittals
- .3 Section 01 91 13 – General Commissioning Requirements
- .4 Section 23 05 00 – Common Work Results for HVAC
- .5 Section 23 05 14 – Variable-Frequency Motor Controllers for HVAC
- .6 Section 23 09 13 – Instrumentation and Control Devices for HVAC
- .7 Section 23 33 13 – Dampers

1.3 REFERENCES

- .1 Associated Air Balance Council (AABC)
 - .1 AABC National Standards for Total System Balance
 - .2 AABC Test and Balance Procedures
- .2 American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE)
 - .1 ASHRAE 111 Practices for Measurement, Testing, Adjusting and Balancing of Building Heating, Ventilation, Air-Conditioning and Refrigeration Systems
- .3 Sheet Metal and Air Conditioning Contractors National Association (SMACNA)
 - .1 HVAC systems - Testing, Adjusting and Balancing (third edition)

1.4 MECHANICAL CONTRACTOR RESPONSIBILITIES

- .1 Provide to the testing and balancing agency and people doing the work of this section, a complete set of contract documents, subsequent changes, and approved submittals for the purpose of their work. Provide subsequent information as required.
- .2 Be available, including relevant mechanical Subcontractors, to assist during the work of this section. Coordinate with Subcontractors and/or suppliers as required.
- .3 Provide additional valves, dampers, sheaves, and belts as required during the work of this section.

- .4 Provide indication and access to all dampers, valves, test ports, nameplates, and other appurtenances as required.
- .5 Repair or replace any damaged insulation as a result of the work of this section.
- .6 Verify and have ready the following items (as applicable) in preparation for the work of this section.
 - .1 Air:
 - .1 Ductwork complete with all terminals installed
 - .2 All volume, smoke and fire dampers are open and functional
 - .3 Clean filters are installed
 - .4 All fans are operating free of vibration and rotating in the correct direction
 - .5 Variable frequency drives (VFDs) have been started and safeties verified
 - .2 Hydronics (Water):
 - .1 Piping is complete with all terminals installed
 - .2 Water flushing/disinfection is complete.
 - .3 Systems have been flushed, filled and air purged.
 - .4 Isolation/shutoff valves are verified fully open.
 - .5 Pumps operating free of vibration and rotating in the correct position.
- .7 Mechanical trade and subtrades shall allow for additional personnel and coordination time as required to assist the Integrated Testing Coordinator in functional testing and reporting of fire protection and life safety systems for compliance with CAN/ULC S-1001 - Integrated Systems Testing of Fire Protection Systems and Life Safety Systems. Mechanical equipment affected by the integrated testing includes, but is not limited to, combination fire/smoke dampers, equipment interlocks and shutdown.

1.5 SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 – Submittal Procedures
- .2 Submissions Prior to Certification:
 - .1 Submit to the City of Winnipeg Representative a Test, Adjust, and Balance (TAB) report for review.
- .3 Closeout Submittals:
 - .1 Provide per Section 01 78 00 - Closeout Submittals.
 - .2 Include the Test, Adjust, and Balance (TAB) report within the Operation and Maintenance (O&M) Manual upon certification.

1.6 QUALITY ASSURANCE

- .1 Agencies and people doing the work of this section shall be certified to do so by AABC, unless specifically allowed otherwise by the City of Winnipeg Representative. See the General Requirements in PART 3.

- .2 Report to the City of Winnipeg Representative and mechanical Subcontractor any deficiencies preventing proper testing, adjusting, and balancing of systems and equipment.
- .3 All measuring equipment shall be in calibration. Upon request, submit the calibration report for measuring equipment used.

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION

3.1 INTENT

- .1 Execute the testing, adjusting, and balancing of systems in accordance with recognized, suitable procedures; and as described herein.

3.2 PREPARATION

- .1 Air balancing precedes hydronic balancing.
- .2 Verify the following items prior to testing and balancing:
 - .1 Air:
 - .1 Ductwork complete with all terminals installed
 - .2 All volume, smoke and fire dampers are open and functional
 - .3 Clean filters are installed
 - .4 All fans are operating free of vibration and rotating in the correct direction
 - .5 Variable frequency drives (VFDs) have been started and safeties verified
 - .6 Automatic temperature control systems are operational
 - .7 Ceilings, windows, and doors are in place
 - .8 There is access to all balancing devices and equipment
 - .2 Domestic Water Systems
 - .1 Piping is complete with all fixtures installed.
 - .2 Water flushing/disinfection is complete.
 - .3 Systems have been flushed, filled and air purged.
 - .4 Isolation/shutoff valves are verified fully open.
 - .5 Pumps operating free of vibration and rotating in the correct position.
 - .6 Equipment measurements to include, but not be limited to, inlet and outlet of heaters, circulator, calibrated balancing devices devices.

3.3 GENERAL REQUIREMENTS

- .1 Agencies and personnel conducting the work of this section shall have both knowledge (from formal instruction/training in suitable testing and balancing procedures), and experience (at least five (5) years of practical work). Confirmation of qualifications shall be submitted upon request.
- .2 Suitable testing and balancing procedures shall be followed as found in:
 - .1 AABC Test and Balance Procedures,
 - .2 ASHRAE 111 Practices for Measurement, Testing, Adjusting and Balancing of Building Heating, Ventilation, Air-Conditioning and Refrigeration Systems, and/or
 - .3 SMACNA HVAC systems - Testing, Adjusting and Balancing (third edition).
- .3 Mark final location/setting of balancing devices and dampers with a permanent indicator.
- .4 Measuring and reporting shall be in the same units of measurement as the design documents.

3.4 PROCEDURES FOR BALANCING AIR SYSTEMS

- .1 General procedures for all air systems:
 - .1 Prepare test reports for all fans and outlets.
 - .2 Prepare single line schematics for systems identifying HVAC components.
 - .3 Choose duct measurement locations suitable for accurate, laminar airflow readings. Generally, a distance of 8.5 duct diameters of straight run is required upstream of a measurement point.
 - .4 Make holes in ducts required for testing and plug upon completion.
 - .5 Record outside and duct air conditions (temperature and humidity) during testing.
 - .6 Locate electrical disconnect switches, interlocks, and motor starters.
- .2 For constant-volume air systems:
 - .1 Adjust fans to deliver total design airflows within the maximum allowable fan speed listed by the fan manufacturer as follows.
 - .1 Measure total airflow:
 - .1 Set the outside air, return, and relief damper positions to simulate the minimum ventilation (outdoor air) requirements.
 - .2 Measure the velocity pressure to two (2) significant figures (inches of water) in each duct location via at least sixteen (16) pitot-tube traverse readings. Convert velocity pressure to air velocity for the conditions present. If the duct configuration does not allow for this, it must be presented in the report and the next best measurement method shall be used.
 - .2 Measure fan static pressures:

- .1 Measure directly at the fan outlet (through the flexible connector if required).
- .2 Measure directly at the fan inlet (through the flexible connector if required).
- .3 Measure directly across each component (filter banks, coils, and fans) in the air handling system.
- .3 Ensure fan speed adjustments do not result in motor overload. Refer to manufacturer's information regarding fan speed safety factors. Modulate dampers over full range while testing in all cooling, heating, economizer modes to determine maximum break power (horsepower, watts, etc.).
- .2 Measure and adjust volume dampers for main and major branch ducts to design airflows.
- .3 Adjust airflows in spaces as follows.
 - .1 Set diffuser/grille pattern to avoid drafts.
 - .2 Measure and adjust all inlets and outlets to design airflows.
- .4 Verification as follows.
 - .1 Record minimum ventilation (outdoor air), return and relief airflows and confirm within design.
 - .2 Test system in full economizer mode.
 - .3 Record final fan operating data (rpm, volts, amps, static profile).

3.5 ACCEPTABLE RESULTS

- .1 The flow rates shall be attempted to be set within the following tolerances:
 - .1 Supply, Return, and Exhaust fans: -5% to +10%
 - .2 Air outlets and inlets: +/- 10%
 - .3 Ventilation air: 0% to +10%
- .2 Pressure relationships take priority over airflow tolerances (For example, if the differential pressure between two spaces is required to be 0.08"wc, this requirement takes priority over setting airflows in and out of the space to meet the above tolerances).
- .3 If unable to set any component within tolerances, it shall be explicitly indicated on the report and brought to the attention of the City of Winnipeg Representative. It is the discretion of the City of Winnipeg Representative to determine if the particular out-of-tolerance setting is appropriate or not.

3.6 TEST, ADJUST, AND BALANCE (TAB) REPORT

- .1 The report shall be a complete record of the HVAC system performance under conditions of operation. The intent is to provide the City of Winnipeg Representative, and maintenance personnel information about the HVAC systems in order to verify functional compliance to the original design.
- .2 Information that shall be included as a minimum:

- .1 The company name, address, and contact information that is responsible for undertaking the work of this section.
- .2 The project name, description, and/or location address.
- .3 The name and contact information for mechanical contractor responsible for the installation.
- .4 The date of the report.
- .5 AABC Certification, or equivalent approved by the City of Winnipeg Representative.
- .6 Testing equipment description, manufacturer, model, and last calibration date.
- .7 Manufacturer nameplate information (make, model, voltage, amps, speed) for motors.
- .8 Curves for fans and pumps (may be deleted if already included in shop drawings).
- .9 List of components set outside of tolerances, and possible reasons why they are such.
- .10 Single line schematics of HVAC systems showing components, location and recordings.
- .11 Calculations and/or methodology descriptions as needed to determine useable units from accumulated data.
- .12 Air conditions (temperature, humidity) during testing.
- .13 Individual component operation data (flow, pressure drop, entering and leaving temperatures).

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

- .1 This section includes guidance on externally applied thermal insulation for ductwork and plenums conveying HVAC air between -40 C (-40 F) and 50 C (122 F), and commercial kitchen exhaust ducts.
- .2 This section does not include thermal insulation for hydronic or HVAC equipment, nor does it include internally applied acoustic liners.

1.2 RELATED SECTIONS

- .1 Section 01 33 00 – Submittal Procedures
- .2 Section 07 84 00 – Firestopping
- .3 Section 23 05 00 – Common Work Results for HVAC
- .4 Section 23 05 29 – Hangers and Supports for HVAC Piping and Equipment
- .5 Section 23 05 53 – Identification for HVAC Piping and Equipment
- .6 Section 23 31 13 – Metal Ducts

1.3 REFERENCES

- .1 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)
 - .1 ANSI/ASHRAE/IESNA 90.1 Energy Standard for Buildings except Low-Rise Residential Buildings
- .2 American Society for Testing and Materials (ASTM International)
 - .1 ASTM B209 Specification for Aluminum and Aluminum-Alloy Sheet and Plate
 - .2 ASTM C612 Specification for Mineral Fiber Block and Board Thermal Insulation
 - .3 ASTM C795 Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel
 - .4 ASTM C921 Practice for Determining the Properties of Jacketing Materials for Thermal Insulation
 - .5 ASTM C1136 Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation
 - .6 ASTM C1290 Standard Specification for Flexible Fibrous Glass Blanket Insulation Used to Externally Insulate HVAC Ducts
 - .7 ASTM C1338 Standard Test Method for Determining Fungi Resistance of Insulation Materials and Facings
 - .8 ASTM E96 Standard Test Methods for Water Vapor Transmission of Materials

- .9 ASTM E2336 Standard Test Methods for Fire Resistive Grease Duct Enclosure Systems
- .3 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets
- .4 National Fire Protection Agency (NFPA)
 - .1 NFPA 96 Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations
- .5 Thermal Insulation Association of Canada (TIAC)
 - .1 Best Practices Guide
- .6 Underwriters Laboratories of Canada (ULC)
 - .1 CAN/ULC S102 Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies
 - .2 CAN/ULC S102.2 Standard Method of Test for Surface Burning Characteristics of Flooring, Floor Coverings, and Miscellaneous Materials and Assemblies
- .7 National Building Code (NBC)
- .8 National Energy Code of Canada for Buildings (NECB)

1.4 DEFINITIONS

- .1 For purposes of this section:
 - .1 "CONCEALED" - insulated ductwork in suspended ceilings, non-accessible chases, or furred-in spaces.
 - .2 "EXPOSED" - will mean "not concealed" as defined herein.
 - .3 "FACING" – a protective layer around the outside of the insulation, for the purpose of vapour retardation, protecting from physical contact, or both.
 - .4 "MINERAL FIBER" - includes glass fiber, rock wool, or slag wool.

1.5 SUBMITTALS

- .1 Submit product data in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Manufacturers Datasheet:
 - .1 Upon request, submit manufacturer's printed product datasheet. Clearly identify products used on this job. Include product characteristics, performance criteria, limitations, and standards met (i.e. CAN/ULC S102).
- .3 Quality Assurance:
 - .1 Upon request, submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

1.6 QUALITY ASSURANCE

- .1 Qualifications:
 - .1 Installer:
 - .1 Has current certifications required in performing work of this Section
 - .2 Has at least five (5) years successful experience in this size and type of project
 - .3 Is qualified to understand, and experienced with, the TIAC Best Practices Guide.
 - .2 Supplier:
 - .1 Has at least five (5) years successful experience in this size and type of project
 - .2 Must be a company specializing in work of this Section.
 - .3 Must be available and competent to give installation support to the installer.
 - .3 Manufacturer:
 - .1 Must be a company specializing in work of this Section.
 - .2 Must be listed in the relevant section of the TIAC Best Practices Guide.
 - .3 Must be available and dedicated to providing installation support for their product.

PART 2 - PRODUCTS

2.1 FIRE AND SMOKE RATING (ALL PRODUCTS)

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

2.2 INSULATION AND FACINGS (HVAC)

- .1 Insulated duct panels (panels that form the entire duct without a metal duct included) are not allowed unless the project City of Winnipeg Representative gives formal approval for a specific application area, either through specific indication on the construction documents or upon request by the Subcontractor.
- .2 Insulation shall be either:
 - .1 Inorganic mineral fiber without formaldehyde meeting ASTM C612 or ASTM C1290, or

- .2 Closed cell elastomeric foam to ASTM E96.
- .3 Facings shall be (depending on application) one of:
 - .1 Foil-Scrim Kraft (FSK) meeting ASTM E96 (Procedure A),
 - .2 Polypropylene-Scrim-Kraft (PSK) meeting ASTM E96 (Procedure A)
 - .3 All-Service Jacket (ASJ) meeting ASTM C 1136, or
 - .4 Substrate suitable for application of weatherproof coating.
- .4 Material used in contact with austenitic stainless steel shall meet ASTM C795.
- .5 All materials shall exhibit zero mold growth when tested to ASTM C1338.
- .6 When rigid foam insulation is required to aid in duct supports, it shall be extruded polystyrene foam insulation with at least 25 psi (1.72 bar) compressive strength.

2.3 INSULATION SECUREMENTS (HVAC)

- .1 "Peel and stick" integral insulation adhesive
- .2 Contact adhesive: Quick setting
- .3 Bands: Stainless steel, 3/4" (19 mm) wide, 20 mil (0.5 mm) thick
- .4 TIAC Best Practices Guide insulation securement devices are acceptable except that no wire or twine is allowed. As a replacement for wire or twine, use bands.

2.4 JACKETS (HVAC)

- .1 Aluminum: Embossed sheet to ASTM B209
- .2 Canvas:
 - .1 6.5 oz/sq.yd. (220 gm/m²) cotton, plain weave, treated with dilute fire retardant lagging adhesive to ASTM C921.
 - .2 Lagging adhesive: Compatible with insulation.

2.5 INSULATION JOINT / JACKET TAPE (HVAC)

- .1 Self-adhesive, reinforced, 2" (50 mm) wide minimum. Provided by insulation manufacturer.

PART 3 - EXECUTION

3.1 PRE-INSTALLATION REQUIREMENTS

- .1 Ductwork joints and seams shall be sealed air-tight.
- .2 Surfaces shall be clean, dry, and free from foreign material.

3.2 INSTALLATION (ALL HVAC APPLICATIONS)

- .1 All mineral fiber insulation, concealed or exposed, shall have a facing on the outer surface.
- .2 Vapor retarder must be complete and airtight around entire exterior surface of insulation. If the air conveyed in the supply duct is always warmer than the air outside of the duct, no continuous vapor barrier is required. A facing membrane is still required for all mineral fiber insulation to protect against physical contact.
- .3 Refer to the TIAC Best Practices Guide to install to the codes specified.

3.3 INSTALLATION (FOR HVAC DUCTS / PLENUMS LOCATED OUTDOORS)

- .1 All insulation assemblies shall have an equivalent thermal resistance rating of R-27 (4.76 m²*C/W), unless otherwise indicated.
- .2 For rectangular ducts:
 - .1 Install multiple layers of unfaced mineral fiber board and an outer layer of faced mineral fiber board per TIAC code CER/3 and finish to TIAC code CRF/3 or CRF/4, or
 - .2 Install multiple layers of peel-and-stick closed cell elastomeric insulation and an outer layer of closed cell elastomeric insulation finished to TIAC code CRF/3.
- .3 For round ducts:
 - .1 Install multiple layers of peel-and-stick closed cell elastomeric insulation and an outer layer of closed cell elastomeric insulation finished with a jacket to TIAC code CRD/3.

3.4 INSTALLATION (FOR DUCTS PENETRATING A BARRIER BETWEEN CONDITIONED AND NON-CONDITIONED SPACE)

- .1 All HVAC ductwork penetrating a barrier between conditioned space and unconditioned space shall be insulated a minimum of 10 feet (3 m) in from the barrier on the conditioned side. Insulation shall have a minimum thermal resistance R-value of 5.0 (0.88 m²*C/W). Outside layer of the insulation shall have a continuous vapor barrier.
 - .1 Exception: If the duct air damper is located interior of the thermal barrier plane, all ductwork between the barrier and the damper shall be insulated to an equivalent thermal resistance rating of R-27 (4.76 m²*C/W), unless otherwise indicated.

3.5 INSTALLATION (HVAC DUCTS AND PLENUMS IN CONDITIONED SPACE)

- .1 All supply air ducts shall be insulated with a minimum thermal resistance R-value of 3.3 (0.58 m²*C/W), with the following exceptions:

- .1 If the maximum temperature difference between the air conveyed in the duct and the air outside the duct is <9 F (5 C), no insulation is required.
 - .2 If the maximum temperature difference between the air conveyed in the duct and the air outside the duct is >40 F (22 C), the minimum thermal resistance R-value shall be increased to 5.0 (0.88 m²*C/W).
 - .3 If the supply ductwork is contained completely within, and serving only, a single conditioned dwelling unit as defined by the National Building Code (NBC), no insulation is required.
- .2 When using closed cell elastomeric insulation:
- .1 For supply air ducts conveying air that is always warmer than the air surrounding the duct, install per manufacturer's instructions using a factory applied peel-and-stick adhesive and joint sealer,
 - .2 Otherwise, install per manufacturer's instructions using a factory applied peel-and-stick adhesive and joint sealer and finish to TIAC code CRD/2.
- .3 When using mineral fiber insulation:
- .1 For supply air ducts conveying air that is always warmer than the air surrounding the duct, install per TIAC code CER/1 or CEF/1.
 - .2 For all other rectangular supply air ducts:
 - .1 For ducts and plenums located less than 8 feet (2.4 m) above the floor, or areas subject to physical contact, install per TIAC code CER/2 and finish to TIAC code CRF/1.
 - .2 For ducts and plenums located above 8 feet (2.4 m) above the floor or in concealed areas, install per TIAC code CER/2 or TIAC code CEF/2.
 - .3 For all other round supply air ducts:
 - .1 For ducts and plenums located less than 8 feet (2.4 m) above the floor, or areas subject to physical contact, install per TIAC code CEF/2 and finish to TIAC code CRD/1.
 - .2 For ducts and plenums located above 8 feet (2.4 m) above the floor or in concealed areas, install per TIAC code CEF/2.

3.6 INSTALLATION (RECOMMENDATIONS - HVAC)

- .1 Maintaining a contiguous vapor barrier is a requirement, but it is sometimes difficult when ductwork is supported. The following technique is not a requirement, rather it is offered as guidance on a possible way to install satisfactorily. A suggested sequence for hanging / supporting insulated, rectangular duct is:
 - .1 Attach rigid foam insulation strips, equal in thickness to the required duct insulation, with suitable adhesive to the bottom of the duct where under duct hangers will be located.
 - .2 Hang the un-insulated duct, resting the rigid insulation strips on the hanger bar.
 - .3 Apply external insulation panels. At each hanger location, raise the duct slightly or lower the hanger bar slightly, butt the insulation up to the rigid strip and seal the vapor barrier across both the wrapped insulation and the rigid foam strip.

- .4 Once the insulation and vapor barrier are in place, let the duct and rigid foam insulation strip back down or raise the hanger bar such that the ductwork is supported, with the vapor barrier located between the foam strip and the hanger bar.
- .5 Move on to the next hanger.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

- .1 This section includes thermal insulation for piping and piping accessories used in HVAC applications.
- .2 This section does not include insulation for piping fluid below -75 C (-103 F) such as used in cryogenic applications.
- .3 This section does not include insulation for engine exhaust piping.

1.2 RELATED SECTIONS

- .1 Section 01 33 00 – Submittal Procedures
- .2 Section 07 84 00 – Firestopping
- .3 Section 23 05 00 – Common Work Results for HVAC
- .4 Section 23 05 29 – Hangers and Supports for HVAC Piping and Equipment
- .5 Section 23 05 53 – Identification for HVAC Piping and Equipment

1.3 REFERENCES

- .1 American Society for Testing and Materials International (ASTM)
 - .1 ASTM B209 Standard Specification for Aluminum and Aluminum Alloy Sheet and Plate
 - .2 ASTM C335 Standard Test Method for Steady State Heat Transfer Properties of Horizontal Pipe Insulation
 - .3 ASTM C449 Standard Specification for Mineral Fiber-Hydraulic-Setting Thermal Insulating and Finishing Cement
 - .4 ASTM C534 Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form
 - .5 ASTM C547 Mineral Fiber Pipe Insulation
 - .6 ASTM C552 Standard Specification for Cellular Glass Thermal Insulation
 - .7 ASTM C795 Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel
 - .8 ASTM C921 Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation
- .2 Canadian General Standards Board (CGSB)
 - .1 CGSB 51-GP-52Ma Vapour Barrier, Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation

- .2 CAN/CGSB-51.53 Poly (Vinyl Chloride) Jacketing Sheet, for Insulated Pipes, Vessels and Round Ducts
- .3 National Research Council of Canada
 - .1 National Energy Code of Canada for Buildings (NECB)
- .4 Thermal Insulation Association of Canada (TIAC)
 - .1 Best Practices Guide
- .5 Underwriters' Laboratories of Canada (ULC)
 - .1 CAN/ULC S102 Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies
 - .2 CAN/ULC S102.2 Standard Method of Test for Surface Burning Characteristics of Flooring, Floor Coverings, and Miscellaneous Materials and Assemblies
 - .3 CAN/ULC S702 Thermal Insulation, Mineral Fibre, for Buildings

1.4 DEFINITIONS

- .1 For purposes of this section:
 - .1 "CONCEALED" - insulated mechanical services in suspended ceilings and non-accessible chases and furred-in spaces.
 - .2 "EXPOSED" - will mean "not concealed" as defined herein.
 - .3 "MINERAL FIBER or FIBRE" – includes mineral wool, rock wool, and slag wool.
 - .4 "RUNOUT" - refers to piping to individual terminal units. This piping cannot exceed 3.7 m (12 feet) long.

1.5 SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Upon request, submit two copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS).
- .3 Shop Drawings:
 - .1 Upon request, submit manufacturer's printed product datasheet. Clearly identify products used on this job. Include product characteristics, performance criteria, and limitations.
- .4 Quality Assurance:
 - .1 Upon request, submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

1.6 QUALITY ASSURANCE

- .1 Qualifications:

- .1 Installer:
 - .1 Has current certifications required in performing work of this Section
 - .2 Has at least five (5) years successful experience in this size and type of project
 - .3 Is qualified to understand, and experienced with, the TIAC Best Practices Guide.
- .2 Supplier:
 - .1 Has at least five (5) years successful experience in this size and type of project
 - .2 Must be a company specializing in work of this Section.
 - .3 Must be available and competent to give installation support to the installer.
- .3 Manufacturer:
 - .1 Must be a company specializing in work of this Section.
 - .2 Must be listed in the relevant section of the TIAC Best Practices Guide.Summary

PART 2 - PRODUCTS

2.1 GENERAL INFORMATION

- .1 The acceptable product shall be selected based on the fluid temperature within the pipe. If the pipe contains fluid with a range of temperatures, use the fluid temperature that is most different than ambient.
- .2 Typical fluid temperature ranges for general applications are given for reference.
 - .1 Cooling coil condensate: 13-20 C (55-68 F)
 - .2 Refrigerant/brine: <4 C (<39 F)
 - .3 Refrigerant suction: [-40]-10 C ([-40]-50 F)
- .3 Thermal conductivity ("k" factor) shall be determined at mean rating temperature in accordance with ASTM C335.

2.2 PIPING INSULATION SYSTEM FOR FLUID <4 C (<39 F)

- .1 Flame spread / smoke developed rating: 25/50 as per CAN/ULC S102 or CAN/ULC S102.2
- .2 Vapor retarder permeance: 0.02 Perms or less
- .3 Thermal conductivity factor 'k': 0.030-0.039 W/m*C @ 24 C mean rating temperature
- .4 For conditioned or unconditioned spaces

- .1 For concealed space
 - .1 Preformed glass fiber pipe insulation with a factory applied jacket, or
 - .2 Closed cell foam elastomeric pipe insulation, or
 - .3 Cellular glass pipe insulation
- .2 For exposed space
 - .1 Preformed glass fiber pipe insulation with a factory applied jacket with either PVC jacket (indoors) or stainless steel or aluminum jacket (outdoors)
- .3 Insulation thickness
 - .1 Runout pipes up to 2 NPS: 25 mm (1")
 - .2 Pipes up to 1 NPS: 25 mm (1")
 - .3 Pipes over 1 NPS: 38 mm (1½")

2.3 PIPING INSULATION SYSTEM FOR FLUID 4-16 C (39-61 F)

- .1 Flame spread / smoke developed rating: 25/50 as per CAN/ULC S102 or CAN/ULC S102.2
- .2 Vapor retarder permeance: 0.02 Perms or less
- .3 Thermal conductivity factor 'k': 0.030-0.039 W/m°C @ 24 C mean rating temperature
- .4 For conditioned or unconditioned spaces
 - .1 For concealed space
 - .1 Preformed glass fiber pipe insulation with a factory applied jacket, or
 - .2 Closed cell foam elastomeric pipe insulation, or
 - .3 Cellular glass pipe insulation
 - .2 For exposed space
 - .1 Preformed glass fiber pipe insulation with a factory applied jacket with either PVC jacket (indoors) or stainless steel or aluminum jacket (outdoors)
 - .3 Insulation thickness
 - .1 All pipes and runouts: 25 mm (1")

2.4 PIPING INSULATION SYSTEM FOR FLUID 17-40 C (62-104 F)

- .1 Flame spread / smoke developed rating: 25/50 as per CAN/ULC S102 or CAN/ULC S102.2
- .2 Thermal conductivity factor 'k': 0.030-0.039 W/m°C @ 24 C mean rating temperature
- .3 For conditioned space
 - .1 No insulation is required
- .4 For unconditioned space

- .1 For concealed space
 - .1 Preformed mineral fiber (low and medium temperature) pipe insulation with a factory applied jacket, or
 - .2 Preformed glass fiber pipe insulation with a factory applied jacket, or
 - .3 Closed cell foam elastomeric pipe insulation, or
 - .4 Cellular glass pipe insulation
- .2 For exposed space
 - .1 Preformed mineral fiber (low and medium temperature) pipe insulation with either PVC jacket (indoors) or stainless steel or aluminum jacket (outdoors)
 - .2 Preformed glass fiber pipe insulation with a factory applied jacket with either PVC jacket (indoors) or stainless steel or aluminum jacket (outdoors)
- .3 Insulation thickness
 - .1 Runout pipes up to 2 NPS: 25 mm (1")
 - .2 Pipes up to 1 NPS: 25 mm (1")
 - .3 Pipes over 1 NPS: 38 mm (1½")

2.5 PIPING INSULATION SYSTEM FOR FLUID 41-60 C (106-140 F)

- .1 Flame spread / smoke developed rating: 25/50 as per CAN/ULC S102 or CAN/ULC S102.2
- .2 Thermal conductivity factor 'k': 0.035-0.040 W/m*C @ 38 C mean rating temperature
- .3 For conditioned space
 - .1 For concealed space
 - .1 Preformed mineral fiber (low and medium temperature) pipe insulation with a factory applied jacket, or
 - .2 Preformed glass fiber pipe insulation with a factory applied jacket, or
 - .3 Closed cell foam elastomeric pipe insulation, or
 - .4 Cellular glass pipe insulation
 - .2 For exposed space
 - .1 Preformed mineral fiber (low and medium temperature) pipe insulation with PVC jacket, or
 - .2 Preformed glass fiber pipe insulation with a factory applied jacket with PVC jacket
 - .3 Insulation thickness
 - .1 Runout pipes up to 2 NPS: 25 mm (1")
 - .2 Pipes up to 1 NPS: 25 mm (1")
 - .3 Pipes over 1 NPS: 38 mm (1½")

- .4 For unconditioned space
 - .1 For concealed space
 - .1 Preformed mineral fiber (low and medium temperature) pipe insulation with a factory applied jacket, or
 - .2 Preformed glass fiber pipe insulation with a factory applied jacket, or
 - .3 Closed cell foam elastomeric pipe insulation, or
 - .4 Cellular glass pipe insulation
 - .2 For exposed space
 - .1 Preformed mineral fiber (low and medium temperature) pipe insulation with either PVC jacket (indoors) or stainless steel or aluminum jacket (outdoors)
 - .2 Preformed glass fiber pipe insulation with a factory applied jacket with either PVC jacket (indoors) or stainless steel or aluminum jacket (outdoors)
 - .3 Insulation thickness
 - .1 Runout pipes up to 2 NPS: 25 mm (1")
 - .2 Pipes up to 1 NPS: 25 mm (1")
 - .3 Pipes over 1 NPS: 38 mm (1½")

2.6 INSULATION

- .1 Mineral fiber shall meet ASTM C547 or CAN/ULC-S702. Mineral fiber shall also meet ASTM C795 if in contact with austenitic stainless steel.
- .2 Glass fiber shall meet ASTM C547. Glass fiber shall also meet ASTM C795 if in contact with austenitic stainless steel.
- .3 Closed cell elastomeric foam shall meet ASTM C534.
- .4 Cellular glass shall meet ASTM C552.

2.7 INSULATION SECUREMENT

- .1 Joint connections, vapor retarder completion, jacket attachment and associated materials otherwise required for installation to the insulation manufacturer's instructions shall be provided by the insulation manufacturer.

2.8 CEMENT

- .1 Thermal insulating and finishing cement to ASTM C449

2.9 VAPOUR RETARDER LAP ADHESIVE

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

2.10 INDOOR VAPOUR RETARDER FINISH

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

2.11 OUTDOOR VAPOUR RETARDER FINISH

- .1 Vinyl emulsion type acrylic, compatible with insulation.
- .2 Reinforcing fabric: fibrous glass, untreated 305 g/m² (9 oz/sq.yd.).

2.12 JACKETS

- .1 Vapor barrier jacket to meet CGSB 51-GP-52Ma.
- .2 Polyvinyl Chloride (PVC):
 - .1 One-piece moulded type to CAN/CGSB-51.53 with pre-formed shapes as required
 - .2 Minimum service temperatures: -20 degrees C
 - .3 Maximum service temperature: 65 degrees C
 - .4 Moisture vapour transmission: 0.02 perm
 - .5 Thickness: 0.5 mm (.020")
 - .6 Fastenings:
 - .1 Use solvent weld adhesive compatible with insulation to seal laps and joints.
 - .2 Slip joints shall be per manufacturer's requirements.
- .3 Aluminum:
 - .1 Material to ASTM B209
 - .2 Thickness: 0.50 mm (.020") sheet
 - .3 Finish: smooth or stucco embossed
 - .4 Joining: longitudinal and circumferential slip joints with 50 mm (2") laps
 - .5 Fittings: 0.5 mm (.020") thick die-shaped fitting covers with factory-attached protective liner
 - .6 Metal jacket banding and mechanical seals: stainless steel, 19 mm (3/4") wide, 0.5 mm (.020") thick at 300 mm (12") spacing
- .4 Metal jacket banding and mechanical seals: stainless steel, 19 mm (3/4") wide, 0.5 mm (.020") thick at 300 mm (12") spacing

PART 3 - EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 PRE-INSTALLATION REQUIREMENT

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

3.3 GENERAL INSTALLATION REQUIREMENTS AND RESTRICTIONS

- .1 Install in accordance with TIAC Best Practices Guide.
- .2 Apply materials in accordance with manufacturer's instructions.
- .3 Closed cell elastomeric insulation shall not be used on externally heat traced piping.
- .4 Maintain uninterrupted continuity and integrity of vapor retarder jacket and finishes.
 - .1 Install hangers, supports outside vapor retarder jacket.
- .5 Upon installation completion, apply labels as per Section 23 05 53 – Identification of HVAC Piping and Equipment

3.4 REMOVABLE INSULATION AND ENCLOSURES

- .1 A removable insulation system compatible with the adjacent piping shall be installed at expansion joints, valves, primary flow measuring elements, flanges, and unions to permit movement of expansion joints and to permit periodic removal and replacement of inline items without damage to adjacent insulation.

3.5 INSTALLATION OF ELASTOMERIC INSULATION

- .1 Insulation shall remain dry. Overlaps shall be installed to manufacturer's instructions. Ensure tight joints.
- .2 Apply vapor retarder to joints, seams, and openings as recommended by manufacturer to ensure contiguous vapour retardation over the entire external area of the insulation.

3.6 INSTALLATION – FOR FLUID TEMPERATURE <15 C (<59 F)

- .1 Insulate valves, valve bonnets, strainers, flanges, and fittings unless otherwise specified.
- .2 TIAC Code: 1501-C, or 1501-CA for elastomeric foam
 - .1 Insulation and jackets shall be attached as per manufacturer's installation documentation.

- .3 For concealed spaces
 - .1 Finish shall be TIAC code: CPF/2
 - .2 P-T ports, and gauges are not to be finished unless in unconditioned or outdoor spaces.
- .4 For exposed spaces (not outdoors)
 - .1 Finish shall be TIAC code: CPF/4
 - .2 P-T ports, and gauges are not to be finished unless in unconditioned or outdoor spaces.
- .5 For outdoor applications
 - .1 Finish shall be TIAC code: CPF/3

3.7 INSTALLATION - FOR FLUID TEMPERATURE >15 C (59 F)

- .1 TIAC Code: 1501-H, 1501-HA for elastomeric foam
 - .1 Insulation and jackets shall be attached as per manufacturer's installation documentation.
 - .2 Valves, bonnets, strainers, P-T ports, and gauges are not to be insulated unless in unconditioned or outdoor spaces.
- .2 For concealed spaces
 - .1 Finish shall be TIAC code: CPF/2
 - .2 Valves, bonnets, strainers, P-T ports, and gauges are not to be finished unless in unconditioned or outdoor spaces.
- .3 For exposed spaces (not outdoors)
 - .1 Finish shall be TIAC code: CPF/4
 - .2 Valves, bonnets, strainers, P-T ports, and gauges are not to be finished unless in unconditioned or outdoor spaces.
- .4 For outdoor applications
 - .1 Finish shall be TIAC code: CPF/3

3.8 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

PART 1 - GENERAL

1.1 SUMMARY

- .1 This section includes the requirements for refrigerant piping and fittings that use a refrigerant listed in CSA B52 Mechanical Refrigeration Code.
- .2 This section also includes refrigerant piping insulation.
- .3 Refer to Section 23 23 16 – Refrigerant Piping Specialties for valves and specialty components used in conjunction with piping of this section for a complete refrigeration system.
- .4 The intent is to have a complete, working refrigeration system that will function under all reasonable conditions. Installation shall meet this intent.

1.2 RELATED SECTIONS

- .1 Section 01 33 00 – Submittal Procedures
- .2 Section 01 91 13 – General Commissioning Requirements
- .3 Section 07 84 00 – Firestopping
- .4 Section 23 05 00 – Common Work Results for HVAC
- .5 Section 23 05 29 – Hangers and Supports for HVAC Piping and Equipment
- .6 Section 23 23 16 – Refrigerant Piping Specialties

1.3 REFERENCES

- .1 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)
 - .1 ASHRAE 34 Designation and Safety Classification of Refrigerants
- .2 American Society of Mechanical Engineers International (ASME)
 - .1 ASME B16.50 Wrought Copper and Copper Alloy Braze-Joint Pressure Fittings
 - .2 ASME B31.5 Refrigeration Piping and Heat Transfer Components
- .3 American Society for Testing and Materials International (ASTM)
 - .1 ASTM A53 Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
 - .2 ASTM A105 Standard Specification for Carbon Steel Forgings for Piping Applications
 - .3 ASTM A106 Standard Specification for Seamless Carbon Steel Pipe for High-Temperature Service
 - .4 ASTM B88 Standard Specification for Seamless Copper Water Tube

- .5 ASTM B210 Standard Specification for Aluminum and Aluminum-Alloy Drawn Seamless Tubes
- .6 ASTM B280 Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service
- .7 ASTM C534 Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form
- .8 ASTM C552 Standard Specification for Cellular Glass Thermal Insulation
- .9 ASTM E96 Test Methods for Water Vapor Transmission of Materials
- .4 American Welding Society (AWS)
 - .1 AWS A5.31 Specification for Fluxes for Brazing and Braze Welding
- .5 Canadian General Standards Board (CGSB)
 - .1 CGSB 51-GP-52Ma Vapour Barrier, Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation
 - .2 CAN/CGSB-51.53 Poly (Vinyl Chloride) Jacketing Sheet, for Insulated Pipes, Vessels and Round Ducts
- .6 Canadian Standards Association (CSA).
 - .1 CSA B51 Boiler, Pressure Vessel, and Pressure Piping Code
 - .2 CSA B52 Mechanical Refrigeration Code
- .7 Thermal Insulation Association of Canada (TIAC)
 - .1 Best Practices Guide
- .8 Underwriters' Laboratories of Canada (ULC)
 - .1 ULC S102 Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies

1.4 SUBMITTALS

- .1 Submit product data in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Manufacturers Datasheet:
 - .1 Upon request, submit manufacturer's printed product datasheet. Clearly identify products used on this job. Include product characteristics, performance criteria, limitations, and standards met (i.e. CAN/ULC S102).
- .3 Quality Assurance:
 - .1 Upon request, submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

1.5 QUALITY ASSURANCE

- .1 Work of this section shall be done by, or under the direct supervision of, a Certified Red Seal Refrigeration and Air Conditioning Mechanic who takes responsibility for the work.

Proof of certification shall be produced upon request.

- .2 Work of this section shall adhere to CSA B52.

PART 2 - PRODUCTS

2.1 FOR REFRIGERATION SYSTEMS USING REFRIGERANTS OTHER THAN AMMONIA

- .1 Piping / Tubing:
 - .1 Type L or ACR copper only, conforming to ASTM B88 or ASTM B280.
 - .1 Exception: Type K65 (rated for R744 refrigerant) for carbon dioxide systems
 - .2 Fittings (Carbon Dioxide Systems):
 - .1 Fittings shall be rated for R744 refrigerant
 - .3 Fittings (Hydrocarbon Refrigerants):
 - .1 Fittings shall be wrought copper or copper alloy conforming to ASME B16.50, or
 - .2 Fittings within variable refrigerant volume (VRV) systems may use "reflok" pipe connectors.
 - .4 Flux:
 - .1 Type FB3-A or FB3-C per standard AWS A5.31.
 - .2 Water-based
 - .5 Brazing filler material:
 - .1 Brazing alloy with melting point above 1100 F (593 C).
 - .6 Insulation:
 - .1 Water vapor permeability shall be less than or equal to 0.02 perm (piping within conditioned space) or 0.01 perm (piping in non-conditioned space) for the complete insulating system with vapor retarder per ASTM E96. Water vapor permeability of the base insulating material shall be less than or equal to 0.1 perm-inch.
 - .2 Flame spread / smoke developed rating: maximum 25/50 as per CAN/ULC S102.
 - .3 Insulation to include protection from damage in exposed locations subject to contact.
 - .4 For Rigid Pipe:
 - .1 Insulation type:
 - .1 Cellular glass to ASTM C552, or
 - .2 Closed cell elastomeric to ASTM C534
 - .2 Thickness:

- .1 Per operating temperature and pipe size table in PART 3 – EXECUTION.
- .5 For Non-rigid Pipe or Coil:
 - .1 Insulation type:
 - .1 Closed cell elastomeric to ASTM C534
 - .2 Thickness:
 - .1 Per design conditions and pipe size table in PART 3 – EXECUTION.
- .7 Weather Barrier Jackets:
 - .1 For all outdoor applications, insulation shall be protected from weather, UV light, and physical abuse with an outer layer of 0.016 in. (0.4 mm) or thicker aluminum jacketing attached with stainless steel banding. Jacket shall not compromise the integrity of the insulation vapor barrier.

PART 3 - EXECUTION

3.1 PREPARATION

- .1 Review and comply with applicable 'hot work' procedures for brazing operations.
- .2 Coordinate installation with trades whose installations are close by or in potential conflict.
- .3 Prepare the layout based on refrigeration equipment manufacturer's recommendations for proper installation. Consider the need for refrigerant piping specialties or traps based on site conditions (length of runs, elevation change, etc.).
- .4 Ensure proposed routing of piping through occupancies meets refrigerant quantity and noted restrictions found in CSA B52.
- .5 Refrigerant piping shall not be routed in public stairwells or exits.

3.2 INSTALLATION (GENERAL)

- .1 Work of this section shall be done by, or under the direct supervision of, a Certified Red Seal Refrigeration and Air Conditioning Mechanic who takes responsibility for the work. Proof of certification shall be produced upon request.
- .2 Work of this section shall adhere to CSA B52.
- .3 Utilize refrigerant piping specialties as required for proper operation of the refrigerant system.
- .4 Piping shall be sloped a minimum 1:250 in the direction of refrigerant flow to return oil to the compressor.
- .5 Reflok style pipe connectors shall only be installed by individuals trained and certified by reflok representatives. Proof of certification shall be provided upon request.

3.3 INSTALLATION (REFRIGERANT SYSTEMS OTHER THAN AMMONIA)

- .1 Piping and Joints:
 - .1 Connections shall be either by brazing or using connectors rated for the refrigerant.
 - .2 Brazing shall be done by a worker with at least five (5) years brazing experience.
 - .3 Brazing shall be done with Nitrogen flowing through the pipe/fitting at three (3) cubic feet per hour (1.4 L/min), or 2 psig (13.8 kPa) regulated from a pressurized cylinder connected at one end.
 - .4 Piping and insulation shall account for thermal expansion and contraction.
- .2 Evacuation / Moisture Removal:
 - .1 A vacuum equivalent to 500 microns shall be applied to the system. If this cannot be achieved, slowly apply dry nitrogen to the system until 150 psig (1034 kPa) is in the system. Leak test joints and connections; disassemble and re-make any leaking joints or connections.
 - .2 Once the system achieves 500 microns of vacuum, introduce dry nitrogen into the system slowly until brought back to atmospheric condition for the purpose of capturing residual moisture.
 - .3 Re-apply a vacuum equivalent to 500 microns to the system. Close the suction valve and shut off the pump. Hold vacuum for 12 hours.
- .3 Charging:
 - .1 Review and adhere to the specific equipment manufacturer's documentation prior to charging. Manufacturer specific requirements and procedures over-rule any general charging techniques.
 - .2 There are many acceptable types of automatic charging equipment that may be used. The following are general guidelines intended avoid poor conditions and to ensure proper system charging. Any charging equipment used shall similarly avoid the poor conditions.
 - .3 To avoid foaming, oil slugging, and poor oil distribution, oil shall be added to the system before refrigerant; or alternatively, metered in correct proportions with refrigerant.
 - .4 Charge the system on the high pressure side to avoid liquid slugging during start-up.
 - .5 Oil, refrigerant, and the system shall be carefully protected from moisture and air during the charging process.

3.4 INSTALLATION (INSULATION)

- .1 Installation of insulation over joints and connections shall be only after system has passed leak testing.
- .2 It is critical that the insulation vapor barrier be complete, undamaged, and robust enough to achieve permeability limits wherever piping and components are insulated.

- .3 Refer to the following tables for insulation thicknesses required for each type of insulation and location used.

Cellular Glass Insulation Thickness (Piping Located <i>Indoors</i>)								
NPS	Pipe Operating Temperature (F)							
	-100	-80	-60	-40	-20	0	20	40
0.5	2.5	2.5	2.5	2.0	2.0	1.5	1.5	1.0
0.75	3.0	2.5	2.5	2.5	2.0	2.0	1.5	1.0
1	3.0	3.0	2.5	2.5	2.0	2.0	1.5	1.0
1.5	3.0	3.0	2.5	2.5	2.0	2.0	1.5	1.0
2	3.5	3.5	3.0	2.5	2.5	2.0	1.5	1.0
2.5	3.5	3.5	3.0	2.5	2.5	2.0	1.5	1.0
3	4.0	3.5	3.5	3.0	2.5	2.0	1.5	1.0
4	4.0	3.5	3.5	3.0	2.5	2.0	1.5	1.0
5	4.0	4.0	3.5	3.0	2.5	2.0	1.5	1.5
6	4.0	4.0	4.0	3.5	3.0	2.0	2.0	1.5
8	4.5	4.5	4.0	3.5	3.0	2.0	2.0	1.5
10	4.5	4.5	4.5	3.5	3.0	2.0	2.0	1.5
12	5.0	5.0	4.5	3.5	3.0	2.0	2.0	1.5
14	5.0	5.0	4.5	4.0	3.5	2.5	2.0	1.5

Cellular Glass Insulation Thickness (Piping Located <i>Outdoors</i>)								
NPS	Pipe Operating Temperature (F)							
	-100	-80	-60	-40	-20	0	20	40
0.5	3.0	3.0	2.5	2.5	2.5	2.0	1.5	1.5
0.75	3.5	3.0	3.0	2.5	2.5	2.0	2.0	1.5
1	4.0	3.5	3.5	3.0	2.5	2.0	2.0	1.5
1.5	4.0	4.0	3.5	3.0	2.5	2.5	2.0	1.5
2	5.0	4.5	4.0	3.5	3.0	3.0	2.5	2.0
2.5	5.0	4.5	4.0	3.5	3.0	3.0	2.5	2.0
3	5.5	5.0	4.5	4.0	3.5	3.0	2.5	2.0
4	6.0	5.5	5.0	4.5	4.0	3.5	3.0	2.5
5	6.5	6.0	5.5	5.0	4.5	4.0	3.0	2.5
6	7.0	6.5	6.0	5.0	4.5	4.0	3.5	2.5
8	7.5	7.0	6.5	5.5	5.0	4.5	3.5	2.5
10	8.0	7.5	7.0	6.0	5.5	4.5	4.0	3.0
12	8.5	8.0	7.5	6.5	6.0	5.0	4.0	3.0
14	9.0	8.5	7.5	7.0	6.0	5.5	4.5	3.5

Closed Cell Elastomeric Insulation Thickness (Piping Located <i>Indoors</i>)								
NPS	Pipe Operating Temperature (F)							
	-100	-80	-60	-40	-20	0	20	40
0.5	2.5	2.5	2.5	2.0	2.0	1.5	1.5	1.0
0.75	2.5	2.5	2.5	2.5	2.0	2.0	1.5	1.5
1	3.0	2.5	2.5	2.5	2.0	2.0	1.5	1.5
1.5	3.0	2.5	2.5	2.5	2.0	2.0	1.5	1.5
2	3.5	3.0	3.0	2.5	2.5	2.0	1.5	1.5
2.5	3.5	3.0	3.0	2.5	2.5	2.0	1.5	1.5
3	3.5	3.5	3.0	3.0	2.5	2.0	2.0	1.5
4	4.0	3.5	3.0	3.0	2.5	2.5	2.0	1.5
5	4.0	3.5	3.5	3.0	2.5	2.5	2.0	1.5
6	4.0	3.5	3.5	3.0	3.0	2.5	2.0	1.5
8	4.0	4.0	3.5	3.0	3.0	2.5	2.0	1.5
10	4.5	4.0	4.0	3.5	3.0	2.5	2.0	1.5
12	4.5	4.0	4.0	3.5	3.0	2.5	2.0	1.5
14	4.5	4.5	4.0	3.5	3.0	2.5	2.0	1.5

Closed Cell Elastomeric Insulation Thickness (Piping Located <i>Outdoors</i>)								
NPS	Pipe Operating Temperature (F)							
	-100	-80	-60	-40	-20	0	20	40
0.5	3.0	2.5	2.5	2.5	2.0	2.0	1.5	1.5
0.75	3.5	3.0	2.5	2.5	2.5	2.0	2.0	1.5
1	3.5	3.5	3.0	2.5	2.5	2.0	2.0	1.5
1.5	4.0	3.5	3.5	3.0	2.5	2.0	2.0	1.5
2	4.5	4.0	4.0	3.5	3.0	2.5	2.0	1.5
2.5	4.5	4.0	4.0	3.5	3.0	2.5	2.0	1.5
3	5.0	5.0	4.5	4.0	3.5	3.0	2.5	2.0
4	5.5	5.0	4.5	4.5	4.0	3.0	2.5	2.0
5	6.0	5.5	5.0	4.5	4.0	3.5	3.0	2.5
6	6.5	6.0	5.5	5.0	4.5	3.5	3.0	2.5
8	7.0	6.5	6.0	5.5	4.5	4.0	3.5	2.5
10	7.5	7.0	6.5	6.0	5.0	4.5	3.5	3.0
12	8.0	7.5	7.0	6.0	5.5	4.5	4.0	3.0
14	8.5	8.0	7.0	6.5	5.5	5.0	4.0	3.0

3.5 PERFORMANCE VERIFICATION

- .1 General Information:
 - .1 The mechanical Subcontractor will have read and adhered to the charging procedures and verifications required in the specific manufacturer's documentation.
- .2 Non-Ammonia Refrigerant Systems:
 - .1 Conditions shall be within the following:
 - .1 Outdoor Air temperature between 55 F (13 C) and 115 F (46 C)
 - .2 Return Air temperature (dry bulb) equal to or above 70 F (21 C)
 - .3 Return Air temperature (wet bulb) equal to or less than 76 F (24 C)
 - .4 Airflow across the evaporator coil between 300 and 500 feet per minute (1.5 and 2.5 m/s).
 - .2 For FIXED metering device systems:
 - .1 Superheat shall be +/- 5 F (3 C) of manufacturer's specified target
 - .3 For VARIABLE metering device systems:
 - .1 Subcooling shall be +/- 3 F (2 C) of manufacturer's specified target
 - .2 Superheat shall be between 4 F (-15 C) and 25 F (-4 C) unless specified in the manufacturer's documentation.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

- .1 This section gives guidance on refrigerant piping specialties used in:
 - .1 Manufactured Systems (i.e. a Chiller or DX Split System)
 - .2 Built-up Hydro-Fluorocarbon (HFC) Refrigeration Systems
 - .3 Carbon Dioxide (R-744) Refrigeration Systems
 - .4 Ammonia (R-717) Refrigeration Systems

1.2 RELATED SECTIONS

- .1 Section 01 33 00 – Submittal Procedures
- .2 Section 01 78 00 – Closeout Submittals
- .3 Section 01 91 13 – General Commissioning Requirements
- .4 Section 23 05 00 – Common Work Results for HVAC
- .5 Section 23 23 00 – Refrigerant Piping

1.3 REFERENCES

- .1 Air-Conditioning, Heating, and Refrigeration Institute (AHRI)
 - .1 AHRI 760 Performance Rating of Solenoid Valves for Use with Volatile Refrigerants
- .2 American Society of Mechanical Engineers (ASME)
 - .1 ASME Boiler and Pressure Vessel Code
- .3 American Welding Society (AWS)
 - .1 AWS A5.31 Specification for Fluxes for Brazing and Braze Welding
- .4 Canadian Standards Association (CSA).
 - .1 CSA B51 Boiler, Pressure Vessel, and Pressure Piping Code
 - .2 CSA B52 Mechanical Refrigeration Code

1.4 SUBMITTALS

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

- .1 Provide manufacturer's printed product datasheets for all pressure vessels and pressure relief devices.
- .2 Upon request, provide manufacturer's printed product datasheets for any specialty item that is not already factory installed on refrigeration units specified on the mechanical equipment schedules.
- .3 Closeout Submittals:
 - .1 Per Section 01 78 00 - Closeout Submittals.
 - .2 Operation and Maintenance (O&M) Manual, plus Instruction:
 - .1 Include product manufacturer's documentation for maintaining the product.
 - .2 Provide clear instruction to the City of Winnipeg to verify and tighten any electrical connection to refrigerant specialty products every twelve (12) months.
 - .3 Provide clear instruction to the City of Winnipeg to visually inspect the entire system for corrosion and physical damage every three (3) months.
 - .4 The following shall also be included unless the system does not contain a pressure relief device, a pressure-limiting device, or any other safety controls.
 - .1 Provide clear instruction to the City of Winnipeg that maintenance work shall be done by an individual certified by the local authority having jurisdiction (AHJ).
 - .2 Provide clear instruction to the City of Winnipeg to replace, or have re-certified (per CSA B51), all pressure relief devices every five (5) years.
 - .3 Provide clear instruction to the City of Winnipeg to test every pressure-limiting device every twelve (12) months for setpoint accuracy and that it stops the necessary pressure-producing equipment.
 - .5 Provide clear instruction to the City of Winnipeg to continue the log of maintenance started by the installing Subcontractor. The log shall include the date, name of the maintenance person, and the description of inspection/maintenance, indicating any items replaced and/or found out of performance parameters.
 - .6 Provide refrigerant type and weight of charge in the system(s).
 - .7 For systems containing 50 lb (23 kg) or more refrigerant, submit a signed and dated declaration of the system pressure testing with zero pressure change. The declaration shall include name of the refrigerant, the quantity of refrigerant, the high side test pressure, the low side test pressure, the testing medium, and the test duration.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

- .1 Products shall meet CSA B52.
- .2 Working pressure rating: 400 psig (27.6 bar) unless otherwise indicated.
 - .1 Exception: Carbon Dioxide system components shall be rated for 1305 psig (90 bar) unless otherwise indicated.
- .3 All pressure vessels and pressure relief devices must be registered with the local authority per CSA B51 prior to installation.
- .4 All piping, fittings and specialties directly connected (not able to be pressure isolated) to a pressure vessel shall have a design pressure rating not less than the pressure vessel.
- .5 A heat exchanger containing refrigerant shall be considered a pressure vessel meeting CSA B51.
- .6 Specialty items shall be compatible with the refrigeration piping connected.
- .7 Refrigerant transfer (evacuation or charging) valves shall be included where appropriate in every system so no refrigerant comes into contact with the atmosphere.

2.2 FOR MANUFACTURED SYSTEMS

- .1 Control and Shut-Off Valves:
 - .1 Sealed to protect against moisture infiltration
 - .2 Brazed connections only
 - .3 Working differential pressure range: Meet or exceed -14 psi to 304 psi (-1 bar to 21 bar)
 - .4 Maximum working pressure: At least 400 psi (27.6 bar)
 - .5 Temperature operating range: Must exceed refrigerant working range in system
- .2 Expansion Valves:
 - .1 Balanced port construction
 - .2 Maximum working pressure: 700 psi (48.3 bar)
 - .3 Temperature operating range: Must exceed refrigerant working range in system

2.3 FOR BUILT-UP HYDRO-FLUOROCARBON (HFC) REFRIGERATION SYSTEMS

- .1 Pressure Vessels (that could potentially containing liquid refrigerant):
 - .1 Standard: CSA B52; and ASME Boiler and Pressure Vessel Code, Section 8, Division 1
 - .2 Pressure Relief:

- .1 For vessels <6" (152 mm) diameter: None required
 - .2 For vessels <3 cu.ft. (0.085 m3): Pressure relief device or fusible plug
 - .3 For vessels <10 cu.ft. (0.28 m3): Pressure relief device
 - .4 For vessels >10 cu.ft. (0.28 m3): Two (2) full capacity pressure relief devices in parallel
- .2 Pressure Relief Devices:
- .1 Standard: CSA B51
 - .2 Pressure Relief Range: 145 to 363 psig (10 to 25 bar); set by manufacturer
 - .1 The required pressure relief 'set pressure' shall be set by the manufacturer to 15% above the refrigeration operating pressure at the installed location.
 - .2 The pressure relief shall only partially open at the 'set pressure' to minimize refrigerant release, but fully open before reaching 10% above 'set pressure'.
 - .3 Temperature Rating: -22 F to 212 F (-30 C to 100 C)
 - .4 Body: Steel capable of low temperature operation
- .3 Ball Valves:
- .1 Globe or Angle style
 - .2 Pressure Rating: 400 psi (27.6 bar)
 - .3 Body: Forged brass or cast bronze
 - .4 Stem: Stainless steel with dual o-ring and packing seal
 - .5 Soft seating material (i.e. nylon, PTFE)
- .4 Solenoid Valves:
- .1 Standard: AHRI 760
 - .2 Maximum Working Pressure Rating: 400 psig (27.6 bar)
 - .3 Maximum Operating Pressure Differential (MOPD): 360 psig (25 bar)
 - .4 Body: Forged brass
 - .5 Seat: PTFE
- .5 Check Valves:
- .1 Functional in any orientation
 - .2 Maximum Working Pressure Rating: 500 psi (34.5 bar)
 - .3 Body: Ductile iron, forged brass or cast bronze
 - .4 PTFE seating material
- .6 Expansion Valves:
- .1 Stainless steel capillary tube and sensing bulb
 - .2 Maximum working pressure: 700 psi (48.3 bar)

- .3 Temperature operating range: Must exceed refrigerant working range in system
- .7 Pressure Regulating Valves:
 - .1 Evaporator, Suction Line Regulator:
 - .1 Adjustable Pressure Range: 0-80 psig (0-5.5 bar)
 - .2 Maximum Working Pressure: 260 psig (17.9 bar)
 - .3 ¼" Schrader valve
 - .2 Condenser Regulator:
 - .1 Adjustable Pressure Range: 73-254 psig (5-17.5 bar)
 - .2 Maximum Working Pressure: 400 psig (28 bar)
 - .3 ¼" Schrader valve
 - .3 Hot Gas Bypass Regulator:
 - .1 Adjustable Pressure Range: 3-87 psig (0.2-6 bar)
 - .2 Maximum Working Pressure: 400 psig (28 bar)
 - .4 Crankcase, Suction Line Regulator:
 - .1 Adjustable Pressure Range: 3-87 psig (0.2-6 bar)
 - .2 Maximum Working Pressure: 261 psig (18 bar)
- .8 Pressure-limiting Devices / Pressure Switches:
 - .1 Snap action contacts
 - .2 Automatic reset
- .9 Filter-Driers:
 - .1 Pressure Rating: 500 psi (34.5 bar)
 - .2 Body: Steel
 - .3 Water Adsorption Media: Solid core molecular sieve
 - .4 Particle Retention Capability: 25 micron filter

PART 3 - EXECUTION

3.1 INSTALLATION – GENERAL

- .1 Work of this section shall be done by, or under the direct supervision of, a Certified Red Seal Refrigeration and Air Conditioning Mechanic who takes responsibility for the work. Proof of certification shall be produced upon request.
- .2 Design and installation shall meet CSA B52.
- .3 Pressure relief devices shall be located and sized per CSA B52. The termination point of

the discharge piping shall also be per CSA B52.

- .4 All specialty items shall be accessible for inspection and maintenance.
- .5 Specialty items attached in refrigeration piping shall be supported such that the installation does not cause excessive force or torque on the piping.
- .6 Segments of the refrigeration system that can be isolated between two closable valves shall include a pressure relief device. The purpose of the pressure relief device is to relieve pressure that builds up from trapped cold refrigerant as it warms up. Sizing the capacity of pressure relief devices shall follow CSA B52.
- .7 Shut-off valves shall be installed in inlet and outlet piping at each condenser, compressor, and liquid receiver. Shut-off valves shall also be installed to isolate pressure vessels, evaporators, pumps for systems containing >50 kg (>110 lb) of refrigerant, and every 100' (30 M) of piping. Install manual shut-off valves with the stem in the horizontal orientation; install solenoid valves with the stem in an upright orientation.
 - .1 Exception: Systems that are self-contained, or have provisions for the pump-out of all refrigerant, do not need shut-off valves installed in those locations.
- .8 Supply and install a permanent sign securely attached close to the charging valves. The sign shall indicate
 - .1 The name and address of the installer
 - .2 Refrigerant type
 - .3 Lubricant type and amount
 - .4 Total weight of refrigerant in system (normal operation)
 - .5 Test pressures (high and low sides)
 - .6 Refrigeration design capacity
 - .7 The power rating for prime movers (example: 10 hp, or 40 FLA @ 575 volt)
- .9 For systems containing >100 lb (45 kg) refrigerant, apply signs designating specialty items and other components requiring signage as listed in CSA B52.

3.2 INSTALLATION – MANUFACTURED SYSTEMS

- .1 Factory assembled refrigerant systems shall be tested per CSA B52.

3.3 INSTALLATION – BUILT-UP HYDRO-FLUOROCARBON (HFC) REFRIGERATION SYSTEMS

- .1 The Subcontractor shall know the classification of refrigerant (i.e. A1, A2L) used in the system as defined in CSA B52 and understand the inherent concerns and limitations.

3.4 EVACUATION, TESTING, AND CHARGING

- .1 If evacuation of refrigerant is required:
 - .1 Only certified Subcontractors may evacuate refrigerant from a system.

- .2 Evacuate to an approved container to a level of no more than 80% by volume (relative to water) as calculated using density tables by the Subcontractor.
- .3 Storage of evacuated refrigerant shall be only in an approved machinery room incorporating the necessary safeguards against leakage.
- .4 Recycle, re-use, or dispose of evacuated refrigerant per local requirements.
- .2 Perform the following tests and inspections:
 - .1 Prior to charging with refrigerant, the complete system (high side and low side) shall be pressure tested to the refrigerant design pressures listed in B52, or the pressure relief device's opening pressure, whichever is less. Pressure shall be maintained for 2 hours. The medium used for pressure testing shall be a gas that is not combustible or a combustible mixture, nor contains more than 20% oxygen. Submit the declaration.
- .3 Cleaning the system:
 - .1 The system shall be left clean, without any accumulation of water, oily dirt, or debris. The Subcontractor shall communicate to the City of Winnipeg the requirement of cleanliness.
- .4 Charging the system:
 - .1 Prior to charging the system, the system shall be dehydrated, clean and evacuated to a level of 500 micrometers Hg (0.0197" Hg) or lower.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

- .1 This section gives guidance for utilizing appropriate metal ductwork for:
 - .1 HVAC supply and return air
 - .2 General exhaust
 - .3 Grease-laden exhaust
 - .4 Conveying flammables or combustibles (under 25% of Lower Flammability Limit)
- .2 This section does not include laboratory, toxic, caustic or corrosive fume exhaust ducts, dust or particulate matter collection systems, or ductwork for handling gases in concentration above 25% of the Lower Flammability Limit (LFL).
- .3 This section does not include ductwork potentially containing a positive or negative pressure greater than 4"wc (1000 Pa). The design of such ducts shall follow 'HVAC Duct Construction Standards – Metal and Flexible' (SMACNA) for ductwork potentially handling up to 10"wc (2500 Pa) positive or negative pressure, or 'Round Industrial Duct Construction Standards' (SMACNA) for ductwork potentially handling more than 10"wc (2500 Pa) or positive or negative pressure.

1.2 RELATED SECTIONS

- .1 Section 07 84 00 – Firestopping
- .2 Section 23 05 00 – Common Work Results for HVAC
- .3 Section 23 05 29 – Hangers and Supports for HVAC Piping and Equipment
- .4 Section 23 07 13 – Duct Insulation
- .5 Section 23 33 33 – Duct-Mounting Access Doors

1.3 REFERENCES

- .1 American Society for Testing and Materials International (ASTM)
 - .1 ASTM A653 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot Dip Process
- .2 National Fire Protection Association (NFPA)
 - .1 NFPA 91 Exhaust Systems for Air Conveying of Vapors, Gases, Mists, and Noncombustible Particulate Solids
- .3 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)
 - .1 HVAC Duct Construction Standards – Metal and Flexible
 - .2 Round Industrial Duct Construction Standards

- .4 Underwriters Laboratory (ANSI/UL)
 - .1 UL 181 Standard for Factory-Made Air Ducts and Air Connectors
 - .2 ANSI/UL 1978 Standard for Grease Ducts

1.4 COORDINATION

- .1 The duct layout design is schematic in nature. Relatively small deviations shall be allowed for and implemented based on site conditions and the work of other trades as long as there is no significant change to flow characteristics.
- .2 There shall be mutual coordination between the trades in planning and installing their respective work to avoid conflict.
- .3 No penetrations through ductwork (pipes, conduit, etc.) are allowed unless explicitly directed by the City of Winnipeg Representative.

1.5 DELIVERY AND STORAGE

- .1 Ductwork to be installed shall be brought on site in relatively small batches to minimize storage space required.
- .2 When storing ductwork, protect from physical damage and environmental conditions (moisture, dust, etc.).

PART 2 - PRODUCTS

2.1 GENERAL INFORMATION

- .1 The mechanical Subcontractor shall review the fan curve(s) and ensure the maximum potential pressure generated by the fan(s) connected to each duct system will not exceed the pressure handling capability of the ductwork.
- .2 Unless otherwise indicated, the following sections of ductwork shall have capability of handling 4"wc (1000 Pa) positive or negative pressure:
 - .1 Vertical ductwork located within a shaft
 - .2 Ductwork conveying flammables or combustibles
 - .3 Supply air ductwork upstream of an airflow restrictor such as a VAV damper
 - .4 Ductwork indicated to be 'medium' pressure
- .3 Unless otherwise indicated, all sections of ductwork shall have capability of handling 2"wc (500 Pa) positive or negative pressure.
- .4 Upon prior approval, metal ductwork for HVAC supply and return air, and general exhaust air, may be substituted for a factory product meeting UL 181.

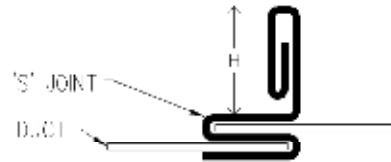
2.2 UP TO 2"WC (500 PA) PRESSURE (NOT GREASE-LADEN EXHAUST)

- .1 Round Duct
 - .1 Unless otherwise indicated, use the following:
 - .2 Spiral seam
 - .3 Galvanized steel to ASTM A653
 - .4 Gages
 - .1 Diameter < 10" (254 mm): 28 gage
 - .2 Diameter 10" to 13" (254 mm to 330 mm): 26 gage
 - .3 Diameter 14" to 19" (356 mm to 483 mm): 24 gage
 - .4 Diameter 20" to 24" (508 mm to 610 mm): 22 gage
 - .5 Diameter 25" to 36" (635 mm to 914 mm): 20 gage
 - .6 Diameter 37" to 48" (940 mm to 1219 mm): 18 gage
- .2 Rectangle Duct
 - .1 Unless otherwise indicated, use the following:
 - .2 Galvanized steel to ASTM A653
 - .3 2"wc (500 Pa) positive and negative pressure rating
 - .4 The mechanical Subcontractor has options for choosing rectangular ductwork gage, lengths, joint connections, and reinforcement type and spacing depending on the dimensions of the particular duct. The options chosen must be within the parameters found in 'HVAC Duct Construction Standards Metal and Flexible' (SMACNA). If the mechanical Subcontractor does not want to choose from appropriate options, the following shall be used by default for all ductwork up to 2"wc (500 Pa) positive or negative pressure:
 - .1 All ductwork shall be 22 gage.
 - .2 Longitudinal seams shall be "Pittsburgh" type seams
 - .3 For duct side dimension up to 14" (356 mm)
 - .1 Maximum 96" (244 cm) duct section length with T-1 type drive slip joints
 - .4 For duct side dimension from 14" (356 mm) up to 26" (660 mm)
 - .1 Maximum 96" (244 cm) duct section length with 1.5" (38 mm) high, 18 gage T-12 type standing 'S' joints
 - .2 Crossbroken or beaded panel area
 - .5 For duct side dimension from 26" (660 mm) up to 48" (122 cm)
 - .1 Maximum 48" (122 cm) duct section length with 1.5" (38 mm) high, 18 gage T-12 type standing 'S' joints
 - .2 Crossbroken or beaded panel area



T-1 DRIVE SLIP JOINT

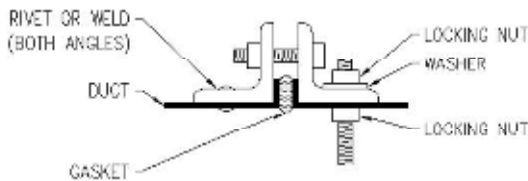
SCALE: NTS



T-12 STANDING 'S' JOINT

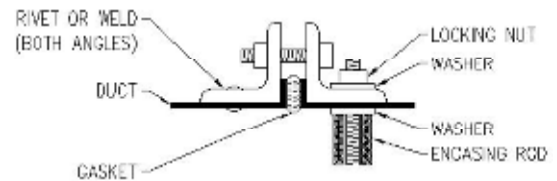
SCALE: NTS

- .6 For duct side dimension from 48" (122 cm) up to 96" (244 cm)
 - .1 Maximum 24" (610 mm) duct section length with T-22 type companion angled and gasketed joints. Duct ends shall be bent up into 3/8" (10 mm) flange with welded corners, sandwiched together by two 1.5"x1.5"x1/4" (38x38x6 mm) angles. Angles shall be welded or riveted to the duct every 12" (305 mm) and connected to each other every 6" (152 mm) with 5/16" (8 mm) bolts and nuts. On one side of each joint, install either a 3/8" (10 mm) internal tie rod (positive pressure duct) or a 1/2" (13 mm) internal tie rod encased in a 1/2" (13 mm) schedule 40 steel pipe (negative pressure duct) through the duct and top and bottom angles at the midpoint location of the duct. At each end of the tie rod, sandwich the duct/angle together using locking nuts inside the duct and outside.
 - .2 Crossbroken or beaded panel area



T-22 JOINT ('+' PRESS.)

SCALE: NTS



T-22 JOINT ('-' PRESS.)

SCALE: NTS

- .3 Fittings
 - .1 Elbows (round duct)
 - .1 Elbows shall have a radius 1.5x the duct diameter.
 - .2 Elbows (rectangle duct)
 - .1 Supply and exhaust ducts shall be either elbows with turning vanes, or with radius 1.5x the duct dimension being bent.
 - .2 Return ducts may be a hard elbow when acoustically lined.

- .3 Branch take-offs
 - .1 Shall have a 45 degree lead in for the direction of airflow.
- .4 Duct transitions
 - .1 Maximum 30 degrees from axial when changing duct dimensions, unless otherwise allowed
- .4 Internal Tie Rods
 - .1 For 2"wc (500 Pa) or less 'positive' pressure duct only.
 - .1 Up to 36" long rod: 1/4" (6 mm) galvanized steel with threaded ends and locked nuts
 - .2 Over 36" long rod: 3/8" (10 mm) galvanized steel with threaded ends and locked nuts
 - .2 For > 2"wc (500 Pa) 'positive', and all 'negative' pressure ducts:
 - .1 As per 'HVAC Duct Construction Standards Metal and Flexible' (SMACNA).
- .5 Sealant
 - .1 Water based emulsion or polymer based mastic
 - .2 Non-flammable, non-combustible
 - .3 Paintable
 - .4 UV and mold resistant
- .6 Tape
 - .1 Tape shall not be the primary sealant.
 - .2 Glass-fiber reinforced
- .7 Gasket Material
 - .1 3/16" x 5/8" (5 mm x 16 mm) tape
 - .2 Non-hardening, butyl-polymer compound
 - .3 Hydrophobic
 - .4 Peel Adhesion: >2.0 PLI (galvanized steel)

PART 3 - EXECUTION

3.1 HVAC SUPPLY AND RETURN AIR AND GENERAL EXHAUST

- .1 The mechanical Subcontractor and installer shall be qualified to acquire and install appropriate ductwork in accordance with 'HVAC Duct Construction Standards Metal and Flexible' (SMACNA). Proof of qualifications shall be available upon request.
- .2 For rectangular ductwork, the mechanical Subcontractor has installation options depending on the ductwork size. Install using joints and reinforcement within the

parameters for the size of duct per 'HVAC Duct Construction Standards Metal and Flexible' (SMACNA).

- .3 Leave a gap between the duct and structure to avoid vibration/noise transfer.
- .4 Unless otherwise indicated, seal all duct connections to 'Seal Class B' per 'HVAC Duct Construction Standards Metal and Flexible' (SMACNA).
- .5 Ensure three (3) feet (1 meter) of straight duct prior to volume-control dampers, and coils.
- .6 Make space allowances for insulation and access doors.
- .7 Dimensions indicated on drawings refer to the open, internal area of a duct cross-section. The actual duct size will be bigger if there is internal insulation.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

- .1 This section gives requirements for the following types of HVAC and general exhaust air duct dampers:
 - .1 Motorized Dampers
 - .2 Manual Intake or Gravity Backdraft Dampers
 - .3 Manual Volume Control Dampers
 - .4 Fire, Smoke, and Fire-Smoke Dampers
- .2 This section does not include guidance on Variable Air Volume (VAV) dampers used as part of a variable volume air distribution system.
- .3 This section does not include specialized exhaust system dampers (i.e. dust collection) or automatic volume control (i.e. venturi valves).

1.2 RELATED SECTIONS

- .1 Section 01 33 00 – Submittal Procedures
- .2 Section 01 78 00 – Closeout Submittals
- .3 Section 07 84 00 – Firestopping
- .4 Section 23 05 00 – Common Work Results for HVAC
- .5 Section 23 05 93 – Testing, Adjusting, and Balancing for HVAC
- .6 Section 23 09 13 – Instrumentation and Control Devices for HVAC
- .7 Section 23 09 93 – Sequence of Operations for HVAC Controls
- .8 Section 23 31 13 – Metal Ducts
- .9 Section 23 33 33 – Duct-Mounting Access Doors

1.3 REFERENCES

- .1 Air Movement and Control Association International, Inc (AMCA)
 - .1 ANSI/AMCA 500-D Laboratory Methods of Testing Dampers for Rating
- .2 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)
 - .1 Fire, Smoke, and Radiation Damper Installation Guide for HVAC Systems
 - .2 HVAC Duct Construction Standards
- .3 Underwriters Laboratories (UL)

- .1 UL 33 Standard for Heat Responsive Links for Fire-Protection Service
- .2 UL 555 Standard for Fire Dampers
- .3 UL 555S Standard for Smoke Dampers
- .4 Underwriters Laboratories of Canada (ULC)
 - .1 CAN/ULC-S112 Standard Method of Fire Test of Fire Damper Assemblies

1.4 SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Shop Drawings:
 - .1 Each fire damper and fire-smoke damper installation type shall be submitted as a shop drawing from the damper manufacturer or firestopping supplier showing damper type, sleeve, and bracket installation details.
- .3 Submissions Prior to Certification:
 - .1 Submit to the City of Winnipeg Representative the Fire Damper Verification report for review.
- .4 Closeout Submittals:
 - .1 Provide per Section 01 78 00 - Closeout Submittals.
 - .2 Include the Fire Damper Verification report within the Operation and Maintenance (O&M) Manual upon certification.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR ALL PRODUCTS

- .1 Dampers for air containing flammable or combustible gases or fumes shall be free of ferrous metal.
- .2 Dampers for laboratory exhaust shall consist only of material suitable for the exhaust. Request more information if unclear on construction documents.

2.2 MOTORIZED DAMPERS

- .1 Damper testing and resultant ratings shall be per ANSI/AMCA 500-D.
- .2 Damper actuators shall be supplied and installed with the damper under the mechanical contractor's scope of work.
- .3 Damper actuators shall be located out of the airstream unless approved by the City of Winnipeg Representative .

- .4 Dampers located at exterior walls, or that convey unconditioned air shall be thermally insulated.
- .5 General Use Dampers (Outside or Unconditioned Air):
 - .1 Frame: 0.08" (2 mm) aluminum, or stainless steel; thermally broken
 - .2 Blades: Internally insulated aluminum
 - .3 Axle shaft: Steel, or stainless steel
 - .4 Pivots: Steel ball bearings, or polycarbonate / acetal copolymer bearings
 - .5 Actuator: Direct-coupled, electric
 - .1 Refer to drawings, schedules, and sections '23 09 13 Instrumentation and Control Devices for HVAC' and '23 09 93 Sequence of Operations for HVAC Controls' for additional actuator requirements (i.e. NEMA rating, control type, feedback signal, fail-safe position).
 - .6 Air Velocity Rating: At least 2000 fpm (10.2 m/s)
 - .7 Pressure Rating: 2"wc (500 Pa)
 - .8 Leakage at Pressure Rating: 3 cfm per sq.ft. of damper at 1"wc (250 Pa)
 - .9 Acceptable Manufacturers: Tamco 9000BF, Greenheck ICD.
- .6 General Use Dampers (Conditioned Air):
 - .1 Frame: Galvanized steel, or stainless steel
 - .2 Blades: Aluminum, or stainless steel
 - .3 Axle shaft: Steel, or stainless steel
 - .4 Pivots: Steel ball bearings, nylon, or brass
 - .5 Actuator: Direct-coupled, electric
 - .1 Refer to drawings, schedules, and sections '23 09 13 Instrumentation and Control Devices for HVAC' and '23 09 93 Sequence of Operations for HVAC Controls' for additional actuator requirements (i.e. NEMA rating, control type, feedback signal, fail-safe position).
 - .6 Air Velocity Rating: At least 2000 fpm (10.2 m/s)
 - .7 Pressure Rating: 2"wc (500 Pa)
 - .8 Leakage at Pressure Rating: 2% or less
- .7 Zero Leakage / "Bubble Tight" Dampers:
 - .1 Blade-to-Frame Seal: Silicone
 - .2 Pivot: External mounted grease-able bearing
 - .3 Actuator: External mounting, fast acting, spring return
 - .1 Refer to drawings, schedules, and sections '23 09 13 Instrumentation and Control Devices for HVAC' and '23 09 93 Sequence of Operations for HVAC Controls' for additional actuator requirements (i.e. NEMA rating, control type, feedback signal, fail-safe position).

- .4 Air Velocity Rating: At least 3500 fpm (17.8 m/s)
- .5 Pressure Rating: 10"wc (2.5 kPa)
- .6 Leakage at Pressure Rating: Zero

2.3 MANUAL INTAKE OR GRAVITY BACKDRAFT DAMPERS

- .1 This section refers to standalone duct dampers. Dampers included within a piece of equipment (i.e. ceiling mount exhaust fan) shall be outside of this specification section and deemed acceptable if the equipment shop drawing is acceptable.
- .2 Gravity backdraft dampers shall have either adjustable weight or spring operated blades.
- .3 Unless otherwise noted, the material shall be the following:
 - .1 Frame: Galvanized steel, or stainless steel
 - .2 Blades: Aluminum, or stainless steel
 - .3 Axle shaft: Steel, or stainless steel
 - .4 Pivots: Steel ball bearings, nylon, or brass.
- .4 Damper shall start to open at a differential pressure less than 0.05"wc (12.4 Pa) and have adjustment capability.
- .5 Damper shall withstand at least 2"wc (500 Pa) back pressure.
- .6 Unless otherwise noted, dampers shall be rated for at least 2000 fpm (10.2 m/s) air speed.
- .7 Damper shall be rated to operate in the orientation installed.

2.4 MANUAL VOLUME CONTROL DAMPERS

- .1 Maximum duct leakage rates shall be adhered to. Axle penetration point shall be suitable sealed to meet the sealing classification required of the attached ductwork.
- .2 Axis of blade rotation shall be supported at two opposing points in housing with either a bearing or synthetic (nylon or similar) bushing.
- .3 For round ducts:
 - .1 Damper shall be a single blade damper incorporating a locking mechanism to hold the damper in a fixed, readable quadrant position.
 - .2 Housing/duct material shall be 20 gauge or thicker galvanized steel; damper blade material shall be 18 gauge or thicker galvanized steel.
 - .3 Damper axle shall be continuous on ducts:
 - .1 12" (305 mm) diameter or greater, or
 - .2 Ducts conveying air at a static pressure of 2"wc (500 Pa) or greater.
- .4 For rectangle ducts:
 - .1 For ducts 12" (305 mm) or less in height (meaning 6" (150 mm) on either side of the axis of rotation),

- .1 The damper shall be a single blade damper incorporating a locking mechanism to hold the blade in a fixed, readable quadrant position.
- .2 For ducts greater than 12" (305 mm) in height (meaning 6" (150 mm) on either side of the axis of rotation),
 - .1 The damper shall be a multi-blade damper with opposed orientation blades incorporating a locking mechanism to hold the blades in a fixed, readable quadrant position.
- .3 Housing/duct material shall be 18 gauge or thicker galvanized steel; damper blade material shall be 16 gauge or thicker galvanized steel.
- .4 Damper blade axle shall be continuous on ducts:
 - .1 Wider than 19" (480 mm) parallel to the axis of rotation, or
 - .2 Ducts conveying air at a static pressure of 2"wc (500 Pa) or greater.

2.5 FIRE, SMOKE, AND FIRE-SMOKE DAMPERS

- .1 Fire Dampers
 - .1 Damper meets UL 555 and ULC S112
 - .2 Fusible link meeting UL 33, activation at 165 F (74 C)
 - .3 Sleeve: 14 gauge steel, or as permitted by UL 555
 - .4 For dampers NOT connected to a duct at the separation (i.e. transfer air opening):
 - .1 Static damper
 - .5 For dampers connected to a duct (on either side or both sides of the separation):
 - .1 Dynamic damper
- .2 Smoke Dampers
 - .1 Damper meets UL 555S
 - .2 Leakage Class II, unless otherwise indicated
 - .3 Temperature Rating: 350 F (177 C)
 - .4 Pressure Rating: 4"wc (1000 Pa)
 - .5 Air Velocity Rating: 2000 fpm (10.2 m/s), unless otherwise indicated
 - .6 Electric actuator:
 - .1 Installed on the damper at the factory
 - .2 Internal auxiliary end switches for position feedback
- .3 Combination Fire-Smoke Dampers
 - .1 Damper meets UL 555 and UL 555S
 - .2 Resettable, re-useable closure link set at 165 F (74 C)
 - .3 Leakage Class I, unless otherwise indicated

- .4 Temperature Rating: 350 F (177 C)
- .5 Pressure Rating: 4"wc (1000 Pa)
- .6 Air Velocity Rating: 2000 fpm (10.2 m/s), unless otherwise indicated
- .7 Electric actuator:
 - .1 120V 1 phase
 - .2 Installed on the damper at the factory
 - .3 Internal auxiliary end switches for position feedback
- .8 Sleeve: 14 gauge steel, or as permitted by UL 555

PART 3 - EXECUTION

3.1 QUALITY ASSURANCE

- .1 Installer qualified in performing work in this section shall have at least five (5) years successful experience in similar installations.
- .2 Damper installers must be current members of SMACNA, have received adequate training, and are proven competent in understanding ductwork and duct accessory installation methods.

3.2 GENERAL INSTALLATION

- .1 Follow damper manufacturer installation instructions.

3.3 SPECIFIC INSTALLATION – MOTORIZED DAMPERS

- .1 Mechanical contractor shall provide a low voltage transformer to power the actuator if required. Coordinate with electrical contractor to provide line voltage.
- .2 Dampers shall include access panels (rated or unrated) supplied under the mechanical scope of work and coordinated with the General Contractor to be installed in wall or ceilings as necessary to allow for suitable access to the damper actuator.

3.4 SPECIFIC INSTALLATION – MANUAL INTAKE OR GRAVITY BACKDRAFT DAMPERS

- .1 The maximum size of duct or opening using a gravity backdraft damper is 124 sq.in. (0.08 m²). Larger ducts or openings require a motorized damper.

3.5 SPECIFIC INSTALLATION – MANUAL VOLUME CONTROL DAMPERS

- .1 Install in an accessible location where the damper position can be read.

3.6 SPECIFIC INSTALLATION – FIRE, SMOKE, AND FIRE-SMOKE DAMPERS

- .1 Review architectural wall ratings and locations of smoke separations prior to duct installation.
- .2 The installation shall follow the instructions provided by the damper manufacturer with no changes.
- .3 Fire Dampers:
 - .1 Required for any duct completely penetrating a fire rated wall with a fire resistance rating
 - .2 Required for any duct terminating at a fire rated wall
 - .3 Required for any non-ducted air flow (transfer) opening within a fire rated wall
 - .4 Air gap between the sleeve and the rough opening shall be between 1/4" (6 mm) and 1.5" (38 mm). For round dampers, the rough opening shall be 7/8" (22 mm) larger than the outside diameter of the damper.
- .4 Smoke Dampers:
 - .1 Required where located on the drawings as part of the smoke management system
 - .2 Damper may be located up to 24" (610 mm) out the plane of the wall.
 - .3 All gaps shall be sealed air tight.
- .5 Fire-Smoke Dampers:
 - .1 Required for any opening (ducted or non-ducted) in a fire rated wall with a fire resistance rating that also separates smoke zones.
 - .2 Air gap between the sleeve and the rough opening shall be between 1/4" (6 mm) and 1.5" (38 mm). For round dampers, the rough opening shall be 7/8" (22 mm) larger than the outside diameter of the damper.
 - .3 Gaps between the damper frame and the duct shall be sealed air tight.

3.7 PERFORMANCE VERIFICATION

- .1 Upon completion of a damper installation, test for full range of easy, unencumbered motion.
- .2 For actuators, verify correct position based on input signal.
- .3 Fire and smoke damper installation shall be verified by an agency or person certified by the Associated Air Balance Council (AABC). Their report shall be submitted.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

- .1 This section includes requirements for turning vanes and rails required for mitered elbows in square/rectangular ducts conveying air.

1.2 RELATED SECTIONS

- .1 Section 01 33 00 – Submittal Procedures
- .2 Section 23 05 00 – Common Work Results for HVAC
- .3 Section 23 31 13 – Metal Ducts

1.3 REFERENCES

- .1 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)
 - .1 HVAC Duct Construction Standards – Metal and Flexible

1.4 SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Shop Drawings:
 - .1 Upon request, submit the manufacturer's printed datasheet showing which vane and rail system is used at each location.
- .3 Quality Assurance:
 - .1 Upon request, provide proof of vane and rail material type and thickness and installation method.

PART 2 - PRODUCTS

2.1 FOR AIR VELOCITY 1000 FPM (5.1 M/S) OR LESS

- .1 Unless otherwise indicated on construction drawings, turning vanes are not required in mitered elbows conveying air with a velocity of 1000 fpm (5.1 m/s) or less.
- .2 When required, rails and vanes shall conform to the requirements specified for air velocities between 1000 fpm (5.1 m/s) and 2500 fpm (12.7 m/s).

2.2 FOR AIR VELOCITY BETWEEN 1000 FPM (5.1 M/S) AND 2500 FPM (12.7 M/S)

- .1 Vanes:
 - .1 Single wall type
 - .2 Material to match rail and duct
 - .1 22 gauge galvanized steel, or
 - .2 22 gauge stainless steel, or
 - .3 22 gauge aluminum
 - .3 4.5" +/- 0.5" (114 mm +/- 13 mm) radius
 - .4 36" (914 mm) maximum length of each vane without requiring tie rod support bracing
 - .1 Vanes over 36" (914 mm) long shall be braced with a tie rod every 24" (610 mm) or less. The tie rod(s) shall be parallel to the supporting rails and travel through each vane. Tie rod(s) shall be welded, or otherwise securely fastened per the City of Winnipeg Representative 's approval, to the ductwork at each end.
- .2 Rails:
 - .1 Material to match vanes and duct
 - .1 22 gauge galvanized steel, or
 - .2 22 gauge stainless steel, or
 - .3 22 gauge aluminum
 - .2 3.25" +/- 0.25" (83 mm +/- 6 mm) spacing between vanes
 - .3 Rail shall allow for vane attachment such that leading and training tangents of vane are parallel to the ductwork/airflow.
- .3 Metal-Bonding Adhesive:
 - .1 Two-part acrylic, suitable for bonding aluminum, stainless steel, and galvanized steel in structural applications
 - .2 Suitable products:
 - .1 3M Scotch-Weld Metal Bonder Acrylic Adhesive DP8407NS
 - .2 Loctite H8600 Structural Adhesive
 - .3 SikaFast 3121

2.3 FOR AIR VELOCITY OVER 2500 FPM (12.7 M/S)

- .1 Vanes:
 - .1 Double wall type
 - .2 Material to match rail and duct

- .1 22 gauge galvanized steel, or
- .2 22 gauge stainless steel, or
- .3 22 gauge aluminum
- .3 4.5" +/- 0.5" (114 mm +/- 13 mm) radius
- .4 72" (1.8 m) maximum length of each vane without requiring tie rod support bracing
 - .1 Vanes over 72" (1.8 m) long shall be braced with a tie rod every 48" (1.2 m) or less. The tie rod(s) shall be parallel to the supporting rails and travel through each vane. Tie rod(s) shall be welded, or otherwise securely fastened per the City of Winnipeg Representative 's approval, to the ductwork at each end.
- .2 Rails:
 - .1 Material to match vanes and duct
 - .1 22 gauge galvanized steel, or
 - .2 22 gauge stainless steel, or
 - .3 22 gauge aluminum
 - .2 3.25" +/- 0.25" (83 mm +/- 6 mm) spacing between vanes
 - .3 Rail shall allow for vane attachment such that leading and training tangents of vane are parallel to the ductwork/airflow.
- .3 Metal-Bonding Adhesive:
 - .1 Two-part acrylic, suitable for bonding aluminum, stainless steel, and galvanized steel in structural applications
 - .2 Suitable products:
 - .1 3M Scotch-Weld Metal Bonder Acrylic Adhesive DP8407NS
 - .2 Loctite H8600 Structural Adhesive
 - .3 SikaFast 3121

PART 3 - EXECUTION

3.1 INTENT

- .1 The turning vanes shall change the direction of the air through a mitered elbow such that the static pressure drop does not exceed 0.1"wc (25 Pa) and there is no noise from metal-to-metal contact during operation.

3.2 INSTALLATION

- .1 Installers shall be knowledgeable in SMACNA's HVAC Duct Construction Standards – Metal and Flexible. It may be referred to; however, the requirements in this specification shall be adhered to.
- .2 Vane to Rail Fastening:
 - .1 Suitable methods:
 - .1 Welded
 - .2 Pressure fit, snap-in, or crimped fastening methods are suitable only when used in conjunction with a metal-bonding adhesive.
- .3 Rail to Duct Fastening:
 - .1 If the duct elbow includes an acoustic liner, the rails shall be fastened to the metal duct with a minimum of three (3) screws per rail located 12" (300 mm) on center. The acoustic liner shall be sandwiched between the duct and the rail.
 - .2 If the duct elbow does not include an acoustic liner, the rails shall be fastened directly to the metal duct using a metal-bonding adhesive, plus a minimum of three (3) screws or rivets per rail located 12" (300 mm) on center.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

- .1 This section includes access doors for metal ducts specified in Section 23 31 13 Metal Ducts.
- .2 This section does not include access doors required in walls, floors, enclosures, etc.

1.2 RELATED SECTIONS

- .1 Section 01 33 00 – Submittal Procedures
- .2 Section 23 05 00 – Common Work Results for HVAC
- .3 Section 23 31 13 – Metal Ducts
- .4 Section 23 33 13 – Dampers

1.3 REFERENCES

- .1 National Fire Protection Agency (NFPA)
 - .1 NFPA 91 Exhaust Systems for Air Conveying Vapors, Gases, Mists, and Noncombustible Particulate Solids
- .2 Underwriters Laboratories of Canada (ULC)
 - .1 Current listing directory

PART 2 - PRODUCTS

2.1 FOR USE IN METAL HVAC DUCTS

- .1 Material: same as duct
- .2 Rated for maximum static pressure within the duct
- .3 Piano style hinge and hand operated, self-tightening cam latch
- .4 Closed cell neoprene gasket between frame and duct, and door and frame.
- .5 Door shall be insulated.
- .6 For secure or vandal resistant applications, cylinder lock and key shall be used.

PART 3 - EXECUTION

3.1 INTENT

- .1 Access doors in ducts are required wherever a maintenance item needs to be accessed (i.e. fire/smoke damper, electric heating coil).
- .2 Access doors are required wherever the duct may be subject to an accumulation of medium or deposits.

3.2 INSTALLATION (GENERAL)

- .1 Follow manufacturer's instructions.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

- .1 This section gives requirements for flexible duct connectors for HVAC air supply and return ducts, and general exhaust ducts, including laboratory exhaust.
- .2 The design intent is to provide a flexible duct connector between every vibration causing device (i.e. fan, air handler), and the associated ductwork for the purpose of minimizing vibration and noise transfer.

1.2 RELATED SECTIONS

- .1 Section 01 33 00 – Submittal Procedures
- .2 Section 23 05 00 – Common Work Results for HVAC
- .3 Section 23 31 13 – Metal Ducts

1.3 REFERENCES

- .1 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)
 - .1 HVAC Duct Construction Standards
- .2 Underwriters Laboratories of Canada (ULC)
 - .1 CAN/ULC-S102 Surface Burning Characteristics of Building Materials and Assemblies

1.4 SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Shop Drawings:
 - .1 Upon request, submit the manufacturer's printed datasheet showing which flexible connector type is used at each location.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR ALL PRODUCTS

- .1 Flexible connectors shall consist only of material suitable for the air exposed to it.

Request more information if unclear on construction documents.

- .2 Meets CAN/ULC S102:
 - .1 Maximum flame spread rating: 25
 - .2 Maximum smoke development rating: 50.

2.2 FABRIC FLEXIBLE CONNECTORS

- .1 Pressure Rating: minimum 10"wc positive and 10"wc negative
- .2 Metal Duct Connection Material: galvanized steel, or stainless steel
- .3 Fabric and Joint Seal: air and water tight
- .4 Fabric Width: minimum 4"; maximum 10"
- .5 Fabric Material:
 - .1 Base fabric:
 - .1 Nylon, polyester, or fiberglass (including blends)
 - .2 Coating:
 - .1 Neoprene (not for acidic, or chlorinated air)
 - .2 Vinyl (not for strong acidic air or air containing alcohols)
 - .3 Silicone (not for acidic air or air containing alcohols)
 - .4 Hypalon (not for steam, or chlorinated air, or air containing disodium phosphate)
 - .5 Teflon

PART 3 - EXECUTION

3.1 QUALITY ASSURANCE

- .1 Installer qualified in performing work in this section shall have at least five (5) years successful experience in similar installations.
- .2 Flexible connector installers must be current members of SMACNA, have received adequate training, and are proven competent in understanding ductwork and duct accessory installation methods.

3.2 GENERAL INSTALLATION

- .1 Follow manufacturer installation instructions.
- .2 Seal seams (fold over sealant and staple) per SMACNA HVAC Duct Construction

Standards.

3.3 SPECIFIC ENVIRONMENT INSTALLATION

- .1 Installer shall review the air contaminants being conveyed in the duct, and the surrounding air prior to ordering and installing suitable flexible connectors. Request more information if unclear on construction documents.
- .2 For outdoor, exposed applications, use Hypalon coated material.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

- .1 This section provides requirements for short length flexible ducts used in HVAC supply systems.
- .2 This section does not include fabric supply distribution ducts, specialized flexible exhaust ducts (i.e. vehicle tailpipe hose), or flexible connectors used for vibration isolation.

1.2 RELATED SECTIONS

- .1 Section 01 33 00 – Submittal Procedures
- .2 Section 23 05 00 – Common Work Results for HVAC
- .3 Section 23 07 13 – Duct Insulation
- .4 Section 23 31 13 – Metal Ducts

1.3 REFERENCES

- .1 Underwriters Laboratories (UL)
 - .1 UL 181 Standard for Factory-Made Air Ducts and Air Connectors
- .2 Underwriters Laboratories of Canada (ULC)
 - .1 CAN/ULC S102 Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies
 - .2 CAN/ULC S102.2 Standard Method of Test for Surface Burning Characteristics of Flooring, Floor Coverings, and Miscellaneous Materials and Assemblies
- .3 National Energy Code of Canada for Buildings (NECB)

1.4 SUBMITTALS

- .1 Submit product data in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Manufacturers Datasheet:
 - .1 Submit manufacturer's printed product datasheet. Clearly identify products used on this job. Include product characteristics, performance criteria, limitations, and standards met (i.e. CAN/ULC S102).

PART 2 - PRODUCTS

2.1 FIRE AND SMOKE RATING

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

2.2 FLEXIBLE DUCT

- .1 Duct shall be Class 0 or 1 per UL 181.
- .2 Flexible ducts shall be insulated when required by the NECB or indicated on the construction drawings. Insulation shall comply with requirements in section 23 07 13 – Duct Insulation.
- .3 Material:
 - .1 Coated, woven fiberglass fabric supported by coated spring-steel wire.
- .4 Pressure Rating:
 - .1 10"wc (2500 Pa) positive
- .5 Air Velocity Capability:
 - .1 5000 fpm (25.4 m/s)
- .6 Temperature Range:
 - .1 -20 F to 200 F (-29 C to 93 C)

PART 3 - EXECUTION

3.1 INTENT

- .1 Wherever practical and possible, use metal ductwork. Flexible ducts introduce a larger pressure drop and more turbulent flow into the system than metal ducting which affects performance and efficiency. Therefore, the use of flexible ducts shall be limited. Flexible ducts may only be used when an offset adjustment is required between the metal ductwork and a termination device such as a ceiling diffuser. Any other application of flexible ductwork requires approval of the City of Winnipeg Representative prior to installation.

3.2 RESTRICTIONS

- .1 Flexible duct shall not be used outside, and shall not be used for conveying outside air.
- .2 Flexible duct shall not be used within 10' (3 m) of ductwork penetrating, or terminating

through, the building thermal envelope.

- .3 Lengths of flexible duct shall be limited to no more than 3' (1 m) per termination device (i.e. diffuser or grille). Installation shall be as short as possible to accomplish the intent.
- .4 Flexible ducts shall not be used to form elbows, and must be drawn taut.

3.3 INSTALLATION

- .1 The installation of flexible duct shall be as short as possible, and not have any kinks, sags, or tight radii bends. If the installation is deemed to be in violation of this somewhat subjective requirement in the opinion of the installation inspector (City of Winnipeg Representative), the mechanical Subcontractor shall be responsible for correcting prior to receiving installation certification.
- .2 Connection to metal ducts shall be made with metal bands or clamps. Between 2" and 4" (50 mm and 100 mm) of duct overlap is required.
- .3 Do not install any ports or flow devices (balancing dampers, pressure pitot tubes, etc.) in flexible duct. Install ports or devices in rigid ductwork only.
- .4 Any exposed flexible duct shall be protected from UV light.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

- .1 This section includes guidance on internally applied acoustic insulation for ductwork and plenums conveying HVAC air between -40 F (-40 C) and 122 F (50 C), and under 4000 fpm (20 m/s).
- .2 Although the products of this section shall include some thermal insulating properties, the use of duct liners shall be for the purpose of insulating ductwork acoustically only.

1.2 RELATED SECTIONS

- .1 Section 01 33 00 – Submittal Procedures
- .2 Section 23 05 00 – Common Work Results for HVAC
- .3 Section 23 31 13 – Metal Ducts

1.3 REFERENCES

- .1 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)
 - .1 ANSI/ASHRAE/IESNA 90.1 Energy Standard for Buildings except Low-Rise Residential Buildings
- .2 American Society for Testing and Materials (ASTM International)
 - .1 ASTM C209 Standard Test Methods for Cellulosic Fiber Insulating Board
 - .2 ASTM C1071 Standard Specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material)
 - .3 ASTM C1104 Standard Test Method for Determining the Water Vapor Sorption of Unfaced Mineral Fiber Insulation
 - .4 ASTM C1338 Standard Test Method for Determining Fungi Resistance of Insulation Materials and Facings
 - .5 ASTM C1534 Standard Specification for Flexible Polymeric Foam Sheet Insulation Used as a Thermal and Sound Absorbing Liner for Duct Systems
 - .6 ASTM C1617 Standard Practice for Quantitative Accelerated Laboratory Evaluation of Extraction Solutions Containing Ions Leached from Thermal Insulation on Aqueous Corrosion of Metals
- .3 Thermal Insulation Association of Canada (TIAC)
 - .1 Best Practices Guide
- .4 Underwriters Laboratories of Canada (ULC)

- .1 CAN/ULC-S102 Surface Burning Characteristics of Building Materials and Assemblies
- .5 National Building Code (NBC)
- .6 National Energy Code of Canada for Buildings (NECB)

1.4 DEFINITIONS

- .1 For purposes of this section:
 - .1 "FACING" – a protective layer around the outside of the insulation, for the purpose of vapour retardation, minimizing microbial growth, and protecting from physical contact.
 - .2 "MINERAL FIBER" - includes glass fiber, rock wool, or slag wool.
 - .3 "PLENUM" – an enclosed region where specific air (supply, return, or exhaust) is transferred between source point(s) and termination point(s) not bound entirely by a metal duct, but does have a rigid structure outside of the insulation itself.

1.5 SUBMITTALS

- .1 Submit product data in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Manufacturers Datasheet:
 - .1 Upon request, submit manufacturer's printed product datasheet. Clearly identify products used on this job. Include product characteristics, performance criteria, limitations, and standards met (i.e. CAN/ULC S102).
- .3 Quality Assurance:
 - .1 Upon request, submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

1.6 QUALITY ASSURANCE

- .1 Qualifications:
 - .1 Installer:
 - .1 Has current certifications required in performing work of this Section
 - .2 Has at least five (5) years successful experience in this size and type of project
 - .3 Is qualified to understand, and experienced with, the TIAC Best Practices Guide.
 - .2 Supplier:
 - .1 Has at least five (5) years successful experience in this size and type of project
 - .2 Must be a company specializing in work of this Section.

- .3 Must be available and competent to give installation support to the installer.
- .3 Manufacturer:
 - .1 Must be a company specializing in work of this Section.
 - .2 Must be listed in the relevant section of the TIAC Best Practices Guide.
 - .3 Must be available and dedicated to providing installation support for their product.

PART 2 - PRODUCTS

2.1 FIRE AND SMOKE RATING (ALL PRODUCTS)

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

2.2 INSULATION

- .1 Insulated duct panels (panels that form the entire duct without a metal duct or plenum structure included) are not allowed unless the project City of Winnipeg Representative gives formal approval for a specific application area, either through specific indication on the construction documents or upon request by the contractor.
- .2 Use only closed cell elastomeric insulation when required within 8' (2.4 m) downstream of a cooling coil or humidifier dispersion tube. Do not use inorganic mineral fiber.
- .3 Duct Acoustic Insulation:
 - .1 Inorganic mineral fiber with mat facing meeting ASTM C1071 Type 1:
 - .1 Material (unless otherwise indicated): density 2.0 PCF, 1" thick
 - .2 Corrosion rate: less than that of 1 PPM chloride solution per ASTM C1617
 - .3 Water vapor sorption: less than 3% per ASTM C1104
 - .4 Microbial growth: does not promote per ASTM C1338
 - .2 Closed cell elastomeric foam to ASTM C1534:
 - .1 Material (unless otherwise indicated): 1" thick
 - .2 Water vapor sorption less than 0.2% per ASTM C209
 - .3 Microbial growth meeting ASTM C1338
- .4 Plenum Acoustic Insulation:
 - .1 Inorganic mineral fiber with mat facing meeting ASTM C1071 Type 2:

- .1 Material (unless otherwise indicated): density 3.0 PCF, 2" thick
- .2 Corrosion rate: less than that of 1 PPM chloride solution per ASTM C1617
- .3 Water vapor sorption: less than 5% per ASTM C1104
- .4 Microbial growth: does not promote per ASTM C1338
- .2 Closed cell elastomeric foam to ASTM C1534:
 - .1 Material (unless otherwise indicated): 1" thick
 - .2 Water vapor sorption less than 0.2% per ASTM C209
 - .3 Microbial growth meeting ASTM C1338

2.3 INSULATION SECUREMENTS

- .1 "Peel and stick" integral insulation adhesive by the insulation manufacturer
- .2 Quick setting contact adhesive by the insulation manufacturer
- .3 Mechanical pins with 0.75 sq.in. (480 mm²) area, 10 mil (0.25 mm) thick head.

PART 3 - EXECUTION

3.1 PRE-INSTALLATION REQUIREMENTS

- .1 Surfaces shall be clean, dry, and free from foreign material.
- .2 Review manufacturer installation documentation prior to installation.

3.2 INSTALLATION

- .1 Do not include both acoustic duct liner and external thermal insulation on the same duct section unless specifically stated to use both by the City of Winnipeg Representative . Only external duct insulation shall be used when both functions are required by the design.
- .2 Unless approved otherwise by the City of Winnipeg Representative , use only closed cell elastomeric insulation within 8' (2.4 m) downstream of a cooling coil or humidifier dispersion tube when acoustic insulation is required. Do not install mineral fiber insulation.
- .3 Acoustic insulation shall be used on ductwork connected to:
 - .1 Air handlers (including rooftop units),
 - .2 Heat pumps,
 - .3 Fans (greater than 400 cfm (188 L/s) capacity),
 - .4 Make-up air units, and
 - .5 Other ducts indicated by the design.

- .4 Unless otherwise indicated, acoustic insulation shall be applied to ductwork from the point of noise generation to a point at least 10' (3 m) away and include at least one elbow.
- .5 Refer to the TIAC Best Practices Guide to install to the codes specified.
 - .1 For duct acoustic insulation, install per TIAC code CIF/1.
 - .1 Exception: Mechanical fasteners shall not be used with closed cell elastomeric insulation.
 - .2 For plenum acoustic insulation, install per TIAC code CIR/1.
 - .1 Exception: Mechanical fasteners shall not be used with closed cell elastomeric insulation.

3.3 INSTALLATION (RECOMMENDATIONS)

- .1 Acoustic insulation works well to mitigate sound when sound waves hit the insulation face directly on, rather than travelling parallel to the surface. Therefore, it is good practice to include insulated elbows rather than only straight runs of duct away from the point of noise generation.

END OF SECTION

PART 1 GENERAL

1.1 SUMMARY

- .1 Section Includes:
 - .1 Materials, components and installation for heat reclaim devices.

1.2 RELATED SECTIONS

- .1 Section 01 33 00 – Submittal Procedures.
- .2 Section 01 74 19 – Construction/Demolition Waste Management and Disposal
- .3 Section 01 78 00 – Closeout Submittals.
- .4 Section 23 05 48 – Vibration and Seismic Controls for HVAC Piping and Equipment.
- .5 Section 23 33 00 – Air Duct Accessories.

1.3 REFERENCES

- .1 American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE)
- .2 ASHRAE 84, Method of Testing Air-to-Air Heat Exchangers (ANSI approved).
- .3 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
- .4 Material Safety Data Sheets (MSDS). American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)
- .5 American National Standards Institute/Air-Conditioning and Refrigeration Institute (ANSI/ARI)
- .6 ANSI/ARI 430, Central Station Air Handling Units.
- .7 Canadian General Standards Board (CGSB)
- .8 CAN/CGSB 1.181, Ready-Mixed Organic Zinc-Rich Coating.
- .9 Canadian Standards Association (CSA)
- .10 CSA B52 Mechanical Refrigeration Code.
- .11 Sheet Metal and Air-Conditioning Contractors' National Association (SMACNA).
- .12 American Bearing Manufacturer's Association (ABMA)
- .13 ANSI/ABMA 9 Load Ratings and Fatigue Life for Ball Bearings

- .14 ANSI/ABMA 11 Load Ratings and Fatigue Life for Roller Bearings.
- .15 Air Movement and Control Association (AMCA)
- .16 AMCA 210, Laboratory Method of Testing Fans for Aerodynamic Performance Rating (ASHRAE)
- .17 AMCA 300 Reverberant Room Method for Sound Testing of Fans.
- .18 American Society of Heating Refrigeration and Air-Conditioning Engineers (ASHRAE).
- .19 ASHRAE 68, Laboratory Method of Testing to Determine the Sound Power in a Duct.
- .20 ANSI/ASHRAE 90.1, (I-P) Energy Standard for Buildings Except Low-Rise Residential Buildings.
- .21 ANSI/ASHRAE 52.2, Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size.
- .22 National Electrical Manufacturer's Association (NEMA)
- .23 NEMA MG1 Motors and Generators

1.4 SHOP DRAWINGS AND PRODUCT DATA

- .1 Submit shop drawings and product data in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Indicate following: fan, fan curves showing point of operation, motor drive, bearings, filters, mixing box, dampers, VAV, coil, include performance data.

1.5 CLOSEOUT SUBMITTALS

- .1 Provide operation and maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.
- .2 Include following: fan, bearings, motor, damper, VAV control, air volume, total cooling, sensible cooling, EDB,EWB, OAT.

1.6 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with Section 01 74 19 - Construction/Demolition Waste Management And Disposal, and with the Waste Reduction Workplan.
- .2 Remove from site and dispose of packaging materials at appropriate recycling facilities. Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard, packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.
- .3 Do not dispose of unused paint materials into sewer systems, into lakes, streams, onto ground or in other locations where it will pose health or environmental hazard.

1.7 EXTRA MATERIALS

- .1 Provide maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Provide one spare set of filters.
- .3 Provide list of individual manufacturer's recommended spare parts for equipment such as bearings and seals, and addresses of suppliers, together with list of specialized tools necessary for adjusting, repairing or replacing, for placement into operating manual.

PART 2 PRODUCTS

2.1 GENERAL

- .1 Configuration: Fabricate as detailed on drawings.
- .2 Performance: As Scheduled.

2.2 DUAL CORE ENERGY RECOVERY

- .1 Unit shall be equipped with Dual Core® energy recovery technology. The unit shall be 90% efficient (sensible +5%) at equal airflow in winter and up to 80% sensible in summer. It shall also provide up to 70% latent recovery in winter mode. Unit shall accomplish this recovery without a defrost cycle that will reduce the effectiveness of the device. Devices employing defrost cycles that bypass the energy recovery device, or reduce the effectiveness are not acceptable. Energy recovery device shall not require frost protection in applications down to -40 degrees. Cores shall be Generation 3, comprised of precisely corrugated high grade aluminum. Stainless steel drain pan beneath heat exchanger. Vertical supply, return, intake and exhaust connections.
- .2 Switchover damper section shall be comprised of low leakage dampers operated by fast acting electric actuators having damper switching times of 0.75 seconds. Dampers that do not switch without objectionable noise are not acceptable.
- .3 Recovery cycles shall be controlled by internal programmed thermostats measuring both supply and exhaust air, and optimizing performance of both heat recovery and free cooling modes.
- .4 Unit to be controlled and monitored via the building control system(EMCS), provide interface to provide controls sequence of operations.
- .5 Standard of Acceptance: Tempeff RGSP. Equipment meeting all performance criteria as manufactured by Eng Air and Solution Air shall also be accepted.
- .6 Unit Construction:
 - .1 Fabricate unit with double wall galvanized panels secured with mechanical fasteners. All access doors shall be sealed with permanently applied bulbtype gasket.
 - .2 Panels and access doors shall be constructed as 2 inch panels; with injected polyurethane foam insulation. R value shall be 6.5 per inch of wall thickness. The outer panel shall be constructed of G90 galvanized steel. The inner liner shall be constructed

of G90 galvanized steel. Manufacturer shall supply test data demonstrating less than L/240 deflection for an unsupported 48x48 panel under 30" W.C pressure. Units that cannot demonstrate this deflection are unacceptable.

- .3 Access Doors shall be flush mounted to cabinetry, with minimum of two hinges, locking latch and full size handle assembly.
- .4 Integral DX cooling coil and electric heating coil. Single point power connection.
- .7 Supply/Return Fans
 - .1 Provide direct-drive plenum fan(s) with ECM motors. Fan assemblies including fan, motor and sheaves shall be dynamically balanced by the manufacturer on all three planes and at all bearing supports. Manufacturer must ensure maximum fan RPM is below the first critical speed.
 - .2 Fan and motor shall be mounted internally on a steel base. Provide access to motor, drive, and bearings through hinged access door. Fan and motor assembly shall be mounted on rubber-in-shear vibration type isolators inside cabinetry.
- .8 Electrical
 - .1 All electrical components shall bear a UL and CSA safety listing.
 - .2 Wiring Termination: Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. All wires shall be number tagged and cross-referenced to the wiring diagram for ease of troubleshooting.
 - .3 Controls must include Self diagnostics and PLC error code. On board fault detection and diagnostics that senses and alerts when the damper is not operating correctly.
 - .4 Air handler manufacturer shall provide and mount a damper controls for standalone operation of the ERV.
- .9 Particulate Filters
 - .1 Filter section with filter racks and guides with hinged and latching access doors for side loading and removal of filters.
 - .2 Flat arrangement with 2" (50mm) deep pleated panel filters, MERV 13A.

2.3 INDOOR FIXED PLATE ENERGY RECOVERY

- .1 Propylene crossflow core, multi-speed PSC motors (independent adjustment), forward curve dual inlet fans, insulated aluminum cabinet, condensate drain. Interlock contacts, manual timer switch(es), Merv 8 filter section.
- .2 Acceptable Manufacturers: Nu-Air, Venmar, Vanee.

2.4 OUTDOOR FIXED PLATE ENERGY RECOVERY

- .1 Outdoor application, polymer membrane energy core, varigreen ECM motors (w/VFD), insulated cabinet, condensate drain, lift off access, supply and exhaust weatherhoods, electric frost control heater, roof curb, terminal strip for EMCS control. Single point power connection, Merv 8 filter section.
- .2 Acceptable Manufacturers: Greenheck ECV-30-P-H.

PART 3 EXECUTION

3.1 INSTALLATION

- .1 Install units in accordance with manufacturer's instructions and as indicated.
- .2 Support independently of adjacent ductwork with flexible connections
- .3 Ensure adequate clearance for servicing and maintenance.
- .4 Do not operate units for any purpose, temporary or permanent, until ductwork is clean, filters are in place, bearings lubricated, and fan has been test run under observation.

3.2 FANS

- .1 Install fan sheaves required for final air balance.
- .2 Install flexible connections at fan inlet and fan outlets.
- .3 Install vibration isolators.

3.3 DRIP PANS

- .1 Install deep seal P-traps and trap seal primer on drip lines.
- .2 Depth of water seal to be 1.5 times static pressure at this point.

3.4 COMMISSIONING

- .1 Commission in accordance with Section 01 91 13 – General Commissioning (Cx) Requirements one day per unit for startup and one day for commissioning.

3.5 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

PART 1 GENERAL

1.1 SUMMARY

- .1 Materials and installation for air handling units AH-1/2 and CU-1/2.

1.2 RELATED REQUIREMENTS

- .1 Section 01 33 00 – Submittal Procedures.
- .2 Section 01 45 00 – Quality Control
- .3 Section 01 78 00 – Closeout Submittals.
- .4 Section 01 91 13 – General Commissioning (Cx) Requirements.
- .5 Section 23 07 19 - HVAC Piping Insulation
- .6 Section 23 23 00 – Refrigerant Piping
- .7 Section 23 23 16 – Refrigerant Piping Specialties
- .8 Division 25 – EMCS

1.3 REFERENCES

- .1 American National Standards Institute/American Society of Heating, Refrigeration and Air-Conditioning Engineers (ANSI/ASHRAE)
 - .1 ANSI/ARI 210/240, Unitary Air-Conditioning and Air-Source Heat Pump Equipment.
 - .2 ARI 270, Sound Rating of Outdoor Unitary Equipment.
- .2 ANSI/UL 1995 B, Standard for Heating and Cooling Equipment.
- .3 Canadian Standards Association (CSA)
 - .1 CSA B52, Mechanical Refrigeration Code.
 - .2 CSA C22.1, Canadian Electrical Code.
- .4 Health Canada / Workplace Hazardous Materials Information System (WHMIS)]
 - .1 Material Safety Data Sheets (MSDS)
- .5 National Roofing Contractors Association (NRCA)
- .6 National Fire Protection Association (NFPA)
 - .1 NFPA 90A, Installation of Air Conditioning and Ventilating Systems.
- .7 American Bearing Manufacturer's Association (ABMA)
 - .1 ANSI/ABMA 9 Load Ratings and Fatigue Life for Ball Bearings
 - .2 ANSI/ABMA 11 Load Ratings and Fatigue Life for Roller Bearings.
- .8 Air Movement and Control Association (AMCA)
 - .1 AMCA 300 Reverberant Room Method for Sound Testing of Fans.
- .9 National Electrical Manufacturer's Association (NEMA)

- .1 NEMA MG1 Motors and Generators
- .2 NEMA ICS 7-1 Safety Standards for Construction and Guide for Selection, Installation and Operation of Adjustable Speed Drive Systems.
- .10 Provincial Boiler, Pressure Vessel and Compressed Gas Regulations.

1.4 SUBMITTALS

- .1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and datasheet for packaged rooftop HVAC units.
- .3 Submit WHMIS MSDS in accordance with Section 02 62 00.01 - Hazardous Materials. Indicate VOC's for adhesive and solvents during application and curing.
- .4 Shop Drawings:
 - .1 Submit shop drawings to indicate project layout and dimensions; indicate:
 - .1 Equipment, piping, and connections, together with valves, strainers, control assemblies, thermostatic controls, auxiliaries and hardware, and recommended ancillaries which are mounted, wired and piped ready for final connection to building system, its size and recommended bypass connections.
 - .2 Piping, valves, fittings shipped loose showing final location in assembly.
 - .3 Control equipment shipped loose, showing final location in assembly.
 - .4 Dimensions, internal and external construction details, recommended method of installation with proposed structural steel support, mounting curb details, sizes and location of mounting bolt holes; include mass distribution drawings showing point loads.
 - .5 Detailed composite wiring diagrams for control systems showing factory installed wiring and equipment on packaged equipment or required for controlling devices of ancillaries, accessories, controllers.
 - .6 Pump and fan performance curves.
 - .7 Details of vibration isolation.
 - .8 Estimate of sound levels to be expected across individual octave bands in dB referred to A rating.
 - .9 Type of refrigerant used.
- .5 Test Reports: submit certified test reports from approved independent testing laboratories indicating compliance with specifications for specified performance characteristics and physical properties.
- .6 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .7 Instructions: submit manufacturer's installation instructions.
- .8 Manufacturer's Field Reports: manufacturer's field reports specified.
- .9 Closeout submittals: submit maintenance and engineering data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals include data as follows:
 - .1 Indicate: brief description of unit, indexed, with details of function, operation, control, and service for components.

- .2 Provide for units, manufacturer's name, type, year, number of units, and capacity.

1.5 QUALITY ASSURANCE

- .1 Pre-Installation Meetings:
 - .1 Convene pre-installation meeting one week prior to beginning work of this Section and on-site installations.
 - .1 Verify project requirements.
 - .2 Review installation and substrate conditions.
 - .3 Co-ordination with other building subtrades.
 - .4 Review manufacturer's installation instructions and warranty requirements.

1.6 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect air conditioning components from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.
- .4 Separate waste materials for reuse and recycling in accordance with Section 01 74 19 - Construction/Demolition Waste Management and Disposal.

PART 2 PRODUCTS

2.1 GENERAL

- .1 Air Handling Units shall be built to the level of quality as herein specified and to the description of the Air Handling Unit Schedule.
- .2 Substitution of any product other than that specified must ensure no deviation below the stated capacities, air flow rate, heat transfer rate, filtration efficiency and air mixing quality. Power requirements must not be exceeded, and where specifically defined, sound power levels must not be exceeded. Applications for "equal" or "alternate" must address these factors.
- .3 Unless stated otherwise, air-handling units are to be shipped to the job in one piece, factory assembled. Modular units assembled to achieve a close approximation to the intent of this specification will not be considered equal. All equipment shall where specified and applicable, be pre-wired and factory certified by an approved testing agency such as ETL, UL, or CSA for the destination.

- .4 All electrical circuits shall undergo a dielectric strength test and shall be factory tested and checked as to proper function.
- .5 UNIT CONSTRUCTION
- .1 Unit casing shall be of minimum 18 ga (1.3 mm) satin coat galvanized sheet metal. Surfaces on indoor and outdoor units shall be cleaned with a degreasing solvent to remove oil and metal oxides. Outdoor units shall be primed with a two-part acid based etching primer. All unprotected metal and welds shall be factory coated.
- .2 All exposed surfaces shall have a finish coat of alkyd enamel to all exposed surfaces with an ASTM B117-11 salt spray rating of 500 hrs.
- .3 All walls, roofs, and floors shall be of formed construction with at least two breaks at each joint. Joints shall be secured by sheet metal screws or pop rivets. Wall and floor joints shall be broken in and on all outdoor units roof joints broken out (exposed) for rigidity. All joints shall be caulked with a water resistant sealant.
- .4 The following components shall be provided with 24 ga (.70 mm) perforated (40% free area) satin coat galvanized metal liner over insulated areas:
Units shall be provided with access doors to the following components: fans, motors, filters, dampers and operators, access plenums, humidifiers/wet cells, electrical control panels and burner/compressor compartments. Access doors shall be as large as practical for easy access. Screwed wall panel access will not be acceptable for the above listed components.
- .5 Units shall be provided with hinged access doors with gasket, fully lined, and a minimum of two lever handles.
- .6 Whenever possible, hinged access doors to areas of negative pressure shall open out, and to areas of positive pressure shall open in. Where space constraints require the use of outward opening doors to an area of positive pressure, a clear warning label and safety device must be affixed.
- .7 All units shall be internally insulated with 1" (25 mm) thick, 1 1/2 lb./ft.3 (24 kg/m³) density coated insulation.
The coated insulation shall be secured to metal panels with a fire retardant adhesive and welded steel pins at 18" (450 mm) o/c. All longitudinal insulation joints and butt ends shall be covered by a sheet metal break to prevent deterioration of exposed edges. Drain pans and all floor areas shall be insulated on the underside.
- .8 Unit casing floors in walk in sections shall be fabricated with 14 ga (2.0 mm) galvanized checker plate steel. Provide reinforcing channels under floor to minimize deflection.
- .9 Cooling coil drain pans shall be fabricated of 304 stainless steel and are an integral part of the floor paneling, a minimum of 2" (51 mm) deep with welded corners. Drain pans shall extend a minimum of 6" (152 mm) downstream of coil face and be provided with a 1 1/2" (38 mm) S.S. M.P.T. drain connection. All cooling coil drain pans shall have a fast pan and be sloped and pitched such that there is no standing water. Intermediate drain pans shall be provided where required for effective moisture removal.
- .6 FANS
- .1 Centrifugal fans shall be rated in accordance with AMCA Standard Test Code - Bulletin 210. Fan manufacturer shall be a member of AMCA. All fans and fan assemblies shall be dynamically balanced during factory test run. Fan shafts shall be selected for stable operation at least 20% below the first critical RPM. Fan shafts shall be provided with a rust inhibiting coating.

- .2 Single low pressure forward curved fans of 18" (457 mm) diameter or smaller shall be equipped with greaseable pillow block bearings supported on a rigid structural steel frame.
- .3 Fan motor sheaves shall be adjustable with motors 7 1/2 HP (5.6 kW) and smaller. On fans with larger motors, fixed drives shall be provided. All drives shall be provided with a rust inhibiting coating. The air balancer shall provide for drive changes (if required) during the air balance procedure.
- .4 Fan and motor sheaves shall be factory installed, fan balanced, and tested prior to shipment.
- .5 Fan motors shall be inverter duty rated compatible with the use of Variable Frequency Drives.
- .6 Refer to Section 25 30 03 Variable Frequency Motor Controllers for HVAC for VFD requirements.
 - .1 Unit mounted manual VFD bypass switch shall lock out VFD. Fan shall run on maximum set volume. Bypass switch and all interlock contacts are factory mounted and pre-wired.
 - .2 Load reactors shall be provided for all 460 and 575 volt applications.
 - .3 Drive(s) shall be factory supplied and installed.
 - .4 Minimum air flow rate of 35% CFM on mixed air DX cooling, and electric heat systems.
- .7 Motor, fan bearings, and drive sheaves assembly shall be located inside the fan plenum to minimize bearing wear and to allow for internal vibration isolation of the fan-motor assembly where required. Motor mounting shall be adjustable to allow for variations in belt tension.
- .8 Fan-motor assemblies shall be provided with vibration isolators. Isolators shall be bolted to steel channel welded to unit floor that is welded to the structural frame of the unit. Use of separate bumpers or snubbers are not acceptable. Fans shall be attached to the discharge panel by a polyvinyl chloride coated polyester woven fabric with a sealed double locking fabric to metal connection.
- .9 The isolators shall be neoprene-in-shear type for single 9" (230 mm) to 15" (380 mm) diameter forward curve fans.
- .10 All forward curve fans 18" (457mm) in diameter and larger and all backward inclined fans shall incorporate vertical spring isolators with leveling bolts and bridge bearing waffled pads with minimum 1" (25 mm) static deflection designed to achieve high isolation efficiency.
- .11 Provide single extended grease line from far side to access side bearing.
- .12 Fan motors shall be ODP (open drip proof) high efficiency.
- .7 COILS
 - .1 Coils shall have 1/2" O.D. diameter tubes as manufactured by Engineered Air and constructed of copper tube, aluminum fin, and copper headers with sweat connectors.
 - .2 Fins constructed of aluminum or copper shall be corrugated for maximum heat transfer and shall be mechanically bonded to the tubes by mechanical expansion of the tubes. The coils shall have a galvanized steel casing. All hydronic and DX refrigerant coils shall be factory tested with air at 300 psig (2068 kPa) while immersed in an illuminated water tank. All condenser refrigerant coils shall be factory tested with air at 650 psig (4482 kPa) while immersed in an illuminated water tank.

- .3 Headers shall be outside the air-handling unit for maximum serviceability except for blow through applications where headers are internal. The non-headered end of the coil shall be fully concealed. Provide auxiliary drain pan complete with ½" (13 mm) SS MPT drain connection at headered end of cooling coils.
 - .4 Provide an insulated header cover to conceal exposed headers.
 - .5 Coils shall be removable from the unit at the header end unless shown otherwise on the drawings. All water coils shall be equipped with a capped vent tapping at the top of the return header or connection and a capped drain tapping at the bottom of the supply header or connection.
 - .6 Hydronic and DX refrigerant coils shall be circuited to provide adequate tube velocities to meet design requirements. Internal turbulators are not acceptable.
 - .7 Multiple row coils shall be of staggered tube design circuited to optimize capacity with minimum pressure drop. Coils requiring Provincial and Pressure Vessel Code certification shall be provided with a Canadian Registration Number as per CSA-B51.
 - .8 Refrigerant evaporator type coils shall be equipped with distributors connected to the coil by copper tubes. When a condensing unit is supplied by Engineered Air and a hot gas bypass valve is required, a 5/8" (16 mm) O.D. spigot will be provided at the top of the suction header. Solenoid valves, expansion valves, and related accessories shall be provided and installed by the refrigeration Subcontractor.
 - .9 Refrigerant coils with multiple compressors shall be alternate tube circuited in order to distribute the cooling effect over the entire coil face at reduced load conditions.
- .8 ELECTRIC HEAT
- .1 Electric resistance heaters shall be provided in the capacities, voltage, and steps of control as noted in the Schedules and shall bear a listing or certification mark from an authorized agency.
 - .2 Heater elements shall be installed a minimum of 12" (305 mm) downstream from air filters.
 - .3 Heater element wiring shall terminate in a full height enclosure at one end of the heater. All internal wiring shall terminate on clearly identified terminal blocks. A wiring diagram shall be provided on the enclosure cover.
 - .4 Heaters shall be equipped with an automatic reset disc type thermal cut-out.
 - .5 Heater elements shall be open type nickel-chromium construction (60% Ni, 15% Cr, 25% Fe). Coil terminal pins shall be mechanically secured and insulated from the frame by means of non-rotating ceramic bushings.
 - .6 Heating coil casings shall be galvanized steel of suitable gauge as required.
 - .7 Heaters to be supplied with protective screens on inlet and outlet sides.
 - .8 Electric Heat Control shall be complete with
 - .1 The controller shall provide 0-10VDC signal to an SCR with proportional and integral control and discharge air sensor to maintain set point temperature and provide rapid response to incremental changes in the discharge air temperature.
 - .2 Silicon Controlled Rectifier (SCR) performing time based sine wave phase control. The SCR shall be controlled by a factory installed proportional integral controller. The control system may be augmented by step and/or ambient controls. The SCR shall be controlled by electronic modulating discharge air control.

.9 FILTER SECTIONS

- .1 Filter sections shall be provided with adequately sized access doors to allow easy removal of filters. Filter removal shall be from one side of the unit.
- .2 The filter modules shall be designed to slide out of the unit. Side removal filters shall slide into a formed metal track, sealing against metal spacers at each end of the track.
- .3 Filters shall be inserted into a frame grid from the upstream side of the filter section. Air filter holding frames shall be satin coated galvanized steel with filter sealing flange, centering dimples, sealing gasket, and lances for appropriate air filter fasteners. Fasteners shall be capable of being installed without the use of tools, nuts, or bolts. A $\frac{3}{4}$ " (19mm) filter sealing flange shall be an integral component of the holding frame complete with a foam gasket to assure filter to frame sealing integrity. On pre and final filter arrangements, the pre-filters shall fit into the same frame structure and all shall be secured with clips. Filter frame structure shall be reinforced as required to withstand the differential pressure.
- .4 2"(50mm) Extended Media (Pleated) Disposable Filters: Filters shall be extended surface pleated complete with 100% synthetic media that does not support microbial growth. Frame shall be a high wet strength beverage board with a cross member design that increases filter rigidity and prevent breaching. Frame shall be recyclable. Filters shall have an expanded metal support grid bonded to the air-exiting side of the filter to maintain pleat uniformity and prevent fluttering. Metal support grid shall be recyclable. The filters shall be MERV 13 as scheduled.
- .5 Provide air switch to indicate clogged filter status via BACNET.

.10 DAMPERS

- .1 Dampers shall be certified low leak tested to AMCA Standard 500-89 by an accredited testing laboratory. These dampers include: rigidly formed satin coat galvanized steel frame with corner reinforcing brackets, heavy duty satin coat galvanized damper blades secured with bolts to continuous $\frac{1}{2}$ " (13 mm) diameter steel drive rods, all weather PVC double seal blade gasket, tempered aluminum alloy blade end seal, complete with epoxy enamel coating.
- .2 Extruded aluminum, low leak, insulated blade Tamco Series 9000.
- .3 Mixing dampers shall be parallel blade type.
- .4 Two position inlet dampers shall be parallel blade type.
- .5 Engineered Air High Efficiency Mix box section c/w short length opposed blade dampers offset to maximize air stream mixing.
- .6 Gravity relief dampers shall be single blade design type.
- .7 Mixing box economizer controller shall be complete with:
 - .1 proportional and integral control with a temperature sensor to maintain set point temperature and provide rapid response to incremental changes in discharge air temperature.
 - .1 The controller shall provide economizer control c/w minimum position from the building EMCS, BACnet IP communication or as required in coordination with Division 25.
 - .2 Automatic high ambient set back shall be provided. The ambient temperature shall be compared to the return air temperature.
 - .3 The economizer shall be disabled above 55°F (12.8°C) ambient temperature.

2.2 AIR COOLED CONDENSING UNITS (CU-1, CU-2)

.1 GENERAL

- .1 Compressors shall be hermetic scroll type set on resilient neoprene mounts. The compressors shall incorporate an internal or external pressure-limiting device to protect the compressor in the event of overpressure. Compressors shall be provided with a means of overload protection. External crankcase heaters shall be locked out during compressor operation.
- .2 Air Cooled Condenser
 - .1 Condenser coils shall be copper tube type, mechanically expanded into aluminum fins. Coils shall be factory pressure tested with air while immersed in an illuminated water tank.
 - .2 Condenser fans shall be direct drive propeller type arranged for vertical draw through airflow. Motors shall be weather resistant type with integral overload protection and designed for vertical shaft condenser fan applications. Fan and motor assemblies shall be mounted in a venturi for optimum efficiency with minimum noise level.
 - .3 Condenser fans shall be fully housed fan with protective screen and fluted blades for optimum efficiency with minimum noise level.
 - .4 Condenser section to form an integral part of the unit.
- .3 Split System Condensing Units
 - .1 The entire package including fan controls, head pressure control, and all other miscellaneous controls and accessories shall be pre-wired and factory certified by an approved testing agency such as ETL, UL, or CSA for the destination.
 - .2 Unit must conform to regulations set out in the Canadian Energy Efficiency Act for condensing units (11.25 to 20 tons). Packaged units shall be tested to CSA Standard C746-17 and must bear an EEV (energy efficiency verification) label provided by CSA.
 - .3 Condensing units shall be designed for a minimum of 15°F (8.3°C) liquid sub-cooling. Condensing units shall operate down to 50°F (10°C) for mixed air and 58°F (14.4°C) for make-up-air as applications. Where applicable, multiple compressor/condenser circuits shall be separate from each other. Suction and liquid lines shall be extended to the outside of the cabinet. Service ports fitted with Schrader fittings shall be connected to the suction and discharge lines for charging or pressure gauge readings.
 - .4 Controls for hermetic compressor units shall include compressor and condenser fan motor contactors, control circuit transformer, cooling relays, non-recycling pump down relays, ambient compressor lockout, anti-short-cycle and inter-stage timers, manual reset high pressure controls, and automatic reset low pressure controls. Head pressure actuated fan cycling control shall be provided on all multiple condenser fan units.
 - .5 Freeze protection provide by hot gas bypass connection or freeze stat as determined by manufacturer.
 - .6 Provide low ambient operation to 55°F (12.8°C).

- .7 Refrigeration specialties such as solenoid valves, TX valves, etc., to be supplied and installed by refrigeration Subcontractor.
- .8 Condensing unit designed for 100 ft. (30 m) refrigeration line length, to be site confirmed.
- .9 The piping system shall be purged and pressure tested with dry nitrogen, then tested again under vacuum. The equipment piping shall be shipped with a nitrogen holding charge.
- .4 Cooling Control
 - .1 The controller module shall be complete with proportional and integral control with a discharge air sensor to maintain set point temperature and provide rapid response to incremental changes in discharge air temperature.
 - .1 The controller shall provide staged mechanical cooling in accordance with schedule
 - .2 The controller shall have built-in minimum run time and anti-cycle timers.
 - .3 Mechanical cooling shall be disabled below a fixed low ambient temperature setpoint.
 - .4 Cooling enable/disable shall be through the building EMCS, BACnet IP communication or as required in coordination with Division 25.
 - .2 When controller is in economizer mode, the mechanical cooling shall be disabled.
- .5 ELECTRICAL
 - .1 Unit shall be provided with standard power block for connecting power to the unit.
 - .2 Control circuit transformer and wiring shall provide 24 VAC control voltage from the line voltage provided to the unit.
 - .3 Unit shall be provided with phase and brown out protection which shuts down all motors in the unit if the electrical phases are more that 10% out of balance on voltage, the voltage is more that 10% under design voltage, or on phase reversal.
- .6 CONSTRUCTION
 - .1 Unit shall be completely factory assembled, piped, and wired and shipped in one section.
 - .2 Unit shall be specifically designed for outdoor application.
 - .3 The condenser coil shall be mechanically protected from physical damage by painted galvanized steel louvers covering the full area of the coil.
 - .4 Access to condenser coils, condenser fans, compressors, and electrical and controls components shall be through hinged access doors with quarter turn, zinc cast, lockable handles.
 - .5 Exterior paint finish shall be capable of withstanding at least 1,000 hours, with no visible corrosive effects, when tested in a salt spray and fog atmosphere in accordance with ASTM B 117-95 test procedure.
 - .6 Unit shall include a forkliftable base.
- .2 FACTORY SUPPLIED CONTROLS/WIRING

- .1 Provide a system of motor control, including all necessary terminal blocks, motor contactors, motor overload protection, grounding lugs, control transformers, auxiliary contactors, and terminals for the connection of external control devices or relays.
- .2 Electric heat units shall include fan access door switch (to shut heater off when door is opened), auxiliary high limit, airflow switch, and heating contactors.
- .3 Fire alarm circuits (where required) shall be powered from a relay in unit circuitry.
- .4 Controls shall be housed in a control panel mounted in or on the unit that will meet the standard of the specific installation.
- .5 Remote Panel - Provide for each air handling unit a remote mounted control panel for the purpose of visual indication of operations. Each panel to include the following items:
 - .1 Engraved lamicoid faceplate, system on light, heat on light, cool on light, clogged filter light with unit mounted filter air pressure switch
 - .2 Provide a discharge air low limit equipped with an automatic by-pass time delay to allow for cold weather start-up. On a heating system failure, this device will shut down the fan and close the outdoor air damper.
- .6 Air Handling Unit Controller
 - .1 The controller shall be ETL and BTL certified.
 - .2 A graphic OLED display module shall provide temperatures and status of the equipment.
 - .3 The controller shall have a 9-button keypad for navigation of screens.
 - .4 The controller shall have a computer connection diagnostics via Ethernet complete with web based interface.
 - .5 The controller shall have 4 distinct modes (heating, economizer, ventilation and cooling). Each mode change is determined by the demand of the system.
 - .6 Minimum operating ambient temperature shall be -40°F (-40°C).
 - .7 The controller shall provide continuous ambient temperature sensing.
 - .8 Self-check on start-up shall be provided to ensure air proving and all sensors are operating within design tolerances.
 - .9 The controller shall have non-recycling auto by-pass low limit with alarm contacts.

PART 3 EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

- .1 Install as per manufacturers' instructions on roof curbs provided by manufacturer.

- .2 Manufacturer's representative to certify installation, supervise start-up and commission unit.

3.3 FIELD QUALITY CONTROL

- .1 Manufacturer's Field Services:
 - .1 Have manufacturer's representative of products supplied under this Section review work involved in handling, installation/application, protection and cleaning of its products, and submit written reports, in acceptable format, to verify compliance of work with Contract.
 - .2 Provide manufacturer's field services, consisting of product use recommendations and periodic site visits for inspection of product installation, in accordance with manufacturer's instructions.
- .2 Verify accessibility, serviceability of components including motorized dampers, filters coils, fans, motors, operators, humidifiers, sensors, electrical disconnects.
- .3 Verify accessibility, cleanability, drainage of drain pans for coils, humidifiers.

3.4 DEMONSTRATION

- .1 Training: in accordance with Section 01 91 13- General Commissioning (Cx)
Requirements: Training of O&M Personnel, supplemented as specified.

3.5 CLEANING

- .1 Perform cleaning operations as specified in Section 01 74 00 – Cleaning and in accordance with manufacturer's recommendations.
- .2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

PART 1 GENERAL

1.1 RELATED REQUIREMENTS

- .1 Section 01 33 00 – Submittal Procedures.
- .2 Section 01 45 00 – Quality Control
- .3 Section 01 78 00 – Closeout Submittals.
- .4 Section 01 91 13 – General Commissioning (Cx) Requirements.
- .5 Section 23 07 19 - HVAC Piping Insulation
- .6 Section 23 23 00 – Refrigerant Piping
- .7 Section 23 23 16 – Refrigerant Piping Specialties
- .8 Division 25 – EMCS

1.2 REFERENCES

- .1 American National Standards Institute/American Society of Heating, Refrigeration and Air-Conditioning Engineers (ANSI/ASHRAE)
 - .1 ANSI/ASHRAE 52.2 latest edition , Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particulate Size.
 - .2 ANSI/ASHRAE 127 latest edition, Method of Testing for Rating Computer and Data Processing Room Unitary Air-Conditioners.
- .2 ASTM International
 - .1 ASTM C547, Specification for Mineral Fiber Pipe Insulation.
- .3 CSA International
 - .1 CSA B52 latest edition, Mechanical Refrigeration Code.
 - .2 CAN/CSA-C656 latest edition, Performance Standard for Single Package Central Air-Conditioners and Heat Pumps.
 - .3 CSA C22.2 No 236/UL 2011 for “Heating and Cooling Equipment”
 - .4 CSA B52 latest edition, Mechanical Refrigeration Code

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for air conditioning components and accessories and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:

- .1 Indicate on drawings:
 - .1 Major components and accessories including sound power levels of units.
 - .2 Type of refrigerant used.
 - .3 Piping schematic indicating site-referenced measurements.
 - .4 Controls wiring schematic indicating connection of all indoor and outdoor equipment, and all ancillary components, and EMCS interconnection.
 - .5 Dimensional, electrical and capacity data; piping and electrical connection Drawings.

1.4 CLOSEOUT SUBMITTALS

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

1.5 DELIVERY, STORAGE AND HANDLING

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

PART 2 PRODUCTS

2.1 SPLIT SYSTEM AIR CONDITIONING UNIT AC-5, AC-6 (CU-5, CU-6)

- .1 General
 - .1 The cooling only system shall be a split direct expansion system with variable speed compressor technology. The condensing unit shall consist of a horizontal discharge, single phase outdoor, a matched capacity indoor section that shall be equipped with a wired wall-mounted controller.
 - .2 The evaporator section shall be horizontal ducted fan coil suspended from structure with spring-type vibration isolation.

- .3 Condensing units shall be roof mounted designed for operation down to outdoor installation.
- .4 The system shall have a total cooling capacity as scheduled
- .5 The unit is to be supplied for operation on a 208volt, 1phase, 60Hz power supply.
- .6 Acceptable Manufacturers: Mitsubishi P-series, Daikin, LG.
- .2 Quality Assurance
 - .1 The units shall be tested by a Nationally Recognized Testing Laboratory (NRTL) and shall bear the ETL label.
 - .2 All wiring shall be in accordance with the National Electrical Code (N.E.C.) and local codes as required.
 - .3 The units shall be rated in accordance with Air-conditioning, Heating, and Refrigeration Institute's (AHRI) Standard 210/240 and bear the ARI Certification label.
 - .4 The units shall be manufactured in a facility registered to ISO 9001 and ISO 14001.
 - .5 A dry air holding charge shall be provided in the indoor section.
 - .6 The outdoor unit shall be pre-charged with R-410A refrigerant.
- .3 Outdoor Air-Cooled Unit
 - .1 The outdoor unit shall be equipped with an electronic control board that interfaces with the indoor unit to perform all necessary operation functions.
 - .2 All roof mounted condensing units are equipped with adaptor and connected to a Central Controller panel (adaptor and controller panel by AC Unit manufacturer) mounted in Mech 119. The central controller shall be extended to the Building EMCS via BACnet, to monitor space temperature and equipment alarms, by Division 25.
 - .3 The outdoor unit shall be capable of cooling operation down to ambient temperature of -40°F (-40C) for cooling only systems without additional low ambient controls (wind baffles shall be required).
 - .4 The outdoor unit shall be able to operate with a maximum height difference of 100 feet (30 meters) between indoor and outdoor units.
 - .5 Cabinet
 - .1 The casing shall be constructed from galvanized steel plate, finished with an electrostatically applied, thermally fused acrylic or polyester powder coating for corrosion protection.
 - .2 Mounting feet shall be provided and shall be welded to the base of the cabinet and be of sufficient size to afford reliable equipment mount and stability.
 - .3 Easy access shall be afforded to all serviceable parts by means of removable panel sections.
 - .4 Cabinet mounting and construction shall be sufficient to withstand 155 MPH wind speed conditions.

- .6 Fan
 - .1 Unit shall be furnished with a single DC fan motor.
 - .2 The fan blade(s) shall be of aerodynamic design for quiet operation, and the fan motor bearings shall be permanently lubricated.
 - .3 The outdoor unit shall have horizontal discharge airflow. The fan shall be mounted in front of the coil, pulling air across it from the rear and dispelling it through the front.
- .7 Coil
 - .1 The L shaped condenser coil shall be of copper tubing with flat aluminum fins to reduce debris build up and allow maximum airflow. The coil shall be protected with an integral metal guard.
 - .2 Refrigerant flow from the condenser shall be controlled by means of an electronic linear expansion valve (LEV) metering device. The LEV shall be control by a microprocessor controlled step motor.
 - .3 All refrigerant lines between outdoor and indoor units shall be of annealed, refrigeration grade copper tubing, ACR Type, meeting ASTM B280 requirements, individually insulated in twin-tube, flexible, closed-cell, CFC-free (ozone depletion potential of zero), elastomeric material for the insulation of refrigerant pipes and tubes with thermal conductivity equal to or better than 0.27 BTU-inch/hour per Sq Ft / °F, a water vapor transmission equal to or better than 0.08 Perm-inch and superior fire ratings such that insulation will not contribute significantly to fire and up to 1" thick insulation shall have a - Flame-Spread Index of less than 25 and a Smoke-development Index of less than 50 as tested by ASTM E 84 and CAN / ULC S-102.
- .8 Compressor
 - .1 The compressor shall be a DC twin-rotor rotary compressor with variable speed inverter drive technology.
 - .2 The compressor shall be driven by inverter circuit to control compressor speed. The compressor speed shall dynamically vary to match the room load.
 - .3 To prevent liquid from accumulating in the compressor during the off cycle, a minimal amount of current shall be automatically, intermittently applied to the compressor motor windings to maintain sufficient heat to vaporize any refrigerant. No crankcase heater is to be used.
 - .4 The outdoor unit shall have an accumulator and high pressure safety switch. The compressor shall be mounted to avoid the transmission of vibration.
- .9 Electrical
 - .1 The electrical power of the unit shall be 208volts or 230 volts, single phase, 60 hertz. The unit shall be capable of satisfactory operation within voltage limits of 198 volts to 253 volts.

- .2 Power for the indoor unit shall be supplied from the outdoor unit.
 - .3 The outdoor unit shall be controlled by the microprocessor located in the indoor unit.
 - .4 The control signal between the indoor unit and the outdoor unit shall be pulse signal 24 volts DC.
- 4 Indoor Unit
- .1 The indoor unit shall be factory assembled, wired and run tested. Contained within the unit shall be all factory wiring, piping, electronic modulating linear expansion device, control circuit board and fan motor. The unit shall have a self-diagnostic function, 3-minute time delay mechanism, an auto restart function, and a test run switch. Indoor unit and refrigerant pipes shall be charged with dehydrated air before shipment from the factory.
 - .2 The casing shall have a white finish. Multi directional drain (2) and refrigerant piping (4) shall be standard. There shall be a separate back plate which secures the unit firmly to the wall.
 - .3 The indoor fan shall be an assembly with one or two line-flow fan(s) direct driven by a single motor. The indoor fan shall be statically and dynamically balanced to run on a motor with permanently lubricated bearings. A manual adjustable guide vane shall be provided with the ability to change the airflow from side to side (left to right). A motorized air sweep louver shall provide an automatic change in airflow by directing the air up and down to provide uniform air distribution.
 - .4 Return air shall be filtered by means of an easily removable, washable filter.
 - .5 The indoor coil shall be of nonferrous construction with smooth plate fins on copper tubing. The tubing shall have inner grooves for high efficiency heat exchange. All tube joints shall be brazed with phos-copper or silver alloy. The coils shall be pressure tested at the factory. A condensate pan and drain shall be provided under the coil. Both refrigerant lines to the indoor units shall be insulated.
 - .6 The unit electrical power shall be 208/230 volts, 1-phase, 60 hertz.
 - .7 The unit shall be equipped with a wired room temperature controller.

2.2 REFRIGERANT CHARGE

- .1 Charge refrigerant system at factory, seal and test.
- .2 Holding charge of refrigerant applied at factory.

PART 3 EXECUTION

3.1 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for air conditioning components installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate.
 - .2 Proceed with installation only after unacceptable conditions have been remedied.

3.2 GENERAL

- .1 Install air conditioning unit in accordance with manufacturer's installation instructions. Install unit plumb and level, firmly anchored in location indicated, and maintain manufacturer's recommended clearances.
- .2 Manufacturer to certify installation.
- .3 Run drain line from cooling coil condensate drain pan to nearest suitable sanitary connection, via indirect connection.

3.3 EQUIPMENT PREPARATION

- .1 Provide services of manufacturer representative to set and adjust equipment for operation as specified.

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 PROTECTION

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

END OF SECTION

PART 1 GENERAL

1.1 RELATED REQUIREMENTS

- .1 Section 01 33 00 – Submittal Procedures.
- .2 Section 01 45 00 – Quality Control
- .3 Section 01 74 19 – Construction/Demolition Waste Management and Disposal
- .4 Section 01 78 00 – Closeout Submittals.
- .5 Section 01 91 13 – General Commissioning (Cx) Requirements.
- .6 Section 23 07 13 - Duct Insulation
- .7 Section 23 07 19 - HVAC Piping Insulation
- .8 Section 23 31 13 - Metal Ducts
- .9 Section 23 33 00 – Air Duct Accessories.
- .10 Division 25 - EMCS

1.2 REFERENCES

- .1 American National Standards Institute/American Society of Heating, Refrigeration and Air-Conditioning Engineers (ANSI/ASHRAE)
 - .1 ANSI/ASHRAE 52.2 latest edition , Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particulate Size.
 - .2 ANSI/ASHRAE 127 latest edition, Method of Testing for Rating Computer and Data Processing Room Unitary Air-Conditioners.
- .2 ASTM International
 - .1 ASTM C547, Specification for Mineral Fiber Pipe Insulation.
- .3 CSA International
 - .1 CSA B52-05(R2009), Mechanical Refrigeration Code.
 - .2 CAN/CSA-C656-05(R2010), Performance Standard for Single Package Central Air-Conditioners and Heat Pumps.
 - .3 CSA B52 latest edition, Mechanical Refrigeration Code

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for air conditioning components and accessories and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
 - .1 Indicate on drawings:

- .1 Major components and accessories including sound power levels of units.
- .2 Type of refrigerant used.
- .3 Piping schematic indicating site-referenced measurements.
- .4 Controls wiring schematic indicating connection of all indoor and outdoor equipment, and all ancillary components, and Building EMCS interconnection.

1.4 CLOSEOUT SUBMITTALS

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

1.5 DELIVERY, STORAGE AND HANDLING

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

PART 2 PRODUCTS

2.1 DESCRIPTION

- .1 The primary mechanical system shall be a VRF (variable refrigerant flow) high efficiency modular (cool/heat/heat recovery) system, consisting of variable speed drive scroll compressor outdoor air cooled condensing units, and indoor fan coil units.
- .2 The VRF system for the office addition shall be capable of providing cooling/heating or simultaneously heating and cooling to the designated zone.
 - .1 Manufacturers: Mitsubishi City Multi-R2 Series, Daikin, LG
- .3 The VRF system for the Arena office area shall be capable of providing cooling or heating only, to the designated zone.
 - .1 Manufacturers: Mitsubishi City Multi-R2 Series, Daikin, LG

2.2 MODULAR AIR-SOURCE CONDENSING UNIT – (HP-1, HP-2A/2B)

- .1 GENERAL
 - .1 The VRF system shall consist of the outdoor unit, stand mounted on roof, affixed to roof structure, indoor fan coil units, and associated direct digital controls (DDC) system for control of all equipment. The outdoor unit shall be designed for offering heating at

extreme outdoor ambient conditions, with a variable speed drive scroll compressor to allow effective heating performance down to -22°F (minus 30°C). The outdoor units shall be equipped with multiple circuit boards that interface to the associated controls system and shall perform all functions necessary for operation. The outdoor unit shall be completely factory assembled, piped, wired, and each unit shall be thoroughly run tested at the factory.

.2 SYSTEM PERFORMANCE RATING

.1 The system shall consist of be one (1) or two (2) modular units piped together in the field using a factory supplied twinning kit. Once connected they shall operate as one unit alternating compressor run cycles to balance total compressor operation hours. The sum of connected capacity of all indoor fan coils shall range from 50% to 150% of outdoor rated capacity. The outdoor unit shall have rated performance for operation in heating mode at -30°C/-22F ambient temperature, and offer approximately 85% total heating output at -25°C/-13°F.

.3 HEAT INTERCHANGER CIRCUIT.

.1 The outdoor unit shall contain a heat interchanger circuit for sub-cooling liquid prior to entering the outdoor coil during the heating mode. The interchanger shall be of a copper tube within a tube construction. The interchanger circuit refrigerant flow shall be controlled by an electronic expansion valve.

.4 ACOUSTIC PERFORMANCE

.1 Outdoor unit shall have a sound pressure level (SPL) rating no higher than a maximum of 60 dB (A) individually or a collective maximum sound pressure rating of 65 dB (A) when combined with other modules in a system. The sound pressure rating is as measured a horizontal distance 1 m from the unit. The individual modular unit shall have a low sound operational mode where the SPL rating is no higher than 50 dB (A) or 55 dB (A) when combined in a single system with other modules (night mode operation).

.5 SYSTEM REFRIGERANT PIPEWORK

.1 Both refrigerant lines from the outdoor unit to indoor units shall be individually insulated. The outdoor unit shall have an accumulator with refrigerant level sensors and controls. The outdoor unit shall have a high pressure safety switch, over-current protection and DC bus protection. The outdoor units shall have the ability to operate with a maximum height difference of 164 feet and can, when combined in a modular format have a total refrigerant tubing length of 3,280 feet when serving up to Qty 50 indoors units. The greatest length is not to exceed 541 feet between the outdoor unit and the indoor units without the need for line size changes or traps. Coordinate with the manufacturer to confirm system layout and piping sizes. The modular variable speed drive outdoor unit shall have rated performance for operation in heating mode and cooling.

.2 The outdoor unit shall have a high efficiency oil separator plus additional logic controls to ensure adequate oil volume in the compressor is maintained.

.6 CONDENSING UNIT CABINET CONSTRUCTION

.1 The casing(s) shall be fabricated of galvanized steel, bonderized and finished with a powder coated baked enamel.

.7 VARIABLE SPEED CONDENSER FAN:

- .1 The outdoor unit module shall be furnished with one direct drive, inverter driven, variable speed propeller type fan. The unit shall be of operation under a maximum of 0.24"W.G external static via a dipswitch setting.
- .2 The fan motor shall have inherent protection, have permanently lubricated bearings, and be completely variable speed. The fan motor shall be mounted for quiet operation. The fan shall be provided with a raised guard to prevent contact with moving parts. The outdoor unit shall have vertical discharge airflow.
- .8 REFRIGERANT
 - .1 R410A refrigerant shall be required for modular outdoor unit system.
- .9 HIGH EFFICIENCY CONDENSER COIL:
 - .1 The outdoor coil shall be of the wrap around configuration with nonferrous construction with lanced or corrugated plate fins on copper tubing. A minimum clearance of 1 3/8" shall be allowed between modular units to facilitate sufficient air flow across the wrap around condenser coils. The coil fins shall have a factory applied corrosion resistant. The outdoor coil shall include four (4) circuits with two position valves for each circuit, except for the last stage. The coil shall be protected with an integral metal guard. Refrigerant flow from the outdoor unit shall be controlled by means of an inverter driven compressor.
- .10 VARIABLE SPEED SCROLL COMPRESSOR:
 - .1 The outdoor units shall be provided complete with an inverter driven scroll hermetic compressor(s). The compressor motor shall be of DC Brushless configuration with control to achieve optimum compressor/motor performance levels particularly during off design conditions.
 - .2 A crankcase heater(s) shall be factory mounted on the compressor(s).Each compressor shall be capable of modulation down to 19% of rated capacity.
 - .3 The compressor(s) shall be equipped with an internal thermal overload. The compressor shall be mounted to avoid the transmission of vibration.
- .11 UNIT ELECTRICAL CHARACTERISTICS
 - .1 The outdoor unit electrical power shall be 208/230 volts, 3 phase, 60 hertz. The unit shall be capable of satisfactory operation within voltage limitations of 187-228 volts (208V/60Hz).The outdoor unit shall be controlled by integral microprocessors.
 - .2 The control circuit between the indoor units and the outdoor unit shall be 30VDC completed using a 2-conductor, twisted pair non-polar shielded cable to provide total integration of the system. The inrush current to the outdoor unit shall not exceed the design full load amp FLA rating for the unit.
- .12 MODULAR CONFIGURATION
 - .1 The outdoor units shall consist of one or two modules each rated for the designated proportion of the total system cooling/heating capacity. Each module is furnished with an inverter driven scroll compressor and inverter driven variable speed propeller type condenser fan. The modular outdoor unit combinations are designed so as to balance the run hours seen by each individual inverter driven scroll compressor. The modules shall be installed in a side by side configuration without the need for intermediate oil balancing pipework.
- .13 FACTORY TWINNING KITS

- .1 Factory manufactured twinning kits will be supplied loose to facilitate the field connection of a maximum of two (2) modular condensing units per system. The high pressure side twinning kit must be installed external to the unit where as the low pressure side twinning kits is installed in the master unit.

2.3 BRANCH CIRCUIT CONTROLLERS

.1 GENERAL:

- .1 The branch circuit controllers shall be specifically used with R410A systems. These units shall be equipped with a circuit board that interfaces to the DDC system and shall perform all functions necessary for operation. The unit shall have a galvanized steel finish. The controller shall be completely factory assembled, piped and wired. Each unit shall be run tested at the factory. This unit shall be mounted indoors, with access and service clearance provided for each controller. The sum of connected capacity of all indoor air handlers shall range from 50% to 150% of rated capacity.

.2 BRANCH CIRCUIT CONTROLLER CONFIGURATION

- .1 The controller shall be constructed from galvanized steel plate partially insulated with polyurethane foam. The base of the unit shall have a foamed polystyrene tray. A brass header pipe with solenoid valves for each distribution port shall distribute the correct phase of refrigerant to each indoor unit.
- .2 The controller shall also include a tube in tube heat exchanger which will recover waste heat from units in cooling operation and distribute this to units requiring heating. The opposite will happen in cooling operation. An integral condensate pan and drain shall be provided, extend to nearest suitable sanitary via indirect connection; provide condensate lift pump in areas that cannot be accommodated by gravity drainage. The refrigeration process in the controller shall be maintained by linear expansion valves which will be controlled by pressure and temperature sensors.
- .3 The boxes will all require 208-230/1/60 VAC mains supply. Control will be via the 30 V DC signal from the outdoor unit. The unit shall be furnished with multiple branch circuits which shall have multiple two-position valves to control refrigerant flow. Service shut-off valves shall be field-provided/installed for each branch to allow service to any indoor unit without field interruption to overall system operation. Linear electronic expansion valves shall be used to control the variable refrigerant flow.

2.4 INDOOR UNITS

.1 GENERAL

- .1 The total capacity of the indoor units shall be between 50 and 150% of the capacity of the outdoor unit. Each indoor unit will have a heat exchanger which shall be constructed from copper tubing with aluminium fins. The flow of refrigerant through the heat exchanger will be controlled by a linear expansion valve. This valve will be controlled by thermistors and a return air thermistor and shall be capable of controlling the variable capacity of the indoor unit between 25% and 100%. Each indoor unit will require a 208VAC power supply. Control will be via the 30 VDC data control signal from the outdoor unit.

.2 MEDIUM STATIC CEILING-CONCEALED DUCTED INDOOR UNIT

- .1 The inline ceiling-concealed ducted indoor fan coil design that mounts above the ceiling with a 2-position, field adjustable return and a fixed horizontal discharge supply and shall have a modulating linear expansion device.

- .2 The indoor unit shall be factory assembled, wired and run tested. Contained within the unit shall be all factory wiring, piping, electronic modulating linear expansion device, control circuit board and fan motor. The unit shall have a self-diagnostic function, 3-minute time delay mechanism, and an auto restart function. Indoor unit and refrigerant pipes shall be charged with dehydrated air before shipment from the factory.
- .3 The unit shall be space saving, ceiling-concealed, ducted. The cabinet panel shall have provisions for a field installed filtered outside air intake.
- .4 The indoor unit fan shall be an assembly with one or two fan(s) direct driven by a single motor. The indoor fan shall be statically and dynamically balanced and run on a motor with permanently lubricated bearings. The fan speed can be modulated via a 3rd party 0-10 V signal. The indoor unit shall have a ducted air outlet system and ducted return air system.
- .5 Return air shall be filtered by means of a standard factory installed return air filter. Provide optional return filter box (rear placement), or where not available, the Subcontractor shall allow fabricate a return duct section with filter rack to accommodate side removal of manufacturer filter. Coordinate interconnection accordingly.
- .6 The indoor coil shall be of nonferrous construction with smooth plate fins on copper tubing. The tubing shall have inner grooves for high efficiency heat exchange. All tube joints shall be brazed with phos-copper or silver alloy. The coils shall be pressure tested at the factory. A condensate pan and drain shall be provided under the coil. The condensate shall be gravity drained from the fan coil. Both refrigerant lines to the indoor units shall be insulated.
- .7 The unit electrical power shall be 208/230 volts, 1-phase, 60 hertz.
- .8 This unit shall use controls provided by the manufacturer to perform functions necessary to operate the system.
- .9 Each zone shall be equipped with a wall mounted zone controller that shall operate the respective VRF fan coil, and enable the associated electric heating coil or electric baseboard heater. The zone controller shall operate in an occupied/unoccupied schedule. The zone controller shall be equipped with integral space humidity sensor function, and occupancy sensor. Refer to sequence of operations for controls requirements.

2.5 LINEAR EXPANSION VALVE KIT

- .1 General:
 - .1 The Linear Expansion Valve Kit shall be a dedicated custom package comprised of the following components:
 - .1 Linear Expansion Valves (P100/P125)
 - .2 NEMA 1 Rated Control Panel
 - .3 Thermistors
 - .4 Custom DX Coil
 - .2 Linear Expansion Valves
 - .1 The Linear Expansion Valve Kit shall be provided with expansion valves loose for installation in parallel in the field.
 - .2 Each Linear Expansion Valve shall be supplied with integrated power cable for termination at the control panel in the field.
 - .3 Control Panel

- .1 The control panel shall be NEMA-1 or equivalent rated for installation indoor or in a suitably rated enclosure. The control panel shall installed in the field in close proximity to the custom direct expansion coil (2-3m) to facilitate the field wiring of package control and power wiring. The control panel shall have the following input/output terminals to facilitate interlocks and communication with third party control systems:
 - .1 ON/OFF Input
 - .2 Analogue Input – Leaving/Return Air Set point Control
 - .3 Contact Input
 - .4 Error Input
 - .5 Operation Signal Output
 - .6 Error Signal Output
 - .7 Fan Signal Output
 - .8 Defrost Signal Output
- .4 Custom Coil:
 - .1 The Linear Expansion Kit shall be provided with a custom direct expansion coil.
- .5 Electrical:
 - .1 The unit electrical power shall be 208/230 volts, 1-phase, 60 hertz.
- .6 Controls:
 - .1 This unit shall use controls provided by the manufacturer to perform functions necessary to operate the system.

2.6 VRF CONTROLS NETWORK

- .1 General
 - .1 The VRF controls network consists of remote controllers, schedule timers, system controllers, centralized controllers, and/or integrated web based interface communicating over a high-speed communication bus. The controls network shall support operation monitoring, graphical user interface, scheduling, error email distribution, personal browsers, online maintenance support, and integration with the Building Energy Management Control Systems (EMCS) using BACnet interfaces.
 - .2 VRF wall mount zone controllers shall consist of heating/cooling temperature control, humidity sensor, occupancy sensor, with visual LCD Display.
 - .3 All VRF manufacturer shall provide Central Controllers with backlit LCD color touch panel and Expansion Controllers as required to suit all connected equipment. All VRF heat pumps shall be wired back to Central/Expansion Controllers wall mounted in Mech 119. All controllers to be connected to Building EMCS by Division 25.
- .2 Electrical Characteristics
 - .1 The VRF controls network shall operate at 30VDC. Controller power and communications shall be via a common non-polar communications bus.
 - .2 Control wiring shall be installed in a system daisy chain configuration from indoor unit to remote controller to indoor unit, to the branch circuit controller (main and subs, if applicable) and to the outdoor unit. Control wiring to remote controllers shall be run from the indoor unit terminal block to the controller associated with that unit. Control wiring for schedule timers, system controllers, and centralized controllers shall be installed in a daisy chain configuration from outdoor unit to outdoor unit, to system controllers, to the power supply. Control wiring for the space remote controllers shall be

from the remote controller to the first associated indoor unit in a daisy chain configuration.

- .3 Wiring shall be 2-conductor (16 AWG), twisted shielded pair, stranded wire, CAT-5e with RJ-45 connection, per manufacturer requirements.

2.7 VRF CONTROL WIRING INSTALLATION

- .1 The Subcontractor shall be responsible for the interconnecting control wiring between the indoor and outdoor units, remote controllers, centralized controllers and Building EMCS interface controllers, and relevant components. This work shall be co-ordinated with the Electrical / Controls Subcontractor for the routing and trunking of the cables.
- .2 All control wiring are to be carried out in 2 core 16 AWG shielded cabling with colour coding per and tagged with ID number at 3 metre intervals as per manufacturer schematics for ease of identification and maintenance.
- .3 Control wiring shall not be run next to power wiring. A minimum space of 100mm between both control and power cables shall apply.
- .4 All control wiring shall be run within conduit per Division 26.

2.8 VRF SYSTEM INSTALLATION

- .1 The fixing of all air conditioning equipment, installation of all refrigerant pipework and full commissioning shall be performed by a specialist refrigerant installer who shall be authorised by the VRF equipment manufacturer. The installation of all internal and external units, refrigerant pipework, inter-connecting wiring, commissioning and testing shall be carried out by an approved refrigerant systems installers.
- .2 Full access shall be afforded to site during the installations stage of the project to allow them to verify that installation methods are fully in accordance with the manufacturer requirements and that the equipment warranties will not be invalidated.

2.9 REFRIGERANT PIPEWORK

- .1 Supply, install, test and commission all interconnecting refrigeration pipework between the outdoor and indoor units.
- .2 All pipework to be carried out in refrigerant quality ACR copper tubing and complete with the appropriate headers and joints. All pipework must be suitable for R410A.
- .3 Longest possible lengths of copper pipe should be utilised to minimise joints on site.
- .4 Appropriate refrigeration installation tools must be utilised. Dry Nitrogen must be utilised at all times in the system during brazing.
- .5 All pipework (suction and liquid lines) to be insulated with slip on closed cell elastomeric pipe insulation (as manufactured by Armaflex, Kflex, Aeroflex) having a wall thickness of not less than ½", meeting the flame spread and smoke developed rating suitable for installation in return plenum. Insulation to meet the requirements of the successful VRF Manufacturer.
- .6 After installation of pipework, and prior to sealing of insulation joints and starting of equipment, pipework should be pressure tested to requirements of Authority having jurisdiction, or as outlined herein, whichever is more stringent. 44 PSIG test for 3 minutes minimum, then 217 PSIG for 3 minimum, then 478 PSIG for 3 minutes minimum, then strength test to 600 PSIG check the system for leaks and deformation, then lower the pressure back to 478 PSIG and

pressure test for 24 hours and checked for leaks. Vacuumed/dehydrated to 300 microns, and hold at that vacuum for 12 hours (minimum)

- .7 Refrigerant (R410A) charge weight must be calculated, to the actual installed length of pipe work in accordance to manufacturer recommendations.
- .8 The charging should be carried out with an appropriate charging station.
- .9 Pipework to be properly fixed and supported at a minimum of 1.5 metres (5 feet) centres or as specified by local code and where required should be run on galvanised trays. All pipework to be labelled with ID number (condensing units ref.) at 3 metre (9 feet) intervals.
- .10 Joints in copper pipe shall be brazed. Brazing shall be carried out to the requirements of the local code and as per the Canadian copper & brass development association recommendations.
- .11 All piping shall be registered and work shall be performed in compliance with local Authority Having Jurisdiction Inspection requirements.

2.10 CONDENSATE PIPEWORK

- .1 A condensate line shall be installed to each fan coil unit. This shall be installed and insulated all as per the standard specification. Minimum size of condensate pipes to be 32mm (1-1/4 inch) copper, insulated and pumped from each fan coil/cassette, drains to be sloped as per code requirements. Coordinate final drain requirements/connection with Manufacturer recommendations.

2.11 VRF ROOF MOUNTED EQUIPMENT STAND

- .1 Product to be supported on Metal framework stand construction of 2" x 2" square tube mild steel with electroplated zinc coating, height adjustable leg assemblies and fittings supported by 17.5" x 17.5" non-penetrative UV stabilized pre-polymer bound rubber mats. Frame is non-penetrative and is designed to avoid roof membrane penetration. Top of stand shall be minimum height of 24" (600mm) above finished roof level.
- .2 Manufacturers: Ecofoot, Bigfoot, Rectorseal

PART 3 EXECUTION

3.1 INSTALLATION

- .1 Install units in accordance with manufacturer's instructions and as indicated.
- .2 Support independently of adjacent ductwork with flexible connections
- .3 Ensure adequate clearance for servicing and maintenance.
- .4 Do not operate units for any purpose, temporary or permanent, until ductwork is clean, filters are in place, bearings lubricated, and fan has been test run under observation.
- .5 Manufacturer to certify installation.

3.2 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for air conditioning components installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate.
 - .2 Proceed with installation only after unacceptable conditions have been remedied.

3.3 EQUIPMENT PREPARATION

- .1 Provide services of manufacturer's field engineer to set and adjust equipment for operation as specified.

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 Commission in accordance with Section 01 91 13 – General Commissioning (Cx) Requirements.

3.6 PROTECTION

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

END OF SECTION

PART 1 GENERAL

1.1 SUMMARY

- .1 Section includes:
 - .1 Materials and installation for direct steam injection, packaged electrode steam generating, steam-to-steam, electric self-contained humidifiers and accessories.

1.2 RELATED SECTIONS

- .1 Section 01 33 00 – Submittal Procedures.
- .2 Section 01 45 00 – Quality Control.
- .3 Section 01 74 19 – Construction/Demolition Waste Management and Disposal
- .4 Section 01 78 00 – Closeout Submittals.
- .5 Section 01 91 13 – General Commissioning (Cx) Requirements.
- .6 Section 23 31 13 – Metal Ducts.

1.3 REFERENCES

- .1 Health Canada / Workplace Hazardous Materials Information System (WHMIS)]
 - .1 Material Safety Data Sheets (MSDS)
- .2 Air-Conditioning and Refrigeration Institute (ARI)
 - .1 ARI 640, Performance Rating of Commercial and Industrial Humidifiers

1.4 SUBMITTALS

- .1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product data:
 - .1 Submit manufacturer's printed product literature, specifications and datasheet for heating, ventilation and air conditioning distribution piping and ductwork.
- .3 Shop drawings:
 - .1 Submit shop drawings to indicate project layout, dimensions, and extent of humidification system.
- .4 Test Reports: submit certified test reports from approved independent testing laboratories indicating compliance with specifications for specified performance characteristics and physical properties.

- .5 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .6 Instructions: submit manufacturer's installation instructions.
- .7 Manufacturer's field reports specified.
- .8 Closeout submittals: submit maintenance and engineering data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.5 QUALITY ASSURANCE

- .1 Pre-Installation Meetings:
 - .1 Convene pre-installation meeting one week prior to beginning work of this Section and on-site installations.
 - .1 Verify project requirements.
 - .2 Review installation and substrate conditions.
 - .3 Co-ordination with other building subtrades.
 - .4 Review manufacturer's installation instructions and warranty requirements.

1.6 DELIVERY, STORAGE AND HANDLING

- .1 Waste Management and Disposal:
 - .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 19 - Construction/Demolition Waste Management and Disposal.
 - .2 Remove from site and dispose of packaging materials at appropriate recycling facilities.
 - .3 Collect and separate for disposal, paper, plastic, polystyrene, corrugated cardboard, packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan (WMP).
 - .4 Separate for reuse and recycling and place in designated containers steel, metal, plastic waste in accordance with Waste Management Plan (WMP).

1.7 MAINTENANCE

- .1 Extra materials:
 - .1 Provide maintenance materials in accordance with Section 01 78 00 – Closeout Submittals.
 - .2 Furnish list of individual manufacturer's recommended spare parts for equipment, addresses of suppliers, and list of specialized tools necessary for adjusting, repairing or replacing, for inclusion into operating manual.
 - .3 Provide following: one complete set of renewable evaporator media.

PART 2 PRODUCTS

2.1 ELECTRIC STEAM HUMIDIFIER

- .1 General
 - .1 Provide self-contained, microprocessor controlled, wall mounted, electric resistive steam humidifiers as indicated, of size and capacity as scheduled. Electrode technology is not acceptable.
 - .2 Humidifier shall meet the requirements of UL 998 and CSA C22.2 No.104 standards to comply with ETL certification.
- .2 Humidifier cabinet:
 - .1 The humidifier casing shall be constructed of cold roll steel and stainless steel base with baked enamel finish to prevent rust.
 - .2 For safety and security reasons, all components, electrical wiring and plumbing connections will not be exposed and must be contained within the cabinet of the unit.
 - .3 The compartmentalized enclosure shall separate the plumbing, controls, and high-voltage sections, preventing heat, humidity or water transfer to the electrical sections and ensuring that the evaporation chamber remains isolated.
 - .4 The plumbing compartment shall be equipped with a drip tray.
 - .5 The front of the unit and the high voltage compartment shall have a lockable door to restrict access by unauthorized personnel.
- .3 Evaporation chamber:
 - .1 Steam shall be generated in a stainless steel cleanable evaporation chamber.
 - .2 The evaporation chamber shall be easily serviceable and removable from the unit. No tools are required during servicing.
 - .3 The electronic level sensing assembly remains permanently fixed and separate from the evaporation chamber.
 - .4 The heating elements and manual reset high temperature safety cut-out switch remain fixed in place, even as the evaporation chamber is removed for service cleaning.
 - .5 The evaporation chamber shall have a water port designed to minimize the risk of blockage caused by sediment build-up. The water port will be easily detachable for servicing by means of a single quick connect assembly.
- .4 Immersion heating element(s):
 - .1 Steam shall be generated by self-cleaning 800/825 Incoloy electric heating immersion elements.
 - .2 The heating elements shall have a high expansion factor, minimizing mineral deposits and enabling most of them to break off and fall to the bottom of the chamber.
- .5 Water level control:
 - .1 The water level detection system shall be self-cleaning, self-calibrating and equipped with a redundancy system, consisting of a high-resolution capacitive sensor and two fail-safe resistive sensors.
 - .2 The humidifier must have the ability to sense foam and take a corrective action by going into drain cycle.

- .3 For safe temperature operation, the humidifier must have both an electronic temperature sensor inside the evaporation chamber and an external bimetallic temperature cut-off.
- .6 Water requirements:
 - .1 The humidifier shall operate under all types of water including tap, deionized and reverse osmosis water, with no additional parts required.
- .7 Feed water:
 - .1 The supply water to the unit shall be controlled by a quiet three port solenoid valve equipped with flow regulators, to supply water into the evaporation chamber, temper the hot water during a drain and clean the water level sensors.
 - .2 To conserve energy, any hot water skimming during normal filling cycle is not acceptable.
 - .3 The humidifier shall have a check valve in the fill water line to prevent backflow of hot contaminated water into the water supply system.
 - .4 The humidifier shall have a pulsed fill mode to ensure that boiling does not stop while the humidifier is refilling, in order to maintain a constant steam output.
- .8 Drain:
 - .1 The humidifier shall have a drain pump which provides a quick drain cycle, minimizing the down time.
 - .2 The humidifier shall have four draining strategies: periodic full drain cycle, water dilute system, AFEC and configurable drain schedule, ensuring maximum energy efficiency, optimal steam output stability and minimal steam output interruptions.
 - .3 To enhance safety and minimize energy consumption, the humidifier shall vary the drain time periods according to variations in water conditions.
 - .4 After 72 hours of no demand, the humidifier will go into "Tank Rinse" or end of season mode, completely draining the unit to eliminate stagnant water.
- .9 Manual drain valve:
 - .1 The humidifier shall be supplied with a manual drain valve which ensures that the unit can be drained even during a power failure.
- .10 Disconnect switch:
- .11 For safety reasons and to conform to local regulations, the humidifier shall have a built-in factory wired disconnect switch, to easily turn off the power without opening any access doors, ensuring that the power is off when accessing the electrical panels. An external disconnect switch is not required.
- .12 Controller:
 - .1 The humidifier shall have an alphanumeric display and control module with 8 function buttons for fast configuration and operation.
 - .2 The Idle Screen shall display common information including humidity demand, actual steam output and state of operation. It will also indicate special diagnostic parameters such as abnormal operation, time delays, etc.

- .3 The humidifier shall be programmable using the menu buttons to view and configure settings including control method, %R.H. set point, control signal type, and indication on number of actual service hours.
- .4 After the maximum number of hours of operation before servicing is due has been exceeded, the unit will display a need for servicing and the Status Display LED on the control panel will turn red.
- .13 SD card:
 - .1 The unit shall be equipped with an SD card slot, to allow for simplified troubleshooting, by storing a history log of all humidifier trends and alarms.
 - .2 The SD card shall allow for on-site firmware upgrades.
- .14 USB connection:
 - .1 The unit shall be equipped with a USB port, to allow on-site firmware upgrades.
- .15 Scheduling system:
 - .1 The humidifier shall be equipped with a configurable and independent scheduling system for unit operation and drain cycle, ensuring that the unit does not operate or drain when not necessary.
 - .2 User rights management:
 - .3 The electronic controller shall be equipped with a user rights management system, which simplifies operation and protects the humidifier from unwanted access by displaying only the features associated to the type of user logged in.
- .16 Modulating control:
 - .1 The control modulating signal shall be 0-10 VDC or 2-10 VDC, 4-20 mA or 0-20 mA to modulate 0-100% of the capacity, from the building EMCS via BACnet.
 - .2 The maximum output (SPAN) can be minimized by using the electronic "MAX OUTPUT" setting.
 - .3 Modulation of all elements shall be achieved using silent SSR's with zero voltage crossing detection and firing. The SSR's will be backed up by an electro-mechanical contactor.
 - .4 To avoid harmonics and peak electrical loads, Time Proportioning modulation using only electro- mechanical relays will not be acceptable.
- .17 Accessories: Include the following:
 - .1 HRO20 humidity controller: Wall mounted, modulating device with electronic display and adjustment buttons that measures from 0-100% RH and provides selectable output signals, with a control range of 10% to 90% RH.
 - .2 SHS80 duct humidity sensor: Duct mounted device with high limit that measures from 0-100% RH range and provides a 0-10VDC output, with a high limit control range of 20% to 90% RH.
 - .3 APS: Air pressure switch shall be diaphragm operated with pitot tube for field installation. Switch shall have a fix control of 0.05" WG (1.3mmWC).
 - .4 Duct distribution manifold complete with supply hose
 - .5 Steam distribution manifold (S.A.M.E2): Type 304 stainless steel manifold with brass nozzle inserts which provide uniform steam distribution over entire length, used in applications with restricted duct dimensions. See schedule for maximum dispersion distance.

- .6 Supply 15 ft flexible steam hose; site confirm.
- .18 Acceptable manufacturers: Neptronic, Dristeem, Pure

PART 3 EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

- .1 Install in accordance with manufacturers instructions.
- .2 Humidifier and evaporator media to be new and clean when project is accepted.
- .3 Install humidistat in accessible location.
- .4 Water service overflow drain: as indicated and to manufacturers' recommendation.
- .5 Install access doors or panels in adjacent ducting.
- .6 When installing in ducting, provide waterproof duct up and downstream in accordance with Section 23 31 13 Metal Ducts.
- .7 Install capped drain connection at low point in duct.

3.3 FIELD QUALITY CONTROL

- .1 Manufacturer's Field Services:
 - .1 Have manufacturer's representative of products, supplied under this Section, review work involved in the handling, installation/application, protection and cleaning, of its products and submit written reports, in acceptable format, to verify compliance of work with Contract.
 - .2 Manufacturer's Field Services: provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.
 - .3 Schedule site visits, to review work, at stages listed:
 - .1 After delivery and storage of products, and when preparatory work, or other work, on which the work of this Section depends, is complete but before installation begins.
 - .2 Twice during progress of work at 25% and 60% complete.
 - .3 Upon completion of the work, after cleaning is carried out.
- .2 Performance Verification (PV):

- .1 General: in accordance with Section 01 91 13 - General Commissioning (Cx)
Requirements: General Requirements, supplemented as specified.
- .2 Timing:
 - .1 After TAB of ducted air systems.
 - .2 At same time as PV of related air handling units.
- .3 Start-up:
 - .1 General: in accordance with Section 01 91 13 - General Commissioning (Cx)
Requirements: General Requirements, supplemented as specified.
 - .2 Verify:
 - .1 Steam lines are sloped to ensure steam condensate is drained away from the humidifier.
 - .2 Vapour lines and manifolds are sloped to ensure condensate is drained away from the duct system.
 - .3 Visually check distribution manifold to ensure:
 - .1 Even distribution of vapour.
 - .2 Freedom from water deposits.
- .4 Commissioning Reports:
 - .1 General: in accordance with Section 01 91 13 - General Commissioning (Cx)
Requirements: reports, supplemented as specified. Include:
 - .1 PV results on approved PV Report Forms.
 - .2 Product Information Report Forms.

3.4 DEMONSTRATION

- .1 Training: in accordance with Section 01 91 13- General Commissioning (Cx) Requirements:
Training of O&M Personnel.

3.5 CLEANING

- .1 Perform cleaning operations as specified in Section 01 74 00 – Cleaning and in accordance with manufacturer's recommendations.
- .2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

- .1 Section Includes.
 - .1 Methods and procedures for start-up, verification and commissioning, for building Energy Monitoring and Control System (EMCS) and includes:
 - .1 Start-up testing and verification of systems
 - .2 Check-out demonstration or proper operation of components.
 - .3 On-site operational tests

1.2 RELATED SECTIONS

- .1 The Contractor is to ensure that all related work is coordinated among all specification sections, as well as between all Divisions, and that the tender price includes all related work. The referenced sections below are for guidance only and are not necessarily a complete list of related sections.
- .2 Section 01 33 00 - Submittal Procedures.
- .3 Section 01 78 00 - Closeout Submittals.
- .4 Section 01 91 13 - General Commissioning (Cx) Requirements.
- .5 Section 25 05 01 - EMCS: General Requirements.

1.3 DEFINITIONS

- .1 For additional acronyms and definitions refer to Section 25 05 01 - EMCS: General Requirements.
- .2 AEL (Average Effectiveness Level): ratio between total test period less any system downtime accumulated within that period and test period.
- .3 Downtime: results whenever EMCS is unable to fulfill required functions due to malfunction of equipment defined under responsibility of EMCS Subcontractor. Downtime is measured by duration, in time, between time that EMCS Subcontractor is notified of failure and time system is restored to proper operating condition. Downtime not to include following:
 - .1 Outage of main power supply in excess of back-up power sources, provided that:
 - .1 Automatic initiation of back-up was accomplished.
 - .2 Automatic shut-down and re-start of components was as specified.

- .2 Failure of communications link, provided that:
 - .1 Controller automatically and correctly operated in stand-alone mode.
 - .2 Failure was not due to failure of any specified EMCS equipment.
- .3 Functional failure resulting from individual sensor inputs or output devices, provided that:
 - .1 System recorded said fault.
 - .2 Equipment defaulted to fail-safe mode.
 - .3 AEL of total of all input sensors and output devices is at least 99 % during test period.

1.4 DESIGN REQUIREMENTS

- .1 Commissioning personnel to be fully aware of and qualified to interpret Design Criteria and Design Intentions.

1.5 SUBMITTALS

- .1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Final Report:
 - .1 Include measurements, final settings and certified test results.
 - .2 Bear signature of commissioning technician and supervisor
 - .3 Revise "as-built" documentation, commissioning reports to reflect changes, adjustments and modifications to EMCS as set during commissioning and submit in accordance with Section 01 78 00 - Closeout Submittals.
 - .4 Recommend additional changes and/or modifications deemed advisable in order to improve performance, environmental conditions or energy consumption.

1.6 CLOSEOUT SUBMITTALS

- .1 Provide documentation, O&M Manuals, and training materials of O&M personnel for review before interim acceptance in accordance with Section 01 78 00 - Closeout Submittals and Section 25 05 03 – EMCS: Project Record Documents.

1.7 COMMISSIONING

- .1 Do commissioning in accordance with Section 01 91 13 – General Commissioning (Cx) Requirements.
- .2 Inform, and obtain approval from, City of Winnipeg representative in writing at least 14 days prior to commissioning or each test. Indicate:
 - .1 Location and part of system to be tested or commissioned.

- .2 Testing/commissioning procedures, anticipated results.
- .3 Names of testing/commissioning personnel.
- .3 Correct deficiencies, re-test until satisfactory performance is obtained.
- .4 Acceptance of tests will not relieve the EMCS Subcontractor from responsibility for ensuring that complete systems meet every requirement of Contract.
- .5 Load system with project software.
- .6 Perform tests and commissioning as required for a complete and fully operational EMCS. Static and dynamic system tests shall be verified at the site facility, and at the existing City of Winnipeg monitoring station (where required), prior to final acceptance.

1.8 COMPLETION OF COMMISSIONING

- .1 Commissioning to be considered as satisfactorily completed when objectives of commissioning have been achieved and reviewed by City of Winnipeg Representative and Commissioning Co-ordinator.

1.9 ISSUANCE OF FINAL CERTIFICATE OF COMPLETION

- .1 Final Certificate of Completion will not be issued until receipt of written approval indicating successful completion of specified commissioning activities including receipt of commissioning documentation.

PART 2 - PRODUCTS

2.1 EQUIPMENT

- .1 Provide sufficient instrumentation to verify and commission the installed system. Provide two-way radios.
- .2 Instrumentation accuracy tolerances: higher order of magnitude than equipment or system being tested.
- .3 Independent testing laboratory to certify test equipment as accurate to within approved tolerances no more than 2 months prior to tests.
- .4 Locations to be approved, readily accessible and readable.
- .5 Application: to conform to normal industry standards.

PART 3 - EXECUTION

3.1 PROCEDURES

- .1 Test each system independently and then in unison with other related systems.
- .2 Commission each system using procedures prescribed by the Commissioning Coordinator.
- .3 Debug system software.
- .4 Optimize operation and performance of systems by fine-tuning PID values and modifying CDLs as required.
- .5 Test full scale emergency evacuation and life safety procedures including operation and integrity of smoke management systems under normal and emergency power conditions as applicable.

3.2 FIELD QUALITY CONTROL

- .1 Pre-Installation Testing.
 - .1 General: consists of field tests of equipment just prior to installation.
 - .2 Testing may be on site or at the EMCS Subcontractor's premises as approved by City of Winnipeg Representative.
 - .3 Configure major components to be tested in same architecture as designed system. Include EMCS equipment and 2 sets of Building Controllers including MCU's, LCU's, and TCU's.
 - .4 Equip each Building Controller with sensor and controlled device of each type (AI, AO, DI, DO).
 - .5 Additional instruments to include:
 - .1 DP transmitters.
 - .2 VAV supply duct SP transmitters.
 - .3 DP switches used for dirty filter indication and fan status.
 - .6 In addition to test equipment, provide inclined manometer, digital micro-manometer, milli-amp meter, source of air pressure infinitely adjustable between 0 and 500 Pa, to hold steady at any setting and with direct output to milli-amp meter at source and to EMCS.
 - .7 After setting, test zero and span in 10 % increments through entire range while both increasing and decreasing pressure.
 - .8 Transmitters above 0.5 % error will be rejected.
 - .9 DP switches to open and close within 2% of setpoint.
- .2 Completion Testing.

- .1 General: test after installation of each part of system and after completion of mechanical and electrical hook-ups, to verify correct installation and functioning.
- .2 Include following activities:
 - .1 Test and calibrate field hardware including stand-alone capability of each controller.
 - .2 Verify each A-to-D convertor.
 - .3 Test and calibrate each AI using calibrated digital instruments.
 - .4 Test each DI to ensure proper settings and switching contacts.
 - .5 Test each DO to ensure proper operation and lag time.
 - .6 Test each AO to ensure proper operation of controlled devices. Verify tight closure and signals.
 - .7 Test operating software.
 - .8 Test application software and provide samples of logs and commands.
 - .9 Verify each CDL including energy optimization programs.
 - .10 Debug software.
 - .11 Blow out flow measuring and static pressure stations with high pressure air at 700 kPa.
 - .12 Provide point verification list in table format including point identifier, point identifier expansion, point type and address, low and high limits and Engineering units. This document will be used in final startup testing.
- .3 Final Startup Testing: Upon satisfactory completion of tests, perform point-by-point test of entire system and provide:
 - .1 2 technical personnel capable of re-calibrating field hardware and modifying software.
 - .2 Detailed daily schedule showing items to be tested and personnel available.
 - .3 Commissioning to commence during final startup testing.
 - .4 O&M personnel to assist in commissioning procedures as part of training.
 - .5 Commissioning to be supervised by qualified supervisory personnel.
 - .6 Commission systems considered as life safety systems before affected parts of the facility are occupied.
 - .7 Operate systems as long as necessary to commission entire project.
 - .8 Monitor progress and keep detailed records of activities and results.
- .4 Final Operational Testing: to demonstrate that EMCS functions in accordance with contract requirements.
 - .1 Prior to beginning of 30 day test demonstrate that operating parameters (setpoints, alarm limits, operating control software, sequences of operation, trends, graphics and CDL's) have been implemented to ensure

- proper operation and operator notification in event of off-normal operation.
- .1 Repetitive alarm conditions to be resolved to minimize reporting of nuisance conditions.
- .2 Test to last at least 30 consecutive 24 hour days.
- .3 Tests to include:
 - .1 Demonstration of correct operation of monitored and controlled points.
 - .2 Operation and capabilities of sequences, reports, special control algorithms, diagnostics, software.
- .4 System will be accepted when:
 - .1 EMCS equipment operates to meet overall performance requirements. Downtime as defined in this Section must not exceed allowable time calculated for this site.
 - .2 Requirements of Contract have been met.
- .5 In event of failure to attain specified AEL during test period, extend test period on day-to-day basis until specified AEL is attained for test period.
- .6 Correct defects when they occur and before resuming tests.
- .5 City of Winnipeg Representative to verify reported results.

3.3 ADJUSTING

- .1 Final adjusting: upon completion of commissioning, set and lock devices in final position and permanently mark settings.

3.4 DEMONSTRATION

- .1 Demonstrate to City of Winnipeg Project Manager or Representative, operation of systems including sequence of operations in regular and emergency modes, under normal and emergency conditions, start-up, shut-down interlocks and lock-outs in accordance with Section 01 91 13 – General Commissioning (Cx) Requirements, and with section 01 79 00 – Demonstration and training.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

- .1 Section Includes.
 - .1 Requirements and procedures for training program, instructors and training materials, for building Energy Monitoring and Control System (EMCS) Work.

1.2 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 25 05 01 - EMCS: General Requirements.

1.3 DEFINITIONS

- .1 CDL - Control Description Logic.
- .2 For additional acronyms and definitions refer to Section 25 05 01 - EMCS: General Requirements

1.4 SUBMITTALS

- .1 Submittals in accordance with Section 01 33 00 - Submittal Procedures and supplemented and modified by requirements of this Section.
- .2 Submit training proposal complete with hour-by-hour schedule including brief overview of content of each segment to City of Winnipeg Representative 30 days prior to anticipated date of beginning of training.
 - .1 List name of trainer, and type of visual and audio aids to be used.
 - .2 Show co-ordinated interface with other EMCS mechanical and electrical training programs.
- .3 Submit reports within one week after completion of Phase 1 and Phase 2 training program that training has been satisfactorily completed.

1.5 QUALITY ASSURANCE

- .1 Provide competent instructors thoroughly familiar with aspects of EMCS installed in facility.

1.6 INSTRUCTIONS

- .1 Provide the services of competent instructors who will give instruction to designated personnel in the adjustment, operation, and maintenance of equipment and systems. Include pertinent safety requirements of the equipment and system specified. The training shall be specifically for the system installed rather than being a general training course. Instructors shall be thoroughly familiar with all aspects of the subject matter they are teaching.
- .2 Training shall be completed to the complete satisfaction of the City of Winnipeg Representative, prior to completion and turnover to City of Winnipeg.

1.7 TIME FOR INSTRUCTION

- .1 Number of days of instruction to be as specified in this section (1 day = 8 hours including two 15 minute breaks and excluding lunch time).

1.8 TRAINING MATERIALS

- .1 Provide equipment, visual and audio aids, and materials for classroom training.
- .2 Supply manual for each trainee, describing in detail data included in each training program. All equipment and material required for classroom training shall be provided by the EMCS Subcontractor.
 - .1 Review contents of manual in detail to explain aspects of operation and maintenance (O&M).

1.9 TRAINING PROGRAM

- .1 Phase 1: 1 day program to begin before 30 day test period at time mutually agreeable to EMCS Subcontractor, City of Winnipeg Representative and Commissioning Coordinator.
 - .1 Train O&M personnel in functional operations and procedures to be employed for system operation.
 - .2 Supplement with on-the-job training during 30 day test period.
 - .3 Include overview of system architecture, communications, operation of computer and peripherals, report generation.
 - .4 Include detailed training on operator interface functions for control of mechanical systems, CDL's for each system, and elementary preventive maintenance.
 - .5 Introduction to Direct Digital Controls and BACnet protocol.
 - .6 Identification of Control Components.
 - .7 Review of DDC Network Diagram for building.
 - .8 Review of shop drawings for building.
 - .9 Detailed discussion of sequences of operation

- .10 Walk through of mechanical systems.
- .2 Phase 2: 1 day program for operators, equipment maintenance personnel and programmers.
 - .1 Provide multiple instructors on pre-arranged schedule. Include at least
 - .1 Operator training: provide operating personnel, maintenance personnel and programmers with condensed version of Phase 1 training.
 - .2 Equipment maintenance training: provide personnel training in maintenance of EMCS equipment, including general equipment layout, trouble shooting and preventative maintenance of EMCS components, maintenance and calibration of sensors and controls.
 - .3 Programmers: provide personnel with training in following subjects in approximate percentages of total course shown:
 - .1 Software and architecture: 10%
 - .2 Application programs: 15%
 - .3 Controller programming: 50%
 - .4 Trouble shooting and debugging:10%
 - .5 Colour graphic generation: 15%
 - .6 Display and interpret summaries
 - .7 Command points
 - .8 Modify points and point groups
 - .9 Define trend logs
 - .10 Schedule and print reports

1.10 ADDITIONAL TRAINING

- .1 List courses offered by name, duration and approximate cost per person per week. Note courses recommended for training supervisory personnel.

1.11 MONITORING OF TRAINING

- .1 City of Winnipeg Representative to monitor training program and may modify schedule and content.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

- .1 Section Includes:
 - .1 General requirements for building Energy Monitoring and Control System (EMCS) that are common to EMCS Sections.

1.2 RELATED SECTIONS

- .1 The Contractor is to ensure that all related work is co-ordinated among all specification sections, as well as between other Divisions, and that the tender price includes all related work. The referenced sections below are for guidance only and are not necessarily a complete list of related sections.
 - .1 Section 01 33 00 – Submittal Procedures.
 - .2 Section 01 70 12 –Safety Requirements.
 - .3 Section 01 74 19 – Construction/Demolition Waste Management and Disposal.
 - .4 Section 01 91 13 – General Commissioning (Cx) Requirements.
 - .5 Section 09 91 00 - Interior Painting.
 - .6 Section 25 01 11 - EMCS: Start-up, Verification and Commissioning.
 - .7 Section 25 01 12 - EMCS: Training.
 - .8 Section 25 05 02 - EMCS: Submittals and Review Process.
 - .9 Section 25 05 03 - EMCS: Project Record Documents.
 - .10 Section 25 05 54 - EMCS: Identification.
 - .11 Section 25 05 60 - EMCS: Field Installation.
 - .12 Section 25 08 20 - EMCS: Warranty and Maintenance.
 - .13 Section 25 10 01 - EMCS: Local Area Network (LAN).
 - .14 Section 25 30 01 - EMCS: Building Controllers
 - .15 Section 25 30 02 - EMCS: Field Control Devices.
 - .16 Section 25 90 01 - EMCS: Site Requirements, Applications and Systems Sequences of Operation.

1.3 REFERENCES

- .1 American National Standards Institute (ANSI)
 - .1 ANSI/ISA 5.5, Graphic Symbols for Process Displays.

- .2 American National Standards Institute (ANSI)/ Institute of Electrical and Electronics Engineers (IEEE).
 - .1 ANSI/IEEE 260.1, American National Standard Letter Symbols Units of Measurement (SI Units, Customary Inch-Pound Units, and Certain Other Units).
- .3 American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE).
 - .1 ASHRAE STD 135, BACNET - Data Communication Protocol for Building Automation and Control Network.
- .4 Canadian Standards Association (CSA International).
 - .1 CAN/CSA-Z234.1, Canadian Metric Practice Guide.
- .5 Consumer Electronics Association (CEA).
 - .1 CEA-709.1-B, Control Network Protocol Specification.
- .6 Department of Justice Canada (Jus).
 - .1 Canadian Environmental Assessment Act (CEAA).
 - .2 Canadian Environmental Protection Act (CEPA).
- .7 Health Canada/Workplace Hazardous Materials Information System (WHMIS).
 - .1 Material Safety Data Sheets (MSDS).
- .8 Transport Canada (TC).
 - .1 Transportation of Dangerous Goods Act (TDGA).
- .9 National Electrical Manufacturers Association (NEMA)
- .10 TIA/EIA-862 Building Automation Systems Cabling Standard For Commercial Buildings

1.4 ACRONYMS, ABBREVIATIONS AND DEFINITIONS

- .1 Acronyms used in EMCS.
 - .1 AEL - Average Effectiveness Level
 - .2 AI - Analog Input
 - .3 AO - Analog Output
 - .4 BACnet - Building Automation and Control Network
 - .5 BC(s) - Building Controller(s)
 - .6 CAB - Canadian Automated Building (CAB) Protocol
 - .7 CAD - Computer Aided Design
 - .8 CDL - Control Description Logic
 - .9 CDS - Control Design Schematic
 - .10 CMS - Central Monitoring Station
 - .11 COSV - Change of State or Value

- .12 CPU - Central Processing Unit
- .13 DI - Digital Input
- .14 DO - Digital Output
- .15 DP - Differential Pressure
- .16 ECU - Equipment Control Unit
- .17 EMCS - Energy Monitoring and Control System
- .18 HVAC - Heating, Ventilation, Air Conditioning
- .19 IDE - Interface Device Equipment
- .20 I/O - Input/Output
- .21 ISA - Industry Standard Architecture
- .22 LAN - Local Area Network
- .23 LCU - Local Control Unit
- .24 MCU - Master Control Unit
- .25 NC - Normally Closed
- .26 NO - Normally Open
- .27 OS - Operating System
- .28 O&M - Operation and Maintenance
- .29 PC - Personal Computer
- .30 PCI - Peripheral Control Interface
- .31 PCMCIA - Personal Computer Micro-Card Interface Adapter
- .32 PID - Proportional, Integral and Derivative.
- .33 RAM - Random Access Memory
- .34 ROM - Read Only Memory
- .35 SP - Static Pressure
- .36 TCU - Terminal Control Unit
- .37 USB - Universal Serial Bus
- .38 UPS - Uninterruptible Power Supply
- .39 WAN- Wide Area Network

1.5 DEFINITIONS

- .1 Point: may be logical or physical.
 - .1 Logical points: values calculated by system such as setpoints, totals, counts, derived corrections and may include, but not limited to result of and statements in CDL's.

- .2 Physical points: inputs or outputs which have hardware wired to controllers which are measuring physical properties, or providing status conditions of contacts or relays which provide interaction which related equipment (stop, start) and value or damper actuators.
- .2 Point Name: composed of two parts, point identifier and point expansion.
 - .1 Point identifier: comprised of three descriptors, “area” descriptor, “system” descriptor and “point” descriptor, for which database to provide 25 character field for each point identifier. “System” is system that point is located on.
 - .1 Area descriptor: building or part of building where point is located.
 - .2 System descriptor: system that point is located on.
 - .3 Point descriptor: physical logical point description. For point identifier “area”, “system” and “point” will be shortforms or acronyms. Database must provide 25 character field for each point identifier.
 - .2 Point expansion: comprised of three fields, one for each descriptor. Expanded form of shortform or acronym used in “area”, “system”, and “point” descriptors is placed into appropriate point expansion field. Database must provide 32 character field for each point expansion.
 - .3 Bilingual systems to include additional point identifier expansion fields of equal capacity for each point name for second language.
 - .4 System to support use of numbers and readable characters including blanks, periods or underscores to enhance user readability for each of the above strings.
- .3 Point Object Type: points fall into following object types:
 - .1 AI (analog input)
 - .2 AO (analog output)
 - .3 DI (digital input)
 - .4 DO (digital output)
 - .5 Pulse inputs
 - .6 BACnet multifunction connections.
- .4 Symbols and engineering unit abbreviations utilized in displays: to ANSI/ISA S5.5.
 - .1 Printouts: to ANSI/IEEE 260.1.
 - .2 Refer also to Section 25 05 54 - EMCS: Identification.

1.6 SYSTEM DESCRIPTION

- .1 Refer to control schematics, sequences of operation and related Divisions of specifications for system architecture.
- .2 Work covered by sections referred to above consists of fully operational BTL certified EMCS, including, but not limited to, following:
 - .1 Building Controllers.

- .2 Control devices as listed in I/O point summaries and/or shown on the control drawings.
- .3 Interface to the existing City of Winnipeg Extended Application and Data Server (ADX).
- .4 Data communications equipment necessary to affect EMCS data transmission system.
- .5 Field control devices.
- .6 Software/Hardware complete with full documentation.
- .7 Complete operating and maintenance manuals.
- .8 Training of personnel.
- .9 Acceptance tests, technical support during commissioning, full documentation.
- .10 Wiring interface co-ordination of equipment supplied by others.
- .11 Miscellaneous work as specified in these sections and as indicated.
- .3 Design Requirements:
 - .1 Design and provide conduit and wiring linking elements of system.
 - .2 Supply sufficient programmable controllers of types to meet project requirements. Quantity and points contents as reviewed prior to installation.
 - .3 Location of controllers.
 - .4 Provide utility power to EMCS.
 - .5 Metric references: in accordance with CAN/CSA Z234.1.
 - .6 All new building EMCS Controllers shall be network capable and be connected and integrated to the appropriate existing City of Winnipeg infrastructure where applicable.
- .4 Language Operating Requirements:
 - .1 Provide English interface to system through operator selectable access codes.
 - .2 Use non-linguistic symbols for displays on graphic terminals wherever possible. Other information to be in English.
 - .3 Operating system executive: provide primary hardware-to-software interface specified as part of hardware purchase with associated documentation to be in English.
 - .4 System manager software: include in English system definition point database, additions, deletions or modifications, control loop statements, use of high level programming languages, report generator utility and other OS utilities used for maintaining optimal operating efficiency.
- .5 Include, in English:
 - .1 Input and output commands and messages from operator-initiated functions and field related changes and alarms as defined in CDL's or assigned limits (i.e. commands relating to day-to-day operating functions and not related to system modifications, additions, or logic re-definitions).

- .2 Graphic "display" functions, point commands to turn systems on or off, manually override automatic control of specified hardware points. Point name expansions in both languages.
- .3 Reporting function such as trend log, trend graphics, alarm report logs, energy report logs, maintenance generated logs.
- .6 The network design to be a fully distributed network, with each primary system having its own locally mounted dedicated controller. Any failure in the network shall **not** in any way affect the control of these primary systems. Connecting hardware points from one system to more than one controller is not acceptable. Any points associated with a system are to be connected to one dedicated controller. Each dedicated controller to have a locally mounted control and display device to allow the operator to view and adjust any point on the controller.
- .7 All wiring associated with the EMCS communication network as well as all control wiring and conduit associated with the EMCS at 50 volts or less. Wire and conduit above 50 volts by Division 26.
- .8 BACnet compliance: full compliance to the BACnet standard (ANSA/ASHRAE) 135, BACnet – A Data communication Protocol for Building Automation and Control Networks is mandatory. Down to the field device level, the EMCS system must meet BACnet standards for system architecture and administration, and use open communication protocols and user friendly programming and graphics. Install the EMCS to communicate at the supervisory layer to the WAN using the BACnet TCP/IP protocol implemented on Ethernet.
- .9 The EMCS system for this facility to be accessible by designated personnel via the WAN for monitoring and programming purposes. The EMCS Subcontractor to provide all the required hardware, software, switches, gateways, wiring, conduit, etc. needed to permit connection of the EMCS to the WAN. This shall include all hardware, software, programming, start-up and commissioning required.

1.7 SUBMITTALS

- .1 Make submittals in accordance with Section 01 33 00 - Submittal Procedures and 25 05 02 - EMCS: Submittals and Review Process.
- .2 Submit for review:
 - .1 Equipment list and systems manufacturers within 10 days after award of contract.
- .3 Quality Control:
 - .1 Provide equipment and material from manufacturer's regular production, CSA certified, manufactured to standard quoted plus additional specified requirements.
 - .2 Where CSA certified equipment is not available submit such equipment to inspection authorities for special inspection and approval before delivery to site.
 - .3 Submit proof of compliance to specified standards with shop drawings and product data in accordance with Section 25 05 02 – EMCS: Submittals and

- Review Process. Label or listing of specified organization is acceptable evidence.
- .4 In lieu of such evidence, submit certificate from testing organization, approved by third party Engineer registered in Canada, certifying that item was tested in accordance with their test methods and that item conforms to their standard/code.
- .5 For materials whose compliance with organizational standards/codes/specifications is not regulated by organization using its own listing or label as proof of compliance, furnish certificate stating that material complies with applicable referenced standard or specification.
- .6 Permits and fees: in accordance with general conditions of contract.

1.8 QUALITY ASSURANCE

- .1 Have local office staffed by factory trained personnel capable of installing and providing instruction, routine maintenance and emergency service on systems outlined herein.
- .2 Provide record of successful previous installations submitting tender showing experience with similar installations utilizing computer-based systems.
- .3 Have access to local supplies of essential parts and provide 7 year guarantee of availability of spare parts after obsolescence.
- .4 Ensure factory qualified supervisory personnel continuously direct and monitor work and attend site meetings.
- .5 Health and Safety:
 - .1 Do construction occupational health and safety in accordance with Section 01 70 12 - Safety Requirements.
- .6 Be able to provide factory trained personnel on site within 24 hours notice or provide instructions on maintenance and emergency service on system.
- .7 BACnet devices to bear BACnet testing laboratories BTL mark and listed on BACnet manufacturers association web site.

1.9 DELIVERY, STORAGE AND HANDLING

- .1 Material Delivery Schedule: provide "Materials Delivery Schedule" within 2 weeks after award of contract.
- .2 Waste Management and Disposal:
 - .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
 - .2 Remove from site and dispose of packaging materials at appropriate recycling facilities.
 - .3 Collect and separate for disposal paper, plastic, polystyrene and corrugated cardboard packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.

- .4 Separate for reuse and recycling and place in designated containers Steel, Metal, Plastic waste in accordance with Waste Management Plan.
- .5 Place materials defined as hazardous or toxic in designated containers.
- .6 Handle and dispose of hazardous materials in accordance with Regional, Municipal, and Provincial regulations.
- .7 Label location of salvaged material's storage areas and provide barriers and security devices.
- .8 Ensure emptied containers are sealed and stored safely.
- .9 Divert unused metal materials from landfill to metal recycling facility.
- .10 Fold up metal and plastic banding, flatten and place in designated area for recycling.

1.10 SCOPE OF WORK

- .1 Include in mechanical section, provision of labour, new materials, tools, transportation, services and facilities for a complete mechanical installation. The installation shall be left complete in all respects and ready for operation. Final installation shall be to the complete satisfaction of the City of Winnipeg Representative.
- .2 Mechanical trade and subtrades shall allow for additional personnel and coordination time as required to assist the Integrated Testing Coordinator in functional testing and reporting of fire protection and life safety systems for compliance with CAN/ULC S-1001 - Integrated Systems Testing of Fire Protection Systems and Life Safety Systems. Mechanical equipment affected by the integrated testing includes but is not limited to, combination fire/smoke dampers, equipment interlocks and shutdown.
 - .1 Coordinate with Electrical Subcontractor for HVAC equipment shutdown and interlock with the fire alarm system.
- .3 The successful mechanical Subcontractor shall be responsible for all sub-trades providing mechanical services to complete this project.
- .4 New Construction:
 - .1 Provide for the complete installation of an integrated control system (EMCS) consisting of but not limited to: intermediate direct digital control (DDC) panels; switches, hubs, wiring; electric and electronic damper actuators, valves, sensors; control transformers. All equipment to be 100% compatible with Native BACnet EMCS Communication Protocol presently utilized by City of Winnipeg. Building EMCS shall be expanded to accommodate the integral VRF system control system architecture outlined herein.
 - .2 All heating, ventilation, air conditioning, and plumbing equipment and installation shall meet or exceed the energy performance criteria in compliance with LEED design requirements.
 - .3 Coordinate with Electrical Subcontractor all electrical lockout relays required to prevent simultaneous heating and cooling in temperature controlled zones where fan coils also utilize electric heaters.
- .5 City of Winnipeg EMCS – Supplementary Specification Requirements

- .1 The EMCS Subcontractor shall provide and install all essential hardware and software to interface to the existing City of Winnipeg Extended Application and Data Server (ADX).
- .2 The EMCS Subcontractor shall design the Metasys User Interface (MUI), to match the existing system. MUI graphics shall use the City of Winnipeg templates.
- .3 The EMCS Subcontractor will not have access to the City of Winnipeg SCT server. All MUI files shall be provided by the EMCS Subcontractor in the correct format for merging into the existing system with support from the City of Winnipeg.
- .4 The EMCS Subcontractor shall create or add MUI user views to match existing structure.
- .5 There is an existing central monitoring system in place. All Direct Digital Controller (DDC) points are identified as centrally monitored points.
- .6 All new controls shall be the Series Network Engine (SNE-XX000) supervisory controller which will utilize BACnet/IP and \ or MS/TP field controllers. The EMCS Subcontractor is required to meet with the City of Winnipeg for additional requests if the SNE-XX000 is not in the projects design or additional requirements are required. See note #2 and 3.
- .7 Field Controllers shall communicate through BACnet/IP or MSTP bus to a SNE-XX000 supervisory controller. See note #1, and 2.
- .8 No LON protocols are to be accepted.
- .9 The EMCS Subcontractor to provide commissioning sheets for all points on field devices.
- .10 The EMCS Subcontractor to communicate with equipment provider to ensure proper field point integration as well as controllability of the equipment, if not package controls.
- .11 If Other vendor (non-JCI) controls are to be used then a seamless integration must be proven before approval will be given. See note #1 and 4.
- .12 Notes:
 - .1 The term BACnet refers to an industry standard protocol which complies with ASHRAE, and must be listed with the BACnet International / BACnet Testing Laboratories (BI/BTL). Basically, states that all devices using the BACnet technology will be able to communicate to each other. The EMCS Subcontractor performing the controller installation should confirm that all devices specified are able to communicate to the proposed devices. Then supply documentation such that all devices supplied will communicate to each other as required for proper operation of the system (PICS Statement, BI/BTL Listing, and ASHRAE listings).
 - .2 If the Metasys Series Network Engine (SNE) are to be installed on the project then the version of these devices and their software must be such that the City of Winnipeg does not be required to update/upgrade the existing ADX server in order for all user views, alarms, and point monitoring to occur. The EMCS Subcontractor must co-ordinate with City staff to determine the correct version to be installed.

- .3 If the Metasys Series Network Engine (SNE) is existing, the EMCS Subcontractor is required to meet with the City of Winnipeg for additional directions.
- .4 All points must be integrated back to the City of Winnipeg ADX server. Important: The only way to bring points into the ADX server is to route them through a Johnson Controls supervisory device.

1.11 SUBSTANTIAL COMPLETION INSPECTION

- .1 Advise City of Winnipeg Representative seven (7) days prior to the date inspection is desired. All systems to be fully operational and any deficiencies should be.
- .2 All deficiencies shall be completed within a timely manner after substantial completion and a letter submitted to City of Winnipeg Representative within that time advising that the work is complete with comments on work done.
- .3 The following shall be an outline checklist of the minimum requirements to be met by the EMCS Subcontractor prior to the Substantial Performance inspection.

Inspection:

- .1 Controls Commissioning, Checklist and 15 day trend logs for all major equipment (AHU's, Boiler Plants, VRF, AC equipment, ERV).
- .2 Major equipment – suppliers start-up test sheets and letters certifying start up and controls interconnections. (boilers, pumps, packaged equipment, VRF).
- .3 Final As-Built Drawings ready for review.

PART 2 - PRODUCTS

2.1 ACCEPTABLE SYSTEMS, MANUFACTURERS

- .1 JCI – MetasysMUI.
- .2 Proposed system to have communication capability utilizing BACnet Protocol. All equipment and installations to be 100% compatible with Native BACnet EMCS Communication Protocol.
- .3 Panel to be NEMA rated to suit environmental requirements.
- .4 Panels to have hinged doors equipped with standard keyed-alike cabinet locks, keyed to same key.
- .5 Wiring within panels to be contained within properly sized rigid PVC slotted wall wire duct. All wiring within the wire duct to be concealed with a non-slip cover.
- .6 Terminations for the connection of power wiring, communication wiring and field mounted devices to be at properly identified terminal blocks mounted within the control

- panel.
- .7 Terminations shall be installed with a demarcation point (connected via multimedia outlet with a patch cord).
 - .8 All control panels to be provided with an internally mounted 120 volt duplex power receptacle.
 - .9 All control panels to be identified with permanently mounted Lamecoid tags to identify the control panel and the systems served by the control panel. Submit schedule of labels with shop drawing submission.
 - .10 Provide low voltage transformers in panels or elsewhere as required.
 - .11 Provide adaptors between metric and imperial components.

PART 3 - EXECUTION

3.1 MANUFACTURER'S RECOMMENDATIONS

- .1 Installation to be to manufacturer's recommendations. Provide printed copies of recommendations with shop drawings or product data.

3.2 PAINTING

- .1 Painting to be in accordance with Section 09 91 00 – Interior Painting..
- .2 Clean and touch up marred or scratched surfaces of factory finished equipment to match original finish.
- .3 Restore to new condition, finished surfaces which have been damaged too extensively to be primed and touched up to make good.
- .4 Clean and prime exposed hangers, racks, fastenings, and other support components.
- .5 Paint all unfinished equipment installed indoors to EEMAC 2Y-1.

END OF SECTION

PART 1 GENERAL

1.1 SUMMARY

- .1 Section Includes.
 - .1 Methods and procedures for shop drawings submittals, preliminary and detailed review process include review meetings for building Energy Monitoring and Control System (EMCS).

1.2 RELATED SECTIONS

- .1 The Contractor is to ensure that all related work is co-ordinated among all specification sections as well as between all Divisions, and that the tender price includes all related work. The referenced sections below are for guidance only and are not necessarily a complete list of related sections.
 - .1 Section 01 33 00 - Submittal Procedures.
 - .2 Section 25 01 11 - EMCS: Start-up, Verification and Commissioning.
 - .3 Section 25 05 01 - EMCS: General Requirements.

1.3 DEFINITIONS

- .1 Acronyms and definitions: refer to Section 25 05 01 - EMCS: General Requirements.

1.4 DESIGN REQUIREMENTS

- .1 Preliminary Design Review: to contain following EMCS Subcontractor and systems information.
 - .1 Location of local office.
 - .2 Description and location of installing and servicing technical staff.
 - .3 Location and qualifications of programming design and programming support staff.
 - .4 List of spare parts.
 - .5 Location of spare parts stock.
 - .6 Names of sub-contractors and site-specific key personnel.
 - .7 Sketch of site-specific system architecture.
 - .8 Specification sheets for each item including memory provided, programming language, speed, type of data transmission.
 - .9 Descriptive brochures.
 - .10 Sample CDL and graphics (systems schematics).
 - .11 Response time for each type of command and report.
 - .12 Item-by-item statement of compliance.
 - .13 Proof of demonstrated ability of system to communicate utilizing BACnet protocol.

1.5 SUBMITTALS

- .1 Submittals in accordance with Section 01 33 00 - Submittal Procedures and coordinate with requirements in this Section.
- .2 Submit preliminary design document within 30 working days after contract award for review.
- .3 Shop Drawings to consist of 3 hard copies and 1 soft copy of design documents, shop drawings, product data and software.
- .4 Hard copy to be completely indexed and coordinated package to assure compliance with contract requirements and arranged in same sequence as specification and cross-referenced to specification section and paragraph number.
- .5 Soft copy to be in AutoCAD - latest version and Microsoft Word latest version format, or PDF structured using menu format for easy loading and retrieval.
- .6 Submittals shall consist of:
 - .1 Data sheets of all products.
 - .2 Wiring and piping interconnection diagrams including panel and device power, and sources.
 - .3 List of materials of all proposed devices and equipment.
 - .4 Software documentation:
 - .5 Sequence of operation, in text form.
 - .6 Application programs.
 - .7 Point Schedules
 - .8 Controls schematics and system diagrams.
 - .9 Project installation schedule.
 - .10 Names of subtrades working for EMCS Subcontractor.
 - .11 Mounting support details for components installed in airflow, waterflow and steam systems.
- .7 Submit shop drawings in a package which contains the various schedules and drawings which completely describe the control system installed.
- .8 Network drawing showing the network connection of all network control units, programmable control units, terminal control units and interconnection with the existing City of Winnipeg Controls systems to indicate the location of each of these elements.
- .9 Schematic control diagram for each system being controlled. Where there are typical systems a drawing to be provided for each system. This drawing to be on a AB size sheet (11 x 17) and shall include a title block which includes as a minimum the drawing title, drawing number, project title, EMCS Subcontractor's name, EMCS Subcontractor's address, EMCS Subcontractor's phone and fax numbers, EMCS Subcontractor's project number and a section to provide a record for revision information.
- .10 The schematic control diagram to include a bill of materials which provides a list of all part numbers and descriptions for the control components on the drawing list to include field equipment as well as panel mounted components.

- .11 The schematic control diagram to include a complete wiring diagram for all electrical connections, including motor starters, heating coils, coiling coils etc.
- .12 The schematic control diagram to include a layout of the control panels for each system. This layout to show the mounting of all panel equipment, including transformers, power supplies, controllers, transducers, sensors, relays, contactors and any other panel mounted equipment.
- .13 The EMCS Subcontractor to include with the shop drawing submittal drawings, showing all wiring details for the connections of sensors, transducers, relays and contactors these details to show terminal numbers and be referenced to the appropriate schedules and drawings.
- .14 The EMCS Subcontractor to supply with the shop drawing package a complete point schedule to show every point connected to the system. This schedule to be in tabular format and provide the point identification, point type, wire tag, termination details reference, referenced drawings, device mounting location and device code numbers.
- .15 The point schedule to provide at a minimum the following information on the software attributes of the point:
 - .1 Tag name – ex. EPT-1
 - .2 Point type – ex. AO-3
 - .3 System name – ex. A/C-1
 - .4 Object name – H-VLV.
 - .5 Expanded ID- Heating control valve
 - .6 Units of measurement - %.
- .16 The point schedule to provide at a minimum the following information on the digital controller to which the point is connected:
 - .1 Controller type – ex. Unitary controller
 - .2 Controller address ex. 256.
 - .3 Cable destination – the termination at the controller, ex. AO-1.
 - .4 Terminal numbers – the termination at the controller.
- .17 The point schedule to provide at minimum the following information on the control panel:
 - .1 Panel identification
 - .2 Panel location
 - .3 Reference drawing
- .18 The point schedule to provide at a minimum the following information on any intermediate device which may be associated with the point:
 - .1 Type of wiring or tubing used
 - .2 Device part number
 - .3 Location of the device.
 - .4 Reference details.
- .19 The point schedule to provide at a minimum the following information on any field device which may be associated with the point;

- .1 Type of wiring or tubing used
- .2 Device part number
- .3 Location of the devices
- .4 Reference details
- .20 The EMCS Subcontractor to supply with the shop drawing package a complete room schedule, to show the equipment associated with the room controls. Schedule to be in tabular format and provide the room number and location, terminal unit number, part numbers for the terminal unit controller, sensors and actuators. Included on this schedule terminal unit type, size, minimum flow and maximum flow.
- .21 Sequence of operation for each system controlled. Sequence to be in complete conformance with the sequence of operations included with this specification. Any changes require the approval of the City of Winnipeg Representative in writing. Sequence to include all modes of operation including fail safe, emergency and fire modes.
- .22 Valve schedule including design flow, CV, size, type, actuator, pressure drop and maximum shut off pressure differential for each control valve.
- .23 Damper schedule including design air flow, size, type actuator and torque requirements for each control damper.
- .24 Provide one permanent, not fading, as built copy of each control drawing, enclosed by an aluminium frame with glass cover, or sealed by plastic laminate in rigid metal bound frame. To be installed at each respective control panel location.
- .25 Catalogue cut sheets of all equipment used. This includes, but is not limited to DDC panels, peripherals, sensors, actuators, dampers, control air system components, etc.
- .26 Range and scale information for all transmitters and sensors. This sheet to clearly indicate one device and any applicable options. Where more than one device to be used is on a single sheet, submit two sheets, individually marked.
- .27 Hardware data sheets for all local access panels, and portable operator terminals.
- .28 Software manuals for all applications programs to be provided as a part of the portable operator terminals, programming devices, and so forth for review.

1.6 PRELIMINARY SHOP DRAWING REVIEW

- .1 Submit preliminary shop drawings within 30 working days of award of contract and include following:
 - .1 Specification sheets for each item. To include manufacturer's descriptive literature, manufacturer's installation recommendations, specifications, drawings, diagrams, performance and characteristic curves, catalogue cuts, manufacturer's name, trade name, catalogue or model number, nameplate data, size, layout, dimensions, capacity, other data to establish compliance.
 - .2 Detailed system architecture showing all points associated with each controller including, signal levels, pressures where new EMCS ties into existing control equipment.

- .3 Spare point capacity of each controller by number and type.
- .4 Controller locations.
- .5 Auxiliary control cabinet locations.
- .6 Single line diagrams showing cable routings, conduit sizes, spare conduit capacity between control centre, field controllers and systems being controlled.
- .7 Valves: complete schedule listing including following information: designation, service, manufacturer, model, point ID, design flow rate, design pressure drop, required Cv, Valve size, actual Cv, spring range, pilot range, required torque, actual torque and close off pressure (required and actual).
- .8 Dampers: sketches showing module assembly, interconnecting hardware, operator locations, operator spring range, pilot range, required torque, actual torque.
- .9 Flow measuring stations: complete schedule listing designation, service, point ID, manufacturer, model, size, velocity at design flow rate, manufacturer, model and range of velocity transmitter.
- .10 Compressor schematic and sizing data.

1.7 DETAIL SHOP DRAWING REVIEW

- .1 Submit detailed shop drawings within 60 working days after award of contract and before start of installation and include following:
 - .1 Corrected and updated versions (hard copy only) of submissions made during preliminary review.
 - .2 Wiring diagrams.
 - .3 Piping diagrams and hook-ups.
 - .4 Interface wiring diagrams showing termination connections and signal levels for equipment to be supplied by others.
 - .5 Shop drawings for each input/output point, sensors, transmitters, showing information associated with each particular point including:
 - .1 Sensing element type and location.
 - .2 Transmitter type and range.
 - .3 Associated field wiring schematics, schedules and terminations.
 - .4 Complete Point Name Lists.
 - .5 Setpoints, curves or graphs and alarm limits (high and low, 3 types critical, cautionary and maintenance), signal range.
 - .6 Software and programming details associated with each point.
 - .7 Manufacturer's recommended installation instructions and procedures.
 - .8 Input and output signal levels.
 - .6 Control schematics, narrative description, CDL's fully showing and describing automatic and manual procedure required to achieve proper operation of project, including under complete failure of EMCS.
 - .7 Graphic system schematic displays of air and water systems with point identifiers and textual description of system, and typical floor plans as specified.
 - .8 Complete system CDL's including companion English language explanations on same sheet but with different font and italics. CDL's to contain specified energy optimization programs.

- .9 Listing of and example of specified reports.
- .10 Listing of time of day schedules.
- .11 Mark up to-scale construction drawing to detail control room showing location of equipment and operator work space.
- .12 Type and size of memory with statement of spare memory capacity.
- .13 Full description of software programs provided.
- .14 Sample of "Operating Instructions Manual" to be used for training purposes.
- .15 Outline of proposed start-up and verification procedures. Refer to Section 25 01 11 – EMCS: Start-up, Verification and Commissioning.

1.8 QUALITY ASSURANCE

- .1 Preliminary Design Review Meeting: Convene meeting within 45 working days of award of contract to:
 - .1 Undertake functional review of preliminary design documents, resolve inconsistencies.
 - .2 Resolve conflicts between contract document requirements and actual items (e.g.: points list inconsistencies).
 - .3 Review interface requirements of materials supplied by others.
 - .4 Review "Sequence of Operations".
- .2 EMCS Subcontractor's factory trained programmer to attend meeting.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

PART 1 GENERAL

1.1 SUMMARY

- .1 Section Includes.
 - .1 Requirements and procedures for final control diagrams and operation and maintenance (O&M) manual, for building Energy Monitoring and Control System (EMCS) Work.

1.2 Related Sections

- .1 Section 01 78 00 - Closeout Submittals.
- .2 Section 25 01 11 - EMCS: Start-up, Verification and Commissioning.
- .3 Section 25 05 01 - EMCS: General Requirements.
- .4 Section 25 05 02 - EMCS: Submittals and Review Process.

1.3 DEFINITIONS

- .1 For additional acronyms and definitions refer to Section 25 05 01 - EMCS: General Requirements

1.4 SUBMITTALS

- .1 Submittals in accordance with Section 01 78 00 - Closeout Procedures, supplemented and modified by requirements of this Section.
- .2 Submit Record Documents, As-built drawings, Operation and Maintenance Manual to City of Winnipeg Representative in English.
- .3 Provide soft copies and hard copies in hard-back, 50 mm 3 ring, D-ring binders.
 - .1 Binders to be 2/3 maximum full.
 - .2 Provide index to full volume in each binder.
 - .3 Identify contents of each manual on cover and spine.
 - .4 Provide Table of Contents in each manual.
 - .5 Assemble each manual to conform to Table of Contents with tab sheets placed before instructions covering subject.

1.5 AS-BUILTS

- .1 Provide 1 copy of detailed shop drawings generated in Section 25 05 02 - EMCS: Submittals and Review Process and include:
 - .1 Changes to contract documents as well as addenda and contract extras.

- .2 Changes to interface wiring.
 - .3 Routing of conduit, wiring and control air lines associated with EMCS installation.
 - .4 Locations of obscure devices to be indicated on drawings.
 - .5 Listing of alarm messages.
 - .6 Panel/circuit breaker number for sources of normal/emergency power.
 - .7 Names, addresses, telephone numbers of each sub-contractor having installed equipment, local representative for each item of equipment, each system.
 - .8 Test procedures and reports: provide records of start-up procedures, test procedures, checkout tests and final commissioning reports as specified in Section 25 01 11 - EMCS: Start-up, Verification and Commissioning.
 - .9 Basic system design and full documentation on system configuration.
- .2 Submit for final review by City of Winnipeg Representative.
 - .3 Provide before acceptance 4 hard and 1 soft copy incorporating changes made during final review.

1.6 O&M MANUALS

- .1 Custom design O&M Manuals (both hard and soft copy) to contain material pertinent to this project only, and to provide full and complete coverage of subjects referred to in this Section.
- .2 Provide 2 complete sets of hard and soft copies prior to system or equipment tests.
- .3 Include complete coverage in concise language, readily understood by operating personnel using common terminology of functional and operational requirements of system. Do not presume knowledge of computers, electronics or in-depth control theory.
- .4 Functional description to include:
 - .1 Functional description of theory of operation.
 - .2 Design philosophy.
 - .3 Specific functions of design philosophy and system.
 - .4 Full details of data communications, including data types and formats, data processing and disposition data link components, interfaces and operator tests or self-test of data link integrity.
 - .5 Explicit description of hardware and software functions, interfaces and requirements for components in functions and operating modes.
 - .6 Description of person-machine interactions required to supplement system description, known or established constraints on system operation, operating procedures currently implemented or planned for implementation in automatic mode.
- .5 System operation to include:
 - .1 Complete step-by-step procedures for operation of system including required actions.
 - .2 Operation of computer peripherals, input and output formats.
 - .3 Emergency, alarm and failure recovery.
 - .4 Step-by-step instructions for start-up, back-up equipment operation, execution of systems functions and operating modes, including key strokes for each command so

that operator need only refer to these pages for keystroke entries required to call up display or to input command.

- .6 Software to include:
 - .1 Documentation of theory, design, interface requirements, functions, including test and verification procedures.
 - .2 Detailed descriptions of program requirements and capabilities.
 - .3 Data necessary to permit modification, relocation, reprogramming and to permit new and existing software modules to respond to changing system functional requirements without disrupting normal operation.
 - .4 Software modules, fully annotated source code listings, error free object code files ready for loading via peripheral device
 - .5 Complete program cross reference plus linking requirements, data exchange requirements, necessary subroutine lists, data file requirements, other information necessary for proper loading, integration, interfacing, program execution.
 - .6 Software for each Controller and single section referencing Controller common parameters and functions.
- .7 Maintenance: document maintenance procedures including inspection, periodic preventive maintenance, fault diagnosis, repair or replacement of defective components, including calibration, maintenance, repair of sensors, transmitters, transducers, controller and interface firmware, plus diagnostics and repair/replacement of system hardware.
- .8 System configuration document:
 - .1 Provisions and procedures for planning, implementing and recording hardware and software modifications required during operating lifetime of system.
 - .2 Information to ensure co-ordination of hardware and software changes, data link or message format/content changes, sensor or control changes in event that system modifications are required.
- .9 Programmer control panel documentation: provide where panels are independently interfaced with building EMCS and existing CMS, including interfacing schematics, signal identification, timing diagrams, fully commented source listing of applicable driver/handler.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

Part 1 GENERAL

1.1 SUMMARY

- .1 Section Includes.
 - .1 Requirements and procedures for identification of devices, sensors, wiring, tubing, conduit and equipment, for building Energy Monitoring and Control System (EMCS) Work and nameplates, materials, colours and lettering sizes.

1.2 Related Sections

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 25 05 01 - EMCS: General Requirements.

1.3 REFERENCES

- .1 Canadian Standards Association (CSA International).
 - .1 CSA C22.1, The Canadian Electrical Code, Part I, Safety Standard for Electrical Installations.

1.4 DEFINITIONS

- .1 For acronyms and definitions refer to Section 25 05 01 - EMCS: General Requirements.

1.5 SYSTEM DESCRIPTION

- .1 Language Operating Requirements: provide identification for control items in English.
- .2 Use color coded communication cables, matched throughout system.

1.6 SUBMITTALS

- .1 Submittals in accordance with Section 01 33 00 - Submittal Procedures and Section 25 05 02 – EMCS: Submittals and Review Process supplemented and modified by requirements of this Section.
- .2 Submit to City of Winnipeg Representative for approval samples of nameplates, identification tags and list of proposed wording.

Part 2 PRODUCTS

2.1 NAMEPLATES FOR PANELS

- .1 Identify by plastic laminate, 3 mm thick melamine, matt white finish, black core, square corners, lettering accurately aligned and engraved into core, mechanically attached with self-tapping screws.
- .2 Sizes: 25 x 67 mm minimum.
- .3 Lettering: minimum 7 mm high, black.
- .4 Inscriptions: machine engraved to identify function.

2.2 NAMEPLATES FOR FIELD DEVICES

- .1 Identify by plastic encased cards attached by plastic tie.
- .2 Sizes: 50 x 100 mm minimum.
- .3 Lettering: minimum 5 mm high produced from laser printer in black.
- .4 Data to include: point name and point address, make, model number.
- .5 Companion cabinet: identify interior components using plastic enclosed cards with point name and point address.

2.3 NAMEPLATES FOR ROOM SENSORS

- .1 Identify by stick-on labels using point identifier.
- .2 Location: as directed by City of Winnipeg Representative.
- .3 Letter size: to suit, clearly legible.

2.4 WARNING SIGNS

- .1 Equipment including motors, starters under remote automatic control: supply and install orange coloured signs warning of automatic starting under control of EMCS.
- .2 Sign to read: "Caution: This equipment is under automatic remote control of EMCS".

2.5 WIRING

- .1 Supply and install numbered tape markings on wiring at panels, junction boxes, splitters, cabinets and outlet boxes.
- .2 Colour coding: to CSA C22.1. Use colour coded wiring in communications cables, matched throughout system.

- .3 Power wiring: identify circuit breaker panel/circuit breaker number inside each EMCS panel.
- .4 All cabling used for Communications must meet the following specifications. CAT 6 cable, 4 pair, 100 ohm, 23/24 AWG, thermoplastic insulated, solid copper conductor unshielded twisted pair (UTP), formed into four individually twisted pairs and enclosed by a thermoplastic jacket, CSA certified fire rated CMP (FT6) in accordance with the latest edition of the NBC shall be installed for all voice and data requirements.

2.6 CONDUIT

- .1 Colour code EMCS conduit.
- .2 Pre-paint box covers and conduit fittings.
- .3 Coding: use fluorescent orange paint and confirm colour with City of Winnipeg Representative during "Preliminary Design Review".

Part 3 EXECUTION

3.1 NAMEPLATES AND LABELS

- .1 Ensure that manufacturer's nameplates, CSA labels and identification nameplates are visible and legible at all times.

END OF SECTION

PART 1 GENERAL

1.1 RELATED SECTIONS

- .1 Section 01 11 00 – Summary of Work.
- .2 Section 01 73 00 – Execution Requirements.
- .3 Section 07 84 00 – Firestopping.
- .4 Section 22 05 00 – Common Work Results for Plumbing.
- .5 Section 22 07 19 – Plumbing Piping Insulation.
- .6 Section 22 13 16 – Sanitary Waste and Vent Piping.
- .7 Section 23 05 00 – Common Work Results for HVAC.
- .8 Section 23 05 05 – Installation of Pipework.
- .9 Section 23 05 29 – Hangers and Supports for HVAC Piping and Equipment.
- .10 Section 23 07 19 – HVAC Piping Insulation
- .11 Section 23-07 13 – Duct Insulation.
- .12 Section 23 23 00 –Refrigerant Piping.
- .13 Section 25 05 01 – EMCS: General Requirements.
- .14 Section 26 05 00 – Common Work Results-Electrical.

1.2 REFERENCES

- .1 American National Standards Institute (ANSI)
 - .1 ANSI/ASME B16.22, Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.

- .2 ANSI C2, National Electrical Safety Code.
- .3 ANSI/NFPA 70, National Electrical Code.
- .2 Canadian Standards Association (CSA)
 - .1 CSA C22.1, Canadian Electrical Code, Part 1.
 - .2 CAN/CSA C22.3 No.1, Overhead Systems.
 - .3 CSA C22.3 No. 7, Underground Systems.
- .3 TIA/EIA-862 Building Automation Systems Cabling Standard For Commercial Buildings

1.3 SYSTEM DESCRIPTION

- .1 Electrical:
 - .1 Provide power wiring from emergency power panels where emergency power is provided to EMCS field panels. If no emergency power provided, install UPS Device. Circuits to be for exclusive use of EMCS equipment. Panel breakers to be identified on panel legends tagged and locks applied to breaker switches.
 - .2 Hard wiring between field control devices and field panels.
 - .3 Communication wiring between field panels and building EMCS.
 - .4 Modify existing starters to provide for EMCS as indicated in I/O Summaries and as indicated.
 - .5 Refer to wiring diagrams included as part of flow diagrams. Trace existing control wiring installation and provide updated wiring schematics including additions and/or deletions to control circuits for approval before commencing work.
 - .6 All control wiring 50 V and less for equipment supplied by Division 25 will be the responsibility of Division 25- Integrated Automation EMCS Subcontractor. Conduit and wire associated with this is the responsibility of Division 25.
- .2 Mechanical:
 - .1 Pipe taps required for EMCS equipment will be supplied and installed by Division 22 or 23 as applicable.
 - .2 Wells and control valves shall be supplied by EMCS Subcontractor and installed by Division 22 or 23 as applicable.
 - .3 Installation of air flow stations, dampers, and other devices requiring sheet metal trades to be mounted by Division 23. Costs to be carried by designated trade.
- .3 Structural:
 - .1 Special steelwork as required for installation of work.

1.4 PERSONNEL QUALIFICATIONS

- .1 Qualified factory trained supervisory personnel to:
 - .1 Continuously direct and monitor all work.
 - .2 Attend site meetings.

PART 2 PRODUCTS

2.1 SPECIAL SUPPORTS

- .1 Structural grade steel, primed and painted after construction and before installation.

2.2 WIRING

- .1 All cabling used for voice and data communications shall be CAT 6 cable, 4 pair, 100ohm, 23/24 AWG, thermoplastic insulated, solid copper conductor unshielded twisted pair (UTP), formed into four individually twisted pairs and enclosed by a thermoplastic jacket, CSA certified as fire rated FT6 (CMP) in accordance with the latest edition of the National Building Code. All wiring shall be run in conduit. Colour code to CSA 22.1.
- .2 For 50V and above copper conductor with chemically cross-linked thermosetting polyethylene insulation rated RW90 and 600V. Colour code to CSA 22.1.
- .3 Sizes:
 - .1 120V Power supply: to match or exceed breaker, size #12 minimum.
 - .2 Wiring for safeties/interlocks for starters, motor control centres, to be stranded, #14 minimum.
 - .3 Field wiring to digital device: #18AWG or 20AWG stranded twisted pair.
 - .4 Analog input and output: shielded #18 minimum solid copper or #20 minimum stranded twisted pair. Wiring must be continuous without joints.
 - .5 More than 4 conductors: #22 minimum solid copper.
- .4 Terminations:
 - .1 Terminate wires with screw terminal type connectors suitable for wire size, and number of terminations.

2.3 CONDUIT

- .1 As per requirements of Electrical Division. All wiring shall be run in conduit.

- .2 Electrical metallic tubing to CSA C22.2 No. 03. Flexible and liquid tight flexible metal conduit to CSA C22.2 No.56. Rigid steel threaded conduit to CSA C22.2 No. 45.
- .3 Junction and pull boxes: welded steel.
 - .1 Surface mounting cast FS: screw-on flat covers.
 - .2 Flush mounting: covers with 25 mm minimum extension all round.
- .4 Cabinets: sheet steel, for surface mounting, with hinged door, latch lock, 2 keys, complete with perforated metal mounting backboard. Panels to be keyed alike for similar functions and or entire contract as approved.
- .5 Outlet boxes: 100 mm minimum, square.
- .6 Conduit boxes, fittings:
 - .1 Bushings and connectors: with nylon insulated throats.
 - .2 With push pennies to prevent entry of foreign materials.
- .7 Fittings for rigid conduit:
 - .1 Couplings and fittings: threaded type steel.
 - .2 Double locknuts and insulated bushings: use on sheet metal boxes.
 - .3 Use factory "ells" where 90 degree bends required for 25 mm and larger conduits.
- .8 Fittings for thin wall conduit:
 - .1 Connectors and couplings: steel, set screw type.

2.4 WIRING DEVICES, COVER PLATES

- .1 Conform to CSA. Shall be in conformance to Division 26.

2.5 SUPPORTS FOR CONDUIT, FASTENINGS, EQUIPMENT

- .1 Solid masonry, tile and plastic surfaces: lead anchors or nylon shields.
 - .1 Hollow masonry walls, suspended drywall ceilings: toggle bolts.
- .2 Exposed conduits or cables:
 - .1 50 mm diameter and smaller: one-hole steel straps.

- .2 Larger than 50 mm diameter: two-hole steel straps.
- .3 Suspended support systems:
 - .1 Individual cable or conduit runs: support with 6 mm diameter threaded rods and support clips.
 - .2 Two or more suspended cables or conduits: support channels supported by 6 mm diameter threaded rod hangers.

PART 3 EXECUTION

3.1 INSTALLATION

- .1 Install equipment, components so that manufacturer's and CSA labels are visible and legible after commissioning is complete.

3.2 SUPPORTS

- .1 Install special supports as required and as indicated.

3.3 ELECTRICAL GENERAL

- .1 Do complete installation in accordance with requirements of:
 - .1 Electrical Divisions, this specification.
 - .2 CSA 22.1 Canadian Electrical Code, latest edition.
 - .3 ANSI/NFPA 70.
 - .4 ANSI C2.
- .2 Fully enclose or properly guard electrical wiring, terminal blocks, high voltage (above 50 V) contacts and mark to prevent accidental injury.
- .3 Do underground installation to CAN/CSA C22.3 No.7, except where otherwise specified.
- .4 Conform to manufacturer's recommendations for storage, handling and installation.
- .5 Check factory connections and joints. Tighten where necessary to ensure continuity.
- .6 Install electrical equipment between 1000 and 2000 mm above finished floor wherever possible and adjacent to related equipment.
- .7 Protect exposed live equipment such as panel, mains, outlet wiring during construction for

personnel safety.

- .8 Shield and mark live parts "LIVE 120 VOLTS" or other appropriate voltage.
- .9 Install conduits, and sleeves prior to pouring of concrete.
- .10 Holes through exterior wall and roofs: flash and make weatherproof.
- .11 Make necessary arrangements for cutting of chases, drilling holes and other structural work required to install electrical conduit, cable, pull boxes, outlet boxes.
- .12 Install cables, conduits and fittings which are to be embedded or plastered over, neatly and closely to building structure to minimize furring.

3.4 CONDUIT SYSTEM

- .1 All Communication wiring shall be installed in conduit. Provide complete conduit system to link Building Controllers to Building EMCS. Conduit sizes to suit wiring requirements and to allow for future expansion capabilities specified for systems. Maximum conduit fills not to exceed 40%. Design drawings do not show conduit layout.
- .2 Install conduits parallel or perpendicular to building lines, to conserve headroom and to minimize interference.
- .3 Do not run exposed conduits in normally occupied spaces unless otherwise indicated or unless impossible to do otherwise. Obtain approval before starting such work. Provide complete conduit system to link field panels and devices with main control centre. Conduit size to match conductors plus future expansion capabilities as specified.
- .4 Locate conduits at least 150 mm from parallel steam or hot water pipes and at least 50 mm at crossovers.
- .5 Bend conduit so that diameter is reduced by less than 1/10th original diameter.
- .6 Field thread on rigid conduit to be of sufficient length to draw conduits up tight.
- .7 Limit conduit length between pull boxes to less than 30 m.
- .8 Use conduit outlet boxes for conduit up to 32 mm diameter and pull boxes for larger sizes.
- .9 Fastenings and supports for conduits, cables, and equipment:
 - .1 Provide metal brackets, frames, hangers, clamps and related types of support structures as indicated and as required to support cable and conduit runs.
 - .2 Provide adequate support for raceways and cables, sloped vertically to equipment.
 - .3 Use supports or equipment installed by other trades for conduit, cable and raceway

supports only after written approval.

- .10 Install polypropylene fish cord in empty conduits for future use.
- .11 Where conduits become blocked, remove and replace blocked sections.
- .12 Pass conduits through structural members only after coordination and written approval.
- .13 Conduits may be run in flanged portion of structural steel.
- .14 Group conduits wherever possible on suspended or surface channels.
- .15 Pull boxes:
 - .1 Install in inconspicuous but accessible locations.
 - .2 Support boxes independently of connecting conduits.
 - .3 Fill boxes with paper or foam to prevent entry of construction material.
 - .4 Provide correct size of openings. Reducing washers not permitted.
 - .5 Mark location of pull boxes on record drawings.
 - .6 Identify AC power junction boxes, by panel and circuit breaker.
- .16 Install terminal blocks or strips indicated in cabinets to Electrical Division.
- .17 Install bonding conductor for 120 volt and above in conduit.

3.5 WIRING

- .1 Install multiple wiring in ducts simultaneously.
- .2 Do not pull spliced wiring inside conduits or ducts.
- .3 Use CSA certified lubricants of type compatible with insulation to reduce pulling tension.
- .4 Tests: use only qualified personnel. Demonstrate that:
 - .1 Circuits are continuous, free from shorts, unspecified grounds.
 - .2 Resistance to ground of all circuits is greater than 50 Megohms.
- .5 Provide test results showing locations, circuits, results of tests.

- .6 Remove insulation carefully from ends of conductors and install to manufacturer's recommendations. Accommodate all strands in lugs. Where insulation is stripped in excess, neatly tape so that only lug remains exposed.
- .7 Wiring in main junction boxes and pull boxes to terminate on terminal blocks only, clearly and permanently identified. Junctions or splices not permitted for sensing or control signal covering wiring.
- .8 Do not allow wiring to come into direct physical contact with compression screw.
- .9 Install ALL strands of conductor in lugs of components. Strip insulation only to extent necessary for installation.

3.6 WIRING DEVICES, COVER PLATES

- .1 Receptacles:
 - .1 Install vertically in gang type outlet box when more than one receptacle is required in one location.
- .2 Cover plates:
 - .1 Install suitable common cover plate where wiring devices are grouped.
 - .2 Use flush type cover plates only on flush type outlet boxes.

3.7 STARTERS, CONTROL DEVICES

- .1 Install and make control connections as indicated. Power connections above 50V by Electrical Division.
- .2 Install correct over-current devices.
- .3 Identify each control wire, terminal for external connections with permanent number marking identical to diagram.
- .4 Performance Verification:
 - .1 Operate switches and controls to verify functioning.
 - .2 Perform start and stop sequences of contactors and relays.
 - .3 Check that interlock sequences, with other separate related starters, equipment and auxiliary control devices, operate as specified.

3.8 GROUNDING

- .1 Install complete, permanent, continuous grounding system for equipment, including conductors,

connectors and accessories.

- .2 Install separate grounding conductors in conduit within building.
- .3 Install ground wire in all PVC ducts and in tunnel conduit systems.
- .4 Tests: perform ground continuity and resistance tests, using approved method appropriate to site conditions.

3.9 TESTS

- .1 General:
 - .1 Perform following tests in addition to tests specified Section 25 08 20 - EMCS: Warranty and Maintenance.
 - .2 Give 14 days written notice of intention to test.
 - .3 Conduct in presence of authority having jurisdiction as requested.
 - .4 Conceal work only after tests satisfactorily completed.
 - .5 Report results of tests to City of Winnipeg Representative in writing.
 - .6 Preliminary tests:
 - .1 Conduct as directed to verify compliance with specified requirements.
 - .2 Make needed changes, adjustments, replacements.
 - .3 Insulation resistance tests:
 - .1 Megger all circuits, feeders, equipment for 120 - 600V with 1000V instrument. Resistance to ground to be more than required by Code before energizing.
 - .2 Test insulation between conductors and ground, efficiency of grounding system to satisfaction of authority having jurisdiction.

3.10 IDENTIFICATION

- .1 Refer to Section 25 05 54- EMCS: Identification.

END OF SECTION

PART 1 GENERAL

1.1 SUMMARY

- .1 Section Includes.
 - .1 Requirements and procedures for warranty and activities during warranty period, for building Energy Monitoring and Control System (EMCS).
- .2 References.
 - .1 Canada Labour Code (R.S. 1985, c. L-2)/Part I - Industrial Relations.
 - .2 CSA Group (CSA), latest versions.
 - .1 CSA Z204, Guidelines for Managing Indoor Air Quality in Office Buildings.

1.2 DEFINITIONS

- .1 BC(s) - Building Controller(s).
- .2 CMS – Central Monitoring Station
- .3 For additional acronyms and definitions refer to Section 25 05 01 - EMCS: General Requirements.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit Manufacturer's recommended preventative maintenance schedule for system components.
- .3 Submit detailed inspection reports completed to establish warranty status of system prior to acceptance of system.
- .4 Submit dated, maintenance task lists completed to establish warranty status and include the following sensor and output point detail, as proof of system verification:
 - .1 Point name and location.
 - .2 Device type and range.
 - .3 Measured value.
 - .4 System displayed value.
 - .5 Calibration detail
 - .6 Indication if adjustment required,
 - .7 Other action taken or recommended.
- .5 Submit network analysis report showing results with detailed recommendations to correct problems found.
- .6 Records and logs: in accordance with Section 01 78 00 - Closeout Submittals.
 - .1 Maintain records and logs of each task on site.

- .2 Organize cumulative records for each major component and for entire EMCS chronologically.
- .3 Submit records, after inspection indicating that planned and systematic tasks have been accomplished.
- .7 Revise and submit in accordance with Section 01 78 00 - Closeout Submittals "As-built drawings" documentation and commissioning reports to reflect changes, adjustments and modifications to EMCS made during warranty period.

1.4 WARRANTY SERVICE CALLS DURING WARRANTY PERIOD

- .1 Provide Technician, materials and equipment required to provide emergency service calls for specified warranty period.
- .2 Warranty Period shall be 24 months.
- .3 Emergency Service Calls:
 - .1 Initiate service calls when notified EMCS is not functioning correctly.
 - .2 Technician to be available during warranty period whenever required at no extra cost.
 - .3 Furnish City of Winnipeg Representative with telephone number where service personnel may be reached at any time.
 - .4 Technician to be on site ready to service EMCS within 4 hours after receiving request for service.
 - .5 Perform Work continuously until EMCS restored to reliable operating condition.
- .4 Operation: to provide proper sequencing of equipment and satisfactory operation of EMCS based on original design conditions and as recommended by manufacturer.
- .5 Provide a record for each service call request, include:
 - .1 Serial number identifying component involved.
 - .2 Location, date and time call received.
 - .3 Nature of trouble.
 - .4 Names of personnel assigned.
 - .5 Instructions of work done.
 - .6 Amount and nature of materials used.
 - .7 Time and date work started.
 - .8 Time and date of completion.
- .6 Provide system modifications in writing.
 - .1 No system modification, including operating parameters and control settings, to be made without prior written approval.
 - .2 Provide a written record of all modifications.

PART 2 PRODUCTS

2.1 NOT USED

- .1 Not Used.

PART 3 EXECUTION

3.1 FIELD QUALITY CONTROL

- .1 Perform Inspections as required by Manufacturer during Warranty calls. Provide detailed written report described in Submittal article.
- .2 Inspections to include, but not limited to:
 - .1 Perform visual, operational checks to BC's, peripheral equipment, interface equipment and other panels.
 - .2 Check equipment cooling fans are operating as required.
 - .3 Review system performance to discuss suggested or required changes.
 - .4 Clean panels as required, micro-processor interior and exterior surfaces.
 - .5 Check signal, voltage and system isolation of BC(s), peripherals, interface and other panels.
 - .6 Verify calibration/accuracy of each input and output device and recalibrate or replace as required.
 - .7 Run system software diagnostics as required.
- .3 Rectify deficiencies revealed by inspections and environmental checks.
- .4 Continue any system debugging and optimization as required.
- .5 Verification of seasonal-sensitive systems to take place during warranty period, after facility has been accepted, taken over and fully occupied.
 - .1 Verify seasonal-sensitive system components during both shoulder seasons: near winter (Fall) conditions and near summer (Spring) conditions.

END OF SECTION

PART 1 GENERAL

1.1 SUMMARY

- .1 Section Includes:
 - .1 System requirements for Local Area Network (LAN) for Building Energy Monitoring and Control System (EMCS).
- .2 Related Sections:
 - .1 Section 25 05 01 – EMCS: General Requirements.

1.2 REFERENCES

- .1 Institute of Electrical and Electronics Engineers (IEEE)/Standard for Information Technology – Telecommunications and information exchange between systems – Local and metropolitan area networks – Specific requirements.
 - .1 IEEE Std 802.3TM, Part 3: Carrier sense multiple access with collision detection (CSMA/CD) access method and physical layer specifications.
- .2 Telecommunications Industries Association (TIA)/Electronic Industries Alliance (EIA).
 - .1 TIA/EIA-568-B, Commercial Building Telecommunications Cabling Standards Set, Part 1 General Requirements, Part 2 Balanced Twisted- Pair Cabling Components, Part 3 Optical Fiber Cabling Components Standard.
 - .2 TIA/EIA-569-C, Telecommunications Pathways and Spaces.
 - .3 TIA/EIA-862 Building Automation Systems Cabling Standard For Commercial Buildings
- .3 Treasury Board Information Technology Standard (TBITS).
 - .1 TBITS 6.9, Profile for the Telecommunications Wiring System in Government Owned and Leased Buildings-Technical Specifications.

1.3 DEFINITIONS

- .1 Acronyms and definitions: refer to Section 25 05 01 – EMCS: General Requirements.

1.4 SYSTEM DESCRIPTION

- .1 Data communication network to link Master Control Units (MCU) to building EMCS and existing CMS in accordance with TIA/EIA-568-A, and TIA/EIA-569-A.
 - .1 Provide reliable and secure connectivity of adequate performance between different sections segments of network.
 - .2 Allow for future expansion of network, with selection of networking technology and communication protocols.

- .2 Data communication network to included, but not limited to:
 - .1 EMCS-LAN.
 - .2 Modems.
 - .3 Network interface cards.
 - .4 Network management hardware and software.
 - .5 Network components necessary for complete network.

1.5 DESIGN REQUIREMENTS

- .1 EMCS Local Area Network (EMCS-LAN).
 - .1 High Speed, high performance, local area network over MS/TP with MCUs communicate with each other and the existing CMS directly on peer to peer basis in accordance with IEEE 802.3/Ethernet Standard.
 - .2 EMCS-LAN to be: BACnet Protocol. Where manufacturer equipment necessitates Modbus protocol, provide necessary convertors and devices to convert to BACnet to permit the communication to the building EMCS and existing CMS.
 - .3 Each EMCS-LAN to be capable of supporting at least 50 devices.
 - .4 Support of combination of MCUs directly connected to EMCS-LAN.
 - .5 High speed data transfer rates for alarm reporting, quick report generation from multiple controllers, upload/download information between network devices. Bit rate to be 10 Megabits per second minimum.
 - .6 Detection and accommodation of single or multiple failures of either MCUs or network media. Operational equipment to continue to perform designated functions effectively in event of single or multiple failures.
 - .7 Commonly available, multiple sourced, networking components and protocols to allow system to co-exist with other networking applications including office automation.
- .2 Dynamic Data Access.
 - .1 LAN to provide for remote access point status and application report data or execute control functions for other devices via LAN, by the existing CMS.
 - .2 Access to data to be based upon logical identification of building equipment.
- .3 Network Medium.
 - .1 Network medium: twisted cable, shielded twisted cable, or fibre optic cable compatible with network protocol to be used within buildings. Fibre optic cable to be used between buildings.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

PART 1 GENERAL

1.1 SUMMARY

- .1 Section Includes:
 - .1 Materials and installation for building automation controllers including:
 - .1 Master Control Unit (MCU).
 - .2 Local Control Unit (LCU)
 - .3 Equipment Control Unit (ECU).
 - .4 Terminal Control Unit (TCU).

1.2 RELATED SECTIONS

- .1 Section 25 05 01 - EMCS: General Requirements.
- .2 Section 25 05 02 - EMCS: Submittals and Review Process.
- .3 Section 25 05 03 - EMCS: Project Records Documents.
- .4 Section 25 30 02 - EMCS: Field Control Devices.
- .5 Section 25 90 01 – EMCS: Site Requirements, Applications and Systems Sequences of Operation.

1.3 REFERENCES

- .1 American Society of Heating, Refrigeration, and Air-Conditioning Engineers, Inc. (ASHRAE).
 - .1 ASHRAE, Applications Handbook, SI Edition.
 - .2 ASHRAE Standard 135 – BAC net – A Data Communications Protocol for Building Automation and Control Networks.
 - .3 ASHRAE Standard 135.1 Method of Test Conformance to BAC net.
- .2 Canadian Standards Association (CSA)
 - .1 C22.2 No.205, Signal Equipment.
- .3 Institute of Electrical and Electronics Engineers (IEEE)
 - .1 IEEE C37.90.1, Surge Withstand Capabilities Test for Protective Relays and Relays Systems.

1.4 DEFINITIONS

- .1 Acronyms used in this section include: see Section 25 05 01 - EMCS: General Requirements.

1.5 SYSTEM DESCRIPTION

- .1 General: Network of controllers comprising of MCU('s), LCU('s), ECU('s) or TCU('s) to be provided as indicated in System Architecture Diagram to support building systems and associated sequence(s) of operations as detailed in these specifications.
 - .1 Provide sufficient controllers to meet intents and requirements of this section.
 - .2 Controllers quantity, and point contents to be approved at time of preliminary design review.
- .2 Controllers: stand-alone intelligent Control Units:
 - .1 Incorporate programmable microprocessor, non-volatile program memory, RAM, power supplies, as required to perform specified functions.
 - .2 Incorporate communication interface ports for communication LANs to exchange information with other Controllers.
 - .3 Capable of interfacing with operator interface device.
 - .4 Execute its logic and control using primary inputs and outputs connected directly to its onboard input/output field terminations or slave devices, and without need with other controller.
 - .1 Secondary input used for reset such as outdoor air temperature may be located in other Controller(s).
- .3 TIA/EIA-862 Building Automation Systems Cabling Standard For Commercial Buildings

1.6 DESIGN REQUIREMENTS

- .1 To include:
 - .1 Scanning of AI and DI connected inputs for detection of change of value and processing the detection of alarm conditions.
 - .2 Perform On-Off digital control of connected points, including the resulting required states generated through programmable logic output.
 - .3 Perform Analog control using programmable logic, (including PID) with adjustable dead bands and deviation alarms.
 - .4 Control of systems as described in sequence of operations.
 - .5 Execution of optimization routines as listed in this section.
- .2 Total spare capacity for MCUs and LCUs: at least 25% of each point type distributed throughout the MCUs and LCUs.
- .3 Field Termination and Interface Devices.
 - .1 To conform to CSA C22.2 No. 205.

- .2 Electronically interface sensors and control devices to processor unit.
- .3 Include, but not be limited to, following:
 - .1 Programmed firmware or logic circuits to meet functional and technical requirements.
 - .2 Power supplies for operation of logic devices and associated field equipment.
 - .3 Lockable wall cabinet.
 - .4 Required communications equipment and wiring .
 - .5 Leave controlled system in "fail-safe" mode in event of loss of communication with, or failure of, processor unit.
 - .6 Input/Output interface to accept as minimum AI, AO, DI, DO functions as specified.
 - .7 Wiring terminations: use conveniently located screw type or spade lug terminals.
- .4 AI interface equipment to:
 - .1 Convert analog signals to digital format with 12 bit analog-to-digital resolution.
 - .2 Provide for following input signal types and ranges:
 - .1 4 - 20 mA;
 - .2 0-10V DC
 - .3 10 K ohm.
 - .3 Meet IEEE C37.90.1 surge withstand capability.
 - .4 Have common mode signal rejection greater than 60 dB to 60 Hz.
 - .5 Where required, dropping resistors to be certified precision devices which complement accuracy of sensor and transmitter range specified.
- .5 AO interface equipment:
 - .1 Convert digital data from controller processor to acceptable analog output signals using 12 bit digital-to-analog resolution.
 - .2 Provide for following output signal types and ranges:
 - .1 4 - 20 mA.
 - .2 0 - 10 V DC.
 - .3 Meet IEEE C37.90.1 surge withstand capability.
- .6 DI interface equipment:
 - .1 Able to reliably detect contact change of sensed field contact and transmit condition to controller.
 - .2 Meet IEEE C37.90.1 surge withstand capability.
 - .3 Accept pulsed inputs up to 2 kHz.
- .7 DO interface equipment:
 - .1 Respond to controller processor output, switch respective outputs. Each DO hardware to be capable of switching up to 0.5 amps at 24 V AC.
 - .2 Switch up to 5 amps at 220 V AC using optional interface relay.
- .4 Controller's and associated hardware and software: operate in conditions of 0°C to 44°C and 20 % to 90 % non-condensing RH.

- .5 Controllers (MCU, LCU): mount in wall mounted cabinet with hinged, keyed-alike locked door.
 - .1 Provide for conduit entrance from top, bottom or sides of panel.
 - .2 ECUs to be mounted in equipment enclosures or separate enclosures.
- .6 Cabinets to provide protection from water dripping from above, while allowing sufficient airflow to prevent internal overheating.
- .7 Provide surge and low voltage protection for interconnecting wiring connections.

1.7 SUBMITTALS

- .1 Make Submittals in accordance with Section 01 33 00 – Submittal Procedures and Section 25 05 02 – EMCS: Submittals and Review Process.
 - .1 Submit product data sheets for each product item proposed for this project.

1.8 MAINTENANCE PROCEDURES

- .1 Provided manufacturers recommended maintenance procedures for insertion in Section 25 05 03 – EMCS: Project Record Documents.

PART 2 PRODUCTS

2.1 MASTER CONTROL UNIT (MCU)

- .1 Primary function of MCU is to provide co-ordination and supervision of subordinate devices. Supervisory role shall include coordination of subordinate devices in the execution of optimization routines such as demand limiting or enthalpy control.
- .2 Include high speed communication LAN Port for Peer to Peer communications with field level devices, other MCU level devices, and existing CMS. Include support for Open System Protocols, BACnet.
- .3 MCU shall have local I/O capacity as follows;
 - .1 To have at least 16 I/O points of which minimum to be 2AO, 6AI, 4DI, 4DO.
 - .2 LCU's to be added to support system functions as indicated in I/O Summary List.
- .4 Central Processor Unit (CPU)
 - .1 Processor to consist of at minimum a 16 bit microprocessor capable of supporting software to meet specified requirements.
 - .2 CPU idle time to be more than 30 % when system configured to maximum input and output with worst case program use.
 - .3 Minimum addressable memory to be at manufacturer's discretion but to support at least all performance and technical specifications. Memory to include:
 - .1 Non-volatile EEPROM to contain operating system, executive,

- application, sub-routine, other configurations definition software. Tape media not acceptable.
- .2 Battery backed (72 hr minimum capacity) RAM (to reduce the need to reload operating data in event of power failure) RAM to contain CDLs, application parameters, operating data or software that is required to be modifiable from operational standpoint such as schedules, setpoints, alarm limits, PID constants and CDL and hence modifiable on-line through operator panel or remote operator's interface.
 - .4 Include uninterruptible clock accurate to plus or minus 5 secs/month, capable of deriving month/day/hour/minute/second, with rechargeable batteries for minimum 72 hr operation in event of power failure.

2.2 LOCAL CONTROL UNIT (LCU)

- .1 Provide multiple control functions for typical built-up and package HVAC, hydronic and electrical systems.
- .2 Minimum of 16 I/O points of which minimum be 4 AOs, 4 AIs, 4 DIs, 4 DOs.
- .3 Points of one Building System to be connected to one controller as listed in I/O Summary designations.
- .4 Microprocessor capable of supporting necessary software and hardware to meet specified requirements. As per MCU requirements (section 2.1) above with the following additions:
 - .1 Include as minimum 2 interface ports for connection to local computer terminal.
 - .2 Design so that shorts, opens or grounds on any input or output will not interfere with other input or output signals.
 - .3 Physically separate line voltage (50V and over) circuits from DC logic circuits to permit maintenance on either circuit with minimum hazards to technician and equipment.
 - .4 Include power supplies for operation of LCU and associated field equipment.
 - .5 In event of loss of communications with, or failure of, MCU, LCU to continue to perform control. Controllers that use defaults or fail to open or close positions not acceptable.
 - .6 Provide conveniently located screw type or spade lug terminals for field wiring.
 - .7 LCU to have 25 % spare input and 25 % output point capacity without addition of cards, terminals, etc.
 - .8 LCU to BTL certified.

2.3 TERMINAL/EQUIPMENT CONTROL UNIT (TCU/ECU)

- .1 Microprocessor capable of supporting necessary software and hardware to meet TCU/ECU functional specifications.
 - .1 The TCU/ECU definition to be consistent with those defined in ASHRAE HVAC Applications Handbook. TCU/ECU shall be BTL certified.

- .2 Controller to communicate directly with EMCS through LAN and provide access from building existing CMS for setting occupied and unoccupied space temperature setpoints, flow setpoints, and associated alarm values, permit reading of sensor values, field control values (% open) and transmit alarm conditions to building EMCS.

2.4 SOFTWARE

- .1 General:
 - .1 Include as minimum: operating system executive, communications, application programs, operator interface, and systems sequence of operation - CDL's.
 - .2 To include "firmware" or instructions which are programmed into ROM, EPROM, EEPROM or other non-volatile memory.
 - .3 Include initial programming of all Controllers, for entire system.
- .2 Program and data storage:
 - .1 Store executive programs and site configuration data in ROM, EEPROM or other non-volatile memory.
 - .2 Maintain CDL and operating data such as setpoints, operating constants, alarm limits in battery-backed RAM or EEPROM for display and modification by operator.
- .3 Programming languages:
 - .1 Control Description Logic software to be programmed using English like or graphical, high level, general control language.
 - .2 Structure software in modular fashion to permit simple restructuring of program modules if future software additions or modifications are required. GO TO constructs not allowed.
- .4 Pseudo or calculated points:
 - .1 Software to have access to any value or status in controller or other networked controller so as to define and calculate pseudo point from other values/status of controller. When current pseudo point value is derived, normal alarm checks must be performed or value used to totalize.
 - .2 Inputs and outputs for any process to be able to include data from controllers to permit development of network-wide control strategies. Processes also to permit operator to use results of one process as input to any number of other processes (eg. cascading).
- .5 Control Description Logic (CDL):
 - .1 Capable of generating on-line project-specific control loop algorithms (CDLs). CDLs to be software based, programmed into RAM or EEPROM. City of Winnipeg must have access to these algorithms for modification or to be able to create new ones.
 - .2 Write CDL in high level language that allows algorithms and interlocking programs to be written simply and clearly. Use parameters entered into system (eg. setpoints) to determine operation of algorithm. Operator to be able to alter operating parameters on-line from existing controls station or BC(s) and to tune

- control loops.
- .3 Perform changes to CDL on-line.
- .4 Control logic to have access to values or status of all points available to controller including global or common values, allowing cascading or inter-locking control.
- .5 Energy optimization routines such as enthalpy control, supply temperature reset, etc. to be LCU or MCU resident functions and form part of CDL.
- .6 MCU to be able to perform following pre-tested control algorithms:
 - .1 Two position control.
 - .2 Proportional Integral and Derivative (PID) control.
 - .3 Automatic control loop tuning.
- .7 Control software to provide the ability to define the time between successive starts for each piece of equipment to reduce cycling of motors.
- .8 Provide protection against excessive electrical-demand situations during start-up periods by automatically introducing time delays between successive start commands to heavy electrical loads.
- .9 Power Fail Restart: Upon detection of power failure system to verify availability of emergency power as determined by emergency power transfer switches and analyze controlled equipment to determine its appropriate status under emergency power conditions and start or stop equipment as defined by I/O Summary. Upon resumption of normal power as determined by emergency power transfer switches, MCU to analyze status of controlled equipment, compare with normal occupancy scheduling, turn equipment on or off as necessary to resume normal operation.
- .6 Event and Alarm management: The system to use a management by exception concept for Alarm Reporting. This is a system wide requirement. Events which occur as a direct result of the primary event to be suppressed by the system and only events which fail to occur to be reported. Such event sequence to be identified in I/O Summary and sequence of operation. Examples of above are, operational temperature alarms limits which are exceeded when main air handler is stopped, or General Fire condition shuts air handlers down, only Fire alarm status shall be reported. The exception is, when an air handler which is supposed to stop or start fails to do so under the event condition.
- .7 Energy management programs: The following programs shall include specific summarizing reports, to include the date stamp indicating sensor details which activated and or terminated the feature.
 - .1 MCU in coordination with subordinate LCU, TCU, ECU to provide for the following energy management routines:
 - .1 Time of day scheduling.
 - .2 Calendar based scheduling.
 - .3 Holiday scheduling.
 - .4 Temporary schedule overrides.
 - .5 Optimal start stop.
 - .6 Night setback control.
 - .7 Enthalpy (economizer) switchover.
 - .8 Peak demand limiting.
 - .9 Temperature compensated load rolling.

- .10 Fan speed/flow rate control.
- .11 Cold deck reset.
- .12 Hot deck reset.
- .13 Glycol Heating water reset.
- .14 Night purge.
- .2 Programs to be executed automatically without need for operator intervention and be flexible enough to allow customization.
- .8 Function/Event Totalization: features to provide predefined reports which show daily, weekly, and monthly accumulating totals and which include high rate (time stamped) and low rate (time stamped) and accumulation to date for month.
 - .1 MCUs to accumulate and store automatically run-time for binary input and output points.
 - .2 MCU to automatically sample, calculate and store consumption totals on daily, weekly or monthly basis for user-selected analog or binary pulse input-type points.
 - .3 MCU to automatically count events (number of times pump is cycled off and on) daily, weekly or monthly basis.
 - .4 Totalization routine to have sampling resolution of 1 min or less for analog inputs.
 - .5 Totalization to provide calculations and storage of accumulations up to 99,999.9 units (eg. kWh, litres, tonnes, etc.).
 - .6 Store event totalization records with minimum of 9,999,999 events before reset.
 - .7 User to be able to define warning limit and generate user-specified messages when limit reached.

2.5 LEVELS OF ADDRESS

- .1 Upon operator's request, EMCS to present status of any single 'point', 'system' or point group, entire 'area', as selected by operator.
 - .1 Display analog values digitally to 1 place of decimals with negative sign as required.
 - .2 Update displayed analog values and status when new values received.
 - .3 Flag points in alarm by blinking, reverse video, different colour, bracketed or other means to differentiate from points not in alarm.
 - .4 Updates to be change-of-value (COV)-driven or if polled not exceeding 2 second intervals.

2.6 POINT NAME SUPPORT

- .1 Controllers (MCU, LCU) to support point naming convention as defined in Section 25 05 01 – EMSC: General Requirements.

PART 3 EXECUTION

3.1 LOCATION

- .1 Location of controllers to be approved by City of Winnipeg Representative.

3.2 INSTALLATION

- .1 Install Controllers in secure enclosures as indicated.
- .2 Provide necessary power from local 120 V branch circuit panel for equipment.
- .3 Install tamper locks on breakers of circuit breaker panel.
- .4 Use Uninterruptible Power Supply (UPS) and emergency power when equipment must operate in an emergency and co-ordinating mode.

END OF SECTION

PART 1 GENERAL

1.1 RELATED SECTIONS

- .1 Section 33 56 13 - Aboveground Fuel Storage Tanks.
- .2 Section 25 05 02 - EMCS: Submittals and Review Process.
- .3 Section 25 05 03 - EMCS: Project Records Documents.

1.2 REFERENCES

- .1 American National Standards Institute (ANSI)
 - .1 ANSI C12.7, Requirements for Watthour Meter Sockets.
 - .2 ANSI/IEEE C57.13, Requirements for Instrument Transformers.
- .2 Canadian Standards Association
 - .1 CSA Type 1 Enclosure
 - .2 CSA Type 4X Enclosures
 - .3 CSA Type 12 Enclosures
- .3 TIA/EIA-862 Building Automation Systems Cabling Standard For Commercial Buildings

1.3 SUBMITTALS

- .1 Submit shop drawings and manufacturer's installation instructions in accordance with Section 25 05 02 - EMCS: Submittals and Review Process.
- .2 Include:
 - .1 Information as specified for each device.
 - .2 Manufacturer's detailed installation instructions.
- .3 Pre-Installation Tests
 - .1 Submit samples at random from equipment shipped, for testing before installation. Replace devices not meeting specified performance and accuracy.
- .4 Manufacturer's Instructions
 - .1 Submit manufacturer's installation instructions for specified equipment and devices.

1.4 CLOSEOUT SUBMITTALS

- .1 Submit operating and maintenance data for inclusion in operation and maintenance manual in accordance with Section 25 05 03 - EMCS: Project Records Documents.

PART 2 PRODUCTS

2.1 GENERAL

- .1 Control devices of each category to be of same type and manufacturer.
- .2 External trim materials to be corrosion resistant. Internal parts to be assembled in watertight, shockproof, vibration-proof, heat resistant assembly.
- .3 Operating conditions: 0 - 32C with 10 - 90 % RH (non-condensing) unless otherwise specified.
- .4 Terminations: use standard conduit box with slot screwdriver compression connector block unless otherwise specified.
- .5 Transmitters to be unaffected by external transmitters (eg. walkie talkies).
- .6 Account for hysteresis, relaxation time, maximum and minimum limits in applications of sensors and controls.
- .7 Outdoor installations: use weatherproof construction in CSA 4X enclosures.
- .8 Devices to be installed in user occupied space must not exceed Noise Criteria (NC) of 35. Noise generated by any device must not be detectable above space ambient conditions.

2.2 TEMPERATURE SENSORS

- .1 General: except for VAV box control to be resistance or thermocouple type to following requirements:
 - .1 Thermistors 10 K ohm, $\pm 0.2^{\circ}$ C accuracy, less than 0.1° C drift over 10 year span. Power supply 5 V dc, 10-35 Vdc, 24 Vac..
 - .2 RTD's: 1000 ohm at 0 $^{\circ}$ C (plus or minus 0.2 ohms) platinum element with strain minimizing construction, 3 integral anchored leadwires. Coefficient of resistivity: 0.00385 ohms/ohm $^{\circ}$ C.
 - .3 Immersion wells: NPS 3/4, stainless steel spring loaded construction, with heat transfer compound compatible with sensor. Insertion length 100 mm as indicated.
- .2 Sensors:
 - .1 Room type: wall mounting, in slotted type covers, LCD display $^{\circ}$ C or $^{\circ}$ F, with guard as indicated. Dual set point momentary push button, override switch.
 - .2 Room type for VAV boxes: as for room type, above. Include setpoint adjustment, local indication, push button override for night set back function.
 - .3 General purpose duct type: suitable for insertion into ducts at any angle, insertion length 460 mm.
 - .4 Averaging duct type: continuous filament with minimum immersion length 6000 mm. Bend probe at field installation time to 100 mm radius at any point along probe without degradation of performance.

- .5 Outside air type: complete with probe length 100 - 150 mm long, non-corroding shield to minimize solar and wind effects, threaded fitting for mating to 13 mm conduit, weatherproof construction in CSA 4X enclosure.
- .6 Immersion type: spring loaded probe, NPT ½ fitting insertion to suit pipe size.

2.3 TEMPERATURE TRANSMITTERS

- .1 Requirements:
 - .1 Input circuit: to accept 3-lead, 100 ohm at 0 deg C, platinum resistance detector type sensors.
 - .2 Power supply: 575 ohms at 24 V DC into load of 575 ohms. Power supply effect less than 0.01 deg C per volt change.
 - .3 Output signal: 4 - 20 mA into 500 ohm maximum load.
 - .4 Input and output short circuit and open circuit protection.
 - .5 Output variation: less than 0.2 % of full scale for supply voltage variation of plus or minus 10 %.
 - .6 Combined non-linearity, repeatability, hysteresis effects: not to exceed plus or minus 0.5 % of full scale output.
 - .7 Maximum current to 100 ohm RTD sensor: not to exceed 22.5 mA.
 - .8 Integral zero and span adjustments.
 - .9 Temperature effects: not to exceed plus or minus 1.0 % of full scale/ 50 °C.
 - .10 Long term output drift: not to exceed 0.25 % of full scale/ 6 months.
 - .11 Transmitter ranges: Select narrowest range to suit application from following:
 - .1 Minus 50 degC to plus 50 degC, plus or minus 0.5 degC.
 - .2 0 to 100 degC, plus or minus 0.5 degC.
 - .3 0 to 50 degC, plus or minus 0.25 degC.
 - .4 0 to 25 degC, plus or minus 0.1 degC.
 - .5 10 to 35 degC, plus or minus 0.25degC.

2.4 HUMIDITY SENSORS

- .1 Requirements:
 - .1 Range: 5 - 95 % RH minimum.
 - .2 Operating temperature range: -40°C to 85°C.
 - .3 Absolute accuracy:
 - .1 Duct sensors: plus or minus 5 %.
 - .2 Room sensors: plus or minus 2 % .
 - .4 Sheath: stainless steel with integral shroud for specified operation in air streams of up to 10 m/s.
 - .5 Maintenance: by simple field method such as washing with solvent or mild detergent solution so as to remove anticipated airborne contaminants.
 - .6 Maximum sensor non-linearity: plus or minus 0.5% RH with defined curves.
 - .7 Room sensors: wall mounted as indicated.
 - .8 Duct mounted sensors: locate so that sensing element is between 1/3 and 2/3 distance across any duct dimension.

- .9 Sensors to be unaffected by external transmitters such as walkie-talkies.
- .10 Power supply: 18-35 Vdc, 18-32 Vac with temperature sensor.

2.5 HUMIDITY TRANSMITTERS

- .1 Requirements:
 - .1 Input signal: from 1000 ohm RTD.
 - .2 Output signal: 4 - 20 mA into 1000 ohm maximum load, 0-5 Vdc, 0-10 Vdc.
 - .3 Input and output short circuit and open circuit protection.
 - .4 Output accuracy: not to exceed 0.1 % of full span.
 - .5 Output linearity error: plus or minus 1.0 % maximum of full scale output.
 - .6 Integral zero and span adjustment.
 - .7 Temperature range: 0-70°C, -40°C to 85°C for outside air.
 - .8 Long term output drift: not to exceed 0.25 % of full scale output/ 6 months.

2.6 PRESSURE/CURRENT (P/I) TRANSMITTERS

- .1 Requirements:
 - .1 Range: as indicated in I/O summaries.
 - .1 Pressure sensing elements: bourdon tube, bellows or diaphragm type.
 - .2 Internal materials: suitable for continuous contact with industrial standard instrument air, compressed air, water, steam, as applicable.
 - .2 Output signal: 4 - 20 mA, 0-5V, 0-10V.
 - .3 Output variations: ± 1 % full scale for supply voltage variations of plus or minus 10 %.
 - .4 Combined non-linearity, repeatability, and hysteresis effects: not to exceed plus or minus 1% of full scale output over entire range.
 - .5 Integral zero and span adjustment.
 - .6 Temperature effects: not to exceed plus or minus 1.5 % full scale/ 50 °C.
 - .7 Over-pressure input protection to at least twice rated input pressure.
 - .8 Output short circuit and open circuit protection.
 - .9 Pressure ranges: see I/O Summaries.
 - .10 Accuracy: plus or minus 1 % of full scale.
 - .11 LCD Display.

2.7 DIFFERENTIAL PRESSURE (KPA) TRANSMITTERS

- .1 Requirements:
 - .1 Internal materials: suitable for continuous contact with industrial standard instrument air, compressed air, water, steam, as applicable.
 - .2 Output signal: 4 - 20 mA, 0-5V, 0-10V.
 - .3 Output variations: ± 1 % full scale for supply voltage variations of plus or minus 10 %.
 - .4 Combined non-linearity, repeatability, and hysteresis effects: not to exceed plus or minus 1 % of full scale output over entire range.

- .5 Integral zero and span adjustment.
- .6 Temperature effects: not to exceed plus or minus 1.5 % full scale/ 50C.
- .7 Over-pressure input protection to at least twice rated input pressure.
- .8 Output short circuit and open circuit protection.
- .9 The unit to have a NPT connections. The enclosure shall be an integral part of the unit.
- .10 LCD Display.

2.8 DIFFERENTIAL PRESSURE (PA) TRANSMITTERS

- .1 Requirements:
 - .1 Output signal: 4 - 20 mA in 400 ohms, 0-5V into 5K ohms minimum, 0-10 V into 10K ohms minimum.
 - .2 Output variations: \pm 1% full scale for supply voltage variations of plus or minus 10%.
 - .3 Integral zero and span adjustment.
 - .4 Temperature effects: not to exceed plus or minus 3% full scale/ 50 C.
 - .5 Output short circuit and open circuit protection.
 - .6 The unit to have a NPT $\frac{1}{2}$ conduit connection. The enclosure shall be an integral part of the unit.
 - .7 Pressure ranges: see I/O Summaries.
 - .8 LCD Display.

2.9 FAN SYSTEM STATIC PRESSURE SENSORS

- .1 As per 2.10

2.10 FAN SYSTEM STATIC PRESSURE TRANSMITTERS

- .1 Requirements:
 - .1 Output signal: 4 - 20 mA in 400 ohms, 0-5V into 5K ohms minimum, 0-10 V into 10K ohms minimum.
 - .2 Output variations: \pm 1% full scale for supply voltage variations of plus or minus 10%.
 - .3 Integral zero and span adjustment.
 - .4 Temperature effects: not to exceed plus or minus 3% full scale/ 50 C.
 - .5 Output short circuit and open circuit protection.
 - .6 The unit to have a NPT $\frac{1}{2}$ conduit connection. The enclosure shall be an integral part of the unit.
 - .7 Pressure ranges: see I/O Summaries.
 - .8 LCD Display.

2.11 DUCT SYSTEM VELOCITY PRESSURE SENSORS

- .1 Requirements:

- .1 Multipoint static and total pressure sensing element with self-averaging manifold with integral air equalizer and straightener section.
- .2 Maximum pressure loss: 37 Pa at 1000 m/s.
- .3 Accuracy: plus or minus 1 % of actual duct velocity.

2.12 FAN SYSTEM VELOCITY PRESSURE TRANSMITTERS

- .1 Requirements:
 - .1 Output signal: 4 - 20 mA linear into 500 ohm maximum load.
 - .2 Calibrated span: not to exceed 25 % of duct velocity pressure at maximum flow.
 - .3 Accuracy: 0.4 % of span.
 - .4 Repeatability: within 0.1 % of output.
 - .5 Linearity: within 0.5 % of span.
 - .6 Deadband or hysteresis: 0.1 % of span.
 - .7 External exposed zero and span adjustment.
 - .8 The unit to have a NPT ½ conduit connection. The enclosure shall be an integral part of the unit.

2.13 PRESSURE AND DIFFERENTIAL PRESSURE SENSORS AND SWITCHES

- .1 Requirements:
 - .1 Range: as indicated in I/O summaries.
 - .1 Pressure sensing elements: bourdon tube, bellows or diaphragm type.
 - .2 Adjustable setpoint and differential.
 - .3 Switch: snap action type, rated at 120V, 15 amps AC or 24 V DC.
 - .4 Sensor assembly: to operate automatically and reset automatically when conditions return to normal. Over-pressure input protection to at least twice rated input pressure.
 - .5 Accuracy: within 2% repetitive switching.
 - .6 Provide sensor pressure and accuracy ratings:
 - .1 Chilled and condenser water: 860 kPa.
 - .2 Hot water: 860 kPa.
 - .3 Low pressure steam, compressed air: 1050 kPa. Range: 0 to 200 kPa. Accuracy: plus or minus 3 kPa.
 - .4 Medium pressure steam, compressed air: 1050 kPa. Range: 0 to 700 kPa. Accuracy: plus or minus 7 kPa.
 - .5 High pressure steam: 2100 kPa. Range: 0 to 2100 kPa. Accuracy: plus or minus 14 kPa.
 - .6 High temperature water: 2700 kPa. Range: 0-2700 kPa. Accuracy: plus or minus 25 kPa.
 - .7 For fan operation: Range: 0 to 3000 Pa. Adjustable differential: 10 to 300 Pa.
 - .7 Provide sensors with isolation valve and snubber between sensor and pressure source on liquid service.

- .8 Sensors on steam and high temperature hot water service: provide pigtail syphon.

2.14 TEMPERATURE SWITCHES

- .1 Requirements:
 - .1 Range: see I/O summaries.
 - .2 Temperature sensor: liquid, vapour or bimetallic type. Operate automatically. Reset automatically, except as follows:
 - .1 Freeze protection: manual reset. Optional if software does not auto restart.
 - .2 Fire detection: manual reset. Optional if software does not auto restart.
 - .3 Duct Heater: high limit manual reset in addition to automatic reset.
 - .3 Adjustable setpoint and differential.
 - .4 Accuracy: plus or minus 1 °C.
 - .5 Snap action rating: 120V, 15 amps or 24V DC as required. Switch to be DPST for hardwire and EMCS connections.
 - .6 Type as follows:
 - .1 Room: for wall mounting on standard electrical box with or without protective guard as indicated.
 - .2 Duct, general purpose: insertion length = 460 mm.
 - .3 Thermowell: stainless steel, with compression fitting for NPS 3/4 thermowell. Immersion length: 100 mm.
 - .4 Freeze detection: continuous element with 6000 mm insertion length, duct mounting, to detect coldest temperature in any 300 mm length.
 - .5 Strap-on: with helical screw stainless steel clamp.

2.15 LIQUID LEVEL SWITCHES

- .1 Requirements:
 - .1 Liquid level activated switch sealed in waterproof and shockproof enclosure.
 - .2 Complete with float, flexible cord, weight. Instrument casing to be suitable for immersion in measured liquid.
 - .3 N.O./N.C. Contacts rated at 15 amps at 120V AC. CSA approval for up to 250 volt 10 amps AC.

2.16 AIR PRESSURE GAUGES

- .1 Diameter: 38 mm minimum.
- .2 Range: zero to two times operating pressure of measured pressure media to nearest standard range.

2.17 ELECTRICAL RELAYS

- .1 Requirements:
 - .1 Double voltage, DPDT, plug-in type with termination base.

- .2 Coils: rated for 120V AC or 24V DC. Other voltage: provide transformer.
- .3 Contacts: rated at 5 amps at 120 V AC.
- .4 Relay to have visual status indication

2.18 SOLID STATE RELAYS

- .1 Requirements:
 - .1 CSA approved.
 - .2 Suitable to the application as recommended by manufacturer.
 - .3 Voltage range: 75-265 VAC
 - .4 Panel mounting.
 - .5 Suitable for AC or DC loads.
 - .6 Output surge absorbing element for inductive on/off loads.
 - .7 Input capacitor/resistor circuit for pulse noise absorption.
 - .8 For input inductive noise use twisted-pair wires for electromagnetic noise and shielded cable for static noise.

2.19 CURRENT TRANSDUCERS

- .1 Requirements:
 - .1 Range: in accordance with Equipment Schedules.
 - .2 Purpose: measure line current and produce proportional signal in one of following ranges:
 - .1 4-20 mA DC.
 - .2 0-5 volt DC.
 - .3 0-10 volts DC.
 - .4 2-10 volts DC.
 - .3 Frequency insensitive from 10 - 80 hz.
 - .4 Accuracy to 0.5% full scale.
 - .5 Zero and span adjustments. Field adjustable range to suit motor applications.
 - .6 Adjustable mounting bracket to allow for secure/safe mounting inside the MCC or starter enclosure.

2.20 CURRENT SENSING RELAYS

- .1 Requirements:
 - .1 Complete with metering transformer ranged to match load, plug-in base and shorting shunt to protect current transformer when relay is removed from socket.
 - .2 Suitable for single or 3 phase metering into single relay.
 - .3 To have adjustable latch level, adjustable delay on latch and minimum differential of 10 % of latch setting between latch level and release level.
 - .4 3-Phase application: provide for discrimination between phases.
 - .5 To have adjustable latch level to allow detection of worst case selection. To be powered from control circuit of motor starter being metered. Relay and base to be

mounted in adjacent auxiliary cabinet only if control circuit power to be brought into auxiliary cabinet. Adjustments to be acceptable from auxiliary cabinet.

- .6 Relay contacts: capable of handling 10 amps at 240 V AC.

2.21 CONTROL DAMPERS

- .1 Construction: blades, 152 mm wide, 1219 mm long, maximum. Modular maximum size, 1219 mm wide x 2438 mm high. Multiple sections to have stiffening mullions and jack shafts.
- .2 Materials
 - .1 Frame: 2.3 mm minimum thickness galvanized steel.
 - .2 Blades: galvanized steel with two sheets 0.5 mm thick or otherwise reinforced to ensure specified low leakage when fully closed.
 - .3 Bearings: oil impregnated sintered bronze. Provide thrust bearings for vertical blades.
 - .4 Linkage and shafts: zinc plated steel.
 - .5 Seals: replaceable neoprene or stainless steel spring on sides, top, bottom of frame, along all blade edges and blade ends.
- .3 Performance:
 - .1 Capacity: refer to I/O Summaries.
 - .2 0.02 L/s.m² maximum allowable leakage against 1000 Pa static pressure.
 - .3 Temperature range: minus 50°C to plus 100°C.
 - .4 Arrangements: dampers mixing warm and cold air to be parallel blade, mounted at right angles to each other, with blades opening to mix air stream.

2.22 ELECTRONIC CONTROL DAMPER OPERATORS

- .1 Requirements
 - .1 Push-pull proportional type as indicated.
 - .2 Spring return for "fail-safe" in Normally Open or Normally Closed position as indicated.
 - .3 Operator: size so as to control dampers against maximum pressure or dynamic closing pressure (whichever is greater).
 - .4 Power requirements: 5 VA maximum at 24 V AC.
 - .5 Operating range: 4-20 mA, 0-10 V DC, 2-10 V DC..

2.23 CONTROL VALVES

- .1 Requirements:
 - .1 NPS 2 and under: bronze with screwed ends.
 - .2 NPS 2 1/2 and over: cast iron with flanged ends.
 - .3 Trim: type 316 stainless steel.
 - .4 Leakage: 0.5 % of rated flow maximum.
 - .5 Two or three port as indicated. Normally Open or Normally Closed, as indicated.

- .6 Flow characteristics: linear or equal percentage as indicated.
- .7 Rangeability: 50:1 minimum.
- .8 Performance: Capacity refer to I/O Summaries and Valve Schedule.

2.24 ELECTRONIC/ELECTRIC VALVE ACTUATORS

- .1 Requirements:
 - .1 Construction: steel, cast iron, aluminum.
 - .2 Control voltage: 0-5, 0-10, 2-10V DC, or 4-20 mA.
 - .3 Positioning time: to suit application, 90 sec maximum.
 - .4 Spring return to normal position as indicated.

2.25 PANELS

- .1 Either free-standing or wall mounted enameled steel cabinets with hinged and key-locked front door.
- .2 To be modular multiple panels as required to handle requirements with additional space to accommodate future capacity, without adding additional cabinets.
- .3 Panels to be lockable with same key.

2.26 ELECTRONIC AIR FLOW MEASUREMENT STATIONS AND TRANSMITTERS

- .1 Each station to contain an array of velocity sensing elements and straightening vanes inside a flanged sheet metal casing. The velocity sensing elements to be of the thermal, temperature compensated thermistor type, with linearizing means. The sensing elements to be distributed across the duct cross section in the quantity and pattern set forth for measurements and instruments of ASHRAE and SMACNA for the traversing of ducted air flows. The resistance to air flow through the airflow measurement station not to exceed 20 Pa gauge at an airflow of 10 m/s. Station construction suitable for operation at airflows of up to 25 m/s over a temperature range of 5 to 50 degrees C, and accuracy plus or minus 3 percent over a range of 0.625 to 12.5 m/s scaled to air volume.
- .2 Transmitters to produce a linear, temperature compensated 4-20 mAdc output corresponding to the required velocity pressure measurement. The transmitter to be a 2-wire, loop powered device with local indication where indicated. The output error of the transmitter not to exceed 0.5 percent of the calibrated measurement.

PART 3 EXECUTION.

3.1 INSTALLATION

- .1 Install field control devices, conduit and wire in accordance with manufacturers recommended methods, procedures and instructions. Wiring and conduit above 50 volts by electrical Division. Coordinate requirements with Electrical Contactor.

- .2 Temperature transmitters, humidity transmitters, current-to-pneumatic transducers, solenoid air valves, controllers, relays: install in CSA 2 enclosures or as required for specific applications. Provide for electrolytic isolation in all cases when dissimilar metals make contact.
- .3 Support field-mounted transmitters, sensors on pipe stands or channel brackets.
- .4 Install wall mounted devices on plywood panel properly attached to wall.

3.2 TEMPERATURE AND HUMIDITY SENSORS

- .1 Stabilize to ensure minimum field adjustments or calibrations.
- .2 To be readily accessible and adaptable to each type of application so as to allow for quick easy replacement and servicing without special tools or skills.
- .3 Outdoor installation:
 - .1 Protect from solar radiation and wind effects by stainless steel shields.
 - .2 Install in CSA 4X enclosures.
- .4 Duct installations
 - .1 Do not mount in dead air space.
 - .2 Location to be within sensor vibration and velocity limits.
 - .3 Securely mount extended surface sensor used to sense average temperature.
 - .4 Thermally isolate elements from brackets and supports so as to respond to air temperature only.
 - .5 Support sensor element separately from coils, filter racks.
- .5 Averaging duct type temperature sensors:
 - .1 Sensor length to be not less than 1000 mm per square metre of duct cross-sectional area.
 - .2 Use multiple sensors where single sensor does not meet minimum length ratio. Wire multiple sensors in series for freeze protection applications.
 - .3 Wire multiple sensors separately for temperature measurement.
 - .4 Use either software averaging algorithm to derive overall average for control purposes or separate inputs, based on site requirements.
- .6 Thermowells: install for piping installations. Where pipe diameter is less than well insertion length, locate well in elbow. Thermowell to restrict flow by less than 30%.

3.3 PANELS

- .1 Arrange for conduit and tubing entry from top, bottom or either side.
- .2 Use modular multiple panels if necessary to handle all requirements, with space for additional 20% PCU or FID if applicable without adding additional panels. Space to accommodate maximum capacity of associated controller (ECU, LCU, MCU, PCU, TCU).
- .3 Wiring and tubing within panels: locate in trays or individually clipped to back of panel.

- .4 Identify wiring and conduit clearly.

3.4 MAGNEHELIC PRESSURE INDICATORS

- .1 Install adjacent to fan system static pressure sensor and duct system velocity pressure sensors.
- .2 Locations to be as indicated or specified.

3.5 PRESSURE AND DIFFERENTIAL PRESSURE SWITCHES

- .1 Install isolation valve and snubber on sensors between sensor and pressure source. In addition, protect sensing elements on steam and high temperature hot water service with pigtail syphon between valve and sensor.

3.6 I/P TRANSDUCERS

- .1 Install air pressure gauge on outlet.

3.7 PRESSURE GAUGES

- .1 Install on pneumatic systems only.
- .2 Install pressure gauges on pneumatic devices, I/P, pilot positioners, motor operators, switches, relays, valves, damper operators, valve actuators.
- .3 Install pressure gauge on output of controller and auxiliary cabinet pneumatic devices.

3.8 AIR PRESSURE GAUGES

- .1 Install on pneumatic systems only.
- .2 Install on pneumatic devices including I/P's, pilot positioners, motor operators.

3.9 LIQUID LEVEL SWITCHES

- .1 Suspend float in sump from flexible cord and with weight mounted not more than 50 mm above switch.

3.10 IDENTIFICATION

- .1 Identify field devices properly.
- .2 Refer to Section 25 05 54 - EMCS: Identification.

3.11 AIR FLOW MEASURING STATIONS

- .1 Cap manifold until cleaning of ducts is completed.

- .2 Provide at supply discharge of primary ventilation air handling units.

3.12 TESTING

- .1 Calibrate and test field devices for accuracy and performance. Submit report detailing tests performed for approval. Provide testing equipment and manpower necessary for random testing by City of Winnipeg representative.

3.13 COMMISSIONING

- .1 Refer to Section 25 08 20 - EMCS: Warranty and Maintenance.

END OF SECTION

PART 1 GENERAL

1.1 DESCRIPTION

- .1 This specification describes a high performance variable frequency drive (VFD) used to control the speed of a NEMA design B induction motor.
- .2 Load filters shall be supplied with all drives.
- .3 A building automation system serial communication module and EMCS communication card shall be supplied with all drives.

1.2 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedure
- .2 Section 01 35 50 – Waste Management and Disposal.
- .3 Section 01 81 00 – Commissioning.

1.3 REFERENCES

- .1 Referenced Standards:
 - .1 Underwriters laboratories (ULC)
 - .1 UL508C Power Conversion Equipment
 - .2 National Electrical Manufacturer's Association (NEMA)
 - .1 ICS 7.0, AC Adjustable Speed Drivers
 - .3 International ElectroTechnical Commission (IEC)
 - .1 IEC 61800 Adjustable Speed Electrical Power Drive Systems
 - .2 IEC 60529 Degrees of Protection Provided by Enclosures
 - .4 International Standards Organization (ISO)
 - .1 ISO-9001 Quality Management Systems
 - .5 Canadian Standards Association (CAN/CSA)
 - .1 CAN/CSA C22.1 Canadian Electrical Code Part 1
 - .6 Institute of Electrical and Electronic Engineers (IEEE)
 - .1 IEEE 519 Recommended Practices and Requirements for Harmonic Content and Control in Electrical Power Systems
 - .7 National Electrical Manufacturers Association (NEMA)
 - .1 NEMA MG-1 Motors and Generators
 - .8 Underwriters Laboratory (UL)
 - .1 UL 508C Standard for Power Conversion Equipment

1.4 SUBMITTALS

- .1 Submittals shall include the following information:
 - .1 Outline dimensions, conduit entry locations and weight.
 - .2 Customer connection and power wiring diagrams.
 - .3 Complete technical product description include a complete list of options provided.
 - .4 Compliance to IEEE 519 – harmonic analysis for particular jobsite including total harmonic voltage distortion and total harmonic current distortion (TDD).
 - .1 The VFD manufacturer shall provide calculations; specific to this installation, showing total harmonic voltage distortion is less than 5%. Input line filters shall be sized and provided as required by the VFD manufacturer to ensure compliance with IEEE standard 519. All VFD's shall include a minimum of 5% impedance reactors, no exceptions.
 - .5 In accordance with Section 01 33 00.

1.5 QUALITY ASSURANCE

- .1 The VFD manufacturing facility shall be ISO 9001 certified. The VFD shall be UL listed, Canadian UL listed, CSA listed, IEEE listed, and NEMA listed.
- .2 All printed circuited boards shall be completely tested and burned-in before being assembled into the completed VFD. The VFD shall then be subjected to a preliminary functional test, burn-in, and computerized final test. The burn-in shall be at 40°C, at full rated load, or cycled load. Drive input power shall be continuously cycled for maximum stress and thermal variation. Conformal coating of boards shall be included for each drive.
- .3 The drive shall be designed to provide 250 000 hours mean time before failure (MTBF) when the specified preventative maintenance is performed.
- .4 VFD manufacturer shall have an analysis laboratory to evaluate the failure of any component. The failure analysis lab shall allow the manufacturer to perform complete electrical testing, x-ray components, and decap or delaminate components and analyze failures within the component.

PART 2 PRODUCTS

2.1 GENERAL

- .1 Product Intent: Using a VFD shall not contribute to motor insulation or bearing failure while providing pulse width modulation speed control. As such, the VFD shall include output filtering to keep the rate of rise of each pulse below 1000 volts/microsecond and have output circuitry to prevent a peak output voltage reaching 1000 volts to ground at the motor.
- .2 Unless otherwise indicated, assume the VFD will operate in a temperature environment from 0 C -40 C (32 F - 104 F).

- .3 For hazardous locations or atmospheres as defined by CAN/CSA C22.1, the VFD supplier shall be made aware of the hazard group and classification. The VFD itself shall not corrode or expire prematurely from the atmosphere surrounding it, regardless of the enclosure.

2.2 VARIABLE FREQUENCY DRIVES

- .1 General Type:
- .1 The drive shall be UL listed to UL 508C.
 - .2 The drive converter shall be a full wave bridge design using diode rectifiers; silicon controlled rectifiers (SCR) are not acceptable. The displacement power factor shall not be less than 0.95 lagging under any speed or load condition.
 - .3 Output pulse width modulation frequency shall have setpoint capability ranges from 3 Hz to 60 Hz.
 - .4 When a VFD is required to control a centrifugal pump or centrifugal fan, the drive shall be a variable torque drive.
- .2 Harmonic Suppression:
- .1 Intent: Drive shall not contribute to harmonic distortion such that the maximum building Total Harmonic Distortion (THD) level is 5% per IEEE 519.
 - .1 Exception: For applications designated as sensitive environments (i.e. hospitals, laboratories, airports, communication centers, etc.), the maximum allowable THD shall be reduced to 3%.
 - .2 In the absence of an approved building harmonic analysis, the following shall be provided:
 - .1 Input AC reactors are required if there are four (4) or more VFDs within one room controlling motors, or the cumulative motor horsepower driven by those VFDs exceeds ten (10) horsepower.
 - .3 If an input AC reactor is used for a single VFD, it shall be internal to the drive.
 - .4 The drive shall include two (2) internal DC link filter reactors; one on the positive (+) DC bus and the negative (-) DC bus (between the input rectifier and the DC bus capacitor).
 - .5 The drive shall include 4-120 joule rated metal oxide varistors (MOVs) and R/C snubber circuitry.
- .3 Carrier Frequency / High Temperature Protection:
- .1 The drive shall include internal and automatic carrier frequency modulation. It shall automatically modulate between a high carrier frequency at low motor current demand, and lower frequency at full motor load.
 - .2 The drive shall recognize an over-temperature condition within itself and reduce its carrier frequency as required to reduce its operating temperature.
 - .3 The drive shall include an internal cooling fan that shall run only when internal drive temperature sensors indicate a cooling requirement.
- .4 Short Circuit Protection:
- .1 The output current on all three phases shall be measured continuously and the drive shall fault-trip very fast (<10 ms) to protect itself and the motor against short circuits, ground faults, and phase loss.

- .2 Drive shall include insulated gate bi-polar transistors (IGBT).
- .5 Power Fluctuation:
 - .1 The drive shall automatically compensate for input voltage +/- 10% from nominal to provide full rated motor voltage and torque. The drive shall withstand momentary fluctuations (transients, drop-outs, voltage drops, and surges).
 - .2 The drive shall automatically try to restart after a voltage trip. The drive shall also include synchronization capability if the motor is still turning.
- .6 Current Limiting:
 - .1 The drive shall limit the current to the motor to 110% of the motor current limit rating.
 - .2 A motor that is trying to accelerate or decelerate a load quicker than the current available shall be limited by the drive.
 - .3 The drive shall ramp up current as required during acceleration (soft start). The drive shall apply only enough current to overcome initial motor inertia. Full line voltage shall not be allowed to be applied to a stopped motor.
 - .4 The drive shall include an internal procedure to automatically measure the electrical characteristics of the motor and use it to optimize drive operation.
- .7 Resonance Protection:
 - .1 The drive shall automatically adjust for resonance damping as required.
 - .2 The drive shall also allow for four (4) programmed frequency bandwidths to avoid.
- .8 Electromagnetic / Radio Frequency Interference (EMI / RFI):
 - .1 The drive shall include filters to attenuate RF and radiated emissions.
- .9 Network Communications
 - .1 The drive shall have an EIA-485 port with removable terminal blocks. The onboard protocols shall be BACnet MS/TP, Modbus, and Johnson Controls N2. Optional communication cards for BACnet/IP, LonWorks, Profibus, Profinet, EtherNet/IP, Modbus TCP, and DeviceNet shall be available. The use of third party gateways are not acceptable.
 - .2 The drive shall have the ability to communicate via two protocols at the same time, one onboard protocol, and one option card based protocol. Once installed, the drive shall automatically recognize any optional communication cards without the need for additional programming.
 - .3 The drive shall not require a power cycle after communication parameters have been updated.
 - .4 The embedded BACnet connection shall be a MS/TP interface. The drive shall be BTL listed to revision 14 or later. Use of non-BTL listed drives are not acceptable.
 - .5 The drive shall be classified as an Applications Specific Controller (B-ASC). The interface shall support all BIBBs defined by the BACnet standard profile for a B-ASC including, but not limited to:
 - .1 Data sharing: read property Multiple-B, write property Multiple-B, COV-B
 - .2 Device management: Time synchronization-B

- .3 Object type support: MSV, Loop
- .6 The drive's relay output status, digital input status, analog input/output values, hand-auto status, warning, and fault information shall be capable of being monitored over the network. The drive's start/stop command, speed reference command, relay outputs, and analog outputs shall be capable of being controlled over the network. Remote drive fault reset shall be possible.
- .7 All VFD drives shall have the internal capability to:
 - .1 Run and stop the motor
 - .2 Control to particular speeds
 - .3 Adjust PID parameters
 - .4 Set and hold to current limits
 - .5 Adjust acceleration/deceleration rates
 - .6 Provide feedback information to a local display including:
 - .1 Output speed / frequency
 - .2 Current
 - .3 Motor torque
 - .4 Power usage
 - .5 Drive temperature
 - .6 HOA status
 - .7 Control terminal status (binary, or value)
- .8 The drive shall have at least:
 - .1 Four (4) programmable digital inputs
 - .2 Two (2) programmable analog inputs (0-10 VDC or 0-20 mA)
 - .3 Two (2) programmable digital/analog outputs (4-20 mA or 0-20 mA)
 - .4 Two (2) programmable relay outputs
- .9 Control terminals shall be galvanically isolated from the power line.
- .10 The drive shall include an internal PID controller to act and react to external control devices.
- .11 The drive shall include a built-in time clock.
- .12 The drive shall include internal "permissive" capability to operate the motor only when permitted by a control input (i.e. A motor start will be delayed while waiting for a damper to fully open; the full open signal is sent to the drive, allowing it to start the motor).
- .13 The drive shall have an internal "sleep mode" to stop the motor after a period of very low demand. Upon a call for motor operation, the drive shall automatically resume normal function.
- .14 The drive shall include a micro-processor based bypass which includes:
 - .1 A smoke control / fire alarm panel override digital input to run the motor at a programmable setpoint regardless of any other input, and
 - .2 Motor protection from single phase power conditions.
- .10 Faults, Warnings, and Alarms:
 - .1 Output ground fault: The drive shall be capable of sensing ground faults on any output phase within 100 ms, shut down and display a fault.

- .2 Overvoltage fault: The drive shall automatically try to alleviate overvoltage situations (i.e. motor acting as a generator) internally. If it cannot be resolved the drive shall shut down and issue a fault prior to exceeding the critical DC bus voltage.
- .3 Zero load: The drive shall trip and issue an alarm if there is zero load (after setting a minimum current limit).
- .4 Overload fault: The drive shall keep an overcurrent demand within 110% and try to reduce it automatically. If it cannot, the drive shall shut down and issue a fault within five (5) seconds.
- .5 High temperature: The drive shall issue a warning and reduce its carrier frequency, and/or reduce its output frequency under a high temperature condition.
- .6 Phase Loss or Imbalance: The drive shall fault trip to protect the DC bus capacitors from a phase loss or imbalance and issue an alarm.
- .7 High / Low Warnings: The drive shall have programmable high and low frequency and current settings, all of which may display a warning and signal a control device.
- .8 Serial Communication Loss: For drives controlled via a serial bus, the drive shall detect a loss of serial communication. After a programmable period of time of controlling the motor at the last known speed, the drive shall have the ability to stop the motor and issue a warning.
- .11 Other Features:
 - .1 The drive shall allow for at least eight (8) programmable setpoint motor speeds.
 - .2 The drive shall have the capability to trickle a small amount of DC current continuously to the motor to protect it against condensation or cold starting.
 - .3 The drive shall include an internal, programmable DC current brake.
 - .4 The wiring to and from the drive may be disconnected while the drive is running without additional interlock protection.
 - .5 The drive shall be equipped with an LC filter (lengthens voltage rise time and reduces the peak voltage and ripple current at the motor) if the drive:
 - .1 Controls more than one motor, or
 - .2 Has cumulative motor leads greater than 500 ft (150 m), or
 - .3 Is coupled with a motor not meeting NEMA MG-1 criteria.
 - .6 Regardless of enclosure rating, VFDs used in vented enclosures and located in high humidity environments, or corrosive environments (air containing salt, sulphur, chlorine, or nitrogen compounds) shall have coated circuit boards.
 - .7 The VFD shall be capable of sensing a loss of load (broken belt / broken coupling) and signal the loss of load condition. The drive shall be programmable to signal this condition via a keypad warning, relay output and/or over the serial communications bus. Relay outputs shall include programmable time delays that will allow for drive acceleration from zero speed without signaling a false underload condition.

2.3 ENCLOSURES

- .1 General Requirements
 - .1 Hand-Off-Auto (HOA) selector switch

- .2 For designated 'critical motor operation' applications, the enclosure shall include by-pass capability to run the motor at full speed when the drive is removed.
- .3 An enclosure shall not include an optional internal disconnect switch provided by the manufacturer. If the enclosure contains an internal disconnect switch as a standard feature, it shall be deemed unsuitable as a primary disconnect, therefore, coordinate with the electrical Subcontractor to provide a suitable, second disconnect switch.
- .2 For Hazardous Environments:
 - .1 Unless explicit and prior approval in writing is obtained from both the mechanical and electrical City of Winnipeg Representatives, VFDs and their enclosures shall not be installed in Zone 0, Zone 1, Zone 2, Zone 20, Zone 21, or Zone 22 explosive locations as defined by CAN/CSA C22.1.
- .3 For Outdoor / Unconditioned, Non-Hazardous Environments:
 - .1 Enclosures shall be fan vented and remove heat when temperature within the enclosure is greater than 80 F (27 C).
 - .2 Enclosures shall include a heater to maintain enclosure temperature above the minimum ambient temperature rating (without de-rating) for the VFD.
 - .3 Enclosure Rating: IEC IP54 or IP55 per IEC 60529
- .4 For Indoor / Conditioned, Non-Hazardous Environments:
 - .1 For dusty or sprinklered locations:
 - .1 Enclosure Rating: IP54 or IP55 per IEC 60529
 - .2 For other locations:
 - .1 Enclosure Rating: IEC IP20 or IP21 per IEC 60529

PART 3 EXECUTION

3.1 INSTALLATION

- .1 Installation shall be per manufacturer's documentation.
- .2 Wiring length shall be less than 50 feet (15 m) between the VFD and the motor.
- .3 The VFD (and enclosure) shall be attached to rigid structure per the manufacturer's installation guide. Mounting directly to ductwork is not acceptable .

3.2 WIRING AND GROUNDING

- .1 Wiring shall conform to requirements in CAN/CSA C22.1.
- .2 The minimum wiring gauge for motor leads shall be per the VFD manufacturer's documentation. If the wire gauge used is larger than the largest specified in the manufacturer documentation, the VFD output current shall be de-rated 5% per gauge size in excess.

- .3 Where VFD's are not packaged with the associated equipment, the installation shall be the responsibility of the EMCS Subcontractor. The EMCS Subcontractor shall install the drive in accordance with the recommendations of the VFD manufacturer as outlined in the installation manual.
- .4 Power wiring shall be completed by Division 26. Three copper conductors and a ground wire are required.
- .5 VFD input wiring shall be separate from the output power wiring, in individual metallic conduit. Do not combine.
- .6 Provide a separate metallic conduit for control wiring.
- .7 Division 25 shall be responsible to complete all wiring in accordance with the recommendations of the VFD manufacturer as outlined in the installation manual.

3.3 START-UP

- .1 Division 25 shall be ultimately responsible for the proper setup of the VFD to perform per the mechanical sequence of operations and any additional fire alarm sequences.
- .2 After testing and balancing is complete, make adjustments to any motor's mechanical output (i.e. sheaves or impeller) so that the motor operates above 55 Hz and 70-95% full load amperage at maximum flow/pressure design. Verify the motor current does not exceed full load amperage at 60 Hz.
- .3 Certified factory start-up shall be provided for each drive by a factory authorized service center in accordance with Section 01 81 00 Commissioning and Section 26 05 00 Common Work Results - Electrical. A certified start-up form shall be filled out for each drive with a copy provided to the City of Winnipeg Representative, and a copy kept on file at the manufacturer.

3.4 PRODUCT SUPPORT

- .1 Factory trained application engineering and service personnel that are thoroughly familiar with the VFD products offered shall be locally available at both the specifying and installation locations. A 24/365 technical support line shall be available on a toll-free line.

END OF SECTION

PART 1 GENERAL

1.1 DESIGN DOCUMENTATION

- .1 Design documentation for each system to include, as a minimum:
 - .1 Narrative type of Sequence of Operation.
 - .2 Control Description Logic (CDL).
 - .3 Input/Output Summary Schedules.
 - .4 Schematics.

1.2 EMCS LANGUAGE DESIGN CRITERIA

- .1 Language: refer to Section 25 05 01 EMCS: General Requirements.
- .2 Levels of EMCS Language
 - .1 Level 1: alarm and operational messages to convey alarm conditions or operational messages.
 - .2 Level 2: full names of equipment and control points. The various systems, their equipment and components and all control points are named in accordance with this section.
 - .3 Level 3: system, equipment, component and control point descriptors: unique, alphanumeric identifiers derived from full names of corresponding system component and control point.
 - .4 Level 4: commands: represent various computer functions and routines.
 - .1 Operational commands - relate to building operations and building system controls.
 - .2 Computer system commands - relate to computer maintenance, upgrading or development software used to improve and maintain the application software for the building site.
 - .5 Level 5: machine language. Languages specific to each manufacturer's product, used internally to perform its functions and routines.
- .3 Additional Equipment, Components and/or Control Points. Where additional equipment, components and/or control points are required on specific projects, the following procedures shall be adopted:
 - .1 Full names of the equipment, component and control points shall be not more than 40 characters, including numerals.
 - .2 SYSTEM descriptors shall be not more than 10 alphanumeric characters. INPUT and OUTPUT descriptors shall be not more than 10 alphanumeric characters. The letters shall be based upon the English language full name, and should, where possible, be the first letter of each word of the full name.
- .4 The descriptor shall be unique.

.5 Descriptors and expansions: table lists standardized system identifiers and point identifiers.

.1 Table:

Identifiers and Expansions

English Identifier (10 characters max)	English Expansion (40 characters max)
OAD	Outside air damper
OAT	Outside air temperature
OAH	Outside air humidity
OAV	Outside air volume
RAD	Return air damper
RAT	Return air temperature
RAH	Return air humidity
RASP	Return air static pressure
MAD	** Mixed air dampers **
MAT	Mixed air temperature
MAPSP	Mixed air plenum static pressure

** MAD shall be used for applications where outside air and return air dampers are controlled from one (1) only output signal.

EAD	Exhaust air damper
PFPD	Pre-filter pressure drop
PFALM	Pre-filter pressure drop alarm
FFPD	Final filter pressure drop
FFALM	Final filter pressure drop alarm
HCVLV	Heating coil valve
HCVLVC	Heating coil valve control
HCVLVS	Heating coil valve status
BPD	Heating coil face and bypass damper
HCFA	Heating coil freeze alarm
CCVLV	Cooling coil valve
CCVLVC	Cooling coil valve control
CCVLVS	Cooling coil valve status
SF#-C	Supply fan # control
SF#-S	Supply fan # status
SF#-VSD	Supply fan # VSD control
SF#-VSDF	Supply fan # VSD fault
SAV	Supply air volume
SAVC	Supply air volume control
SAT	Supply air temperature

SAH	Supply air humidity
SAVP	Supply air velocity pressure
SASP	Supply air static pressure
RF#-C	Return fan #control
RF#-S	Return fan # status
RF#-VSD	Return fan # VSD control
RF#-VSDF	Return fan # VSD fault
RAV	Return air volume
RAVC	Return air volume control
RAT	Return air temperature
RAH	Return air humidity
RAVP	Return air velocity pressure
RASP	Return air static pressure
EF#-C	Exhaust fan # control
EF#-S	Exhaust fan s# status
EXAT	exhaust air temperature
EXAV	exhaust air volume
CP#C	Circulating pump # control
CP#F	Circulating pump # flow rate
CP#DP	Circulating pump # discharge pressure
CP#S	Circulating pump # status
HTA	High temperature alarm
LTA	Low temperature alarm
HTCO	High temperature cutout
LTCO	Low temperature cutout
HLA	High level alarm
LLA	Low level alarm
HLCO	High level cutout
LLCO	Low level cutout
HWF	Heating water flow rate
HWST	Heating water supply temperature
HWRT	Heating water return temperature
RM-T	Room temperature
RM-H	Room humidity
RM-SP	Room static pressure (add reference point)

Examples of specific space conditions:

RM-TNPER 2	Space temperature, North Perimeter, 2 nd floor
RM-SPSPER 19	Space static pressure, South Perimeter, 19th floor
RM-HEINT 9	Space humidity, East Interior, 9th floor
AFS	Air Flow Switch
AFM	Air Flow Monitor

F	Flow
P	Pressure
ST	Supply temperature
RT	Return temperature
FA	Fire alarm
FTA	Fire trouble alarm
GWS	Glycol Water Supply
GW	Glycol Water Return
DCW	Domestic cold water system
DHW	Domestic hot water system
DHWR	Domestic hot water system Recirculation
SANP	Sanitary sewage - pumped system
STMP	Storm water - pumped system
SPRD	Sprinkler - Dry pipe system
SPRW	Sprinkler - Wet pipe system
FSTP	Fire standpipe & hose system

1.3 I/O SUMMARY SCHEDULES

.1 General:

- .1 The EMCS Subcontractor shall provide a complete I/O summary schedule similar to the one listed below, listing and describing all I/O's in detail. EMCS Subcontractor's standard schedule may be used provided all relevant information is provided.
- .2 PCU no: identifies the PCU to which all points in the I/O Summary Schedule are wired.
- .3 Building/Area: unique label given to each building forming part of a multi-building facility.
- .4 Area/System Label: unique label given to each area of the building or to each system.
 - .1 Column 1: Point no: I/O Summary Schedule reference number.
 - .2 Column 2: Point label: unique label for each point in the system. Point labels may be repeated for other buildings or systems.
 - .3 Column 3: Description: describes the point label in expanded terms.
 - .4 Column 4: Type: (eg. AI, AO, DI, DO).
 - .5 Column 5: Eng. Units: Describes the engineering units used (eg. for AI, AO: C, kPa, Amp Volt. For DI, DO: OFF, ON).
 - .6 Column 6: Access level: Defines the level of access for varying complexity of functions. Usually associated with password feature. Usually assigned value between 0 (lowest) and 4 (highest).
 - .7 Column 7: Sensor type: describes in 2 or 3 words.

- .8 Column 8: Assoc. Point: Identifies/ describes points for purposes of alarm suppression, software interlocks.
- .9 Column 9: Type: defines the type of alarm (eg. CR = CRITICAL, CA = CAUTIONARY, M = MAINTENANCE).
- .10 Column 10: DI/DO, NO/NC: defines the NORMAL condition of alarm. (NC = NORMALLY CLOSED. NO = NORMALLY OPEN).
- .11 Column 11: Limits: Defines alarm levels (eg. L2 = Low alarm, Level2. H1 = High alarm, Level1).
- .12 Column 12: Alarm Mess: Defines alarm message number. This number is related to pre-composed message detailing the problem and describing the required action.
- .13 Column 13: Maint Mess: defines maintenance message number. This number as related to pre-composed message detailing the problem and describing the required action.
- .14 Column 14: Set Point: Defines the design set-point of the control loop.
- .15 Column 15: Dead band: defines the range above or below the set-point at which no change in output signal is to occur.
- .16 Column 16: Dev alarm limit: defines the limit on deviation of the measured value from the set-point (sometimes also referred to as the "error limit").
- .17 Column 17: NC/NO: defines NORMAL condition when de-energized. NC - NORMALLY CLOSED. NO = NORMALLY OPEN. DA/RA: defines the form of action. DA = direct acting. RA = REVERSE ACTING.
- .18 Column 18: Contacts: NO/NC: defines NORMAL condition when de-energized. NC = NORMALLY CLOSED. NO = NORMALLY OPEN.
- .19 Column 19: Delay Succ starts: defines the time limits (usually in seconds). To prevent overheating of motors or equipment from frequent re-starting.
- .20 Column 20: Heavy motor delay: defines the time (usually up to 60seconds). To prevent heavy electrical load from simultaneous starting of large consumption equipment.
- .21 Column 21: auto-reset: A = AUTOMATIC. M=MANUAL.
- .22 Column 22: Programs:
 - .1 Examples of Applications Programs include: Night set-back; optimum start/stop; demand limiting (load shedding).
 - .2 Optimization routines (eg. chiller optimization, supply air temperature optimization, enthalpy control) should be described as part of CDL's.
 - .3 Parameters for all application programs should be provided separately as part of the design documentation (eg. the Systems Operation Manual).
 - .4 Note requirements for computer totalization, recording, print-out of accumulated value of a point over a period of time. If totalization depends upon a number of analog points, include for pseudo energy points.
 - .5 Run time totals: for calculation of operation of digital points.

- .6 Optimum start/stop: Example: HVAC unit to start before scheduled occupancy, based upon HVAC unit capacity, heat loss, interior and exterior environmental conditions, etc.

.1 Schedule:

INPUT/OUTPUT			SCHEDULE PCU NO.					(see 1.3.2)			
PROJECT NO.			BLDG/AREA		NAME			(see 1.3.3)			
PROJECT NAME			AREA/SYSTEM		NAME			(see 1.3.3)			
POINT IDENTIFICATION			ALARMS								
1	2	3	4	5	6	7	8	9	10	11	
Point No	Point Label	Descrip	Type	Eng. Unit	Access Level	Sensor type	Assoc Point	Type (M,CR)	DI/DO NO/NC	Limits	
MESSAGES											
12	13	14	15	16	17	18	19	20	21	22	
Alarm	Maint	Set-	Dead	Dev.	NO/NC	Cont's	Delay	Heavy	Auto	Pro g	
Limit		Point MO/MA	band start	alarm delay	DA/RA	NO/NC	succ.	Motor	reset		

1.4 CONTROL NARRATIVE SEQUENCE OF OPERATIONS

.1 INTERCONNECTION OF EQUIPMENT WITH FIRE ALARM

- .1 In compliance with the Authority Having Jurisdiction, selective air handling systems within the facility shall be designed to shut down upon alarm condition at the Fire Alarm System. This shutdown control must be directed by the Fire Alarm System, and not through EMCS control software. Division 25 shall coordinate fully with Electrical/Fire Alarm Subcontractor(s), all requirements necessary to facilitate interconnection and achieve shutdown.
- .2 Refer to Controls Schematics for additional control points to be applied to the following sequence of operations.

.2 OFFICE AREA HEAT RECOVERY VENTILATOR HRV-2

- .1 The Office Addition heat recovery ventilator shall operate to provide ventilation and exhaust to all occupied areas of the addition. The HRV shall operate continuously when the building is occupied.
- .2 The HRV shall be equipped with an integral electric heating coil (w/SCR modulation), and a duct mount distribution manifold coupled to an electric steam-generating humidifier.
- .3 Provide a supply air temperature sensor at each floor to maintain discharge temperature of 65°F (18°C), initial and adjustable. On a discharge air temperature call for heating, the electric heating coil SCR shall modulate. On a discharge air temperature call for cooling, DX cooling coil and associated air cooled condensing unit are energized and operating to maintain discharge air temperature setpoint. Electric heating coils shall be disabled if the HRV is in economizer or cooling mode.

- .4 A freeze-stat shall be provided in the supply air duct to de-energize the HRV on sensing discharge temperature below 50°F(10°C), and wired to the EMCS to acknowledge freeze alarm.
- .5 Provide for differential pressure switches across the supply and exhaust filter sections to indicated clogged filter status to the EMCS.
- .6 Provide airflow measuring station on supply and return discharge of heat recovery ventilator for verification of airflow rate.
- .7 Humidity sensors in the occupied area, which through the EMCS, will output a signal to the packaged electric humidifier to control average space humidity. Provide a discharge humidity high-limit sensor in the supply duct. Coordinate with the humidifier supplier. Upon detection of suite humidity levels above setpoint, the humidifier shall remain off.
- .8 Provide EMCS connection to electric humidifier controller via BACnet.
- .9 The following points will be connected to the EMCS controller, including but not limited to.
 - .1 Analog inputs:
 - .1 Supply discharge air temperature.
 - .2 Supply discharge air humidity high limit.
 - .3 Space humidity sensor.
 - .4 Outdoor air temperature (global).
 - .5 Outdoor air humidity (global).
 - .6 Supply air static pressure.
 - .7 Supply duct static pressure.
 - .8 Supply air fan speed.
 - .9 Exhaust air fan speed.
 - .10 Exhaust air static pressure.
 - .2 Analog outputs
 - .1 Supply fan airflow volume (airflow measuring station).
 - .2 Exhaust fan airflow volume (airflow measuring station).
 - .3 Electric heating coil (SCR modulation).
 - .4 Humidifier modulation control.
 - .5
 - .3 Digital inputs
 - .1 Freeze alarm status.
 - .2 Supply fan status.
 - .3 Exhaust fan status.
 - .4 Clogged filter (supply).
 - .5 Clogged filter (exhaust).
 - .6 High-limit humidity (alarm).
 - .4 Digital outputs
 - .1 Supply fan start/stop.
 - .2 Exhaust fan start/stop.

- .3 LOBBY AREA HEAT RECOVERY VENTILATOR HRV-1
 - .1 The Lobby heat recovery ventilator shall operate to provide ventilation and exhaust to all occupied areas of the addition. The HRV shall operate continuously when the building is occupied.
 - .2 The HRV shall be equipped with an integral electric heating coil (w/SCR modulation).
 - .3 Provide a supply air temperature sensor at each floor to maintain discharge temperature of 65°F (18°C), initial and adjustable. On a discharge air temperature call for heating, the electric heating coil SCR shall modulate. On a discharge air temperature call for cooling, DX cooling coil and associated air cooled condensing unit are energized and operating to maintain discharge air temperature setpoint. Electric heating coils shall be disabled if the HRV is in economizer or cooling mode.
 - .4 A freeze-stat shall be provided in the supply air duct to de-energize the HRV on sensing discharge temperature below 50°F (10°C), and wired to the EMCS to acknowledge freeze alarm.
 - .5 Provide for differential pressure switches across the supply and exhaust filter sections to indicated clogged filter status to the EMCS.
 - .6 Provide airflow measuring station on supply and return discharge of heat recovery ventilator for verification of airflow rate.
 - .7 Provide EMCS connection to electric humidifier controller via BACnet.
 - .8 The following points will be connected to the EMCS controller, including but not limited to.
 - .1 Analog inputs:
 - .1 Supply discharge air temperature.
 - .2 Outdoor air temperature (global).
 - .3 Supply air static pressure.
 - .4 Supply duct static pressure.
 - .5 Supply air fan speed.
 - .6 Exhaust air fan speed.
 - .7 Exhaust air static pressure.
 - .2 Analog outputs
 - .1 Supply fan airflow volume (airflow measuring station).
 - .2 Exhaust fan airflow volume (airflow measuring station).
 - .3 Electric heating coil (SCR modulation).
 - .4 Humidifier modulation control.
 - .3 Digital inputs
 - .1 Freeze alarm status.
 - .2 Supply fan status.
 - .3 Exhaust fan status.
 - .4 Clogged filter (supply).
 - .5 Clogged filter (exhaust).
 - .4 Digital outputs
 - .1 Supply fan start/stop.

.2 Exhaust fan start/stop.

.4 VRF EQUIPMENT CONTROL

.1 Roof Mounted VRF Heat Pumps:

- .1 The VRF manufacturer shall provide a complete controls devices package to permit the proper operation of the VRF equipment. The wiring requirements for all VRF devices shall be borne by this Division, and shall be in compliance with the manufacturer recommendations and standards outlined herein. All VRF functions shall be based on control strategies inherent to the VRF manufacturer.
- .2 Control wiring from each roof mount heat pump unit shall be extended to respective Central Controllers mounted in Mech 120. The BACnet communication interface shall be provided by the VRF manufacturer, shall have a visual display of all connected equipment and components, and shall be interconnected to the building EMCS for monitoring, control, and troubleshooting purposes, by Division 25.

.2 VRF Fan Coil Control

- .1 Each zone shall be equipped with a wall mounted space temperature controller that shall operate the respective VRF fan coil, and enable/modulate the associated electric heating coil (or electric baseboard/force flow heater as required). The controller shall operate in an occupied/unoccupied schedule, and shall be equipped with a space humidity sensor function, and occupancy sensor.
- .2 The controller shall have an occupancy sensor to bring the VRF fan coil operation to occupied mode when the space is occupied.
- .3 A carbon dioxide sensor shall be located in each Meeting room, to monitor and alarm levels in respective zones.
- .4 Occupied mode:
 - .1 VRF fan coils shall operate continuously, cycle in heating or cooling to maintain thermostatic setpoint.
- .5 Unoccupied mode:
 - .1 VRF fan coils shall cycle in heating or cooling to maintain night setback thermostatic setpoint.
- .6 Heating:
 - .1 The fan coil temperature controller shall modulate VRF heating to maintain thermostatic setpoint. As VRF heating capacity is lessened with reduced ambient temperatures, the associated fan coil temperature controller will modulate the respective Electric Heating Coil to maintain temperature setpoint.
 - .2 Where auxiliary electric heaters (baseboard or force flows) are within the fan coil zone, a current sensing relay on the duct heater shall enable the respective auxiliary electric heaters for operation; temperature control of the respective electric heaters shall be independent of the fan coil controller.
- .7 Cooling:
 - .1 The fan coil temperature controller shall modulate VRF cooling to maintain thermostatic setpoint.

- .2 Auxiliary electric heating coils, baseboards, or force flow heaters shall be inherently disabled.
- .3 The following points will be connected to the EMCS controller, including but not limited to.
 - .1 Analog inputs:
 - .1 CO2 (IAQ) sensors required in multi-occupant areas:
 - .1 Wasac 122 (FC-2-4 to 2-6)
 - .2 Wasac 125 (FC-1-1)
 - .3 Wading Pools (FC-1-3)
 - .4 Staff 126 (FC-1-5)
 - .5 Bylaw 127 (FC-1-6)
 - .6 Zone Humidity sensor.
 - .2 Analog output.
 - .1 CO2 level/alarm.
 - .3 Digital input.
 - .1 Zone occupancy status.
 - .4 Digital output.
 - .1 Occupancy signal to zone thermostat.
- .5 AIR HANDLING UNITS
 - .1 ARENA MPR AREA (AH-2, HRV-5):
 - .1 The air handling unit and HRV will provide ventilation, heating and cooling to the zone. The unit shall be equipped with a BACnet card to monitor/control setpoints, extended to the building EMCS.
 - .2 Un-Occupied Mode.
 - .1 The AH-2 supply fan shall remain off. Mixing dampers shall be in 100% return position, relief damper fully closed and relief fans off.
 - .2 HRV-5 shall remain off. Associated motorized dampers fully closed.
 - .3 The remote relief air dampers shall be fully closed.
 - .4 The unit shall modulate the electric heating, or DX cooling sections, as required to maintain setback temperature setpoint via wall mount temperature sensor.
 - .3 Occupied Mode.
 - .1 The supply fan shall energize and operate continuously. Mixing dampers shall open to minimum outdoor air position.
 - .2 Remote damper actuators shall open to match operation of air unit outdoor damper via building pressure controller, to maintain building pressure.
 - .3 The unit shall modulate the electric heating, or DX cooling sections, as required to maintain temperature setpoint via wall mount temperature sensor.
 - .4 Carbon dioxide CO2 sensors within the space shall measure IAQ levels in the space.

- .1 Upon detection of CO2 levels above setpoint, motorized mixed air dampers at AH-2 and relief dampers shall fully close. Motorized dampers serving HRV-5 shall open, and upon proof of open, HRV-5 shall energize. Should dampers fail to prove, alarm signal shall be acknowledged at the OWS.
- .2 HRV-5 shall have integral preheating coil defrost strategy to prevent frost buildup within the unit.
- .3 Once CO2 levels are below setpoint, HRV-5 shall de-energize and associated dampers close. Motorized mixed air dampers AH-2 and relief dampers shall revert to minimum positions.
- .5 Economizer free-cooling shall be enabled when the outdoor air enthalpy conditions permit cooling of space with outdoor air. Return dampers shall modulate close, outdoor air dampers shall modulate open, relief dampers modulate to maintain building pressure. Upon a call for free cooling, HRV-5 shall be de-energized and associated dampers shall close.
- .4 The following controller points will be connected to the EMCS controller, including but not limited to.
 - .1 Analog inputs:
 - .1 Discharge air temperature.
 - .2 Space temperature.
 - .3 CO2 level (IAQ)
 - .2 Analog Outputs:
 - .1 Supply fan airflow volume
 - .2 Electric heating coil (SCR modulation).
 - .3 DX Cooling Capacity
 - .4 Mixed air and relief dampers
 - .3 Digital input:
 - .1 AH fan status.
 - .4 Digital output:
 - .1 AH fan start/stop.
 - .2 Outdoor air intake damper.
 - .3 Return air damper (HRV)
 - .4 Supply air damper (HRV)
- .2 ARENA STORAGE AREAS (AH-1):
 - .1 The air handling unit will provide ventilation, heating and cooling to the zone. The unit shall be equipped with a BACnet card to monitor/control setpoints, extended to the building EMCS.
 - .2 Un-Occupied Mode.
 - .1 The supply fan shall remain off. Mixing dampers shall be in 100% return position, relief damper fully closed and relief fans off.
 - .2 The remote relief damper shall be fully closed.

- .3 The unit shall modulate the electric heating, or DX cooling sections, as required to maintain setback temperature setpoint via wall mount temperature sensor.
- .3 Occupied Mode.
 - .1 The supply fan shall energize and operate continuously. Mixing dampers shall open to minimum outdoor air position.
 - .2 Remote relief damper actuators shall open to match operation of air unit outdoor damper via building pressure controller.
 - .3 The unit shall modulate the electric heating, or DX cooling sections, as required to maintain temperature setpoint via wall mount temperature sensor.
- .4 The following controller points will be connected to the EMCS controller, including but not limited to.
 - .1 Analog inputs:
 - .1 Discharge air temperature.
 - .2 Space temperature.
 - .3 Building pressure
 - .2 Analog Outputs:
 - .1 Supply fan airflow volume
 - .2 Electric heating coil (SCR modulation).
 - .3 DX Cooling Capacity
 - .4 Mixed air and relief dampers
 - .3 Digital input:
 - .1 AH fan status.
 - .4 Digital output:
 - .1 AH fan start/stop.
 - .2 Outdoor air intake damper.
- .3 ARENA OFFICE AREA (AH-3):
 - .1 The air handling unit will provide ventilation, heating and cooling to the zone. The unit shall be equipped with a BACnet card to monitor/control setpoints, extended to the building EMCS.
 - .2 Un-Occupied Mode.
 - .1 The AH-3 supply fan shall remain off. Economizer mixing dampers shall be in 100% return position. Supply and return dampers at the envelope penetrations shall be closed.
 - .2 Upon a call for heating or cooling, supply and return dampers at the envelope penetrations shall open and upon proof of opening, the unit shall modulate the electric heating, or DX cooling sections, as required to maintain setback temperature setpoint via wall mount temperature sensor.
 - .3 Occupied Mode.
 - .1 The supply and return dampers at the envelope penetrations shall open, upon proof of open the supply fan shall energize and operate continuously. Mixing dampers shall open to minimum outdoor air position.

- .2 The unit shall cycle the electric heating, or DX cooling sections, as required to maintain temperature setpoint.
 - .3 The unit shall be equipped with a power exhaust/relief dampers (field installed) on the return ductwork, per manufacturer recommendations.
 - .4 The following controller points will be connected to the EMCS controller, including but not limited to.
 - .1 Analog inputs:
 - .1 Space temperature.
 - .2 Digital output:
 - .1 Supply and return dampers.
 - .3 BACnet Bus for AH-3 controller features.
- .6 FAN COIL/HRV UNITS (FC-1/HRV-3, FC-2/HRV-4)
- .1 MPR 136 (FC-1/HRV-3):
 - .1 The fan coil and associated HRV units will provide ventilation, heating and cooling to the zone.
 - .2 Un-Occupied Mode.
 - .1 The fan coil shall remain off.
 - .2 HRV shall remain off, associated intake motorized damper in fully closed position.
 - .3 The unit shall modulate the electric heating, or DX cooling sections, as required to maintain setback temperature setpoint via wall mount temperature sensor.
 - .3 Occupied Mode.
 - .1 Via programmable schedule, or manual override switch in MPR 136 and adjacent Wasac Office 135, the fan coil fan shall energize, motorized HRV intake damper shall open, HRV shall energize and run continuously.
 - .2 Duct mount defrost preheat coil shall modulate to maintain discharge air temperature setpoint.
 - .3 Fan coil electric heating, or DX cooling sections, shall cycle as required to maintain temperature setpoint via wall mount temperature sensor.
 - .4 Carbon dioxide CO2 sensors within the space shall measures IAQ levels in the space.
 - .4 The following controller points will be connected to the EMCS controller, including but not limited to.
 - .1 Analog inputs:
 - .1 Space temperature.
 - .2 CO2 level (IAQ)
 - .2 Digital output:
 - .1 Intake and exhaust dampers.
 - .2 SECURE STORAGE/ASSEMBLY 138 (FC-2/HRV-4):

- .1 The fan coil and associated HRV units will provide ventilation, heating and cooling to the zone.
- .2 Un-Occupied Mode.
 - .1 The fan coil shall remain off.
 - .2 HRV shall remain off, associated intake motorized damper in fully closed position.
 - .3 The unit shall modulate the electric heating, or DX cooling sections, as required to maintain setback temperature setpoint via wall mount temperature sensor.
- .3 Occupied Mode.
 - .1 Via programmable schedule, or manual override switch in adjacent Storage 138, the fan coil fan shall energize, motorized HRV intake damper shall open, HRV shall energize and run continuously.
 - .2 Duct mount defrost preheat coil shall modulate to maintain discharge air temperature setpoint.
 - .3 Fan coil electric heating, or DX cooling sections, shall cycle as required to maintain temperature setpoint via wall mount temperature sensor.
 - .4 Carbon dioxide CO2 sensors within the space shall measure IAQ levels in the space.
- .4 The following controller points will be connected to the EMCS controller, including but not limited to.
 - .1 Analog inputs:
 - .1 Space temperature.
 - .2 CO2 level (IAQ)
 - .2 Digital output:
 - .1 Intake and exhaust dampers.
- .7 DOMESTIC HOT WATER RECIRCULATION PUMPS
 - .1 CP-2:
 - .1 The pump shall run based on stand alone programmable time clock with a user-adjustable schedule.
 - .2 CP-1:
 - .1 The pump shall be controlled based on a programmed schedule from the building energy monitoring and control system (EMCS).
 - .2 Digital output:
 - .1 CP-1 start/stop.
- .8 DOMESTIC WATER SUB-METERS (TYPICAL OF 3)
 - .1 Interface with domestic water sub-meter e-coder/readers to be extended to EMCS to monitor water consumption for each of the three zones.

1.5 INPUT/OUTPUT POINT SUMMARY TABLE

- .1 The input/output list summarize the Input/Output (I/O) points for the various systems as outlined within the Building EMCS specifications and control schematic drawings. However, the tables are not all inclusive as they are for general description of minimum points requirements to achieve the listed sequence of operations. The number and location of these devices shall be found on the floor plans and/or listed in relevant schedules. All points and field devices required to accomplish the specified sequence of operation shall be provided.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION (NOT APPLICABLE)

END OF SECTION

Part 1 General

1.1 MEASUREMENT PROCEDURES

- .1 Provide Lump sum price for the foundation work in accordance with the structural drawings. Indicate quantity of piles to be sleeved that are included in lump sum price. Indicate additional cost per sleeved pile exceeding sleeve allowance.
- .2 Friction Piles:
 - .1 Provide Lump sum price for the foundation work in accordance with the structural drawings.

1.2 REFERENCES

- .1 American Society for Testing and Materials International (ASTM)
 - .1 ASTM A36/A36M-05, Standard Specification for Carbon Structural Steel.
 - .2 ASTM A53/A53M-05, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
- .2 American Welding Society (AWS)
 - .1 AWS D1.4/D1.4M-05, Structural Welding Code - Reinforcing Steel.
- .3 Canadian Standards Association (CSA International)
 - .1 CSA-A23.1/A23.2-04(July 2005), Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
 - .2 CAN/CSA-G30.18-M92(2002), Billet Steel Bars for Concrete Reinforcement.
 - .3 CSA-G40.20/G40.21-04, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
 - .4 CAN/CSA-S16-01(R2007), Limit States Design of Steel Structures.
 - .5 CSA W48-01(R2006), Filler Metals and Allied Materials for Metal Arc Welding.

1.3 EXISTING CONDITIONS

- .1 Sub-surface investigation report has been included as part of this specification. Contractor is to review the report and become familiar with the subsurface conditions.
- .2 Notify Contract Administrator in writing if subsurface conditions at site differ from those indicated and await further instructions from Geotechnical Contract Administrator.

1.4 SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Shop Drawings:
 - .1 Indicate: size of pile, reinforcing steel and ties.
- .3 Caissons Installation:
 - .1 Provide caisson installation sequence for review of the Contract Administrator at least two weeks in advance of caisson installation.

Part 2 Products

2.1 MATERIALS

- .1 Concrete mixes and materials: in accordance with Section 03 30 00 - Cast-in-Place Concrete.
- .2 Reinforcing steel: to CAN/CSA-G30.18 and in accordance with Section 03 20 00 - Concrete Reinforcing.
- .3 Steel casing: As required and designed by installer.
- .4 Grout: in accordance with Section 03 30 00 - Cast-in-Place Concrete.

2.2 SOURCE QUALITY CONTROL

- .1 Mill report to CAN/CSA-S16.
- .2 Concrete tests: to CSA-A23.1/A23.2.

Part 3 Execution

3.1 INSTALLATION

- .1 Friction Piles:
 - .1 Bore holes to diameters and lengths as indicated. The tips of the piles should not penetrate the glacial till.
 - .2 Install within 50mm of exact centres set out, 2% of vertical plumb and 25mm of required elevation. Correction of deviations beyond those defined to be at the discretion of the Contract Administrator, costs for correction are to be borne by the Contractor.
 - .3 Remove loose material, foreign matter and water as directed by geotechnical Contract Administrator.
 - .4 Vibrate top 4500mm of each pile.
- .2 Protective steel casing:
 - .1 Install casing as required. Cost of casing shall be included in lump sum for foundation work.
- .3 Remove stones up to 300mm in dimension, boulders over 300mm and rock in whole or in part before boring tool is deflected. If required, lower boring tool and clean hole to ensure that machine auger has reached the required depth.
- .4 Check each caisson shaft for toxic and explosive gases and provide appropriate protective measures for personnel working in shaft.
- .5 Dispose of excavated materials off site.
- .6 Install steel reinforcement in accordance with Section 03 20 00 - Concrete Reinforcing and as indicated.
- .7 Fill pile excavations with concrete to elevations as indicated.

- .1 Place concrete in one continuous pour in accordance with Section 03 30 00 - Cast-in-Place Concrete.
- .8 Steel protective casing may be removed at option of Contractor.
- .9 Where steel protective casing is to be removed, provide concrete with minimum slump of 125 mm and with retarder to prevent arching or setting of concrete.
 - .1 Withdraw casing in conjunction with concrete placing, keeping bottom of casing below level of concrete.
- .10 Where steel protective casing is left in place, fill void space between casing and shaft excavation with concrete.
- .11 Use tremie pipe or concrete pumping as required. Costs of tremied concrete shall be included in the lump sum for the foundation work.

3.2 PROTECTION

- .1 If superimposed work is to be placed later, protect top of each unit with at least 150mm of damp sand.

3.3 DEFECTIVE PILES

- .1 Cased concrete shaft piles rejected where:
 - .1 Soil has entered casing.
 - .2 Water has entered casing.
 - .3 Casing is damaged, out of tolerance or alignment.
- .2 Defective Friction Piles:
 - .1 Leave rejected pile in place, place adjacent pile and modify pile cap as directed in writing by Contract Administrator.
 - .2 No extra compensation will be made for additional piles and other costs due to installation of damaged or defective piles.
- .3 Defective Caissons:
 - .1 Perform remedial work as directed by Contract Administrator and Geotechnical Contract Administrator.

3.4 SAFETY

- .1 Conform to the latest regulations of the Provincial Building Protection Act and Provincial Building Code and provide all necessary safety equipment required.

3.5 FIELD QUALITY CONTROL

- .1 Independent review of friction piling and caisson operations shall be done by an independent inspection and testing agency under a cash allowance and retained by the City of Winnipeg.
- .2 Maintain accurate records for each caisson and pile installation, including:
 - .1 Pile size and length, location of pile.

- .2 Location.
 - .3 Top of Caisson Elevation.
 - .4 Bearing Condition.
 - .5 Bearing Capacity.
 - .6 Presence of Water.
 - .7 Other pertinent information.
- .3 Provide Contract Administrator with three copies of records.

3.6 CLEANING

- .1 Proceed in accordance with Section 01 74 00 – Project Clean-Up.
- .2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General

1.1 Waste Management and Disposal

- .1 Place materials defined as hazardous or toxic in designated containers.
- .2 Do not dispose of unused solvent materials into landfill. Divert materials to municipal hazardous materials depot as approved by Contract Administrator.

Part 2 Products

2.1 Materials

- .1 Abrasives and solvents used for removal of paint, oil, grease, rubber deposits: proprietary products specially designed for pavement cleaning, subject to approval by Contract Administrator.

Part 3 Execution

3.1 Removing pavement markings

- .1 Remove rubber tire deposits and paint markings, in areas as directed by Contract Administrator, by water blasting, rotary grinding, heater planing or other method approved in writing by Contract Administrator.
- .2 Exercise care to avoid dislodging of coarse aggregate particles, excessive removal of fines, damage to bituminous binder or damage to joint and crack sealers.
- .3 Do not heat pavement surfaces above 120 degrees C, when using heater planning equipment.

3.2 Pavement surface cleaning

- .1 Remove sealing compound which has protruded excessively, where directed by Contract Administrator.
 - .1 Dispose of removed material as directed by Contract Administrator.
- .2 Remove dust, contaminants, loose and foreign materials, oil and grease, in areas as directed by and by method approved in writing by Contract Administrator.
- .3 Use rotary power brooms or vacuum sweepers supplemented by hand brooming.

3.3 Cleaning

- .1 Progress Cleaning: clean in accordance with Section 01 74 00 - 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 00 - Cleaning.
- .3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 19 - Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

Part 1 General

1.1 DESCRIPTION

- .1 Provide all labour, materials, methods, equipment and accessories for the supply and installation of unit pavers in concrete blockouts as indicated on the Drawings.

1.2 RELATED SECTIONS

- .1 32 16 15 – Site Concrete

1.3 REFERENCES

- .1 City of Winnipeg Standard Construction Specifications:
 - .1 CW 3110 – Sub-Grade, Sub-Base and Base Course Construction
 - .2 CW 3335 – Installation of Interlocking Paving Stones on a Lean Concrete Base
- .2 City of Winnipeg Standard Construction Details:
 - .1 SD-240B – Interlocking Paving Stones on Lean Concrete Base.

1.4 SUBMITTALS

- .1 Submittals in accordance with Submittal Procedures specification.
- .2 Submit full sized sample of unit paver.

1.5 QUALITY CONTROL

- .1 All workmanship and all materials furnished and supplied under this specification are subject to close and systematic inspection and testing by the Contract Administrator including all operations, from the selection and production of materials, through to final acceptance of the Work.
- .2 The Contractor shall be wholly responsible for the control of all operations incidental thereto notwithstanding any inspection of approval that may have been previously given.
- .3 The Contract Administrator reserves the right to reject any materials or Works that are not in accordance with the requirements of this specification.

1.6 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate metal, plastic, wood and corrugated cardboard packing and place in designated areas for disposal and recycling.

Part 2 Products

2.1 Materials

- .1 Pre-Cast Concrete Unit Paving (Pedestrian/Vehicular Lane and Tabletop Crossing Strips):
 - .1 600 x 300 x 100mm Broadway Paver, colour: Charcoal, running bond double row pattern.

- .2 600 x 300 x 100mm Broadway Paver, colour: Natural, running bond main pattern.
- .3 Available from Barkman Concrete, ph. 1-800-461-2278.
- .2 Pre-Cast Concrete Unit Paving (Plaza and indicator Strips):
 - .1 600 x 300 x 65mm Broadway Paver, colour: Charcoal, running bond double row pattern.
 - .2 600 x 300 x 65mm Broadway Paver, colour: Natural, running bond main pattern.
 - .3 600 x 300 x 65mm Broadway Paver, colour: Sierra Grey, running bond main pattern.
 - .4 Available from Barkman Concrete, ph. 1-800-461-2278.
- .3 Bedding Sand: shall be fine aggregate to the requirements of specification CW3335.
- .4 Joint Sand: to the requirements of specification CW3335.
- .5 Granular base: crushed limestone to specification CW 3110.
- .6 Joint Sand: to the requirements of specification CW 3330.

Part 3 Execution

3.1 MANUFACTURERS INSTRUCTIONS

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

3.2 INSTALLATION OF PAVERS

- .1 Contractor to verify the exact dimensions of all unit pavers types prior to the construction of concrete blockouts. Use physical samples of the specified pavers when constructing form work for blockouts. Paver longitudinal edge shall not be cut.
- .2 Contractor to review paving layout and patterns with Contract Administrator.
- .3 Install concrete sidewalk w/blockouts as specified on Drawings.
- .4 Preparation of Sand Base
 - .1 Remove all accumulated debris from blockouts.
 - .2 Install bedding sand to a minimum of 25mm as specified on the Drawings and to CW 3335.
 - .3 Do not compact sand base prior to installing pavers.
- .5 Installation of Unit Pavers
 - .1 Unit pavers shall be installed in formed concrete blockouts and over compacted subgrade in accordance with the specification CW3335, set in locations and patterns as shown on the Drawings. Spaces between joints shall be 5mm maximum and shall be uniform and consistent while maintaining true patterns as indicated on the Drawings.
 - .2 Commence installation of pavers against edge to obtain straightest possible course for installation.

- .3 Pavers shall be cut with saw only to obtain true even undamaged edges. Chipped pavers are unacceptable.
- .4 Crews shall work on installed pavers, not on sand layer.
- .5 Compact pavers into the bedding sand layer using approved vibratory compactors until they are at the proper grade, uniformly level and free of any movement.
- .6 Spread and fine grade joint sand over paving surface and sweep into joints.
- .7 Sweep remaining sand over all paving areas and remove from site.
- .8 Replace at no extra cost all whole or cut stones marked as unacceptable.
- .9 Remove cracked, chipped, broken or otherwise damaged paving materials from Site immediately.
- .10 Ensure a perfect / flush match between pavers and the edge of the block outs on all edges.

3.3

CLEANING

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

END OF SECTION

Part 1 General

1.1 DESCRIPTION

- .1 This specification shall cover the supply and installation of all sidewalk paving, cast in place concrete header, cast in place concrete planter and seatwalls and miscellaneous accessories.

1.2 RELATED SECTIONS

- .1 N/A.

1.3 REFERENCES

- .1 American Society for Testing and Materials International (ASTM)
 - .1 ASTM D698-(1998), Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400ft-lbf/ft³) (600 kN-m/m³).
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-1.2-98, Boiled Linseed Oil.
 - .2 CAN/CGSB-3.3-99, Kerosene.
- .3 Canadian Standards Association (CSA)
 - .1 CAN/CSA-A23.1/A23.2-94, Concrete Materials and Methods of Concrete Construction/Methods of Test for Concrete.
- .4 City of Winnipeg Standard Construction Specifications, current edition.
 - .1 CW 3110 – Sub-Grade, Sub-Base and Base Course Construction.
 - .2 CW 3310 – Portland Cement Concrete Pavement Works.
 - .3 CW 3325 – Portland Cement Concrete Sidewalk.

1.4 SAFETY PRECAUTIONS

- .1 The Contractor shall provide guards, barricades, dust screens, and/or other construction necessary to secure the safety of workers, the public, and personnel alike and shall comply with all Provincial statues applicable to the Work of their nature. Protective clothing and equipment shall be worn at all times during sandblasting operations. The Contractor shall provide all other protective measures as may be required by any law in force in Manitoba.

1.5 CERTIFICATES

- .1 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. Certification letter to be sealed by an Engineer registered in the Province of Manitoba.
- .2 Provide certification that plant, equipment, and materials to be used in concrete comply with requirements of CSA-A23.1. Certification letter to be sealed by an engineer registered in the Province of Manitoba.

1.6 QUALITY ASSURANCE

- .1 Minimum two (2) weeks prior to starting concrete work, submit proposed quality control procedures for review by Contract Administrator on the following items:

- .1 Falsework erection.
- .2 Hot weather concrete.
- .3 Cold weather concrete
- .4 Curing.
- .5 Finishes.
- .6 Formwork removal.
- .7 Joints.

1.7 SUBMITTALS

- .1 Submittals in accordance with Submittal Procedures specification.
- .2 The Contractor shall furnish a 1m x 1m concrete sample – 1/2 broom finish and 1/2 troweled finish for approval by the Contract Administrator prior to construction. If the sample is rejected, additional sample panels shall be made until approval is obtained. The approved sample panel will be kept at the jobsite and will become the quality standard for site concrete finishes.
- .3 Submit concrete test results indicating compliance with the specifications.
- .4 Submit product data sheets for concrete accessories.

1.8 QUALITY CONTROL

- .1 Only qualified concrete installers with more than 10 years of experience installing site concrete works will be accepted.
- .2 All workmanship and all materials furnished and supplied under this Specification are subject to close and systematic inspection and testing by the Contract Administrator including all operations from the selection and production of materials, through to final acceptance of the Work.
- .3 The Contractor shall be wholly responsible for the control of all operations incidental thereto notwithstanding any inspection or approval that may have been previously given.
- .4 The Contract Administrator reserves the right to reject any materials or Works that are not in accordance with the requirements of this Specification.

1.9 SITE CONDITIONS

- .1 Concrete installation to be completed under ideal conditions when temperatures will not be falling below 5°C overnight and only once all other preparatory work including base preparation, layout, forming and reinforcing has been inspected and approved.

1.10 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.
- .2 Modifications to maximum time limit must be agreed to by Contract Administrator and concrete producer as described in CSA A23.1/A23.2.
- .3 Deviations to be submitted for review by Contract Administrator.
- .4 Concrete Delivery: ensure continuous concrete delivery from plant meets CSA A23.1/A23.2.

1.11 TESTING

- .1 The inspection and testing of site concrete will be carried out by a testing laboratory appointed by the Contractor and approved by the Contract Administrator. Testing laboratory to be certified in accordance with CSA A283. The Contractor shall coordinate the timing of this testing in an efficient way.
- .2 Test concrete for every batch delivered to site. Field annotate with sequential pour numbers the areas covered by each batch of concrete delivered to the site should a batch be deemed unacceptable after twenty-eight (28) days.

1.12 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate metal, plastic, wood and corrugated cardboard packing and place in designated areas for disposal and recycling.

Part 2 Products

2.1 MATERIALS

- .1 Sub-grade, sub-base and granular base construction to CW 3110.
- .2 Portland cement concrete constituent materials, reinforcing, expansion / isolation joint filler, and forms to CW 3310.

Part 3 Execution

3.1 RELATED WORK

- .1 Ensure all mechanical and electrical rough-ins are fully coordinated and in place. Coordinate with mechanical and electrical Contractors prior to concrete installation.
- .2 Prior to concrete installation, ensure rough grading is complete and sub-grade / sub-base fill is compacted and approved by the Contract Administrator prior to installing base course material.
- .3 Do not complete any soft landscape finishes prior to completing site concrete works and all other hard landscape elements.

3.2 LAYOUT

- .1 Accurately lay out paving, planter and seatwall work to patterns and conditions shown on the Drawings and verify with Contract Administrator prior to construction.
- .2 Provide additional control points and stakeouts as required to effect correct alignments and grade elevations.
- .3 Adjust stakes as necessary to allow for installation of concrete.
- .4 Advise Contract Administrator of discrepancies and on-site conditions detrimental to critical layouts and obtain approved corrections.

3.3 GRANULAR BASE

- .1 Place granular base course base material to lines, widths, and depths as indicated on the Drawings and to CW 3310.

- .2 Obtain Contract Administrator's approval of base course and compaction tests before forming and pouring concrete.

3.4 FORMING

- .1 Obtain approval of layout and compaction testing from Contract Administrator prior to forming.
- .2 Form concrete and place reinforcement to CW 3310.

3.5 CONCRETE INSTALLATION

- .1 Obtain approval from Contract Administrator of all forming and reinforcing steel prior to placing concrete.
- .2 Install concrete to CW 3310 & CW 3325.

3.6 CONCRETE FINISHING AT TIME OF POURING

- .1 Immediately after floating, give concrete walkway surfaces a uniform broom finish producing regular corrugations not exceeding 2mm deep, by drawing broom in one direction perpendicular to a centre line established with the Contract Administrator. Run all broom finishes at the same angle.
- .2 Planters and Seatwalls to be smooth, even concrete surfaces, free of all honeycomb, objectionable fins, projections, offsets, streaks or other surface imperfections.

3.7 TOLERANCES

- .1 Finish surfaces to within 3mm in 3m as measured with 3m straightedge placed on surface.

3.8 SAW CUT CONTROL JOINTS

- .1 Install saw cut transverse joint at 1500mm on centre and to the depths indicated on the Drawings.

3.9 ISOLATION JOINTS

- .1 Install isolation joints along lengths adjacent to buildings and permanent structures.
- .2 Install joint filler in isolation joints to CW 3310.

3.10 CURING

- .1 Cure concrete by adding moisture continuously in accordance with CAN/CSA-A23.1 to exposed finished surfaces for at least one (1) day after placing or sealing moisture in by curing compound as approved by Contract Administrator.
- .2 Apply curing compound evenly to form continuous film, in accordance with manufacturer's requirements. Cover newly poured concrete during curing period if inclement weather or cold weather conditions are imminent.

3.11 BACKFILL

- .1 Allow concrete to cure for seven (7) days prior to backfilling.
- .2 Backfill to designated elevations with material as indicated on the Drawings. Compact and shape to required contours as indicated.

3.12 DEFECTIVE CONCRETE WORK

- .1 Remove and re-pour areas showing checking, slumping, cracking, spalling or honeycombing.

3.13 ACCEPTANCE

- .1 Obtain final approval of concrete installation via a site inspection with the Contract Administrator.

3.14 CLEANING

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

END OF SECTION

Part 1 General

1.1 DESCRIPTION

- .1 This specification to cover all labour, equipment and materials required to mark parking stall lines, no parking areas and accessible parking symbols.

1.2 RELATED SECTIONS

- .1 N/A.

1.3 REFERENCES

- .1 CAN/CGSB – 1.5 – M91, Low Flash Petroleum Spirits Thinner.
- .2 CGSB 1-GP-12c-68, Standard Paint Colours.
- .3 CGSB 1-GP-71-83, Method, of Testing Paints and Pigments.
- .4 CGSB 1-GP-74M-79, Paint, Traffic, Alkyd.

1.4 SUBMITTALS

- .1 Submittals in accordance with Submittal Procedures specification.
- .2 Proof of Non-Toxic Composition: Product data confirming chemical composition for traffic paint conforms to the latest health and environmental standards of the local jurisdiction.

1.5 SAMPLES

- .1 Submit samples, on request, in accordance with Section 01 33 00 Submittal Procedures.
- .2 Submit to the Contract Administrator the following material sample quantities at least two (2) weeks prior to commencing work.
 - .1 One painted sample of each type of paint.
 - .2 Sampling to CSGB 1-GP-71.
- .3 Clearly mark samples with name of project and its location, paint manufacturer's name and address, name of paint, CGSB specification number and formulation number and batch number.

Part 2 Products

2.1 MATERIALS

- .1 Paint shall conform to City of Winnipeg specifications for reflectorized traffic paint or suitable equivalent for application to asphalt and/or concrete surface.
 - .1 CGSB 1-GP-74M + Amdt-May-81, alkyd traffic paint.
 - .2 High Gloss Traffic Paint (IBIS Products Limited).
- .2 Paint colours shall be to CGSB 1-GP-12C
 - .1 Blue: Pride Enterprises, Handicap Blue 15813 or approved equal.
 - .2 Traffic Yellow: To CGSB1-GP-12C.
 - .3 Thinner: To CAN/CGSB-1.5M91.

Part 3 Execution

3.1 EQUIPMENT REQUIREMENTS

- .1 Paint applicator to be an approved pressure type mobile distributor capable of applying paint in single, double and dashed lines. Applicator to be capable of applying marking components uniformly, at rates specified, and to dimensions as indicated, and to have positive shut-off.

3.2 CONDITION OF SURFACES

- .1 Pavement surface to be dry, free from ponding water, frost, ice, dust, oil, grease and other foreign materials. Clean paved areas as necessary to achieve acceptable surface preparation.

3.3 TRAFFIC CONTROL

- .1 Barricade areas to be painted to all vehicular traffic during installation and for six (6) hours after installation.

3.4 APPLICATION

- .1 Lay out parking stall lines, no parking zones, and accessible parking symbols as indicated on the Drawings. Obtain the Contract Administrator's approval prior to painting.
- .2 Unless otherwise approved by the Contract Administrator, apply paint only when air temperature is above 10°C, wind speed is less than 50 km/h and no rain is forecast within the next eight (8) hours.
- .3 Apply traffic paint evenly at rate of 3 sq.m. per litre. Do not thin paint unless approved by Contract Administrator.
- .4 Parking stall paint lines to be 100mm wide, of uniform colour and density with sharply defined edges.
- .5 Paint parking stall and no parking lines yellow. Paint accessible parking symbols white within blue rectangle.
- .6 Thoroughly clean distributor tank before refilling with paint of a different colour.

3.5 TOLERANCE

- .1 Paint markings to be within plus or minus 6mm of dimensions indicated, straight and true and aligned with fixed features such as curbs, sidewalks and walls.
- .2 Remove incorrect markings and re-apply at no extra cost to The City.

3.6 PROTECTION OF COMPLETED WORK

- .1 Protect pavement markings until dry.

3.7 CLEANING

- .1 Upon completion of installation, remove construction and accumulated environmental dirt, surplus materials, rubbish, tools and equipment barriers from site

END OF SECTION

Part 1 General

1.1 Related requirements

- .1 Section 03 30 00 - Cast-in-Place Concrete

1.2 Reference standards

- .1 The City of Winnipeg
 - .1 Standard Construction Specification CW 3550 - Chain link and Drift Control Fence.
 - .2 All referenced standard construction specifications found within CW 3550.
- .2 ASTM International (ASTM):
 - .1 ASTM A53/A53M- 20, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless
 - .2 ASTM A90/A90M- 21, Standard Test Method for Weight Mass of Coating on Iron and Steel Articles with Zinc or Zinc-Alloy Coatings
 - .3 ASTM A121- 19, Standard Specification for Zinc-Coated (Galvanized) Steel Barbed Wire
 - .4 ASTM A123/A123M- 13, Standard Specification for Zinc (Hot Dip Galvanized) coatings on Iron and Steel Products
 - .5 A653/A653M- 13, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
 - .6 ASTM C618- 19, Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete
 - .7 ASTM F1664- 08, Standard Specification for Poly(Vinyl Chloride) (PVC)-Coated Steel Tension Wire Used with Chain-Link Fence
- .3 Canadian General Standards Board (CGSB):
 - .1 CAN/CGSB-1.181-99, Ready-Mixed Organic Zinc-Rich Coating
 - .2 CAN/CGSB-138.1-96, Fabric for Chain Link Fence
 - .3 CAN/CGSB-138.2-96, Steel Framework for Chain Link Fence
 - .4 CAN/CGSB-138.3-96, Installation of Chain Link Fence
 - .5 CAN/CGSB-138.4-96, Gates for Chain Link Fence
- .4 CSA Group (CSA):
 - .1 CSA A23.1/A23.2- 14, Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete
 - .2 CAN/CSA-A3000- 18, Cementitious Materials Compendium
- .5 Master Painters Institute (MPI):
 - .1 Architectural Painting Specification Manual - current edition

1.3 Action and informational submittals

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for concrete mixes, fences, posts and gates, sliding gate operator and panic door hardware and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Sustainable Design Submittals:
 - .1 LEED Submittals: in accordance with Section 01 35 20 - LEED Sustainable Requirements.
 - .2 Construction Waste Management: Refer to Section 01 74 19 - Construction Waste Management and Disposal.
 - .3 Material product attribute documentation: Refer to Product Check Sheet as listed in 01 35 20 – LEED Sustainable Requirements to determine applicable type of documentation required for each product.
 - .4 Low-Emitting Materials:
 - .1 Submittals are required for any sealants, adhesives, paints, coatings, composite wood, flooring, wall panels, insulation or ceiling components within the inner most weather proofing barrier.
 - .2 Refer to Product Check Sheet as listed in 01 35 20 – LEED Sustainable Requirements to determine applicable type of documentation required for each product.
- .4 Shop Drawings:
 - .1 Submit drawings stamped and signed by professional engineer registered or licensed in the Province of Manitoba, Canada showing proposed system, site specific details, and integration of gate operator based on actual site conditions. Indicate locations, dimensions, openings and requirements of related work.

1.4 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 in accordance with manufacturer's recommendations.
 - .2 Store and protect fence and gate materials, swing gate door hardware and sliding truck gate operator from damage.
 - .3 Replace defective or damaged materials with new.
- .4 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding, and packaging materials as specified in Construction Waste Management Plan in accordance with Section 01 74 19 - Construction Waste Management and Disposal.

Part 2 Products

2.1 Materials

- .1 Use only those products meeting the specifications listed under CW 3550 found on the City of Winnipeg web site at: <http://www.winnipeg.ca/matmgt/spec/>.
- .2 Chain-link fence fabric: to CAN/CGSB-138.1.
 - .1 Fabric shall be No. 9 gauge steel wire woven into a uniform 2" (50 mm) diamond pattern mesh or as specified. Size of mesh shall be determined by measuring the minimum clear distance between the wires forming the parallel sides of the mesh. Permissible variation in size of mesh shall be 1/8" (3 mm). Diameter of wire shall be no less than 3.68 mm. The top and bottom selvage shall be knuckles.
 - .2 Fabric shall be zinc coated before weaving by the hot dip process to an average mass per unit area of not less than 490 g/m².
 - .3 Mesh fabric shall not be excessively rough, or have blisters, sal ammoniac spots, bruises or flaking.
 - .4 Chain link fabric shall have a minimum tensile strength of 415 MPa.
 - .5 Height of fabric: as indicated on drawings.
- .3 Terminal Posts: to CAN/CGSB-138.2 , galvanized steel pipe.
 - .1 Fence Height: 3050 mm
 - .2 Pipe Dia. (outside): 3 1/2" (89mm)
- .4 Line Posts: to CAN/CGSB-138.2 , galvanized steel pipe.
 - .1 Standard seamless, continuous weld, schedule 40 hot dip galvanized steel pipe weighing 5.43 kg per lineal metre. Tubing, conduit or open seam pipe will not be accepted. Line posts shall be supplied with weatherproof eye top caps to accommodate continuous horizontal top rail.
 - .1 Fence Height: 3050 mm
 - .2 Pipe Dia. (outside): 2 3/8" (60.3mm)
- .5 Top and Bottom Rails to CAN/CGSB-138.2 , galvanized steel pipe.
 - .1 Top rails, or bottom rails where specified, shall be standard continuous weld, schedule 40 hot dip galvanized steel pipe weighing 3.38 kg per lineal metre. Top rails shall be 22'-0" (6700 mm) in length and have an outside diameter of not less than 1 3/4" (43mm)
- .6 Top and Bottom Rail Sleeve Couplings
 - .1 Top and bottom rail sleeve couplings shall be schedule 40, hot dip galvanized steel pipe, 6 3/4" (171 mm) long and 1 7/8" (45 mm) inside diameter to accommodate a 1 3/4" (43 mm) outside diameter top rail and manufactured specifically as a top/bottom rail sleeve coupling for chain link fence.
- .7 Bottom tension wire: to CAN/CGSB-138.2 , No. 6 gauge, single strand, galvanized steel wire.
- .8 Turnbuckles

- .1 Shall be drop forged steel and be hot dip galvanized. The average overall length shall be approximately 300mm, with ends in the closed position. Bolt diameter shall be 10mm and shall be capable of taking up a minimum of 150mm slack.
- .9 Braces
 - .1 Shall be schedule 40 hot dip galvanized steel pipe, not less than 43mm outside diameter and weigh 3.38 kg per lineal metre.
- .10 Tie wire fasteners: aluminum alloy wire.
- .11 Tension bar: To ASTM A653/A653M, 5 x 20 mm minimum galvanized steel. and not less than 50mm shorter than the height of the fabric with which they are to be used. Cut ends of tension bars shall be ground smooth to remove all sharp edges and burrs.
- .12 Tension Bands: 3 x19 mm galvanized flat steel c/w 8 x 32 mm galvanized carriage bolts and nuts to fasten top rail receptacles to terminal posts.
- .13 Brace Bands: 3 x 19 mm galvanized flat steel c/w 8 x 32 mm galvanized carriage bolts and nuts to fasten top rail receptacles to terminal posts.
- .14 Fabric Clips: No. 9 gauge aluminum alloy wire.
- .15 Weatherproof post tops/caps, receptacles and fitting: shall be of adequate strength and may be of aluminum alloy, malleable steel or pressed steel. All ferrous metals shall be hot dip galvanized.
- .16 Gates: To CAN/CGSB-138.4.
 - .1 Gate posts are to be 6 5/8" (168 mm) diameter, schedule 40.
- .17 Gate frames: To ASTM A53/A53M, galvanized steel pipe, standard weight 45 mm outside diameter pipe for outside frame, 35 mm outside diameter pipe for interior bracing.
 - .1 Fabricate gates as indicated with electrically welded joints, and hot-dip galvanized after welding.
 - .2 Fasten fence fabric to gate with twisted selvage at top.
 - .3 Furnish gates with galvanized malleable iron hinges, latch and latch catch with provision for padlock which can be attached and operated from either side of installed gate.
 - .4 Furnish double gates with chain hook to hold gates open and centre rest with drop bolt for closed position.
 - .5 Gate wheels for swing gates wider than 6'-0" shall be 16" (400mm) solid rubber tire with 3/4" wheel bearings, or approved alternate.
 - .6 Gate Fabric to match fence
 - .7 Hinges shall permit the gate to swing back 180 degrees in line with the fence and shall be installed so as not to permit easy removal of the gate.
- .18 Organic zinc rich coating: To CAN/CGSB-1.181.
- .19 Post Plates where fence is installed on top of concrete floors: Provide a custom fabricated plate welded to posts and mechanically fastened to concrete. Fastener type to suit site conditions.

2.2 Finishes

- .1 Galvanizing:

- .1 For chain link fabric: To CAN/CGSB-138.1 Grade 2.
- .2 For pipe: 550 g/m² minimum to ASTM A90.
- .3 For other fittings: To ASTM A123/A123M.

Part 3 Execution

3.1 Examination

- .1 Verification of Conditions: Verify conditions of substrate previously installed under other Sections or Contracts are acceptable for fence and gate installation in accordance with manufacturer's written instructions.
 - .1 Inform Contract Administrator of unacceptable conditions immediately upon discovery.
 - .2 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Contract Administrator.

3.2 Preparation

- .1 Grading:
 - .1 Remove debris and correct ground undulations along fence line to obtain smooth uniform gradient between posts.
 - .1 Provide clearance between bottom of fence and ground surface of 30 mm to 50 mm.

3.3 Erection of fence

- .1 Erect fence along lines as indicated and to CAN/CGSB-138.3.
- .2 Posts shall be plumbed and set to give correct alignment. Bending of posts to give correct alignment is not acceptable
- .3 Weatherproof post tops/caps shall be securely attached to eliminate removal by hand. Eye top caps shall allow for the insertion of a top rail in a horizontal position.
- .4 Space line posts 10-0' (3 m) apart, measured parallel to ground surface.
- .5 Space straining posts at equal intervals not to exceed 150 m if distance between end or corner posts on straight continuous lengths of fence over reasonably smooth grade, is greater than 150 m.
- .6 Install additional straining posts at sharp changes in grade.
- .7 Install corner post where change in alignment exceeds 10 degrees.
- .8 Install end posts at end of fence and at buildings.
 - .1 Install gate posts on both sides of gate openings.
- .9 Install brace between end and gate posts and nearest line post, placed in centre of panel and parallel to ground surface.
 - .1 Install braces on both sides of corner and straining posts in similar manner.
- .10 Install overhang tops and caps.
- .11 Install top rail between posts and fasten securely to posts and secure waterproof caps and overhang tops.

- .12 Install bottom tension wire, stretch tightly and fasten securely to end, corner, gate and straining posts with turnbuckles and tension bar bands.
- .13 Lay out fence fabric. Stretch tightly to tension recommended by manufacturer and fasten to end, corner, gate and straining posts with tension bar secured to post with tension bar bands spaced at 12" (300 mm) intervals.
 - .1 Knuckled selvedge at bottom.
 - .2 Twisted selvedge at top.
- .14 Tension bars, bands and bolts shall be used to fasten the fabric to terminal posts. Maximum spacing for tension bands and bolts shall be 380mm. Top of tension bars shall not protrude above the bottom of the top rail
- .15 The bottom tension wire shall be stretched taut along the bottom of the fabric and securely attached to all terminal and line posts and attached to the bottom edge of the fabric at 450mm maximum spacing using hog rings.
- .16 Secure fabric to top rails, line posts and bottom tension wire with tie wires at 450 mm intervals.
 - .1 Give tie wires minimum two twists.
- .17 Where turnbuckles are specified for installation, they shall be used to stretch the bottom tension wire taut and be able to take up a minimum of 150 mm slack.

3.4 Installation of gates

- .1 Install gates in locations as indicated.
- .2 Level ground between gate posts and set gate bottom approximately 1 1/2" (40 mm) above ground surface.
- .3 Install gate stops where indicated.

3.5 Touch up

- .1 Clean damaged surfaces with wire brush removing loose and cracked coatings. Apply two coats of organic zinc-rich paint to damaged areas.
 - .1 Pre-treat damaged surfaces according to manufacturers' instructions for zinc-rich paint.

3.6 Cleaning

- .1 Progress Cleaning: Clean in accordance with Section 01 74 00 - Cleaning.
- .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 reuse and recycling in accordance with Section 01 74 19 - Construction Waste Management and Disposal.

END OF SECTION

Part 1 General

1.1 Related requirements

- .1 Section 01 33 00 - Submittal procedures
- .2 Section 01 61 00 - Common product requirements
- .3 Section 03 30 00 - Cast-in-Place Concrete
- .4 Section 09 91 00 - Painting

1.2 Reference standards

- .1 ASTM International (ASTM):
 - .1 ASTM A641/A641M - Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire
 - .2 A653/A653M- 13, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
 - .3 ASTM B117 - Practice for Operating Salt-Spray (Fog) Apparatus
 - .4 ASTM D523 - Test Method for Specular Gloss
 - .5 ASTM D714 - Test Method for Evaluating Degree of Blistering in Paint
 - .6 ASTM D822 - Practice for Conducting Tests on Paint and Related Coatings and Materials using Filtered Open-Flame Carbon-Arc Light and Water Exposure Apparatus
 - .7 ASTM D1654 - Test Method for Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments
 - .8 ASTM D2244 - Test Method for Calculation of Color Differences from Instrumentally Measured Color Coordinates
 - .9 ASTM D2794 - Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact)
 - .10 ASTM D3359 - Test Method for Measuring Adhesion by Tape Test
 - .11 ASTM F2453/F 2453M – Standard Specification for Welded Wire Mesh Fence Fabric
- .2 Canadian General Standards Board (CGSB):
 - .1 CAN/CGSB-1.181-99, Ready-Mixed Organic Zinc-Rich Coating
- .3 CSA Group (CSA):
 - .1 CSA A23.1/A23.2- 14, Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete
- .4 Master Painters Institute (MPI):
 - .1 Architectural Painting Specification Manual - current edition

1.3 Action and informational submittals

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

- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for fences, posts and gates and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Sustainable Design Submittals:
 - .1 LEED Submittals: in accordance with Section 01 35 21 - LEED Requirements.
 - .2 Construction Waste Management: Refer to Section 01 74 19 - Construction/Demolition Waste Management and Disposal.
 - .3 Material product attribute documentation: Refer to Product Check Sheet as listed in 01 35 20 – LEED Sustainable Requirements to determine applicable type of documentation required for each product.
 - .4 Low-Emitting Materials:
 - .1 Submittals are required for any sealants, adhesives, paints, coatings, composite wood, flooring, wall panels, insulation or ceiling components within the inner most weather proofing barrier.
 - .2 Refer to Product Check Sheet as listed in 01 35 20 – LEED Sustainable Requirements to determine applicable type of documentation required for each product.
- .4 Shop Drawings:
 - .1 Submit drawings stamped and signed by professional engineer registered or licensed in the Province of Manitoba, Canada showing proposed system, site specific details. Indicate locations, dimensions, openings and requirements of related work.

1.4 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 in accordance with manufacturer's recommendations.
 - .2 Store and protect fence and gate materials and swing gate door hardware from damage.
- .4 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding, and packaging materials as specified in Construction Waste Management Plan in accordance with Section 01 74 19 - Waste Management and Disposal.

Part 2 Products

2.1 Manufacturers

- .1 Rampart 280 Welded Wire
 - .1 Wallace Perimeter Security
 - .2 Address: 90 Lawson Crescent, Winnipeg, Manitoba Canada, R3P 2H8

- .3 Phone: 866.300.1110, Fax: 204.284.1868
- .4 Website: wallaceperimetersecurity.com
- .2 Or approved equal.

2.2 Fabrication

- .1 Concrete mixes and materials: in accordance with CSA A23.1.
 - .1 Nominal coarse aggregate size: 20-5.
 - .2 Compressive strength: 20 MPa minimum at 28 days.
 - .3 Where concrete piles are specified for post installation, the concrete shall conform to CW 2160 and be sulphate resistant type 50, minimum compressive strength of 25 MPa at 28 days, air content of 4%-7% maximum slump of 80mm and a maximum size of coarse aggregate of 40mm.
- .2 Welded wire panels:
 - .1 Panel heights: 3050mm (10'-0") - use a multiple of 1830mm (6'-0") and 1220mm (4'-0") stacked panels as required.
 - .2 Wire mesh panels shall be precut to specified lengths of 8'-2" (2508 mm) wide. Panel sizes to suit fence height and fencing configuration shown on the drawings.
 - .3 Steel Wire mesh fence panels shall be welded by resistance welding per ASTM F2453 using pre-galvanized steel wire using Vertical 4 GA (6mm) pre-galvanized steel wires and two Horizontal 0 GA (8mm) pre-galvanized steel wires to form a mesh opening of 2" x 8" (50mm x 200mm).
 - .4 One end of the vertical wires of the panel shall exceed 1" (25mm) from the first horizontal wire creating a spiked top.
 - .5 The cold rolled wire shall have a tensile strength of at least 74,000 psi and 68,000 psi shear strength. Wire strand shall be galvanized before welded (GBW), .50 ounces per square foot zinc coating conforming to the ASTM A641.
- .3 Posts:
 - .1 Size: 76mm (3") x 76mm (3") square posts
 - .2 Height: Posts to terminate 3050mm (10'-0") above grade
 - .3 Posts to be set in concrete piles, post and pile depth/size to suit site conditions.
 - .4 Brackets: 12 ga. (3mm / 1/8" thick) steel brackets shaped for line post connections, corner post connections, end post connections, and panel connections as required to suit fence height and fencing configuration shown on drawings.
 - .1 Bracket fasteners: 5/16-18 x 1.5" (38mm) Carriage Bolts & 5/16-18 Nuts
- .4 Privacy Inserts:
 - .1 Size and length of inserts to suit welded wire fencing (Rampart 280 - DOUBLE WIRE - Welded Wire Fence or approved equal)
 - .2 Provide inserts throughout all exterior welded wire fencing shown on drawings, full height of fence and at gates. Weave inserts through welded wire fencing.
 - .3 Insert material: Polyethylene
 - .4 Color: Black (RAL#9005)

- .5 Gate - install commercial double swing and single swing gates - opening sizes as indicated on the drawings.
 - .1 Gate infill to be Rampart 286 Welded Wire (or approved equal)
 - .2 Gate frame to be custom welded steel pipe.
 - .3 Install locking hardware - standard drop latch with Master Lock padlock model 3KA (or approved equal).
 - .4 Hinges shall permit the gate to swing back 180 degrees in line with the fence and shall be installed so as not to permit easy removal of the gate.
 - .5 Provide a welded or bolted header above gate openings.

2.3 Coating

- .1 Hot-dip galvanized: Coat wire mesh with 0.5 oz./sq. ft. (150 g/m²) zinc in conformity with ASTM A641 (1989) Class 1.
- .2 Pre-galvanized and polyester powder coated: The polyester surface coating color shall be standard black. Polyester coating to be minimum 4 mils with an average thickness of 100µm applied by an electrostatic method. Coating shall cover all surfaces of the wire sections.
- .3 Corrosion: Wires to be galvanized according to ASTM A641/A641M with a minimum of 40 gr/m². After the welding process, panels to be pre-treated and provided with a conversion layer for a better anti-corrosion effect and better adhesion of the polyester powder coating.
- .4 All panels, gates, posts, brackets, and base flanges to have black powder coated finish as noted above. Fasteners to be black.

Part 3 Execution

3.1 Examination

- .1 Verification of Conditions: Verify conditions of substrate previously installed under other Sections or Contracts are acceptable for fence and gate installation in accordance with manufacturer's written instructions.
 - .1 Inform Contract Administrator of unacceptable conditions immediately upon discovery.
 - .2 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Contract Administrator.

3.2 Preparation

- .1 Grading:
 - .1 Remove debris and correct ground undulations along fence line to obtain smooth uniform gradient between posts.
 - .1 Provide clearance between bottom of fence and ground surface of 30 mm to 50 mm.

3.3 Erection of fence

- .1 Installation shall be laid out by the Subcontractor in accordance with the construction plans. The manufacturers' gate drawings shall identify the necessary gate hardware and installation recommendations required for the application.
- .2 Erect fence along lines as indicated on drawings.
- .3 Excavate concrete pile/post holes to a depth suiting the site conditions.
- .4 Posts shall be set in the centre of concrete piles. Brace to hold posts in plumb position and true to alignment and elevation until concrete has set.
- .5 Tops of concrete piles shall be crowned or domed to shed water and be installed 100mm below the finished grade.
- .6 Posts shall be plumbed and set to give correct alignment. Bending of posts to give correct alignment is not acceptable
- .7 Weatherproof post tops/caps shall be securely attached to eliminate removal by hand.
- .8 Space line posts 2604mm (102.5") apart, measured parallel to ground surface.
- .9 Install end posts at end of fence and at existing walls.
- .10 Install gate posts on both sides of gate openings. Install single and double swing gates to suit configuration shown on the drawings.
 - .1 Brace gate opening with additional posts as required for stability.
- .11 Connect welded wire panels to posts by installing corner, end, and line post brackets to suit configuration shown on the drawings.

3.4 Installation of gates

- .1 Install gates in locations as indicated.
- .2 Level ground between gate posts as required. Set gate bottom approximately 1 1/2" (40 mm) above ground surface.

3.5 Touch up

- .1 Clean damaged surfaces with wire brush removing loose and cracked coatings.
 - .1 Pre-treat damaged surfaces and finish according to manufacturers' instructions.

3.6 Cleaning

- .1 Progress Cleaning: Clean in accordance with Section 01 74 00 - Cleaning.
- .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 reuse and recycling in accordance with Section 01 74 19 - Waste Management and Disposal.

END OF SECTION

Part 1 General

1.1 DESCRIPTION

- .1 This specification shall cover the supply and installation of waste receptacles, bollards, tactile warning surfaces, benches & anti-skate guards.

1.2 RELATED SECTIONS

- .1 32 16 15 – Site Concrete

1.3 SUBMITTALS

- .1 Submittals in accordance with Submittal Procedures specification.
- .2 Submit product data for: waste receptacle & decorative/safety bollard, top-mounted bench, & wall-mounted bench.
- .3 Indicate dimensions, sizes, assembly, anchorage, materials, finishes, and installation details for each furnishing specified.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver materials to site, suitably packaged, clearly marked indicating manufacturer name and any other identifying symbols or information. Do not deliver materials long before they are required on site. Cause no delays to schedule.
- .2 Store materials in a dry location off the ground and prevent damage.
- .3 Replace immediately all materials damaged or unfit for use during delivery or storage.

1.5 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate metal, plastic, wood and corrugated cardboard packing and place in designated areas for disposal and recycling.

Part 2 Products

2.1 SITE FURNITURE

- .1 Waste Receptacle: Gretchen Litter 25-gallon capacity, side opening, matte black powdercoated frame, IPE (premium, exterior, no finish) wood, surface mounted. Available from Landscape Forms, Tracy Cook, ph. 1-800-430-6206.
- .2 Decorative/Safety Bollard: Modena Braille Bollard MBB-37, carbon black low lustre powercoated finish, walnut 100%recycled plastic lumber colour slats, surface mounted. Available from Wishbone LTD., Ronay Shelton, ph. 1-866-626-0476.
- .3 Collapsible Bollard: Model #BCB-48, 1.22m x 0.15m collapsible bollard (padlock not included), safety yellow colour, surface mounted with stainless steel anchor bolts, nuts, washers. Available from Belson Outdoors, ph. 1-800-323-5664.

- .4 Top-Mounted Bench: Link Piano Key Bench-Straight, backless, armless, IPE premium, matte black powder coated frame, top of wall mount. Available from Landscape Forms, Tracy Cook, ph. 1-800-430-6206.
- .5 Wall-Mounted Bench: Link Piano Bench-Straight, full backrest, two end arms, IPE premium, matte black powder coated frame and armrests, wall mount. Available from Landscape Forms, Tracy Cook, ph. 1-800-430-6206.
- .6 Tactile Warning Surfaces: Armor-Tile by Engineered Plastics Inc, Exterior Sidewalk Detectable Warning Area: Vitrified Polymer Composite (VPC) cast-in-place detectable/warning surface tiles with a non-slip UV-stabilized surface coating of aluminium oxide particles on a pattern of raised, truncated domes. 609 x 1220mm, safety yellow. Available from Alsip's, 204-791-2760.
- .7 Anti-Skateboard Guards: 45 degree chamfer anti-skateboard guards, including the following kit pieces: security screws for mounting the guards, security screw bit for use with multi-drivers or drills concrete drill bit and epoxy. Available from B.C. Site Service, 1.866.598.8414, or approved equal.
- .8 Precast Concrete Splash Pads: Precast concrete splashpads at rainwater discharge locations, as shown on drawings.
 - .1 Size: 30"(762mm) L x 12"(304mm) W x 3.13"(80mm) H.
 - .2 Provide galvanized steel anchor pins, in quantity as necessary to sufficiently secure splashpads in place.
 - .3 Standard of Acceptance: Barkman Concrete 30", Model #141474
- .9 Precast Concrete Curb Stops:
 - .1 Precast concrete curb stops at parking stall locations, as shown on drawings.
 - .2 Size: 84"(2135mm) L x 8" (203mm) W x 6" (152mm) H, with chamfered profile.
 - .3 Provide galvanized steel anchor pins, in quantity as necessary to sufficiently secure curb stops in place.

Part 3 Execution

3.1 INSTALLATION

- .1 General
 - .1 Ensure that all related Work has been approved by the Contract Administrator commencing site furniture installation.
 - .2 Assemble furnishings in accordance with manufacturer's instructions. Obtain Contract Administrator approval of assembled furnishings prior to mounting.
 - .3 Stake out or mark site furniture locations on site for Contract Administrator approval prior to installation
 - .4 Install all furnishings true, plumb, anchored and firmly supported to the manufacturers express written specifications, and as shown on the Drawings.
 - .5 Waste receptacles are to be embedded in concrete. Coordinate with concrete installation.
 - .6 Decorative/Safety Bollards are to be embedded in concrete. Coordinate with concrete installation.
 - .7 Top-Mounted Benches are to be embedded in concrete. Coordinate with concrete installation.

- .8 Wall-Mounted Benches are to be embedded in concrete. Coordinate with concrete installation.
- .9 Anti-Skate Guards to be installed in accordance with the Drawings and manufacturers written specifications and installation guide.
- .10 Precast Concrete Splash Pads: Place concrete splashpads at rainwater discharge locations, as shown on drawings. Secure concrete splash pads to ground surface using galvanized steel anchor pins, in accordance with manufacturer's instructions.
- .11 Precast Concrete Curb Stops: Place concrete curb stops at parking stall locations, as shown on drawings. Secure concrete curb stops to ground surface using galvanized steel anchor pins, in accordance with manufacturer's instructions.

3.2 TOUCH-UPS

- .1 Touch-up minor damage to finishes with matching paint available from the supplier, to approval of Contract Administrator.
- .2 Site furnishings with major damage to finishes will be rejected.

3.3 ACCEPTANCE

- .1 Site furnishings will be subject to a thorough field inspection and will not be accepted until all workmanship and deficiencies have been addressed.

3.4 CLEANING

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

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 This specification shall cover the supply and installation of reflective metal signs as indicated on the Drawings.

1.2 RELATED SECTIONS

- .1 32 16 15 – Site Concrete
- .2 32 91 19 – Planting Medium Placement & Finished Grading

1.3 REFERENCES

- .1 American Society for testing and Materials International (ASTM)
 - .1 ASTM A276-91a, Specification for Stainless and Heat-Resisting Steel Bars and Shapes.
 - .2 ASTM B209M-92a, Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
 - .3 ASTM B210M-92a, Specification for Aluminum-Alloy Drawn Seamless Tubes.
 - .4 ASTM B211M-92a, Specification for Aluminum and Aluminum-Alloy Bar, Rods and Wire.
- .2 Canadian Standards Association (CSA)
 - .1 CAN / CSA-G40.21-M92, Structural Quality Steels.
 - .2 CAN / CSA-G164-M92, Hot Dip Galvanizing of Irregularly Shaped Articles.
 - .3 CSA W47.2-M1987, Certification of Companies for Fusion Welding of Aluminum.
- .3 Canadian General Standards Board (CGSB)
 - .1 CAN / CGSB-1.94-M89, Xylene Thinner (Xylol).
 - .2 CAN / CGSB-1.99-92, Exterior and Marine Phenolic Resin Varnish.
 - .3 CAN / CGSB-1.104-M91, Semi gloss Alkyd Air Drying and Baking Enamel.
 - .4 CAN / CGSB-1.132-M90, Zinc Chromate Primer, Low Moisture Sensitivity.
 - .5 CGSB 1-GP-12c-65, Standard Paint Colours.
 - .6 CGSB 31-GP-3M-88, Corrosion Preventive Compound, Cold Application, Soft Film.
 - .7 CGSB 31-GP-101Ma-89, Chemical Conversion Films for Aluminum and Aluminum Alloys.

1.4 SUBMITTALS

- .1 Submit in accordance with Submittal Procedures specification.
- .2 Shop Drawings:
 - .1 Submit shop drawings for graphic layout proofs.
 - .2 Submit shop drawings indicating method of attachment of reflective metal signs to fence.
 - .3 Use construction drawings as reference only in preparing submittals. Field verify as-built conditions and dimensions. Report any discrepancies to Contract Administrator if as-built conditions are significantly different from the Drawings.

- .4 Drawings to clearly indicate size, assembly, welds, hardware, materials, core thicknesses, finishes, connections, joints, method of anchorage, number and size of anchors, supports, reinforcement, installation details and accessories for all aspects of the Work.
- .3 Samples: Submit a 300 x 300mm sample of reflective metal sign.
- .4 Contract Administrator shall provide original artwork for entry sign and reflective metal signs in vector based digital format.

1.5 QUALITY ASSURANCE

- .1 Fabricate and Installer: trained and qualified fabricators and installers, fully certified to produce high quality, custom signage with a minimum of ten (10) years experience, fabricating and installing large pylon signs and custom designed elements. General contractor to provide signage company curriculum vitae and 3 references for Contract Administrators approval prior to proceeding with the Work in this specification.
- .2 All workmanship and all materials furnished and supplied under this specification shall be of the highest standards and are subject to close and systematic inspection and testing by the Contract Administrator including all operations, from the selection of materials, through to final acceptance of the Work.
- .3 Strict conformance to the specifications will be enforced. The Contract Administrator shall be wholly responsible for the control of all operations incidental thereto notwithstanding any inspection or approval that may have been previously given.
- .4 The Contract Administrator reserves the right to reject any materials or works that are not in accordance the requirements of this specification.

1.6 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate metal, plastic, wood and corrugated cardboard packing and place in designated areas for disposal and recycling.

Part 2 Products

2.1 REFLECTIVE METAL SIGNS

- .1 Aluminum Metal Panel: 0.80 gauge metal plate, sign grade, aluminum panel 5052 H36 or H38, size and shape as indicated on the Drawings.
- .2 Sheeting: 3M Brand Scotchlite Series 3200 Engineering Grade Reflective Sheeting, or approved equal, complete with permanent pressure sensitive adhesive backing. Sheeting colours as noted on the Drawings. Sheeting to comply with ASTM D4956-90.
- .3 Inks: Matched, UV stable, waterproof transparent inks as required. 3M Scotchlite 700 series, enamel baked ink system, or approved equal.
- .4 Artwork: standard and custom signs as indicated on the Drawings.
- .5 Final design of artwork for reflective metal signs to be coordinated with the City.
- .6 Mounting Hardware:
 - .1 Hot dipped galvanized signposts, 50 mm square steel posts, conforming to the Standard Specification for Hot Rolled Carbon Sheet Steel, structural quality. ASTM designation A570-79.
 - .2 Hot-dipped galvanized screws and capable of securely fixing signage in place. Sizes as noted on the Drawings.
 - .3 Hot dipped galvanized washers and fasteners to suit.

- .4 Anchor base, sleeve and concrete wedge anchors matched to signpost for use in surface mount applications.
- .5 Concrete wedge anchors matched to signpost for use in wall mount applications.

Part 3 Execution

3.1 REFLECTIVE METAL SIGNS FABRICATION AND INSTALLATION

- .1 Provide proposed colour sample to Contract Administrator for approval prior to fabrication.
- .2 Send proofs of sign graphics and letters at 1:1 for Contract Administrators approval prior to fabrication.
- .3 Debur degrease and etch edges of sign plates to accept reflective sheeting decals in accordance with decal manufacturer's recommendations.
- .4 Apply sheeting in accordance with manufacturer's written specifications. Decals shall be centred precisely on base plate. Trim sheeting to form clean, smooth edge along perimeter of base plates.
- .5 Sign Base Installation: friction drive posts into compacted fill or surface mount to concrete sidewalk as indicated on the Drawings.
- .6 Fasten signage as indicated on the Drawings. Confirm sign orientation on site with the Contract Administrator.

3.2 TESTING AND TOUCH-UP'S

- .1 Clean and repair any damaged surfaces as recommended by product manufacturer leaving finished product clean and unblemished.
- .2 Obtain final approval from the Contract Administrator making any and all necessary adjustments prior to leaving the site.

3.3 ACCEPTANCE

- .1 Work will be accepted only if it is erected true to the design intent in conformation with shop drawings.

3.4 CLEANING

- .1 Upon completion of installation, remove construction and accumulated environmental dirt, surplus materials, rubbish, tools and equipment barriers from site.

END OF SECTION

Part 1 General

1.1 DESCRIPTION

- .1 This specification shall cover the supply, installation, and final contouring of planting medium for planting beds and clay rich planting medial for soil cells as indicated on the Drawings.

1.2 RELATED SECTIONS

- .1 32 94 51 – Structural Soil Cells

1.3 REFERENCES

- .1 Agriculture and Agri-Food Canada
 - .1 The Canadian System of Soil Classification, Third Edition, 1998.
- .2 Canadian Council of Ministers of the environment (CCME) Guidelines.
- .3 The City of Winnipeg Standard Construction Specifications
 - .1 CW 1130 – Site Requirements
 - .2 CW 3540 – Topsoil and Finished Grading for Establishment of Turf Areas

1.4 SUBMITTALS

- .1 Submittals in accordance with Submittal Procedures specification.
- .2 Soil Testing: submit certified test reports for planting medium and clay-rich planting medium showing compliance with or recommended amendments in accordance with the performance characteristics and physical properties as described in Item 1.5 - Quality Assurance.
- .3 Certificates: submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

1.5 QUALITY ASSURANCE

- .1 Inform Contract Administrator of proposed source of materials to be supplied and provide a sample for review by Contract Administrator prior to installation.
- .2 Testing of planting medium to be carried out and paid for by Contractor. Prepare and ship planting medium samples to approved laboratory in accordance with Provincial regulations and laboratory requirements, indicating intended use on each sample.
- .3 Test planting medium for nutrients N, P, K, micronutrients, soluble salt content, pH value and OM (organic matter).
- .4 Acceptance of planting medium is subject to an inspection of material and confirmation of test results. Do not commence soft landscaping work until Contract Administrator has accepted planting medium.

1.6 DELIVERY, STORAGE AND HANDLING

- .1 Store materials in a dry area, protected from freezing, sedimentation, and contamination.

- .2 Deliver and store fertilizer in waterproof bags labelled with weight, analysis, and name of manufacturer.

1.7 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate metal, plastic, wood and corrugated cardboard packing and place in designated areas for disposal and recycling.

Part 2 Products

2.1 MATERIALS

- .1 Black Topsoil: In accordance with CW 3540 for topsoil except organic matter to be in the range of 5-10%.
- .2 Peatmoss: deliver from partially decomposed fibrous or cellular stems and leaves of species of sphagnum mosses. Elastic and homogeneous, brown in colour. Free of wood and deleterious material that could prohibit growth. Shredded particle minimum size: 5 mm.
- .3 Compost:
 - .1 Mixture of soil, decomposing organic matter used as fertilizer, mulch or soil conditioner.
 - .2 Dark brown in colour, no objectionable odour.
 - .3 Processed organic matter containing 40% or more organic matter as determined by Walkley-Black or Lost On Ignition (LOI) test.
 - .4 Must be sufficiently decomposed (i.e. stable) so that any further decomposition does not adversely affect plant growth (C:N ratio below 25:1) and contain no toxic or growth inhibiting contaminants.
 - .5 Composed bio-solids to: CCME Guidelines for Compost Quality, Category A.
- .4 Coarse Sand: Clean, hard fine silica sand, well washed and free of impurities, chemical or organic matter. Coarse texture, and to the following gradation:

<u>Particle Size (mm)</u>	<u>% Passing Through Screen</u>
2.0	100%
1.0	95 to 100%
0.5	80 to 100%
0.25	0 to 30%
0.15	0 to 8%
0.075	0 to 1%

- .5 Planting Medium for Planting Beds:
 - .1 All planting media shall be a thorough blend of the materials noted above in the proportions and to the fertility parameters noted below.
 - .2 Keep all materials moist during blending stage to facilitate uniform mixing and to minimize peat, soil, and sand separation
 - .3 Final mix shall have a pH of between 6.5 and 8 unless otherwise noted.

- .4 Provide a two-gallon sample of the planting medium tested including test results.
- .5 Planting medium for planting beds, tree pits and sod areas to contain (by volume):
 - .1 40% Topsoil
 - .2 35% Peat
 - .3 20% Coarse Sand
 - .4 5% Compost
- .6 Clay-Rich Planting Medium for Soil Cells: planting shall be a blend of black topsoil, compost, and coarse sand, to the following proportion:
 - .1 70% Black Topsoil
 - .2 15% Compost
 - .3 15% Coarse Sand
- .7 Fertilizer: Synthetic start-up slow-release fertilizer with a N-P-K analysis of 12-36-15 ratio at a rate of 4 kg per 100m² which is 8 pounds per 100ft².

Part 3 Execution

3.1 PREPARATION OF PLANTING BEDS

- .1 Confirm rough grades conform to the Drawings and that rough grading operations have been reviewed and approved by the Contract Administrator prior to proceeding.
- .2 Report any discrepancies in sub-grade conditions to the Contract Administrator immediately upon discovery
- .3 Excavate planting beds by hand or using approved soft digging technology unless otherwise directed by Contract Administrator. Dispose of all rock, clay soils and other deleterious materials off Site.
- .4 Fine grade sub-grade, eliminating uneven areas and low spots, sloped to drain as indicated on the Drawings. Remove debris, roots, branches, stones in excess of 50mm diameter and building materials that may have accumulated since rough grading was completed.
- .5 Remove subsoil that has been contaminated with oil or gasoline.
- .6 Remove stones, roots, grass, weeds, construction materials, debris and foreign non-organic objects from planting medium.
- .7 Protect bottom of all excavations against freezing.
- .8 Remove water that enters excavations prior to planting. Ensure source of water is not groundwater.
- .9 Scarify bottom of planting bed excavations to a depth of 150mm.
- .10 Cover bottom of each planting bed excavation with bone meal fertilizer per manufacturers written specifications and application rate for each type of application.
- .11 Do not backfill planting bed with planting medium until the Contract Administrator has approved planting bed preparations.

3.2 PLACING AND SPREADING OF PLANTING MEDIUM

- .1 Place planting medium after Contract Administrator has accepted sub-grade.
- .2 Place planting medium in uniform layers not exceeding 150mm.
- .3 Spread planting medium as indicated on the drawings to follow minimum depths after settlement:
 - .1 300mm for planting beds to 75mm below finished grade to allow for wood mulch to specification 32 93 10.
 - .2 100mm for sodded areas.
- .4 Tamp down or roll soil with manual or mechanized equipment until it forms a firm solid surface that lightly takes a foot imprint.

3.3 APPLICATION OF FERTILIZER

- .1 Prior to planting and sodding, spread fertilizer over entire area at rate and ratio determined by soil test, or as specified above.
- .2 Mix fertilizer thoroughly into upper 50mm of planting medium.
- .3 Contractor to conduct a final soil test and provide results to the Contract Administrator.
- .4 Installation fertilizer thoroughly into upper 50mm of planting medium.
- .5 Amendments to soil and continued testing to achieve acceptance after test no. 1 will be paid for by the Contractor at no additional cost to The City.

3.4 FINISHED GRADING

- .1 To CW 3540.
- .2 Fine grade entire planting medium area to elevations as indicated on the Drawings. Eliminate rough spots and low areas. Leave surfaces smooth, uniform and firm against foot printing with a fine loose texture.
- .3 Protect beds from erosion at drainage outlets until planting and mulching is completed.

3.5 ACCEPTANCE

- .1 Leave surfaces smooth, uniform and firm against foot printing with a fine loose texture.
- .2 Leave surfaces to within 10mm of design grades uniformly sloping and maintaining positive drainage as indicated on the Drawings.
- .3 Amend all low spots and creases prior to proceeding with planting and seeding operations.
- .4 The Contract Administrator reserves the right to spot test the planting medium installed throughout the site should the finished product look, smell, feel or appear in any way different from the approved tested samples provided in any location.
- .5 Surfaces will be accepted when finished grading and soil quality meet all the standards and quality of workmanship noted within this section and when all adjacent hard surfaces have been cleaned to the Contract Administrators satisfaction.

3.6 SURPLUS MATERIAL

- .1 Dispose of unused planting medium off site in accordance with CW 1130.

3.7 CLEANING

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

END OF SECTION

Part 1 General

1.1 DESCRIPTION

- .1 Provide all labour, materials, methods, equipment and accessories for the supply and installation of structural soil cell system, drainage pipe, including drainage material and all related work.

1.2 RELATED SECTIONS

- .1 32 91 19 – Planting Medium & Finished Grading

1.3 REFERENCES

- .1 Government of Manitoba Standard Construction Specifications No. 900 – Aggregate for Granular Base Course.

1.4 SUBMITTALS

- .1 Product Data: For each type of product, submit manufacture’s product literature with technical data sufficient to demonstrate that the product meets these specifications.
- .2 Shop Drawings: Submit manufacturer supplied shop drawings for structural soil cell system.
- .3 Submit product samples of root barrier, geogrid, cable tie, anchor spikes, and non-woven geotextile.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver materials in manufacturer’s original, unopened, undamaged palletized units with identification numbers intact.
- .2 Bulk Materials:
 - .1 Do not deliver or place backfill, soils and soil amendments in frozen, wet, or muddy conditions.
 - .2 Do not dump or store bulk materials near structures, utilities, sidewalks, pavements, and other facilities, or on existing turf areas or plants.
 - .3 Provide protection including tarps, plastic and or matting between bulk materials and finished surfaces sufficient to protect the finish material.
- .3 Provide erosion-control measures to prevent erosion or displacement of bulk materials and discharge of soil-bearing water runoff or airborne dust to adjacent properties, water conveyance systems, and walkways. Provide additional sediment control to retain excavated material, backfill, soil amendments and planting mix within the project limits as needed.
- .4 Protect structural cells from damage during delivery, storage and handling.
- .5 Store under tarp to protect from sunlight when time from delivery to installation exceeds one week. Storage should occur on smooth surfaces, free from dirt, mud and debris.

- .6 Handling is to be performed with equipment appropriate to the size (height) of cells and site conditions, and may include, hand, handcart, forklifts, extension lifts, small cranes, etc., with care given to minimize damage to structural cell components.
- .7 Contractor shall be responsible for the supply, safe storage and handling of all materials.

1.6 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate metal, plastic, wood and corrugated cardboard packing and place in designated areas for disposal and recycling.

Part 2 Products

2.1 MATERIALS

- .1 Structural Cell System:
 - .1 1X silva cell system, one base, six 1X posts and one deck. Assembled Dimensions (Each Cell): 47.2 inches long by 23.6 inches wide by 16.7 inches high (1200 mm long by 600 mm wide by 424 mm high).
 - .2 DeepRoot barrier, UB-12-2.
 - .3 DeepRoot Water & Air Vent: water and air system 01, cast iron body, stainless steel grate.
 - .4 Geogrid per structural cell manufacturers requirements.
 - .5 Cable tie for attaching geogrid to silva cell per manufacturers requirements.
 - .6 Geotextile per structural cell system manufacturers requirements.
 - .7 Galvanized anchoring spikes 300mm long x 10mm Dia.
 - .8 Manufactured by DeepRoot Green Infrastructure, LLC ph. 1.800.458.7668.
- .2 Drainage Pipe & Drainage Material:
 - .1 Drainage Pipe: 150mm dia. perforated PVC pipe
 - .2 Drainage Material: Granular drainage material in accordance with specification CW3120 - Installation of Sub Drains.
- .3 Non-woven geotextile fabric to CW3130.
- .4 Base Course and Backfill Material: GBC-1, Class "A" Gravel to Manitoba No. 900 Specifications for Aggregate for Granular Base Course. No crushed limestone.
- .5 Compacted planting medium mound and planting medium to planting medium & finished grading specification.

Part 3 Execution

3.1 CONSTRUCTION METHOD

- .1 Silva cell modules must be transported and stored on manufacturers pallets with pallet wrap intact until ready for installation. Pallets should be positioned on firm level base, so as not to impede traffic or workflow.

- .2 Prior to the start of work layout and stake the limits of excavation and horizontal and vertical control points sufficient to install the structural cells and required drainage features in the correct locations.
- .3 The Contractor must ensure that all buried utilities and services are located and if necessary, protected and exposed prior to any excavation in accordance with specification CW1120.
- .4 Excavate and confirm to the dimensions and depth shown on the Drawings, including provision for drainage and base course layer, allowing 200mm (8") additional clearance in length and width. Side walls of excavated pit to be clean, straight, and within 15° of vertical. Soft dig / day lighting process to be used in area of existing underground utilities. Ensure subgrade slopes to sub drain trench toward perforated drainage pipe system (min 2.0% slope).
- .5 Clear excavation of all construction debris, trash, rubble and any foreign material. Excavate and remove oil spills and other soil contamination sufficiently to remove the harmful material. Fill over excavations with approved fill and compact to the required subgrade compaction.
- .6 All excavated material shall be disposed of off-site in accordance with specification CW1130.
- .7 Compact sub-grade in accordance with specification CW3110.
- .8 Install non-woven geotextile fabric for aggregate sub base and tree planting bed sides in accordance with CW3130.
- .9 Install drainage pipe, drainage material and aggregate sub-base below structural cell system to the depths indicated in the Drawings and compact to a minimum of 95% of maximum dry density at optimum moisture content, in accordance with ASTM D 698 Standard Proctor Method.
- .10 Assemble and install structural cell system in accordance with manufacturer's specifications.
- .11 Install silva cells, anchoring spikes, geogrid, cable ties, planting medium, root barrier and backfill. These three materials must be installed and compacted together in alternating operations in 200mm lifts to top of silva cells to achieve correct compaction relationships within the structural cell system. Compact per manufacturers recommendations.
- .12 Place geotextile over top of silva cell system, 450mm overlap past excavation.
- .13 Install root barrier directly adjacent to concrete edge restraint.

3.2 PROTECTION

- .1 Maintain a minimum of 100mm of aggregate sub-base over the geotextile material during construction. Use only low-pressure tire or low impact track vehicles with a maximum surface pressure under vehicle of 4 pounds per square inch, on top of structural cells prior to the installation of final paving.
- .2 When vehicle must cross structural cells that does not have final paving surfaces installed, use plates or mats to distribute vehicle loads to levels that would be expected at

deck surface once final paving has been installed. Use low-pressure tire or low impact track vehicles.

- .3 Ensure that all construction traffic is kept away from limits of structural cells until final surface materials are in place. No vehicles shall drive directly on the structural cell deck.

3.3 ACCEPTANCE

- .1 Contractor to notify Contract Administrator three (3) days prior to installation of structural cell system. The Contract Administrator will inspect the placement of silva cells when initially installed and determine acceptance.

3.4 CLEANING

- .1 Perform clean up during installation and upon completion of the Work. Maintain the site free of soil, sediment, trash and debris. Remove excess soil materials, debris, and equipment from the site following completion of the Work of this Section.
- .2 Repair damage to adjacent materials and surfaces resulting from installation of this Work using mechanics skilled in remedial work of the construction type and trades affected.

END OF SECTION

APPENDIX – A

**GEOTECHNICAL REPORT
(APRIL 2024)**



Quality Engineering | Valued Relationships

City of Winnipeg

Old Exhibition Arena Addition Geotechnical Investigation Report

Prepared for:

Iain Currie
City of Winnipeg, Municipal
Accommodations Division
4th Floor, 185 King Street
Winnipeg, MB
R4B 1J1

Project Number: 0020-049-00

Date: April 10, 2024



Quality Engineering | Valued Relationships

April 10, 2024

Our File No. 0020-049-00

Iain Currie
City of Winnipeg, Municipal Accommodations Division
4th Floor, 185 King Street
Winnipeg, MB
R4B 1J1

**RE: Old Exhibition Arena Addition
Geotechnical Investigation Report**

TREK Geotechnical Inc. is pleased to submit our final report for the geotechnical investigation for the above noted project.

Please contact the undersigned should you have any questions.

Sincerely,

TREK Geotechnical Inc.
Per:

A handwritten signature in blue ink, appearing to read "Kent Bannister", is written over a light blue horizontal line.

Kent Bannister, M.Sc., P.Eng.
Senior Geotechnical Engineer

Encl.

Revision History

Revision No.	Author	Issue Date	Description
0	TC	April 10, 2024	Final Report

Authorization Signatures

Prepared By:



Tyler Chapko, EIT
Geotechnical Engineering Intern



Gil Robinson, M.Sc., P. Eng.
Senior Geotechnical Engineer

Reviewed By:



Kent Bannister, M. Sc., P.Eng.
Senior Geotechnical Engineer



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Appendix A Laboratory Testing Results

1.0 Introduction

This report summarizes the results of the geotechnical investigation completed by TREK Geotechnical Inc. (TREK) for the City of Winnipeg for the replacement of the southern portion of the Old Exhibition Arena located at 80 Sinclair Street in Winnipeg, Manitoba. The terms of reference for the investigation are included in our proposal to Crosier Kilgour & Partners Ltd. dated November 1, 202, the work was approved by the City of Winnipeg in Purchase Order #0000706394. The scope of work includes a sub-surface investigation, laboratory testing, and provision of geotechnical design and construction recommendations for suitable foundations. Recommendations for concrete slabs, pavements, temporary excavations, foundation concrete, and construction support services are also provided.

2.0 Background

The City of Winnipeg is planning to redevelop the Old Exhibition Arena at 80 Sinclair Street. The arena portion of the building will be renovated and the existing single storey portion of the building, which housed the entry, canteen, changerooms and other amenities, will be demolished and replaced with a new addition. The addition will be in the same general location but offset to the west with a plaza area on the east side of the new addition.

The new addition will be a one storey steel framed structure that is approximately 790 m² (8,500 ft²) in size that will be pile supported. The addition will have a structural concrete floor slab over a void space. The roof structure will most likely be comprised of conventional steel roof deck on pre-engineered steel joists or steel beams. Some new pavement is being considered as part of the redevelopment plans.

3.0 Field Program

3.1 Sub-surface Investigation

A sub-surface investigation was completed on February 22, 2024, under the supervision of TREK personnel to determine the soil stratigraphy and groundwater conditions at the proposed site. Four test holes were drilled and sampled at the locations shown on Figure 01. The test holes were drilled by Paddock Drilling Ltd. with a truck-mounted Acker MP-8 geotechnical drill rig equipped with 125 mm solid stem augers. Test holes were backfilled with auger cuttings and bentonite to surface. Sub-surface soils encountered during drilling were visually classified based on the Unified Soil Classification System (USCS). Disturbed (auger cutting and split spoon) samples were taken at regular intervals and relatively undisturbed (Shelby Tube) samples were collected at select depths. Standard Penetration Tests (SPTs) were completed at depths where split spoon samples were taken. Undrained shear strength testing was performed in the field on the grab samples (i.e. auger cuttings / disturbed samples) using Torvane and/or Pocket Penetrometer testing devices, the results are provided on the test hole logs for general information only.

All samples retrieved during drilling were transported to TREK's testing laboratory in Winnipeg, Manitoba. Laboratory testing consisted of moisture content determination on all auger cutting samples. Laboratory testing consisted of moisture content determination on all samples and unconfined

compressive strength testing, and bulk unit weight measurements on the Shelby tube samples. Laboratory testing results are included in Appendix A.

Test hole locations were recorded using a handheld GPS. Test hole elevations were surveyed using a rod and level and were tied into a temporary benchmark set to a local elevation of 100.0 m. The temporary benchmark is on the concrete sidewalk at the front of the building, at the location indicated by TBM on Figure 01. The test hole logs include a description of the soil units encountered and other pertinent information such as groundwater, sloughing conditions, and a summary of the laboratory testing results.

3.2 Soil Stratigraphy

A brief description of the soil units encountered during drilling is provided below. All interpretations of soil stratigraphy for the purposes of design should refer to the detailed information provided on the attached test hole logs.

The site soil stratigraphy generally consists of surficial gravel, clay fill, or clay overlying silt, lacustrine silty clay and silt till.

Gravel was encountered at grade in Test Holes 24-03 and -04, which were drilled in areas of the site where granular pavement surface is present. The road on the south side of the arena may also have some areas paved with asphalt. The gravel layer is approximately 75 mm thick. Approximately 0.2 m of high plasticity clay fill was encountered below the gravel in TH24-03.

Silt was encountered in all four test holes at depths of 0.2 to 0.7 m below grade and extended to depths of 1.0 to 2.0 m below grade. The silt contains trace clay, trace sand and is light brown, moist, loose, and is of low plasticity.

Lacustrine silty clay is present beneath the silt and extends down to the silt till layer which was encountered in TH24-02 at a depth of approximately 11.7 m below grade. The lacustrine silty clay contains trace silt inclusions and is dark brown becoming grey with depth, moist, with a stiff consistency becoming firm with depth and is of high plasticity.

Silt till was encountered in TH24-02 at a depth of approximately 11.7 m below site grade and extended to the maximum depth explored of 12.6 m. In Winnipeg, the silt till typically contains a heterogenous mixture of clay, sand, and gravel within a predominately silt matrix. Although not confirmed during drilling with 125 mm diameter augers, cobbles and boulders are commonly present within the silt till. The silt till encountered in the test hole contains trace clay, trace sand, trace gravel, is grey, moist, and compact.

3.3 Power Auger Refusal

Power auger refusal was not encountered in any of the four test holes drilled for this project.

3.4 Groundwater and Sloughing Conditions

Groundwater seepage and sloughing was not observed in the test holes during drilling. Squeezing in of the clay was observed below 9.1 m depth in TH24-02. Just after removing the augers from the test holes, the test holes were dry and typically open to the depth drilled. Test Hole 24-02 was drilled to a depth of 12.6 m and was open to a depth of 10.2 m just after the augers were removed from the test hole.

These observations are short-term and should not be considered reflective of (static) groundwater levels at the site which would require monitoring over an extended period of time to determine. It is important to recognize that groundwater conditions may vary seasonally, annually, or as a result of construction activities.

4.0 Foundation Recommendations

Cast-in-place concrete (CIPC) friction piles are a suitable foundation type to support the proposed addition based on the observed sub-surface conditions and anticipated loading conditions. Recommendations for these pile types according to the Manitoba Building Code (MBC 2024) which is based on the National Building Code of Canada (NBCC, 2020) are provided in the following sections.

4.1 Limit States Design (NBCC, 2020)

Limit States Design recommendations for deep foundations in accordance with the National Building Code of Canada (NBCC, 2020) are provided below. Limit States Design requires consideration of distinct loading scenarios comparing the structural loads to the foundation bearing capacity using resistance and load factors that are based on reliability criteria. Two general design scenarios are evaluated corresponding to the serviceability and ultimate capacity requirements.

The **Ultimate Limit State (ULS)** is concerned with ensuring that the maximum structural loads do not exceed the nominal (ultimate) capacity of the foundation units. The ULS foundation bearing capacity is obtained by multiplying the nominal (ultimate) bearing capacity by a resistance factor (reduction factor), which is then compared to the factored (increased) structural loads. The ULS bearing capacity must be greater or equal to the maximum factored load to provide an adequate margin of safety. The resistance factors used under the MBC (2011) were based on the recommended values contained in Commentary K for the NBCC (2010). Since the Structural Commentaries for NBCC 2020 are not published at this time, recommended geotechnical resistance factors are not provided in the code. Table 1 summarizes the resistance factors that can be used for the design of deep foundations as recommended in Table 6.2 of the Canadian Foundation Engineering Manual (5th Ed. 2023). These values are consistent with resistance factors provided in commentaries for past versions of the NBCC. Different resistance factors should be applied depending upon the method of analysis and verification testing completed during construction.

The **Service Limit State (SLS)** is concerned with limiting deformation or settlement of the foundation under service loading conditions such that the integrity of the structure will not be impacted. The Service Limit State should generally be analysed by calculating the settlement resulting from applied

service loads and comparing this to the settlement tolerance of the structure. However, the settlement tolerance of the structure is typically not yet defined at the preliminary design stage. As such, recommendations are provided for evaluating the SLS that are developed on the basis of limiting settlement to 25 mm or less. A more detailed settlement analysis should be conducted to refine the estimated settlement and/or adjust our recommendations if a more stringent settlement tolerance is required.

Table 1. ULS Resistance Factors for Deep Foundations

Resistance to Axial Load for Deep Foundations (Analysis Methods)	Resistance Factor
Semi-empirical analysis using laboratory and in-situ test data	0.4
Analysis using static loading test results ^(Note 1)	0.6
Uplift resistance by semi-empirical analysis.	0.3
Uplift resistance using loading test results ^(Note 1)	0.4

1. TREK should be contacted to determine the number of tests required for use of the associated resistance factor.

4.2 Cast-in-Place Concrete Friction Piles

Cast-in-place concrete friction piles will derive a majority of their resistance in shaft friction (adhesion) with a relatively small contribution from end bearing. Table 2 provides the recommended factored ULS axial (compressive and uplift) unit resistances for shaft adhesion and end bearing. Piles designed based on the factored ULS resistances are expected to exhibit less than 10 mm of settlement under applied service loads (SLS).

Table 2. Recommended Factored ULS Resistance for CIPC Friction Piles

Pile Depth Below Existing Site Grade (m approx.)	Factored ULS Unit Resistance (kPa)		
	Compression $\phi = 0.4$		Uplift $\phi = 0.3$
	Shaft Adhesion	End Bearing ⁽¹⁾	Shaft Adhesion
0 to 2.5 ⁽²⁾	-	-	-
2.5 to 10.5	18.0	85	13.5

1. For piles with a diameter of less than 1.0 m. If larger pile diameters are required TREK should be contacted to provide revised end bearing values.
2. When determining effective pile lengths, the upper 2.5 m of the pile shaft below existing site grade should be ignored to account for the presence of fill, silt and the potential for soil shrinkage away from the pile.

Additional Design Recommendations:

1. Piles should be designed with a maximum depth of 10.5 m below existing grade to avoid penetration into softer clays and/or the silt till and to protect against heaving at the base of the pile shaft.

2. Piles should have a minimum diameter of 400 mm and a minimum length of 6 m. Piles exposed to freezing conditions should have a minimum length of 8 m, refer to Section 4.4 for Adfreezing Effects for piles that will be exposed to freezing conditions.
3. The piles should have a minimum spacing of 3 pile diameters, measured center to center, between new and existing piles. If a closer spacing is required, TREK should be contacted to provide an efficiency (reduction) factor to account for potential group effects.
4. Piles require steel reinforcement designed by a structural engineer for the anticipated axial (compression and tension), lateral and bending loads induced from the structure as well as forces induced from seasonal movements (i.e. shrinkage/swelling and frost-related movements) of the bearing soils.

Pile Installation Recommendations:

1. Temporary steel casings (sleeves) should be available and used if sloughing of the pile hole occurs and/or to control groundwater seepage, if encountered. Care should be taken in removing sleeves to prevent sloughing (necking) of the shaft walls and a reduction in the cross-sectional area of the pile.
2. Concrete should be placed in one continuous operation immediately after the completion of drilling the pile hole to avoid potential construction problems such as sloughing or caving of the pile hole and groundwater seepage. Concrete placed by free-fall methods should be poured under dry conditions. If groundwater is encountered, it should be controlled or removed. If water cannot be controlled or removed, the concrete should be placed using tremie methods.
3. Concrete placed by free-fall methods should be directed through the middle of the pile shaft and steel reinforcing cage to prevent striking of the drilled shaft walls to protect against soil contamination of the concrete.
4. The drilling of all pile shafts should be observed and documented by TREK to verify the soil conditions and proper installation of the piles.

4.3 Pile Caps and Grade Beams

A minimum void of 150 mm should be provided underneath all pile caps and grade beams to accommodate volumetric changes in the underlying sub-grade soils (i.e. swelling, shrinkage, and thermal expansion and contraction in unheated areas). Void forms should be used under pile caps and grade beams and should be capable of deforming a minimum of 150 mm without transferring excessive stress to the structure.

Excavations around pile caps and grade beams should be backfilled with granular sub-base material (refer to Section 7.0 Pavements for the granular sub-base material requirements). The backfill should be compacted to 90 to 92 percent of the SPMDD.

4.4 Adfreezing Effects

Concrete piles, grade beams and below grade walls subjected to freezing conditions should be designed to resist adfreeze and uplift forces related to frost action acting along the vertical face of the member within the maximum depth of frost penetration (2.4 m). In this regard concrete members may be subject to an adfreeze bond stress of 65 kPa within the depth of frost penetration. Adfreeze forces will be

resisted by structural dead loads and uplift resistance provided by the length of the pile below the depth of frost penetration. The following design recommendations apply to piles subject to adfreeze forces:

1. A load factor (α) of 1.2 may be used in the calculation of adfreezing forces.
2. The geotechnical resistance for this ULS condition can be calculated using a factored ULS uplift resistance of 40 kPa applied below 2.4 m from existing site grade. A resistance factor of 0.8 was used to calculate the factored uplift resistance.
3. Unfactored structural dead loads should be added to the resistance.
4. Piles subject to adfreezing forces should be installed to a minimum depth of 8.0 m or as calculated by the method above, whichever is greater.
5. Piles require steel reinforcement designed by a structural engineer for the anticipated axial (compression and tension), lateral and bending loads induced from the structure as well as forces induced from seasonal movements (i.e. shrinkage/swelling and frost-related movements) of the bearing soils.
6. Measures such as flat lying rigid polystyrene insulation could be considered to reduce frost penetration depths and thereby adfreezing and uplift forces.
7. Due to presence of a shallow silt layer, a greased, polyethylene wrapped Sonotube should be placed around the upper 1.8 m of the pile shaft to act as a bond breaker and provide additional protection against frost heave.

4.5 Lateral Resistance

The soil response (sub-grade reaction) to lateral loads can be modeled in a simplified manner that assumes the soil around a pile can be simulated by a series of horizontal springs for preliminary design of pile foundations. The soil behaviour can be estimated using an equivalent spring constant referred to as the lateral sub-grade reaction modulus (K_s) as provided in Table 3. The majority of lateral resistance will typically be offered by the upper 5 to 10 m of soil, depending on the relative stiffness of the pile and soil units.

Table 3. Recommended Values for Lateral Sub-grade Reaction Modulus (K_s)

Approximate Pile Depth Below Existing Site Grade (m)	Soil Type	K_s (kPa/m) ¹
0 to 2.5	Mixed Soils	2,000/d
2.5 to 10.5	Silty Clay	3,000/d

Note 1: d = pile diameter.

It should be understood that using the lateral sub-grade reaction modulus assumes a linear response to lateral loading and therefore is only appropriate under the following conditions:

- maximum pile deflections are small (less than 1% of the pile diameter),
- loading is static (not cyclic), and
- pile material behaves linear elastically (does not reach yield conditions).

If one or more of these conditions are not met, a more rigorous analysis that includes non-linear behavior of the piles and surrounding soil is required (e.g. p-y curve method). In this regard, a lateral pile analysis that incorporates the material and section properties of the piles, lateral pile deflection criteria, and a more realistic elastic-plastic model of the soil response to loading should be carried out to confirm the lateral load capacity of the piles.

4.6 Foundation Concrete

All foundation concrete should be designed by a structural engineer for the anticipated axial (compression and uplift), lateral, and bending loads from the structure. Based on local experience gathered through previous work in Winnipeg, the degree of exposure for concrete subjected to sulphate attack is classified as severe according to Table 3, CSA A23.1-19 (Concrete Materials and Methods of Concrete Construction). Accordingly, all concrete in contact with the native soil should be made with high sulphate-resistant cement (HS or HSb). Furthermore, the concrete should have a minimum specified 56-day compressive strength of 32 MPa and have a maximum water to cement ratio of 0.45 in accordance with Table 2, CSA A23.1-19 for concrete with severe sulphate exposure (S2). Concrete that may be exposed to freezing and thawing should be adequately air entrained to improve freeze-thaw durability in accordance with Table 4, CSA A23.1-19.

4.7 Foundation Inspection Requirements

In accordance with Section 4.2.2.3 *Field Review* of the NBCC (2020), the designer or other suitably qualified person shall carry out a field review on:

- a) continuous basis during:
 - i. the construction of all deep foundation units with all pertinent information recorded for each *foundation unit*,
 - ii. during the installation and removal of retaining structures and related backfilling operations,
 - iii. during the placement of engineered fills that are to be used to support the *foundation units*, and
- b) as required, unless otherwise directed by the *authority having jurisdiction*,
 - i. in the construction of all *shallow foundation units*, and
 - ii. in excavating, dewatering, and other related works

In accordance with Engineers and Geoscientists of Manitoba (EGM), a Professional Engineer, or delegated staff responsible to them must perform site reviews for the work presented in the documents they've sealed.

For conformance with the NBCC and EGM requirements, TREK should be retained on a full-time basis to observe and document the installation of all pile foundations, shoring or engineered fills supporting the structure, and on an as-required basis for other components such as subgrade inspections and compaction testing. TREK is familiar with the geotechnical conditions present and the underlying

design assumptions of our foundation recommendations. TREK is therefore solely qualified to evaluate any design modifications deemed to be necessary should altered sub-surface conditions be encountered.

5.0 Concrete Slabs

5.1 Structural Floor Slabs

Structural floor slabs over a void space are preferred given the presence of fill, high plastic expansive silty clay, and soft silt soils at this site which can affect the performance of floor slabs on grade. A minimum void space of 150 mm beneath structural floor slabs is recommended to accommodate volumetric changes in the underlying sub-grade soils. The void can consist of a compressible layer (e.g., void form) to permit sub-grade soil movements without engaging the floor slab, or alternatively install a crawl space. Void forms should be selected such that they can deform a minimum of 150 mm without transferring excessive stresses to the structure. A vapour barrier should be placed between the floor slab and the void form (if present).

5.2 Grade Supported Exterior Concrete Slabs

If some movement can be tolerated, grade-supported exterior concrete slabs can be considered. Vertical movement of grade-supported slabs should be expected due to seasonal changes in the underlying sub-grade soils (i.e., freeze, thaw, swelling and shrinkage). Although difficult to predict, movements on the order of 25 to 50 mm should be expected and in the longer term could reasonably be in the order of 100 to 150 mm. The vertical slab movements will be differential and are not expected to be uniform across the slab. A factor impacting the magnitude of floor slab movements, which should be expected, are the climatic effects during construction which might impact changes in the sub-soil moisture conditions. For these reasons, it is not possible to assess the amount of soil movement which will occur with any degree of accuracy.

Additional Recommendations:

1. Existing fill materials, organics, silt, and any other deleterious material should be removed such that the sub-grade consists of native stiff silty clay. This may require the removal of up to 2 m of silt soils based on the observed conditions in the test holes. Assuming that removal of the silt may not be practical from a cost or constructability perspective, it is recommended that pile supported structural slabs are used where vertical movements cannot be tolerated. If increased risk of seasonal movements due to free/thaw is acceptable, the silt could be partially removed, recommendations for bridging a silt subgrade with geotextile and granular base are provided below.
2. Excavation should be completed with an excavator equipped with a smooth bucket and operating from the edge of the excavation in order to minimize disturbance to the exposed sub-grade at all times.
3. After excavation, the sub-grade should be inspected by TREK prior to placement of new fill and granular base materials to identify soft areas, silt, or organics. Soft and silt areas should be repaired as per directions provided by TREK. This may consist of excavating an additional 150 to 300 mm of granular sub-base and placing a non-woven geotextile on the sub-grade and backfilling with a

50 mm down granular sub-base material. The additional sub-base material should be placed in lifts no greater than 150 mm and compacted to a minimum of 98% of the SPMDD. Organics must be removed in their entirety.

4. The sub-grade should be protected from freezing, drying and flooding. If any of these conditions occur, the sub-grade should be scarified, moisture conditioned as appropriate, and re-compacted to a minimum of 95% of the SPMDD.
5. Exterior concrete slabs should be placed on a 250 mm thick layer of 50 mm down crushed granular sub-base underlying a 150 mm thick base consisting of 25 mm down crushed granular base course. The crushed granular material should be placed in lifts no greater than 150 mm and compacted to 98% of the SPMDD.
6. The granular base and sub-base materials should consist of a well graded, durable crushed limestone in accordance with the current City of Winnipeg Specification No. CW 3110-23 for Granular A material.
7. Floor slabs should be designed to resist all structural loads and to minimize slab cracking associated with movements as a result of swelling, shrinkage, and thermal expansion and contraction of the sub-grade soils.
8. To accommodate slab movements, it may be desirable to provide control joints to reduce random cracking and isolation joints to separate the slab from other structure elements. Allowances should be made to accommodate vertical movements of light-weight structures (e.g., partitions) bearing on the slab.

6.0 Lateral Earth Pressures

The magnitude of lateral earth pressures from retained soil acting against below grade walls will depend on the retained material type, method of placing and compacting the backfill, and the magnitude of rotation of the walls. In this regard, free-draining granular fill should be used as backfill. Table 4 below provides K_o values for calculation of lateral earth pressures developed from backfill acting on below grade walls that are not free to rotate.

Table 4. Lateral Earth Pressure Parameters for Below Grade Wall Design

Design Parameter	Backfill
At-Rest Earth Pressure Coefficient (K_o)	0.5
Passive Earth Pressure Coefficient (K_p)	3.0
Active Earth Pressure Coefficient (K_a)	0.3
Estimated Bulk Unit Weight, γ	20 kN/m ³
Estimated Effective Unit Weight, γ'	10 kN/m ³

Backfill drainage should be provided by installing a sub-drainage system at the base of the wall to prevent the build-up of hydrostatic pressures (e.g. weeping tile directed to a sump pit), the total lateral

earth pressure force is the area of the triangular pressure distribution acting on a below grade wall which can be derived based on the following equation:

$$P = K\gamma D$$

where,

P = lateral earth pressure at depth D (kPa)

K = earth pressure coefficient (unitless)

γ = bulk unit weight of retained soil (20 kN/m³)

D = depth below finished grade to where earth pressure is being calculated (m)

Backfill (retained soil) should not be placed and compacted until the walls can support lateral earth pressures. Over-compaction of the retained fill may result in earth pressures that are considerably higher than those predicted in design. Compaction of granular fill within about 1.5 m of the walls should be conducted with a light hand-operated vibrating plate compactor and the number of compaction passes should be limited. A compacted density between 90 and 92% (i.e., no more than 92%) of the Standard Proctor Maximum Dry Density should be specified for fill placed directly adjacent to the walls.

7.0 Pavement Recommendations

The following section on pavement structure should be used for asphalt pavements. The recommended pavement structure is provided in Table 5 for car parking areas and areas subject to heavier vehicular loads. Crushed limestone material consistent with the current City of Winnipeg Specification No. CW 3110-23 for Granular A material are recommended for the base and sub-base layers.

Concrete sidewalks should be constructed in accordance with the current City of Winnipeg Specification No. CW 3325-R5 for Portland Cement Concrete Sidewalks.

Table 5. Recommended Pavement Sections

Material	Layer Thickness		Compaction Requirements
	Car Parking Areas	Heavy Vehicular Loads	
Asphalt (If desired)	100 mm	100 mm	Mix Design by others
25 mm down crushed limestone (Base)	75 mm	100 mm	100% of the SPMDD
50 mm down crushed limestone (Sub-Base)	250 mm	350 mm	98% of the SPMDD
Non-Woven Geotextile (Titan TE-8 or equivalent)	Required	Required	Install as per manufacturer's recommendations

Additional Granular Road Structure Recommendations:

- Existing fill materials, organics, silt, and any other deleterious material should be stripped such that the sub-grade consists of stiff, native silty clay. This may require the removal of up to 2.0 m of fill and/or silt soils based on the observed conditions in the test holes. Assuming that removal

of the fill and/or silt may not be practical from a cost or constructability perspective and provided the potential for an increase in risk of settlement or seasonal movements is recognized, the sub-grade may consist of the existing clay fill or silt. If clay fill is encountered the upper 200 mm should be scarified, moisture conditioned as appropriate, and re-compacted to 95% of the Standard Proctor Maximum Dry Density (SPMDD). Where silt or a soft subgrade is present, recommendations are provided below for bridging the subgrade.

2. Excavation should be completed with an excavator equipped with a smooth bucket operating from the edge of the excavation in order to minimize disturbance to the exposed sub-grade.
3. After excavation, the sub-grade should be inspected by TREK prior to placement of granular base materials. The sub-grade should be proof rolled with a fully loaded tandem axle truck to identify soft areas, silt, or organic clay (fill or native). Soft and silt areas should be repaired as per directions provided by TREK. This will likely consist of excavating an additional 150 to 300 mm and placing a non-woven geotextile on the sub-grade and backfilling with a 50 mm down granular sub-base material. Geogrid may also be recommended to help bridge soft subgrades. The additional sub-base material should be placed in lifts no greater than 150 mm and compacted to a minimum of 98% of the SPMDD.
4. The sub-grade should be protected from mechanical disturbance, freezing, drying, or inundation with water at all times. If any of these conditions occur the sub-grade should be scarified, moisture conditioned as appropriate, and re-compacted to a minimum of 95% of the SPMDD or the disturbed zone may have to be excavated and replaced with 50 mm down granular sub-base.
5. A non-woven geotextile should be placed in accordance with the manufacturer's recommendations on the prepared sub-grade prior to placement of granular fill. Titan Environmental TE-8 or equivalent would be appropriate for use.
6. The granular sub-base and base materials should be placed in lift thicknesses no greater than 150 mm and compacted as per recommendations in Table 5.

8.0 Site Drainage

Drainage adjacent to structures and exterior slabs should promote runoff away from the structure. A minimum gradient of about 2% should be used for both landscaped and paved areas and maintained throughout the life of the structure. The water discharge from roof leaders and run-off from exposed slabs should be directed away from the structures.

9.0 Temporary Excavations

Excavations must be carried out in compliance with the appropriate regulations under the Manitoba Workplace Safety and Health Act. Any open-cut excavation greater than 3 m deep must be designed and sealed by a professional engineer. If space is limited or the stability of adjacent structures may be endangered by an excavation, a shoring system may be required to prevent damage to, or movement of, any part of adjacent structures, and the creation of a hazard to workers and the public. TREK should be contacted to review temporary excavation plans and provide engineering support as required upon completion of the building and parkade design.

Excavation stability is the responsibility of the Contractor for the duration of construction. Excavations should be monitored regularly and flattened as necessary to maintain stability recognizing that excavation stability is time and weather dependent. Excavated slopes should be covered with polyethylene sheets to prevent wetting and drying.

Stockpiles of excavated material and heavy equipment should be kept away from the edge of any excavation by a distance equal to or greater than the depth of excavation. Dewatering measures should be completed as necessary to maintain a dry excavation and permit proper completion of the work. If seepage is encountered, it should be collected and pumped out of the excavation. If saturated silts or sands are encountered, shoring or slope flattening may be required. To prevent wet silts and sands from entering the excavation, gravel buttressing could be used in conjunction with sump pits for dewatering. Surface water should be diverted away from the excavation and the excavation should be backfilled as soon as possible following construction.

10.0 Seismic Site Classification

The site classification for seismic site response was determined based on Table 4.1.8.4.-B in Section 4.1.8 *Earthquake Load and Effects* of the NBCC (2020). Site Class E applies to this site based on the average shear strength of the clay soil at this site. The seismic site classification could possibly be improved by undertaking a geophysical site survey to measure shear wave velocities in the upper 30 m of the soil profile.

11.0 Closure

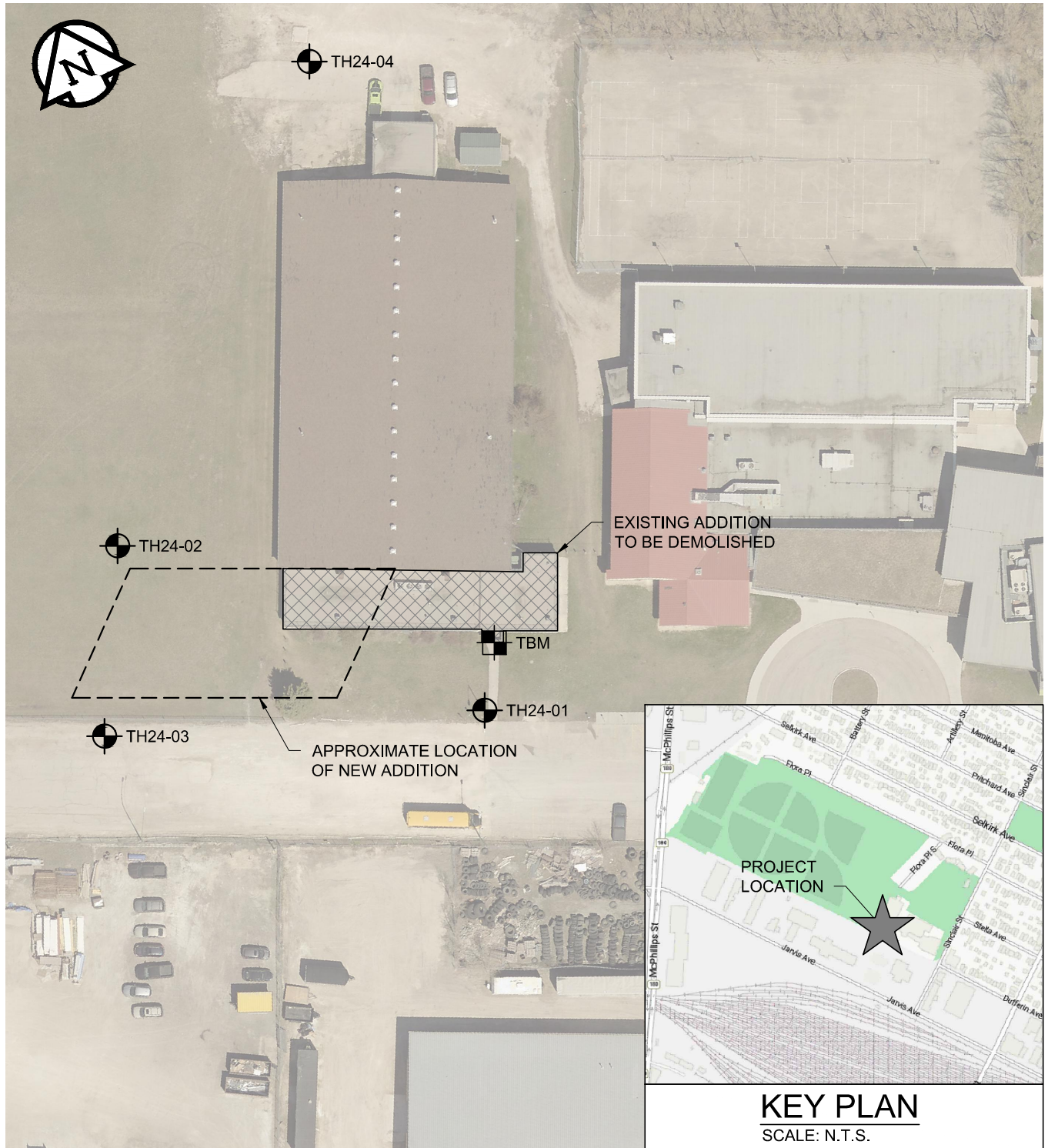
The geotechnical information provided in this report is in accordance with current engineering principles and practices (Standard of Practice). The findings of this report were based on information provided (field investigation and laboratory testing). Soil conditions are natural deposits that can be highly variable across a site. If subsurface conditions are different than the conditions previously encountered on-site or those presented here, we should be notified to adjust our findings if necessary.

All information provided in this report is subject to our standard terms and conditions for engineering services, a copy of which is provided to each of our clients with the original scope of work or standard engineering services agreement. If these conditions are not attached, and you are not already in possession of such terms and conditions, contact our office and you will be promptly provided with a copy.

This report has been prepared by TREK Geotechnical Inc. (the Consultant) for the exclusive use of City of Winnipeg (the Client) and their agents for the work product presented in the report. Any findings or recommendations provided in this report are not to be used or relied upon by any third parties, except as agreed to in writing by the Client and Consultant prior to use.

Figures

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LEGEND:

- TEST HOLE (TREK, 2024)
- TEMPORARY BENCHMARK

NOTES:

1. AERIAL IMAGERY FROM CITY OF WINNIPEG (2021).
2. TEST HOLE LOCATIONS WERE RECORDED USING A HANDHELD GPS UNIT.
3. TEST HOLE ELEVATIONS WERE SURVEYED RELATIVE TO A TBM (ASSIGNED ELEVATION 100.0 m) LOCATED ON THE SIDEWALK IN FRONT OF THE EXISTING ARENA (UTM 14U, 5531155 m N, 631901 m E).

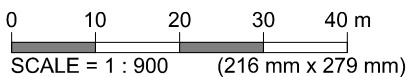


Figure 01
 Test Hole Location Plan

Test Hole Logs

GENERAL NOTES

- Classifications are based on the United Soil Classification System and include consistency, moisture, and color. Field descriptions have been modified to reflect results of laboratory tests where deemed appropriate.
- Descriptions on these test hole logs apply only at the specific test hole locations and at the time the test holes were drilled. Variability of soil and groundwater conditions may exist between test hole locations.
- When the following classification terms are used in this report or test hole logs, the primary and secondary soil fractions may be visually estimated.

Major Divisions	USCS Classification	Symbols	Typical Names	Laboratory Classification Criteria		Particle Size	Material		
Coarse-Grained soils (More than half the material is larger than No. 200 sieve size)	Gravels (More than half of coarse fraction is larger than 4.75 mm)	GW	Well-graded gravels, gravel-sand mixtures, little or no fines	Determine percentages of sand and gravel from grain size curve, depending on percentage of fines (fraction smaller than No. 200 sieve) coarse-grained soils are classified as follows: Less than 5 percent..... GW, GP, SW, SP More than 12 percent..... GM, GC, SM, SC 6 to 12 percent..... Borderline cases requiring dual symbols*	$C_u = \frac{D_{60}}{D_{10}}$ greater than 4; $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 and 3	mm	Sand		
		GP	Poorly-graded gravels, gravel-sand mixtures, little or no fines		Not meeting all gradation requirements for GW			ASTM Sieve Sizes	#10 to #4 #40 to #10 #200 to #40
		Sands (More than half of coarse fraction is smaller than 4.75 mm)	GM		Silty gravels, gravel-sand-silt mixtures	Atterberg limits below "A" line or P.I. less than 4	Above "A" line with P.I. between 4 and 7 are borderline cases requiring use of dual symbols	mm	Coarse Medium Fine
			GC		Clayey gravels, gravel-sand-silt mixtures	Atterberg limits above "A" line or P.I. greater than 7			
	Fine-Grained soils (More than half the material is smaller than No. 200 sieve size)	Sands with fines (Appreciable amount of fines)	SW		Well-graded sands, gravelly sands, little or no fines		Atterberg limits below "A" line or P.I. less than 4	Material Boulders Cobbles Gravel Coarse Fine	
			SP		Poorly-graded sands, gravelly sands, little or no fines		Not meeting all gradation requirements for SW		
		Silts and Clays (Liquid limit less than 50)	SM		Silty sands, sand-silt mixtures		Atterberg limits below "A" line or P.I. less than 4		Particle Size ASTM Sieve Sizes mm > 300 75 to 300 19 to 75 4.75 to 19
			SC		Clayey sands, sand-clay mixtures		Atterberg limits above "A" line or P.I. greater than 7		
			ML		Inorganic silts and very fine sands, rock floor, silty or clayey fine sands or clayey silts with slight plasticity		Von Post Classification Limit Strong colour or odour, and often fibrous texture		
			CL		Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays				
Silts and Clays (Liquid limit greater than 50)	OL	Organic silts and organic silty clays of low plasticity	MH OR OH						
	MH	Inorganic silts, micaceous or distomaceous fine sandy or silty soils, organic silts							
Highly Organic Soils	CH	Inorganic clays of high plasticity, fat clays	OH						
	OH	Organic clays of medium to high plasticity, organic silts							
Pt		Peat and other highly organic soils							

* Borderline classifications used for soils possessing characteristics of two groups are designated by combinations of groups symbols. For example; GW-GC, well-graded gravel-sand mixture with clay binder.

Other Symbol Types

	Asphalt		Bedrock (undifferentiated)		Cobbles
	Concrete		Limestone Bedrock		Boulders and Cobbles
	Fill		Cemented Shale		Silt Till
			Non-Cemented Shale		Clay Till

LEGEND OF ABBREVIATIONS AND SYMBOLS

LL - Liquid Limit (%)	▽ Water Level at Time of Drilling
PL - Plastic Limit (%)	▼ Water Level at End of Drilling
PI - Plasticity Index (%)	▽ Water Level After Drilling as Indicated on Test Hole Logs
MC - Moisture Content (%)	
SPT - Standard Penetration Test	
RQD- Rock Quality Designation	
Qu - Unconfined Compression	
Su - Undrained Shear Strength	
VW - Vibrating Wire Piezometer	
SI - Slope Incliner	

FRACTION OF SECONDARY SOIL CONSTITUENTS ARE BASED ON THE FOLLOWING TERMINOLOGY

TERM	EXAMPLES	PERCENTAGE
and	and CLAY	35 to 50 percent
"y" or "ey"	clayey, silty	20 to 35 percent
some	some silt	10 to 20 percent
trace	trace gravel	1 to 10 percent

TERMS DESCRIBING CONSISTENCY OR COMPACTION CONDITION

The Standard Penetration Test blow count (N) of a non-cohesive soil can be related to compactness condition as follows:

<u>Descriptive Terms</u>	<u>SPT (N) (Blows/300 mm)</u>
Very loose	< 4
Loose	4 to 10
Compact	10 to 30
Dense	30 to 50
Very dense	> 50

The Standard Penetration Test blow count (N) of a cohesive soil can be related to its consistency as follows:

<u>Descriptive Terms</u>	<u>SPT (N) (Blows/300 mm)</u>
Very soft	< 2
Soft	2 to 4
Firm	4 to 8
Stiff	8 to 15
Very stiff	15 to 30
Hard	> 30

The undrained shear strength (Su) of a cohesive soil can be related to its consistency as follows:

<u>Descriptive Terms</u>	<u>Undrained Shear Strength (kPa)</u>
Very soft	< 12
Soft	12 to 25
Firm	25 to 50
Stiff	50 to 100
Very stiff	100 to 200
Hard	> 200



Sub-Surface Log

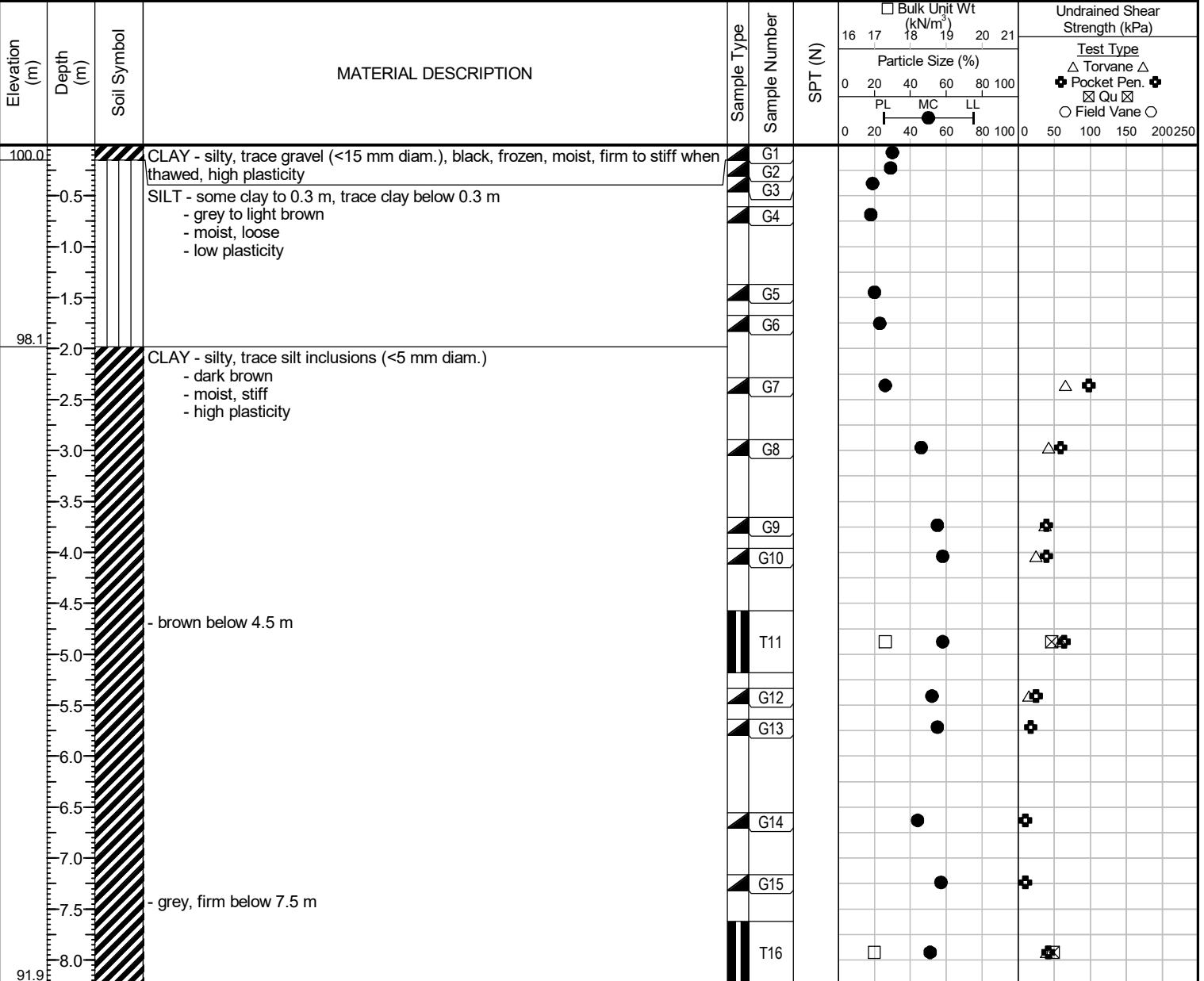
TH24-01

1 of 1

Client: City of Winnipeg **Project Number:** 0020 049 00
Project Name: Old Exhibition Arena Addition - 80 Sinclair Street **Location:** UTM-14U, 5531144 N, 631899 E
Contractor: Paddock Drilling Ltd. **Ground Elevation:** 100.11 m (local)
Method: 125mm Solid Stem Auger, Acker MP8 Truck Mounted Rig **Date Drilled:** 22 February 2024

Sample Type: Grab (G) Shelby Tube (T) Split Spoon (SS) / SPT Split Barrel (SB) / LPT Core (C)

Particle Size Legend: Fines Clay Silt Sand Gravel Cobbles Boulders



Notes:
 1. No sloughing or seepage observed during drilling.
 2. Test hole open to 8.2 m depth and dry immediately after removing auger from test hole.
 3. Test hole backfilled with auger cuttings and betonite chips to surface.
 4. Test hole elevation was surveyed using a rod and level relative to a temporary benchmark (TBM) established as 100.0 m on the concrete sidewalk at the front entrance of the building at UTM 14U, N-5531155, E-631901.

Logged By: Nikhil Baral **Reviewed By:** Kent Bannister **Project Engineer:** Gil Robinson

SUB-SURFACE LOG LOGS 2024-02-23 OLD EX ARENA ADDITION 0_A_NB 0020 049 00.GPJ TREK.GDT 10/4/24



Sub-Surface Log

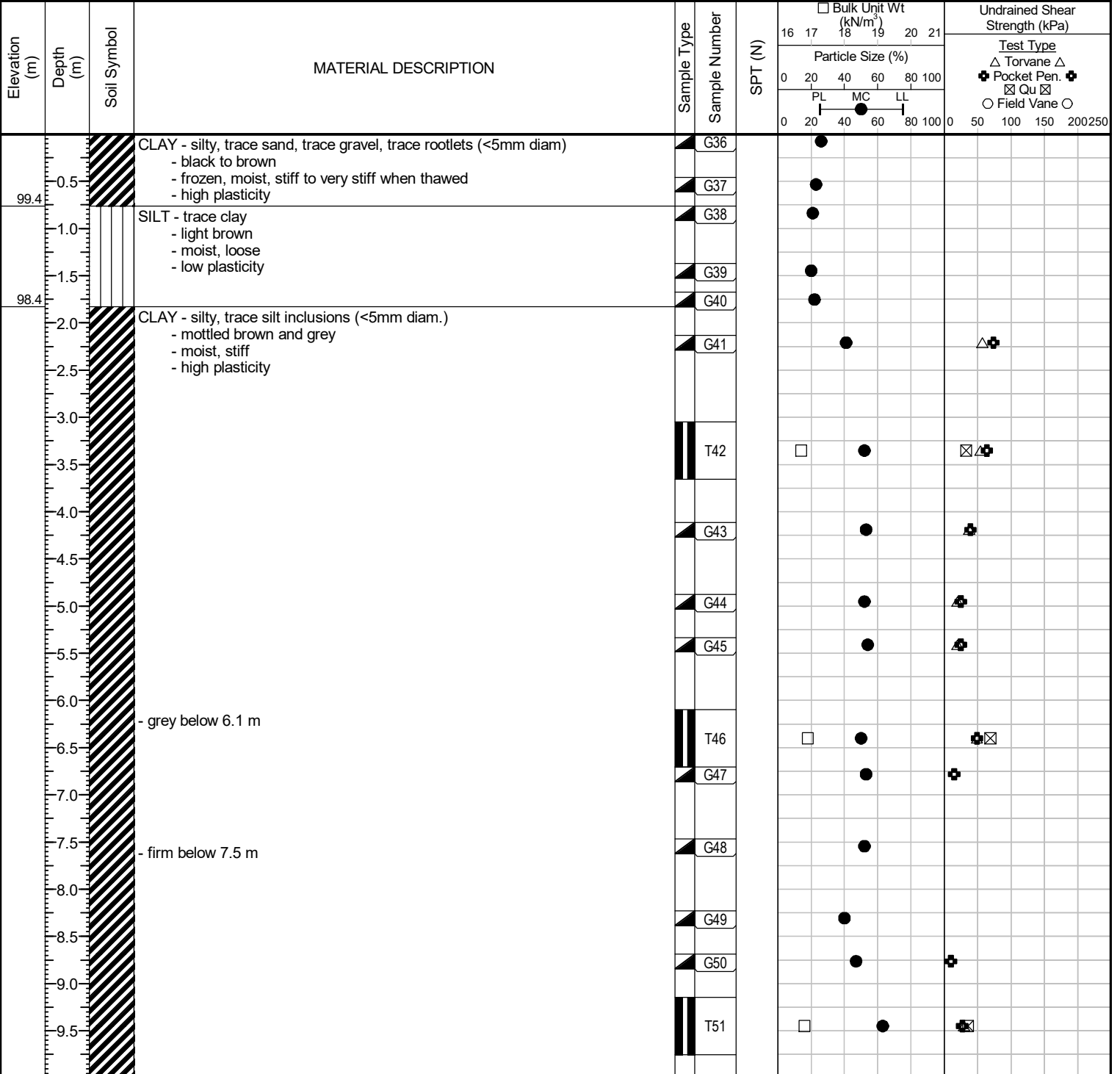
TH24-02

1 of 2

Client: City of Winnipeg **Project Number:** 0020 049 00
Project Name: Old Exhibition Arena Addition - 80 Sinclair Street **Location:** UTM-14U, 5531191 N, 631857 E
Contractor: Paddock Drilling Ltd. **Ground Elevation:** 100.21 m (local)
Method: 125mm Solid Stem Auger, Acker MP8 Truck Mounted Rig **Date Drilled:** 22 February 2024

Sample Type: Grab (G) Shelby Tube (T) Split Spoon (SS) / SPT Split Barrel (SB) / LPT Core (C)

Particle Size Legend: Fines Clay Silt Sand Gravel Cobbles Boulders



SUB-SURFACE LOG LOGS 2024-02-23 OLD EX ARENA ADDITION 0_A_NB 0020 049 00.GPJ TREK.GDT 10/4/24

Logged By: Nikhil Baral **Reviewed By:** Kent Bannister **Project Engineer:** Gil Robinson



Sub-Surface Log

TH24-02

2 of 2

Elevation (m)	Depth (m)	Soil Symbol	MATERIAL DESCRIPTION	Sample Type	Sample Number	SPT (N)	Bulk Unit Wt (kN/m ³)		Particle Size (%)		Undrained Shear Strength (kPa)	
							18	19	0	100	0	200
88.5	10.5			G52								
	11.0			G53								
	11.5			T54								
	12.0		SILT (TILL) - trace clay, trace sand, trace gravel (<20 mm diam.) - grey - moist, compact	G55								
87.6	12.5			S56		13						

END OF TEST HOLE AT 12.6 m IN SILT (TILL)

Notes:

1. No seepage observed during drilling.
2. Test hole squeezing observed below 9.1 m depth.
3. Test hole open to 10.2 m and dry depth immediately after removing auger from test hole.
4. Test hole backfilled with auger cuttings and betonite chips to surface.
5. Test hole elevation was surveyed using a rod and level relative to a temporary benchmark (TBM) established as 100.0 m on the concrete sidewalk at the front entrance of the building at UTM 14U, N-5531155, E-631901.



Sub-Surface Log

TH24-03

1 of 1

Client: City of Winnipeg Project Number: 0020 049 00
 Project Name: Old Exhibition Arena Addition - 80 Sinclair Street Location: UTM-14U, 5531165 N, 631843 E
 Contractor: Paddock Drilling Ltd. Ground Elevation: 100.00 m (local)
 Method: 125mm Solid Stem Auger, Acker MP8 Truck Mounted Rig Date Drilled: 22 February 2024

Sample Type: Grab (G) Shelby Tube (T) Split Spoon (SS) / SPT Split Barrel (SB) / LPT Core (C)

Particle Size Legend: Fines Clay Silt Sand Gravel Cobbles Boulders

Elevation (m)	Depth (m)	Soil Symbol	MATERIAL DESCRIPTION	Sample Type	Sample Number	SPT (N)	Bulk Unit Wt (kN/m ³)					Undrained Shear Strength (kPa)						
							16	17	18	19	20	21	Test Type					
							Particle Size (%)											
							0	20	40	60	80	100						
							0	20	40	60	80	100	0	50	100	150	200	250
							PL MC LL					Pocket Pen. Qu Field Vane						
99.9			GRAVEL - silty, some sand, grey, dry, well graded fine sand to fine gravel, subrounded to subangular gravel		G17	●												
			CLAY (FILL) - silty, trace sand, trace gravel, black, frozen, moist to wet, firm to stiff when thawed, high plasticity		G18	●												
99.7					G19	●												
	-0.5		SILT - trace to some clay, trace sand - light brown - moist, loose - low plasticity		G20	●												
	-1.0				G21	●												
98.9			CLAY - silty - dark brown - moist, stiff - high plasticity		G22	●											+	
	-1.5				G23	●												+
	-2.0				G24	●												△+
	-2.5				G25	●												△+
	-3.0				G26	●												△+

END OF TEST HOLE AT 3.0 m IN CLAY
 Notes:
 1. No seepage or sloughing observed during drilling.
 2. Test hole open to 3.0 m depth and dry immediately after removing auger from test hole.
 3. Test hole backfilled with auger cuttings, bentonite and asphalt cold patch at surface.
 4. Test hole elevation was surveyed using a rod and level relative to a temporary benchmark (TBM) established as 100.0 m on the concrete sidewalk at the front entrance of the building at UTM 14U, N-5531155, E-631901.

Logged By: Nikhil Baral Reviewed By: Kent Bannister Project Engineer: Gil Robinson

SUB-SURFACE LOG LOGS 2024-02-23 OLD EX ARENA ADDITION 0_A_NB 0020 049 00.GPJ TREK.GDT 10/4/24



Sub-Surface Log

TH24-04

1 of 1

Client: City of Winnipeg **Project Number:** 0020 049 00
Project Name: Old Exhibition Arena Addition - 80 Sinclair Street **Location:** UTM-14U, 5531247 N, 631915 E
Contractor: Paddock Drilling Ltd. **Ground Elevation:** 100.06 m (local)
Method: 125mm Solid Stem Auger, Acker MP8 Truck Mounted Rig **Date Drilled:** 22 February 2024

Sample Type: Grab (G) Shelby Tube (T) Split Spoon (SS) / SPT Split Barrel (SB) / LPT Core (C)

Particle Size Legend: Fines Clay Silt Sand Gravel Cobbles Boulders

Elevation (m)	Depth (m)	Soil Symbol	MATERIAL DESCRIPTION	Sample Type	Sample Number	SPT (N)	Bulk Unit Wt (kN/m ³)					Undrained Shear Strength (kPa)						
							16	17	18	19	20	21	0	50	100	150	200	250
100.0			GRAVEL - silty, some sand, grey, dry, well graded fine sand to fine gravel, subrounded to subangular gravel		G27	●												
99.8			CLAY AND SILT - trace sand, trace gravel, brown, frozen, moist to wet, soft to firm when thawed, intermediate plasticity		G28	●												
	-0.5		SILT - trace to some clay - light brown - moist, loose - low plasticity		G29	●												
	-1.0				G30	●												
98.8			CLAY - silty - dark brown - moist, stiff - high plasticity - brown below 1.4 m		G31	●												
	-1.5				G32	●								△	+			
	-2.0				G33	●								△	+			
	-2.5				G34	●								△	+			
	-3.0				G35	●								△	+			

END OF TEST HOLE AT 3.0 m IN CLAY
 Notes:
 1. No seepage or sloughing observed.
 2. Test hole open to 3.0 m depth and dry immediately after removing auger from test hole.
 3. Test hole backfilled with auger cuttings, betonite chips to surface.
 4. Test hole elevation was surveyed using a rod and level relative to a temporary benchmark (TBM) established as 100.0 m on the concrete sidewalk at the front entrance of the building at UTM 14U, N-5531155, E-631901.

Logged By: Nikhil Baral **Reviewed By:** Kent Bannister **Project Engineer:** Gil Robinson

SUB-SURFACE LOG LOGS 2024-02-23 OLD EX ARENA ADDITION 0_A_NB 0020 049 00.GPJ TREK.GDT 10/4/24

Appendix A
Laboratory Testing



Quality Engineering | Valued Relationships

MEMORANDUM

Date March 7, 2024
To Nikhil Baral, TREK Geotechnical
From Angela Fidler-Kliewer, TREK Geotechnical
Project No. 0020-049-00
Project Old Exhibition Arena Addition
Subject Laboratory Testing Results – Lab Req. R24-054

Distribution Gil Robinson

Attached are the laboratory testing results for the above noted project. The testing included moisture content determinations, and unconfined compressive strength and related testing on Shelby tube sample.

Regards,

Angela Fidler-Kliewer, C.Tech.

Attach.

Review Control:

<i>Prepared By:</i> AFK	<i>Reviewed By:</i> AFK	<i>Checked By:</i> NJF
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MT



LABORATORY REQUISITION

CLIENT City of Winnipeg /CKB
 PROJECT NAME Old Exhibition Arena Addition

PROJECT NO: 0020 049 00
 FIELD TECHNICIAN: Nikhil Baral

TREK LABORATORY REQUISITION LOGS 2024-02-23 OLD EX ARENA ADDITION 0 NB 0020 048 00 GPJ TREK GEOTECHNICAL GDT 23/2/24

TEST HOLE NUMBER	SAMPLE NUMBER	DEPTH OF SAMPLE (ft)	TARE NUMBER (LAB USE ONLY)	MOISTURE	VISUAL CLASS.	ATTERBERG LIMITS	HYDROMETER	GRADATION	STD. PROCTOR	UNCONFINED AND AUXILIARY TESTS	Soil Description/Comments
TH24-01	G1	0.0 - 0.5		X							Clay (H) Silt
TH24-01	G2	0.5 - 1.0		X							"
TH24-01	G3	1.0 - 1.5		X							silt
TH24-01	G4	2.0 - 2.5		X							"
TH24-01	G5	4.5 - 5.0		X							"
TH24-01	G6	5.5 - 6.0		X							"
TH24-01	G7	7.5 - 8.0		X							clay
TH24-01	G8	9.5 - 10.0		X							"
TH24-01	G9	12.0 - 12.5		X							"
TH24-01	G10	13.0 - 13.5		X							"
TH24-01	T11	15.0 - 17.0		X	X				X		"
TH24-01	G12	17.5 - 18.0		X							"
TH24-01	G13	18.5 - 19.0		X							"
TH24-01	G14	21.5 - 22.0		X							"
TH24-01	G15	23.5 - 24.0		X							"
TH24-01	T16	25.0 - 27.0		X	X				X		"
TH24-02	G36	0.0 - 0.5		X							organic clay
TH24-02	G37	1.5 - 2.0		X							silt
TH24-02	G38	2.5 - 3.0		X							"
TH24-02	G39	4.5 - 5.0		X							"
TH24-02	G40	5.5 - 6.0		X							"
TH24-02	G41	7.0 - 7.5		X							clay
TH24-02	T42	10.0 - 12.0		X	X				X		"
TH24-02	G43	13.5 - 14.0		X							"
TH24-02	G44	16.0 - 16.5		X							"
TH24-02	G45	17.5 - 18.0		X							"
TH24-02	T46	20.0 - 22.0		X	X				X		"
TH24-02	G47	22.0 - 22.5		X							"
TH24-02	G48	24.5 - 25.0		X							"
TH24-02	G49	27.0 - 27.5		X							"
TH24-02	G50	28.5 - 29.0		X							"
TH24-02	T51	30.0 - 32.0		X	X				X		"
TH24-02	G52	33.0 - 33.5		X							"
TH24-02	G53	34.0 - 34.5		X							"
TH24-02	T54	35.0 - 37.0		X	X				X		Clay/T:ll

REQUESTED BY: Nikhil Baral REPORT TO: Guy Robinson
 REQUISITION DATE: Feb 25, 2024 DATE REQUIRED: Feb March 7, 2024
 COMMENTS: _____

REQUISITION NO. R24-054

City of Winnipeg / CRB

CLIENT: University of Manitoba
PROJECT NAME: Old Exhibition Arena Addition

PROJECT NO: 0020 049 00
FIELD TECHNICIAN: Nikhil Baral

TEST HOLE NUMBER	SAMPLE NUMBER	DEPTH OF SAMPLE (ft)	TARE NUMBER (LAB USE ONLY)	MOISTURE	VISUAL CLASS.	ATTERBERG LIMITS	HYDROMETER	GRADATION	STD. PROCTOR	UNCONFINED AND AUXILIARY TESTS	Soil Description/Comments
TH24-02	G55	38.5 - 39.0		X							Silt / Till
TH24-02	S56	40.0 - 41.5		X							
TH24-03	G17	0.0 - 0.3		X							Gravel Sand
TH24-03	G18	0.3 - 0.6		X							Clay / silt
TH24-03	G19	0.6 - 1.1		X							
TH24-03	G20	1.1 - 1.5		X							
TH24-03	G21	2.5 - 3.0		X							
TH24-03	G22	3.5 - 4.0		X							silt clay / silt
TH24-03	G23	5.5 - 6.0		X							clay
TH24-03	G24	6.5 - 7.0		X							
TH24-03	G25	8.5 - 9.0		X							
TH24-03	G26	9.5 - 10.0		X							
TH24-04	G27	0.0 - 0.3		X							Sand
TH24-04	G28	0.3 - 1.0		X							Clay / silt
TH24-04	G29	1.0 - 1.5		X							
TH24-04	G30	2.0 - 2.5		X							
TH24-04	G31	3.5 - 4.0		X							silt
TH24-04	G32	4.5 - 5.0		X							Clay / silt
TH24-04	G33	5.5 - 6.0		X							clay
TH24-04	G34	6.5 - 7.0		X							
TH24-04	G35	9.5 - 10.0		X							

TREK LABORATORY REQUISITION LOGS 2024-02-23 OLD EX ARENA ADDITION 0 NB 0020 049 00 GPJ TREK GEOTECHNICAL.GDT 23/2/24

REQUESTED BY: Nikhil Baral REPORT TO: Neil Robinson
REQUISITION DATE: Feb 25, 2024 DATE REQUIRED: March 9, 2024
COMMENTS: _____

REQUISITION NO. R24-054



www.trekgeotechnical.ca
 1712 St. James Street
 Winnipeg, MB R3H 0L3
 Tel: 204.975.9433 Fax: 204.975.9435

**Moisture Content Report
 ASTM D2216-98**

Project No. 0020-049-00
Client City of Winnipeg/CKB
Project Old Exhibition Arena Addition

Sample Date 22-Feb-24
Test Date 04-Mar-24
Technician MT

Test Hole	TH23-01	TH23-01	TH23-01	TH23-01	TH23-01	TH23-01
Depth (m)	0.0 - 0.2	0.2 - 0.3	0.3 - 0.5	0.6 - 0.8	1.4 - 1.5	1.7 - 1.8
Sample #	G01	G02	G03	G04	G05	G06
Tare ID	H3	H14	N99	AB62	A51	P09
Mass of tare	8.8	8.4	8.6	6.6	8.4	8.6
Mass wet + tare	188.8	178.6	184.2	180.4	188.4	188.8
Mass dry + tare	147.1	140.0	155.7	154.3	158.5	155.4
Mass water	41.7	38.6	28.5	26.1	29.9	33.4
Mass dry soil	138.3	131.6	147.1	147.7	150.1	146.8
Moisture %	30.2%	29.3%	19.4%	17.7%	19.9%	22.8%

Test Hole	TH23-01	TH23-01	TH23-01	TH23-01	TH23-01	TH23-01
Depth (m)	2.3 - 2.4	2.9 - 3.0	3.7 - 3.8	4.0 - 4.1	5.3 - 5.5	5.6 - 5.8
Sample #	G07	G08	G09	G10	G12	G13
Tare ID	W99	W102	F112	F21	E8	AB96
Mass of tare	8.6	8.6	8.2	8.6	8.6	6.8
Mass wet + tare	181.4	172.2	173.8	194.2	199.2	178.2
Mass dry + tare	146.0	120.7	114.6	125.8	133.8	117.3
Mass water	35.4	51.5	59.2	68.4	65.4	60.9
Mass dry soil	137.4	112.1	106.4	117.2	125.2	110.5
Moisture %	25.8%	45.9%	55.6%	58.4%	52.2%	55.1%

Test Hole	TH23-01	TH23-01	TH23-02	TH23-01	TH24-02	TH24-02
Depth (m)	6.6 - 6.7	7.2 - 7.3	0.0 - 0.2	0.5 - 0.6	0.8 - 0.9	1.4 - 1.5
Sample #	G14	G15	G36	G37	G38	G39
Tare ID	F56	A104	Z72	W75	Z68	AA23
Mass of tare	8.8	8.8	8.6	8.2	8.4	6.8
Mass wet + tare	205.2	179.4	181.6	198.4	186.0	176.0
Mass dry + tare	144.7	117.5	145.5	163.4	155.1	148.2
Mass water	60.5	61.9	36.1	35.0	30.9	27.8
Mass dry soil	135.9	108.7	136.9	155.2	146.7	141.4
Moisture %	44.5%	56.9%	26.4%	22.6%	21.1%	19.7%



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**Moisture Content Report
 ASTM D2216-98**

Project No. 0020-049-00
Client City of Winnipeg/CKB
Project Old Exhibition Arena Addition

Sample Date 22-Feb-24
Test Date 04-Mar-24
Technician MT

Test Hole	TH24-02	TH24-02	TH24-02	TH24-02	TH24-02	TH24-02
Depth (m)	1.7 - 1.8	2.1 - 2.3	4.1 - 4.3	4.9 - 5.0	5.3 - 5.5	6.7 - 6.9
Sample #	G40	G41	G43	G44	G45	G47
Tare ID	Z87	AB06	D10	K14	F86	E94
Mass of tare	8.4	6.8	8.6	8.8	8.8	8.4
Mass wet + tare	184.2	182.4	176.6	181.6	184.0	185.0
Mass dry + tare	152.4	131.1	118.5	122.7	122.7	123.6
Mass water	31.8	51.3	58.1	58.9	61.3	61.4
Mass dry soil	144.0	124.3	109.9	113.9	113.9	115.2
Moisture %	22.1%	41.3%	52.9%	51.7%	53.8%	53.3%

Test Hole	TH24-02	TH24-02	TH24-02	TH24-02	TH24-02	TH24-02
Depth (m)	7.5 - 7.6	8.2 - 8.4	8.7 - 8.8	10.1 - 10.2	10.4 - 10.5	11.7 - 11.9
Sample #	G48	G49	G50	G52	G53	G55
Tare ID	A107	P36	E19	W34	E33	H25
Mass of tare	8.6	8.6	8.8	8.4	8.6	8.4
Mass wet + tare	188.8	181.4	191.0	196.8	189.8	192.0
Mass dry + tare	127.4	131.6	133.1	132.0	137.3	173.6
Mass water	61.4	49.8	57.9	64.8	52.5	18.4
Mass dry soil	118.8	123.0	124.3	123.6	128.7	165.2
Moisture %	51.7%	40.5%	46.6%	52.4%	40.8%	11.1%

Test Hole	TH24-02	TH24-03	TH24-03	TH24-03	TH24-03	TH24-03
Depth (m)	12.2 - 12.6	0.0 - 0.1	0.1 - 0.2	0.2 - 0.3	0.3 - 0.5	0.8 - 0.9
Sample #	S56	G17	G18	G19	G20	G21
Tare ID	C26	A106	C2	P24	Z39	AC37
Mass of tare	8.6	8.4	8.4	8.6	8.6	6.8
Mass wet + tare	195.2	196.8	177.0	179.2	188.2	175.4
Mass dry + tare	179.1	185.6	135.1	139.4	151.5	138.8
Mass water	16.1	11.2	41.9	39.8	36.7	36.6
Mass dry soil	170.5	177.2	126.7	130.8	142.9	132.0
Moisture %	9.4%	6.3%	33.1%	30.4%	25.7%	27.7%



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**Moisture Content Report
 ASTM D2216-98**

Project No. 0020-049-00
Client City of Winnipeg/CKB
Project Old Exhibition Arena Addition

Sample Date 22-Feb-24
Test Date 04-Mar-24
Technician MT

Test Hole	TH24-03	TH24-03	TH24-03	TH24-03	TH24-03	TH24-04
Depth (m)	1.1 - 1.2	1.7 - 1.8	2.0 - 2.1	2.6 - 2.7	2.9 - 3.0	0.0 - 0.1
Sample #	G22	G23	G24	G25	G26	G27
Tare ID	N39	W09	P27	M21	AB54	C14
Mass of tare	8.4	8.6	8.6	6.8	6.8	8.6
Mass wet + tare	194.2	195.2	184.0	191.2	174.2	174.0
Mass dry + tare	147.1	140.5	127.9	128.5	115.5	162.3
Mass water	47.1	54.7	56.1	62.7	58.7	11.7
Mass dry soil	138.7	131.9	119.3	121.7	108.7	153.7
Moisture %	34.0%	41.5%	47.0%	51.5%	54.0%	7.6%

Test Hole	TH24-04	TH24-04	TH24-04	TH24-04	TH24-04	TH24-04
Depth (m)	0.1 - 0.3	0.3 - 0.5	0.6 - 0.8	1.1 - 1.2	1.4 - 1.5	1.7 - 1.8
Sample #	G28	G29	G30	G31	G32	G33
Tare ID	W36	H72	A21	W06	N93	F18
Mass of tare	8.6	6.7	8.8	8.8	8.6	8.6
Mass wet + tare	182.2	194.0	176.8	191.6	191.0	185.2
Mass dry + tare	146.6	151.8	133.9	162.2	146.5	135.7
Mass water	35.6	42.2	42.9	29.4	44.5	49.5
Mass dry soil	138.0	145.1	125.1	153.4	137.9	127.1
Moisture %	25.8%	29.1%	34.3%	19.2%	32.3%	38.9%

Test Hole	TH24-04	TH24-04				
Depth (m)	2.0 - 2.1	2.9 - 3.0				
Sample #	G34	G35				
Tare ID	K23	E67				
Mass of tare	8.6	6.8				
Mass wet + tare	188.8	172.8				
Mass dry + tare	137.4	116.8				
Mass water	51.4	56.0				
Mass dry soil	128.8	110.0				
Moisture %	39.9%	50.9%				



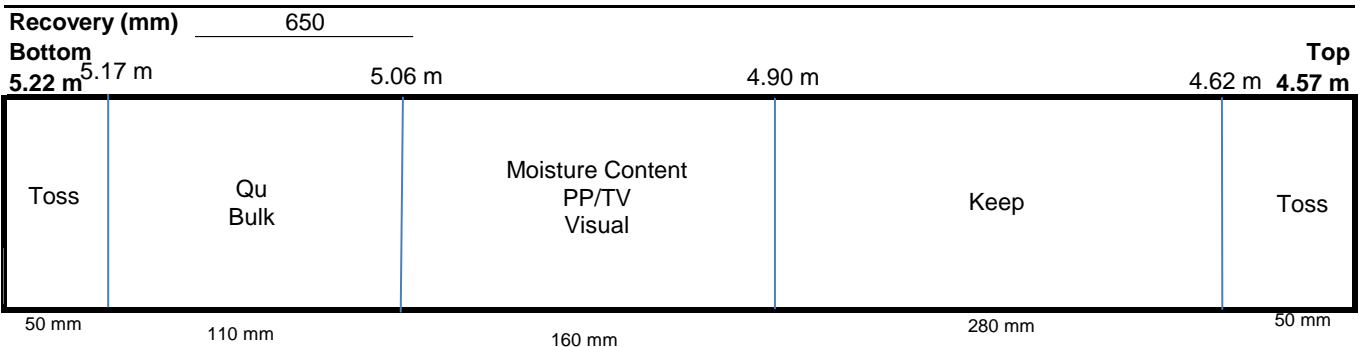
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Shelby Tube Visual

Project No. 0020-049-00
Client City of Winnipeg/CKB
Project Old Exhibition Arena Addition

Test Hole TH24-01
Sample # T11
Depth (m) 4.6 - 5.2
Sample Date 22-Feb-24
Test Date 05-Mar-24
Technician MT

Tube Extraction



Visual Classification

Material	CLAY
Composition	silty
trace silt inclusions (<5mm diam.)	
Color	brown
Moisture	moist
Consistency	stiff
Plasticity	high plasticity
Structure	laminated (light brown and grey clay, <5mm thick)
Gradation	-

Torvane

Reading	0.60
Vane Size (s,m,l)	m
Undrained Shear Strength (kPa)	58.8

Pocket Penetrometer

Reading	1	1.30
	2	1.50
	3	1.40
	Average	1.40
Undrained Shear Strength (kPa)		68.6

Moisture Content

Tare ID	E64
Mass tare (g)	6.6
Mass wet + tare (g)	315.2
Mass dry + tare (g)	202.4
Moisture %	57.6%

Unit Weight

Bulk Weight (g)	1092.6	
Length (mm)	1	149.86
	2	149.92
	3	149.88
	4	149.86
Average Length (m)	0.150	
Diam. (mm)	1	72.90
	2	71.92
	3	72.76
	4	72.32
Average Diameter (m)	0.072	

Volume (m³)	6.18E-04
Bulk Unit Weight (kN/m³)	17.3
Bulk Unit Weight (pcf)	110.3
Dry Unit Weight (kN/m³)	11.0
Dry Unit Weight (pcf)	70.0

Project No. 0020-049-00
Client City of Winnipeg/CKB
Project Old Exhibition Arena Addition

Test Hole TH24-01
Sample # T11
Depth (m) 4.6 - 5.2
Sample Date 22-Feb-24
Test Date 05-Mar-24
Technician MT

Unconfined Strength

	kPa	ksf
Max q_u	92.5	1.9
Max S_u	46.3	1.0

Specimen Data

Description CLAY - silty, trace silt inclusions (<5mm diam.), brown, moist, stiff, high plasticity, laminated (light brown and grey clay, <5mm thick)

Length	149.9	(mm)	Moisture %	58%	
Diameter	72.5	(mm)	Bulk Unit Wt.	17.3	(kN/m ³)
L/D Ratio	2.1		Dry Unit Wt.	11.0	(kN/m ³)
Initial Area	0.00413	(m ²)	Liquid Limit	-	
Load Rate	1.00	(%/min)	Plastic Limit	-	
			Plasticity Index	-	

Undrained Shear Strength Tests

Torvane

Reading	Undrained Shear Strength	
tsf	kPa	ksf
0.60	58.8	1.23
Vane Size		
m	68.6	1.43

Pocket Penetrometer

Reading	Undrained Shear Strength	
tsf	kPa	ksf
1.30	63.8	1.33
1.50	73.6	1.54
1.40	68.7	1.43
Average	68.7	1.43

Failure Geometry

Sketch:

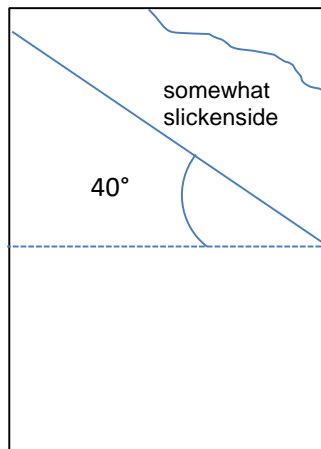
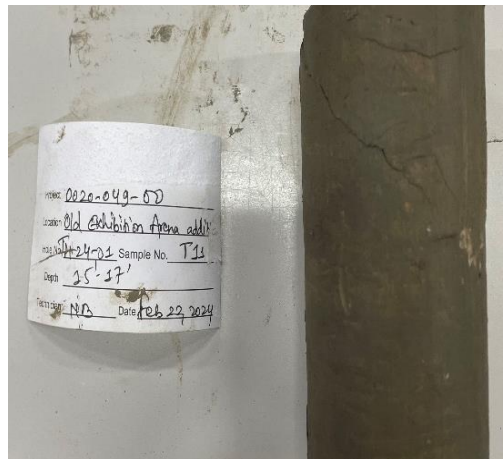


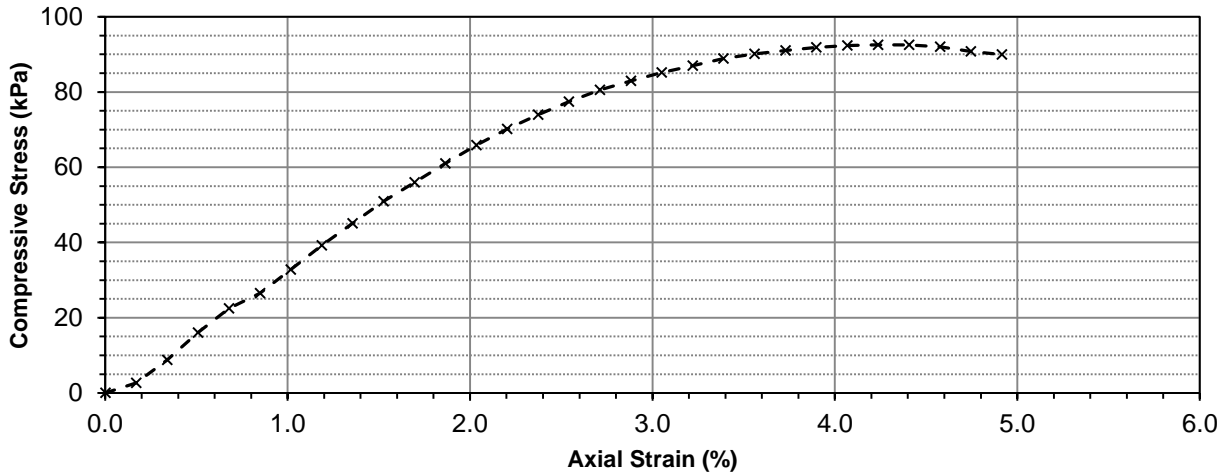
Photo:





Project No. 0020-049-00
Client City of Winnipeg/CKB
Project Old Exhibition Arena Addition

Unconfined Compression Test Graph



Unconfined Compression Test Data

Deformation Dial Reading	Load Ring Dial Reading	Deflection (mm)	Axial Strain (%)	Corrected Area (m ²)	Axial Load (N)	Compressive Stress, q _u (kPa)	Shear Stress, S _u (kPa)
0	0.72	0.0000	0.00	0.004125	0.0	0.00	0.00
10	0.94	0.2540	0.17	0.004132	11.1	2.68	1.34
20	1.44	0.5080	0.34	0.004139	36.3	8.77	4.38
30	2.04	0.7620	0.51	0.004146	66.5	16.05	8.02
40	2.57	1.0160	0.68	0.004154	93.2	22.45	11.22
50	2.91	1.2700	0.85	0.004161	110.4	26.53	13.27
60	3.43	1.5240	1.02	0.004168	136.6	32.77	16.39
70	3.97	1.7780	1.19	0.004175	163.8	39.24	19.62
80	4.46	2.0320	1.36	0.004182	188.5	45.07	22.54
90	4.95	2.2860	1.53	0.004189	213.2	50.89	25.45
100	5.38	2.5400	1.69	0.004197	234.9	55.97	27.98
110	5.81	2.7940	1.86	0.004204	256.6	61.03	30.51
120	6.22	3.0480	2.03	0.004211	277.2	65.83	32.92
130	6.59	3.3020	2.20	0.004218	295.9	70.14	35.07
140	6.92	3.5560	2.37	0.004226	312.5	73.95	36.98
150	7.22	3.8100	2.54	0.004233	327.6	77.40	38.70
160	7.50	4.0640	2.71	0.004240	341.7	80.59	40.30
170	7.71	4.3180	2.88	0.004248	352.3	82.94	41.47
180	7.91	4.5720	3.05	0.004255	362.4	85.17	42.58
190	8.08	4.8260	3.22	0.004263	371.0	87.03	43.51
200	8.25	5.0800	3.39	0.004270	379.5	88.88	44.44
210	8.37	5.3340	3.56	0.004278	385.6	90.14	45.07
220	8.46	5.5880	3.73	0.004285	390.1	91.04	45.52
230	8.54	5.8420	3.90	0.004293	394.2	91.82	45.91



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Unconfined Compressive Strength
ASTM D2166

Project No. 0020-049-00
Client City of Winnipeg/CKB
Project Old Exhibition Arena Addition

Unconfined Compression Test Data (cont'd)

Deformation Dial Reading	Load Ring Dial Reading	Deflection (mm)	Axial Strain (%)	Corrected Area (m ²)	Axial Load (N)	Compressive Stress, q _u (kPa)	Shear Stress, S _u (kPa)
240	8.60	6.0960	4.07	0.004300	397.2	92.36	46.18
250	8.63	6.3500	4.24	0.004308	398.7	92.55	46.27
260	8.64	6.6040	4.41	0.004316	399.2	92.50	46.25
270	8.61	6.8580	4.58	0.004323	397.7	91.99	45.99
280	8.52	7.1120	4.75	0.004331	393.1	90.78	45.39
290	8.46	7.3660	4.91	0.004339	390.1	89.92	44.96



Project No. 0020-049-00
Client City of Winnipeg/CKB
Project Old Exhibition Arena Addition

Test Hole TH24-01
Sample # T16
Depth (m) 7.6 - 8.2
Sample Date 22-Feb-24
Test Date 05-Mar-24
Technician MT

Tube Extraction

Recovery (mm) 640						Top
Bottom						7.66 m 7.62 m
8.26 m	8.22 m	8.07 m	7.92 m	7.81 m		
Toss	Keep	Qu Bulk	Moisture Content PP/TV Visual	Keep	Toss	
40 mm	150 mm	155 mm	110 mm	145 mm	40 mm	

Visual Classification

Material	CLAY
Composition	silty
trace silt inclusions (<5mm diam.)	
Color	grey
Moisture	moist
Consistency	firm
Plasticity	high plasticity
Structure	-
Gradation	-

Moisture Content

Tare ID	Z101
Mass tare (g)	9.0
Mass wet + tare (g)	352.8
Mass dry + tare (g)	236.7
Moisture %	51.0%

Unit Weight

Bulk Weight (g)	1095.2
Length (mm)	1 149.71
	2 149.64
	3 149.98
	4 150.07
Average Length (m)	0.150
Diam. (mm)	1 73.26
	2 73.19
	3 73.21
	4 73.27
Average Diameter (m)	0.073

Torvane

Reading	0.40
Vane Size (s,m,l)	m
Undrained Shear Strength (kPa)	39.2

Pocket Penetrometer

Reading	1 0.80
	2 0.90
	3 0.85
Average	0.85
Undrained Shear Strength (kPa)	41.7

Volume (m³)	6.31E-04
Bulk Unit Weight (kN/m³)	17.0
Bulk Unit Weight (pcf)	108.3
Dry Unit Weight (kN/m³)	11.3
Dry Unit Weight (pcf)	71.7

Project No. 0020-049-00
Client City of Winnipeg/CKB
Project Old Exhibition Arena Addition

Test Hole TH24-01
Sample # T16
Depth (m) 7.6 - 8.2
Sample Date 22-Feb-24
Test Date 05-Mar-24
Technician MT

Unconfined Strength

	kPa	ksf
Max q_u	97.4	2.0
Max S_u	48.7	1.0

Specimen Data

Description CLAY - silty, trace silt inclusions (<5mm diam.), grey, moist, firm, high plasticity

Length	149.9	(mm)	Moisture %	51%	
Diameter	73.2	(mm)	Bulk Unit Wt.	17.0	(kN/m ³)
L/D Ratio	2.0		Dry Unit Wt.	11.3	(kN/m ³)
Initial Area	0.00421	(m ²)	Liquid Limit	-	
Load Rate	1.00	(%/min)	Plastic Limit	-	
			Plasticity Index	-	

Undrained Shear Strength Tests

Torvane

Reading	Undrained Shear Strength	
	kPa	ksf
0.40	39.2	0.82
Vane Size		
m	41.7	0.87

Pocket Penetrometer

Reading	Undrained Shear Strength	
	kPa	ksf
0.80	39.2	0.82
0.90	44.1	0.92
0.85	41.7	0.87
Average	0.85	41.7
		0.87

Failure Geometry

Sketch:

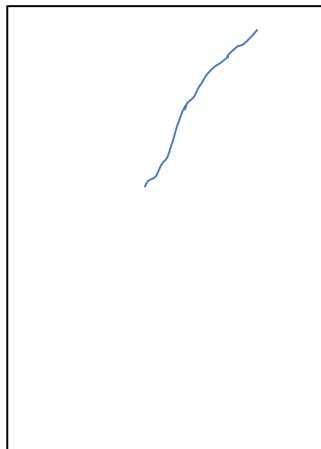
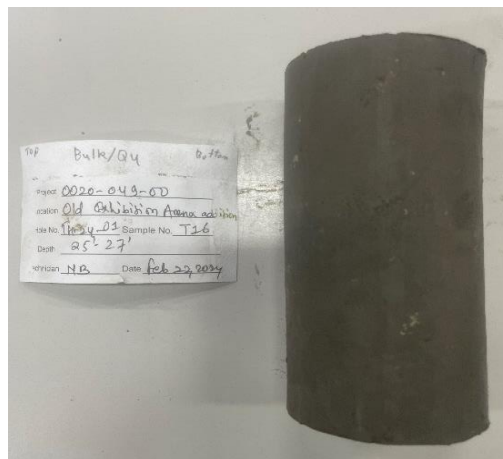
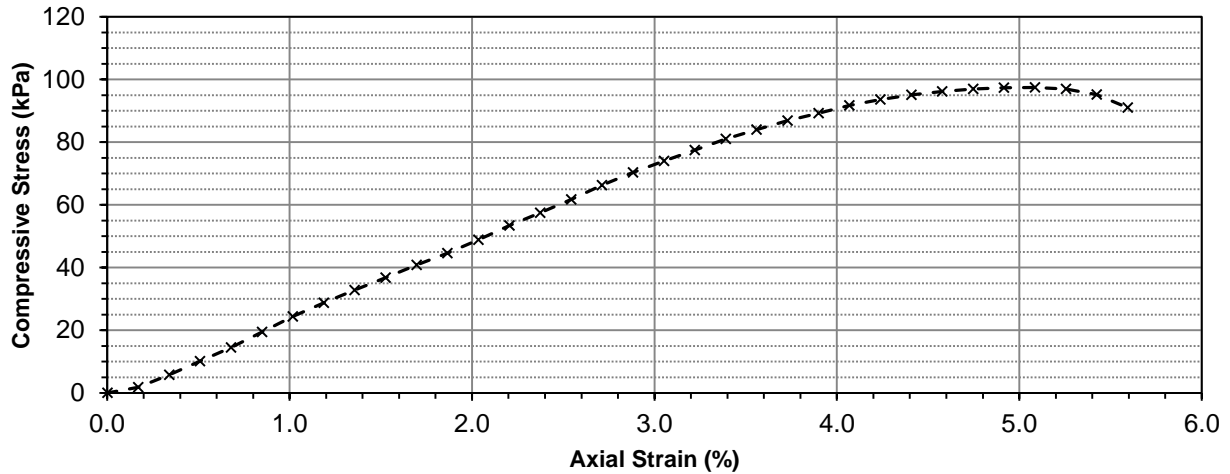


Photo:



Project No. 0020-049-00
Client City of Winnipeg/CKB
Project Old Exhibition Arena Addition

Unconfined Compression Test Graph



Unconfined Compression Test Data

Deformation Dial Reading	Load Ring Dial Reading	Deflection (mm)	Axial Strain (%)	Corrected Area (m ²)	Axial Load (N)	Compressive Stress, q _u (kPa)	Shear Stress, S _u (kPa)
0	0.74	0.0000	0.00	0.004212	0.0	0.00	0.00
10	0.89	0.2540	0.17	0.004219	7.6	1.79	0.90
20	1.22	0.5080	0.34	0.004226	24.2	5.72	2.86
30	1.59	0.7620	0.51	0.004234	42.8	10.12	5.06
40	1.96	1.0160	0.68	0.004241	61.5	14.50	7.25
50	2.38	1.2700	0.85	0.004248	82.7	19.46	9.73
60	2.80	1.5240	1.02	0.004255	103.8	24.40	12.20
70	3.17	1.7780	1.19	0.004263	122.5	28.73	14.37
80	3.52	2.0320	1.36	0.004270	140.1	32.82	16.41
90	3.86	2.2860	1.53	0.004277	157.3	36.77	18.38
100	4.21	2.5400	1.70	0.004285	174.9	40.82	20.41
110	4.54	2.7940	1.86	0.004292	191.5	44.62	22.31
120	4.91	3.0480	2.03	0.004300	210.2	48.88	24.44
130	5.30	3.3020	2.20	0.004307	229.8	53.36	26.68
140	5.66	3.5560	2.37	0.004314	248.0	57.48	28.74
150	6.03	3.8100	2.54	0.004322	266.6	61.69	30.85
160	6.43	4.0640	2.71	0.004330	286.8	66.24	33.12
170	6.79	4.3180	2.88	0.004337	304.9	70.31	35.15
180	7.12	4.5720	3.05	0.004345	321.6	74.02	37.01
190	7.43	4.8260	3.22	0.004352	337.2	77.48	38.74
200	7.75	5.0800	3.39	0.004360	353.3	81.04	40.52
210	8.02	5.3340	3.56	0.004368	366.9	84.01	42.01
220	8.28	5.5880	3.73	0.004375	380.0	86.86	43.43
230	8.50	5.8420	3.90	0.004383	391.1	89.24	44.62



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Unconfined Compressive Strength ASTM D2166

Project No. 0020-049-00
Client City of Winnipeg/CKB
Project Old Exhibition Arena Addition

Unconfined Compression Test Data (cont'd)

Deformation Dial Reading	Load Ring Dial Reading	Deflection (mm)	Axial Strain (%)	Corrected Area (m ²)	Axial Load (N)	Compressive Stress, q _u (kPa)	Shear Stress, S _u (kPa)
240	8.73	6.0960	4.07	0.004391	402.7	91.72	45.86
250	8.91	6.3500	4.24	0.004398	411.8	93.62	46.81
260	9.05	6.6040	4.41	0.004406	418.8	95.06	47.53
270	9.16	6.8580	4.58	0.004414	424.4	96.14	48.07
280	9.25	7.1120	4.75	0.004422	428.9	97.00	48.50
290	9.30	7.3660	4.92	0.004430	431.4	97.40	48.70
300	9.32	7.6200	5.09	0.004438	432.5	97.45	48.72
310	9.29	7.8740	5.25	0.004446	430.9	96.94	48.47
320	9.15	8.1280	5.42	0.004454	423.9	95.18	47.59
330	8.80	8.3820	5.59	0.004462	406.2	91.05	45.53



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Shelby Tube Visual

Project No. 0020-049-00
Client City of Winnipeg/CKB
Project Old Exhibition Arena Addition

Test Hole TH24-02
Sample # T42
Depth (m) 3.0 - 3.7
Sample Date 22-Feb-24
Test Date 28-Feb-24
Technician KM

Tube Extraction

Recovery (mm) 610										Top
Bottom	3.62 m	3.45 m	3.28 m	3.16 m						3.05 m
3.66 m										
Toss	Keep	Qu Bulk	Moisture Content PP/TV Visual	Toss						
40 mm	170 mm	170 mm	120 mm	110 mm						

Visual Classification

Material	CLAY
Composition	silty
	trace silt inclusions (<5mm diam.)
	trace precipitates (sulphates, <5mm diam.)
Color	mottled grey and brown
Moisture	moist
Consistency	stiff
Plasticity	high plasticity
Structure	-
Gradation	-

Torvane

Reading	0.55
Vane Size (s,m,l)	m
Undrained Shear Strength (kPa)	53.9

Pocket Penetrometer

Reading	1	1.30
	2	1.30
	3	1.30
	Average	1.30
Undrained Shear Strength (kPa)		63.7

Moisture Content

Tare ID	H43
Mass tare (g)	8.6
Mass wet + tare (g)	260.4
Mass dry + tare (g)	174.5
Moisture %	51.8%

Unit Weight

Bulk Weight (g)	1013.8
Length (mm)	1 144.72
	2 144.62
	3 144.69
	4 144.66
Average Length (m)	0.145
Diam. (mm)	1 72.14
	2 72.33
	3 72.47
	4 72.17
Average Diameter (m)	0.072

Volume (m³)	5.94E-04
Bulk Unit Weight (kN/m³)	16.7
Bulk Unit Weight (pcf)	106.6
Dry Unit Weight (kN/m³)	11.0
Dry Unit Weight (pcf)	70.3

Project No. 0020-049-00
Client City of Winnipeg/CKB
Project Old Exhibition Arena Addition

Test Hole TH24-02
Sample # T42
Depth (m) 3.0 - 3.7
Sample Date 22-Feb-24
Test Date 28-Feb-24
Technician KM

Unconfined Strength

	kPa	ksf
Max q_u	65.5	1.4
Max S_u	32.8	0.7

Specimen Data

Description CLAY - silty, trace silt inclusions (<5mm diam.), trace precipitates (sulphates, <5mm diam.), mottled grey and brown, moist, stiff, high plasticity

Length	144.7	(mm)	Moisture %	52%
Diameter	72.3	(mm)	Bulk Unit Wt.	16.7 (kN/m ³)
L/D Ratio	2.0		Dry Unit Wt.	11.0 (kN/m ³)
Initial Area	0.00410	(m ²)	Liquid Limit	-
Load Rate	1.00	(%/min)	Plastic Limit	-
			Plasticity Index	-

Undrained Shear Strength Tests

Torvane

Reading	Undrained Shear Strength	
	kPa	ksf
tsf		
0.55	53.9	1.13
Vane Size		
m	63.7	1.33

Pocket Penetrometer

Reading	Undrained Shear Strength	
	kPa	ksf
tsf		
1.30	63.8	1.33
1.30	63.8	1.33
1.30	63.8	1.33
Average	1.30	63.8
		1.33

Failure Geometry

Sketch:

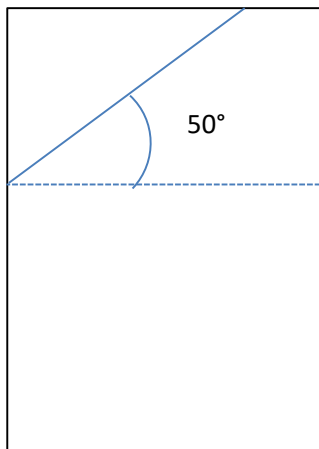
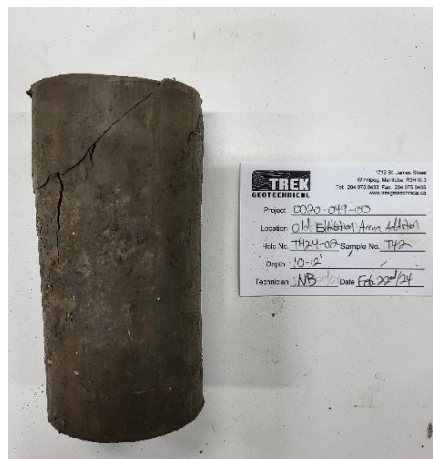


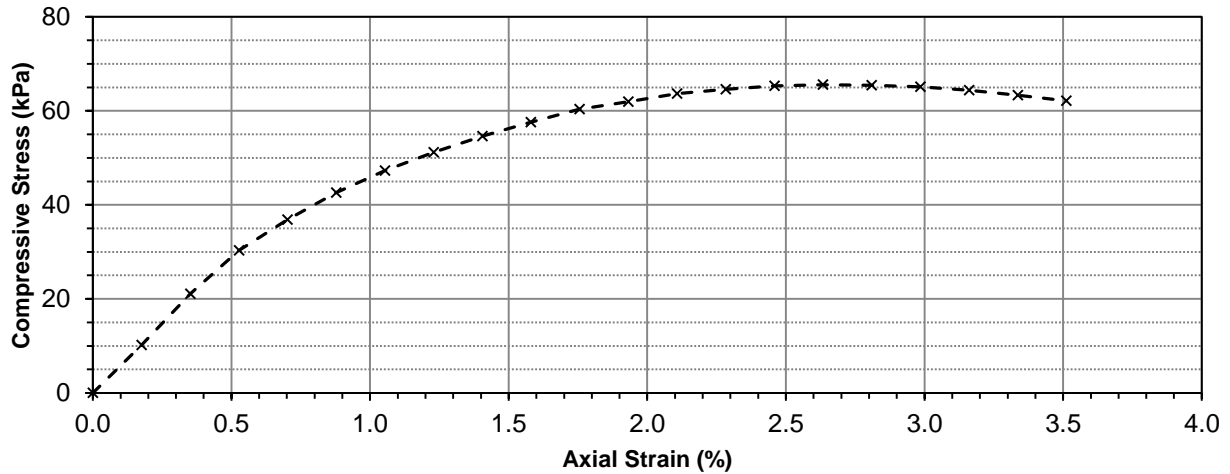
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Project No. 0020-049-00
Client City of Winnipeg/CKB
Project Old Exhibition Arena Addition

Unconfined Compression Test Graph



Unconfined Compression Test Data

Deformation Dial Reading	Load Ring Dial Reading	Deflection (mm)	Axial Strain (%)	Corrected Area (m ²)	Axial Load (N)	Compressive Stress, q _u (kPa)	Shear Stress, S _u (kPa)
0	0.75	0.0000	0.00	0.004103	0.0	0.00	0.00
10	1.58	0.2540	0.18	0.004110	41.8	10.18	5.09
20	2.47	0.5080	0.35	0.004117	86.7	21.06	10.53
30	3.23	0.7620	0.53	0.004125	125.0	30.31	15.15
40	3.77	1.0160	0.70	0.004132	152.2	36.84	18.42
50	4.25	1.2700	0.88	0.004139	176.4	42.62	21.31
60	4.64	1.5240	1.05	0.004147	196.1	47.28	23.64
70	4.97	1.7780	1.23	0.004154	212.7	51.20	25.60
80	5.26	2.0320	1.40	0.004161	227.3	54.63	27.31
90	5.51	2.2860	1.58	0.004169	239.9	57.55	28.78
100	5.75	2.5400	1.76	0.004176	252.0	60.34	30.17
110	5.89	2.7940	1.93	0.004184	259.1	61.92	30.96
120	6.04	3.0480	2.11	0.004191	266.6	63.62	31.81
130	6.13	3.3020	2.28	0.004199	271.2	64.58	32.29
140	6.20	3.5560	2.46	0.004206	274.7	65.31	32.65
150	6.23	3.8100	2.63	0.004214	276.2	65.55	32.77
160	6.23	4.0640	2.81	0.004222	276.2	65.43	32.71
170	6.21	4.3180	2.98	0.004229	275.2	65.07	32.54
180	6.16	4.5720	3.16	0.004237	272.7	64.36	32.18
190	6.08	4.8260	3.34	0.004245	268.6	63.29	31.65
200	5.99	5.0800	3.51	0.004252	264.1	62.11	31.06



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Shelby Tube Visual

Project No. 0020-049-00
Client City of Winnipeg/CKB
Project Old Exhibition Arena Addition

Test Hole TH24-02
Sample # T46
Depth (m) 6.1 - 6.7
Sample Date 22-Feb-24
Test Date 28-Feb-24
Technician KM

Tube Extraction

Recovery (mm) 630										Top
Bottom	6.73 m	6.71 m	6.54 m	6.37 m	6.20 m					6.10 m
Toss	Moisture Content PP/TV Visual	Qu Bulk	Keep	Toss						
20 mm	170 mm	170 mm	170 mm	100 mm						

Visual Classification

Material	CLAY
Composition	silty
	trace gravel (<10mm diam.)
	trace silt inclusions (<5mm diam.)
Color	grey
Moisture	moist
Consistency	firm to stiff
Plasticity	high plasticity
Structure	laminated (grey and brown clay, <5mm thick)
Gradation	-

Torvane

Reading	0.50
Vane Size (s,m,l)	m
Undrained Shear Strength (kPa)	49.0

Pocket Penetrometer

Reading	1	1.10
	2	1.10
	3	1.00
	Average	1.07
Undrained Shear Strength (kPa)		52.3

Moisture Content

Tare ID	f69
Mass tare (g)	8.7
Mass wet + tare (g)	262.0
Mass dry + tare (g)	177.0
Moisture %	50.5%

Unit Weight

Bulk Weight (g)	1068.5	
Length (mm)	1	149.96
	2	149.45
	3	149.56
	4	149.51
Average Length (m)	0.150	
Diam. (mm)	1	73.05
	2	72.09
	3	72.73
	4	72.56
Average Diameter (m)	0.073	

Volume (m³)	6.20E-04
Bulk Unit Weight (kN/m³)	16.9
Bulk Unit Weight (pcf)	107.7
Dry Unit Weight (kN/m³)	11.2
Dry Unit Weight (pcf)	71.5

Project No. 0020-049-00
Client City of Winnipeg/CKB
Project Old Exhibition Arena Addition

Test Hole TH24-02
Sample # T46
Depth (m) 6.1 - 6.7
Sample Date 22-Feb-24
Test Date 28-Feb-24
Technician KM

Unconfined Strength

	kPa	ksf
Max q_u	138.2	2.9
Max S_u	69.1	1.4

Specimen Data

Description CLAY - silty, trace gravel (<10mm diam.), trace silt inclusions (<5mm diam.), grey, moist, firm to stiff, high plasticity, laminated (grey and brown clay, <5mm thick)

Length	149.6	(mm)	Moisture %	51%
Diameter	72.6	(mm)	Bulk Unit Wt.	16.9 (kN/m ³)
L/D Ratio	2.1		Dry Unit Wt.	11.2 (kN/m ³)
Initial Area	0.00414	(m ²)	Liquid Limit	-
Load Rate	1.00	(%/min)	Plastic Limit	-
			Plasticity Index	-

Undrained Shear Strength Tests

Torvane

Reading	Undrained Shear Strength	
tsf	kPa	ksf
0.50	49.0	1.02
Vane Size		
m	52.3	1.09

Pocket Penetrometer

Reading	Undrained Shear Strength	
tsf	kPa	ksf
1.10	54.0	1.13
1.10	54.0	1.13
1.00	49.1	1.02
Average	52.3	1.09

Failure Geometry

Sketch:

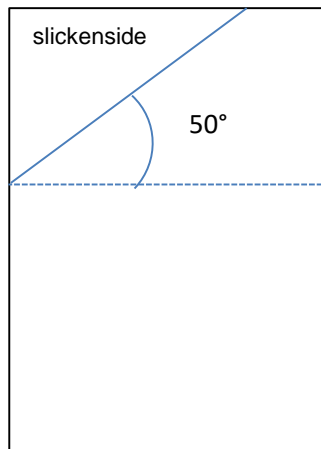


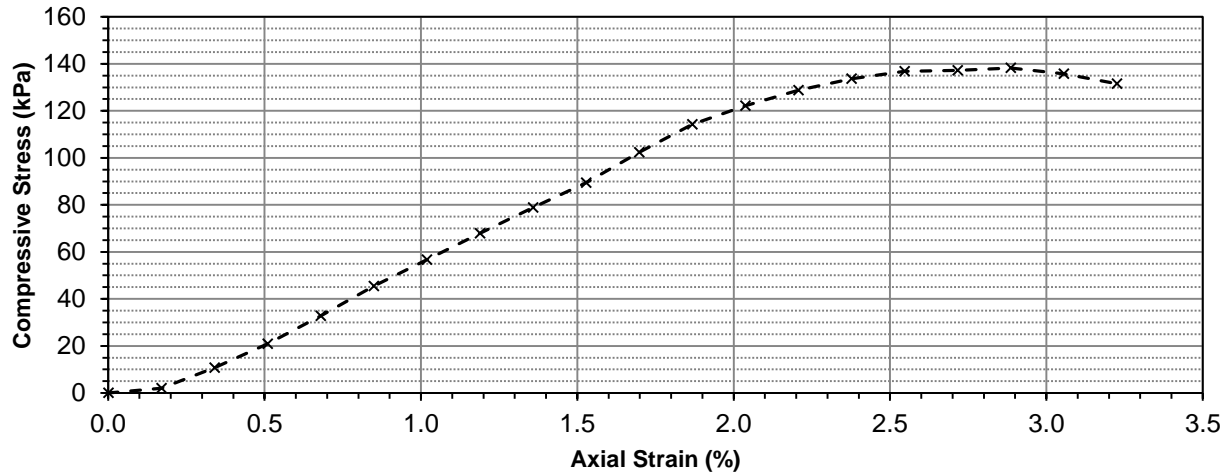
Photo:





Project No. 0020-049-00
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Project Old Exhibition Arena Addition

Unconfined Compression Test Graph



Unconfined Compression Test Data

Deformation Dial Reading	Load Ring Dial Reading	Deflection (mm)	Axial Strain (%)	Corrected Area (m ²)	Axial Load (N)	Compressive Stress, q _u (kPa)	Shear Stress, S _u (kPa)
0	0.76	0.0000	0.00	0.004141	0.0	0.00	0.00
10	0.92	0.2540	0.17	0.004148	8.1	1.94	0.97
20	1.64	0.5080	0.34	0.004155	44.4	10.68	5.34
30	2.48	0.7620	0.51	0.004162	86.7	20.83	10.42
40	3.47	1.0160	0.68	0.004169	136.6	32.77	16.38
50	4.52	1.2700	0.85	0.004176	189.5	45.38	22.69
60	5.46	1.5240	1.02	0.004183	236.9	56.63	28.32
70	6.40	1.7780	1.19	0.004190	284.3	67.84	33.92
80	7.33	2.0320	1.36	0.004198	331.1	78.89	39.45
90	8.22	2.2860	1.53	0.004205	376.0	89.42	44.71
100	9.31	2.5400	1.70	0.004212	430.9	102.31	51.16
110	10.32	2.7940	1.87	0.004219	481.9	114.20	57.10
120	11.00	3.0480	2.04	0.004227	516.1	122.11	61.06
130	11.58	3.3020	2.21	0.004234	545.4	128.81	64.40
140	12.01	3.5560	2.38	0.004241	567.0	133.69	66.85
150	12.29	3.8100	2.55	0.004249	581.1	136.78	68.39
160	12.34	4.0640	2.72	0.004256	583.7	137.14	68.57
170	12.45	4.3180	2.89	0.004264	589.2	138.20	69.10
180	12.26	4.5720	3.06	0.004271	579.6	135.71	67.86
190	11.92	4.8260	3.23	0.004279	562.5	131.47	65.74



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Shelby Tube Visual

Project No. 0020-049-00
Client City of Winnipeg/CKB
Project Old Exhibition Arena Addition

Test Hole TH24-02
Sample # T51
Depth (m) 9.1 - 9.8
Sample Date 22-Feb-24
Test Date 28-Feb-24
Technician MT

Tube Extraction

Recovery (mm) 640 (overpush)

Bottom 9.78 m 9.74 m 9.62 m 9.54 m 9.38 m 9.20 m **Top** 9.14 m

Toss	Keep	Moisture Content PP/TV Visual	Qu Bulk	Keep	Toss
40 mm	120 mm	80 mm	160 mm	180 mm	60 mm

Visual Classification

Material CLAY
Composition silty
 trace sand
 trace silt inclusions (<5mm diam.)

Color grey
Moisture moist
Consistency firm
Plasticity high plasticity
Structure -
Gradation -

Torvane

Reading 0.30
Vane Size (s,m,l) m
Undrained Shear Strength (kPa) 29.4

Pocket Penetrometer

Reading 1 0.60
 2 0.55
 3 0.50
Average 0.55
Undrained Shear Strength (kPa) 27.0

Moisture Content

Tare ID J74
Mass tare (g) 7.2
Mass wet + tare (g) 365.2
Mass dry + tare (g) 227.4
Moisture % 62.6%

Unit Weight

Bulk Weight (g) 1075.8
Length (mm) 1 150.54
 2 150.74
 3 150.78
 4 150.59
Average Length (m) 0.151

Diam. (mm) 1 72.90
 2 72.80
 3 72.93
 4 73.01
Average Diameter (m) 0.073

Volume (m³) 6.29E-04
Bulk Unit Weight (kN/m³) 16.8
Bulk Unit Weight (pcf) 106.8
Dry Unit Weight (kN/m³) 10.3
Dry Unit Weight (pcf) 65.7

Project No. 0020-049-00
Client City of Winnipeg/CKB
Project Old Exhibition Arena Addition

Test Hole TH24-02
Sample # T51
Depth (m) 9.1 - 9.8
Sample Date 22-Feb-24
Test Date 28-Feb-24
Technician MT

Unconfined Strength

	kPa	ksf
Max q_u	71.5	1.5
Max S_u	35.7	0.7

Specimen Data

Description CLAY - silty, trace sand, trace silt inclusions (<5mm diam.), grey, moist, firm, high plasticity

Length	150.7	(mm)	Moisture %	63%	
Diameter	72.9	(mm)	Bulk Unit Wt.	16.8	(kN/m ³)
L/D Ratio	2.1		Dry Unit Wt.	10.3	(kN/m ³)
Initial Area	0.00418	(m ²)	Liquid Limit	-	
Load Rate	1.00	(%/min)	Plastic Limit	-	
			Plasticity Index	-	

Undrained Shear Strength Tests

Torvane

Reading	Undrained Shear Strength	
	kPa	ksf
0.30	29.4	0.61
Vane Size		
m	27.0	0.56

Pocket Penetrometer

Reading	Undrained Shear Strength	
	kPa	ksf
0.60	29.4	0.61
0.55	27.0	0.56
0.50	24.5	0.51
Average	0.55	27.0
		0.56

Failure Geometry

Sketch:

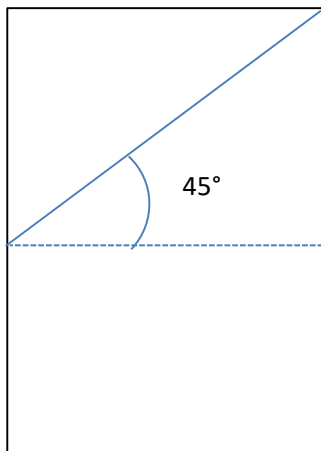
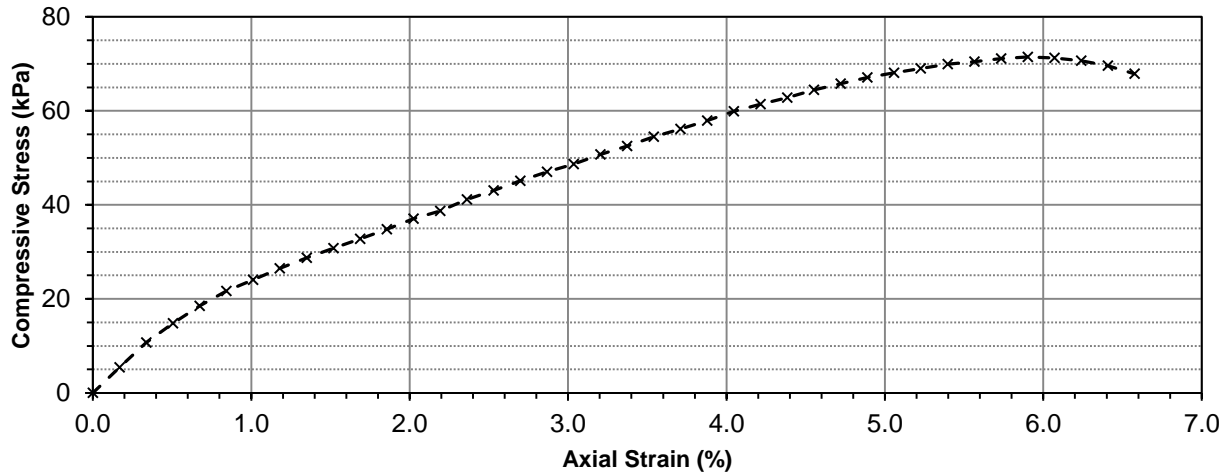


Photo:



Project No. 0020-049-00
Client City of Winnipeg/CKB
Project Old Exhibition Arena Addition

Unconfined Compression Test Graph



Unconfined Compression Test Data

Deformation Dial Reading	Load Ring Dial Reading	Deflection (mm)	Axial Strain (%)	Corrected Area (m ²)	Axial Load (N)	Compressive Stress, q _u (kPa)	Shear Stress, S _u (kPa)
0	0.72	0.0000	0.00	0.004175	0.0	0.00	0.00
10	1.17	0.2540	0.17	0.004182	22.7	5.42	2.71
20	1.61	0.5080	0.34	0.004189	44.9	10.71	5.35
30	1.95	0.7620	0.51	0.004196	62.0	14.77	7.39
40	2.26	1.0160	0.67	0.004203	77.6	18.47	9.23
50	2.53	1.2700	0.84	0.004211	91.2	21.67	10.83
60	2.73	1.5240	1.01	0.004218	101.3	24.02	12.01
70	2.94	1.7780	1.18	0.004225	111.9	26.48	13.24
80	3.13	2.0320	1.35	0.004232	121.5	28.70	14.35
90	3.31	2.2860	1.52	0.004239	130.5	30.79	15.40
100	3.48	2.5400	1.69	0.004247	139.1	32.76	16.38
110	3.66	2.7940	1.85	0.004254	148.2	34.83	17.42
120	3.85	3.0480	2.02	0.004261	157.8	37.02	18.51
130	4.00	3.3020	2.19	0.004269	165.3	38.73	19.36
140	4.21	3.5560	2.36	0.004276	175.9	41.14	20.57
150	4.38	3.8100	2.53	0.004283	184.5	43.07	21.53
160	4.56	4.0640	2.70	0.004291	193.5	45.11	22.55
170	4.73	4.3180	2.87	0.004298	202.1	47.02	23.51
180	4.88	4.5720	3.03	0.004306	209.7	48.70	24.35
190	5.06	4.8260	3.20	0.004313	218.7	50.72	25.36
200	5.22	5.0800	3.37	0.004321	226.8	52.49	26.25
210	5.40	5.3340	3.54	0.004328	235.9	54.50	27.25
220	5.55	5.5880	3.71	0.004336	243.4	56.15	28.07
230	5.71	5.8420	3.88	0.004343	251.5	57.91	28.95



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Unconfined Compressive Strength
ASTM D2166

Project No. 0020-049-00
Client City of Winnipeg/CKB
Project Old Exhibition Arena Addition

Unconfined Compression Test Data (cont'd)

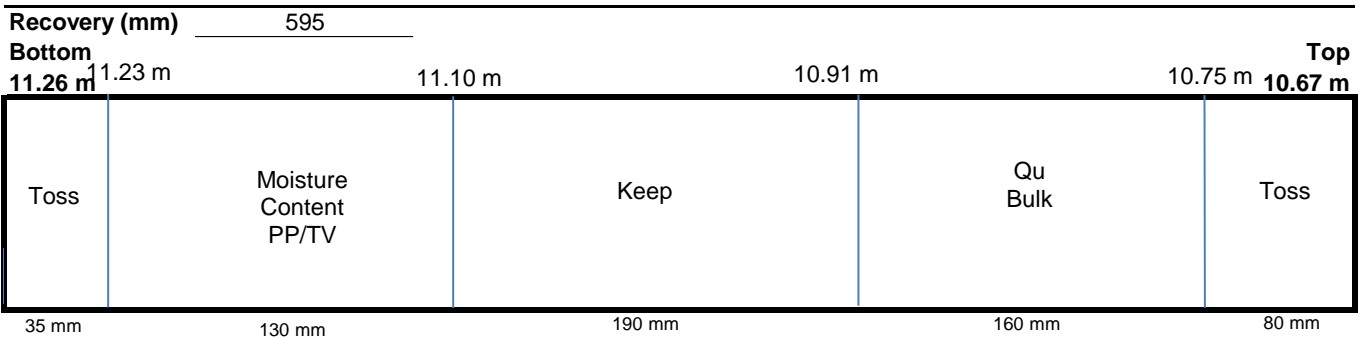
Deformation Dial Reading	Load Ring Dial Reading	Deflection (mm)	Axial Strain (%)	Corrected Area (m ²)	Axial Load (N)	Compressive Stress, q _u (kPa)	Shear Stress, S _u (kPa)
240	5.89	6.0960	4.05	0.004351	260.6	59.89	29.94
250	6.03	6.3500	4.21	0.004359	267.6	61.40	30.70
260	6.16	6.6040	4.38	0.004366	274.2	62.79	31.40
270	6.31	6.8580	4.55	0.004374	281.8	64.41	32.21
280	6.44	7.1120	4.72	0.004382	288.3	65.79	32.90
290	6.56	7.3660	4.89	0.004390	294.4	67.06	33.53
300	6.66	7.6200	5.06	0.004397	299.4	68.08	34.04
310	6.75	7.8740	5.23	0.004405	303.9	68.99	34.50
320	6.84	8.1280	5.39	0.004413	308.5	69.90	34.95
330	6.90	8.3820	5.56	0.004421	311.5	70.46	35.23
340	6.97	8.6360	5.73	0.004429	315.0	71.13	35.56
350	7.01	8.8900	5.90	0.004437	317.0	71.45	35.73
360	7.00	9.1440	6.07	0.004445	316.5	71.21	35.61
370	6.96	9.3980	6.24	0.004453	314.5	70.63	35.32
380	6.88	9.6520	6.41	0.004461	310.5	69.60	34.80
390	6.74	9.9060	6.57	0.004469	303.4	67.90	33.95



Project No. 0020-049-00
Client City of Winnipeg/CKB
Project Old Exhibition Arena Addition

Test Hole TH24-02
Sample # T54
Depth (m) 10.7 - 11.3
Sample Date 22-Feb-24
Test Date 05-Mar-24
Technician MT

Tube Extraction



Visual Classification

Material	CLAY (TILL)
Composition	silty
	trace sand
	trace gravel (<10mm diam.)
Color	grey
Moisture	moist
Consistency	firm
Plasticity	high plasticity
Structure	-
Gradation	-

Torvane

Reading	0.30
Vane Size (s,m,l)	m
Undrained Shear Strength (kPa)	29.4

Pocket Penetrometer

Reading	1	0.80
	2	0.80
	3	0.75
	Average	0.78
Undrained Shear Strength (kPa)		38.4

Moisture Content

Tare ID	N71
Mass tare (g)	8.6
Mass wet + tare (g)	347.0
Mass dry + tare (g)	248.0
Moisture %	41.4%

Unit Weight

Bulk Weight (g)	1054.8
Length (mm)	1 138.33
	2 139.04
	3 138.17
	4 138.77
Average Length (m)	0.139
Diam. (mm)	1 72.05
	2 71.77
	3 71.66
	4 71.50
Average Diameter (m)	0.072

Volume (m³)	5.60E-04
Bulk Unit Weight (kN/m³)	18.5
Bulk Unit Weight (pcf)	117.5
Dry Unit Weight (kN/m³)	13.1
Dry Unit Weight (pcf)	83.2

Project No. 0020-049-00
Client City of Winnipeg/CKB
Project Old Exhibition Arena Addition

Test Hole TH24-02
Sample # T54
Depth (m) 10.7 - 11.3
Sample Date 22-Feb-24
Test Date 05-Mar-24
Technician MT

Unconfined Strength

	kPa	ksf
Max q_u	32.3	0.7
Max S_u	16.1	0.3

Specimen Data

Description CLAY (TILL) - silty, trace sand, trace gravel (<10mm diam.), grey, moist, firm, high plasticity

Length	138.6	(mm)	Moisture %	41%	
Diameter	71.7	(mm)	Bulk Unit Wt.	18.5	(kN/m ³)
L/D Ratio	1.9		Dry Unit Wt.	13.1	(kN/m ³)
Initial Area	0.00404	(m ²)	Liquid Limit	-	
Load Rate	1.00	(%/min)	Plastic Limit	-	
			Plasticity Index	-	

Undrained Shear Strength Tests

Torvane

Reading	Undrained Shear Strength	
	kPa	ksf
0.30	29.4	0.61
Vane Size		
m	38.4	0.80

Pocket Penetrometer

Reading	Undrained Shear Strength	
	kPa	ksf
0.80	39.2	0.82
0.80	39.2	0.82
0.75	36.8	0.77
Average	0.78	38.4
		0.80

Failure Geometry

Sketch:

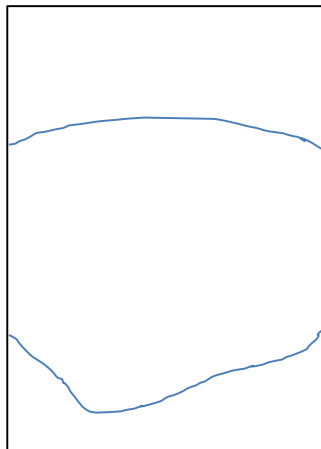


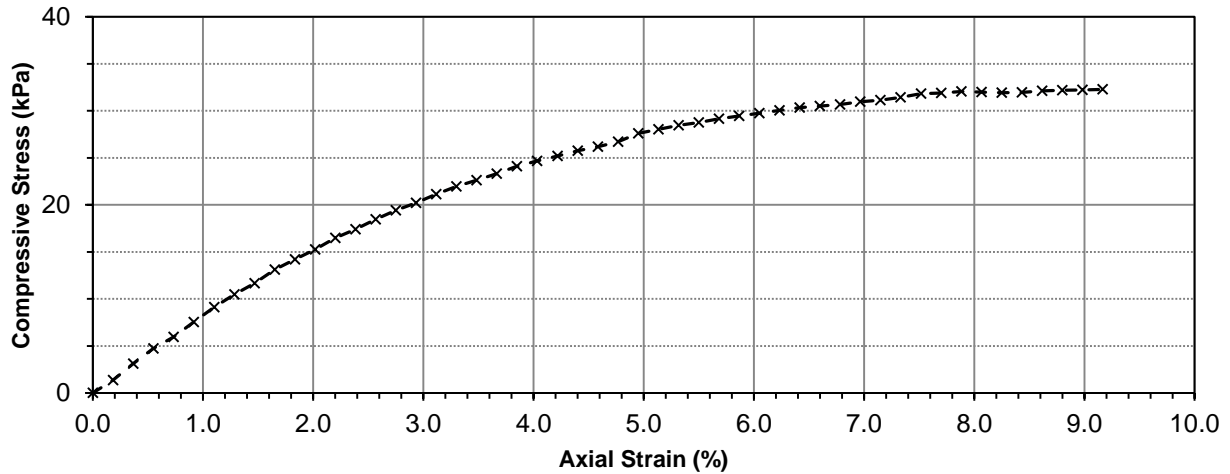
Photo:





Project No. 0020-049-00
Client City of Winnipeg/CKB
Project Old Exhibition Arena Addition

Unconfined Compression Test Graph



Unconfined Compression Test Data

Deformation Dial Reading	Load Ring Dial Reading	Deflection (mm)	Axial Strain (%)	Corrected Area (m ²)	Axial Load (N)	Compressive Stress, q _u (kPa)	Shear Stress, S _u (kPa)
0	0.75	0.0000	0.00	0.004043	0.0	0.00	0.00
10	0.86	0.2540	0.18	0.004050	5.5	1.37	0.68
20	1.00	0.5080	0.37	0.004058	12.6	3.11	1.55
30	1.13	0.7620	0.55	0.004065	19.2	4.71	2.36
40	1.23	1.0160	0.73	0.004073	24.2	5.94	2.97
50	1.36	1.2700	0.92	0.004080	30.7	7.54	3.77
60	1.49	1.5240	1.10	0.004088	37.3	9.12	4.56
70	1.60	1.7780	1.28	0.004095	42.8	10.46	5.23
80	1.70	2.0320	1.47	0.004103	47.9	11.67	5.84
90	1.82	2.2860	1.65	0.004111	53.9	13.12	6.56
100	1.91	2.5400	1.83	0.004118	58.5	14.20	7.10
110	2.00	2.7940	2.02	0.004126	63.0	15.27	7.64
120	2.10	3.0480	2.20	0.004134	68.0	16.46	8.23
130	2.18	3.3020	2.38	0.004141	72.1	17.40	8.70
140	2.27	3.5560	2.57	0.004149	76.6	18.46	9.23
150	2.35	3.8100	2.75	0.004157	80.6	19.40	9.70
160	2.42	4.0640	2.93	0.004165	84.2	20.21	10.11
170	2.50	4.3180	3.12	0.004173	88.2	21.14	10.57
180	2.57	4.5720	3.30	0.004181	91.7	21.94	10.97
190	2.63	4.8260	3.48	0.004189	94.8	22.62	11.31
200	2.69	5.0800	3.67	0.004197	97.8	23.30	11.65
210	2.76	5.3340	3.85	0.004205	101.3	24.10	12.05
220	2.81	5.5880	4.03	0.004213	103.8	24.65	12.32
230	2.86	5.8420	4.22	0.004221	106.4	25.20	12.60



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Unconfined Compressive Strength ASTM D2166

Project No. 0020-049-00
Client City of Winnipeg/CKB
Project Old Exhibition Arena Addition

Unconfined Compression Test Data (cont'd)

Deformation Dial Reading	Load Ring Dial Reading	Deflection (mm)	Axial Strain (%)	Corrected Area (m ²)	Axial Load (N)	Compressive Stress, q_u (kPa)	Shear Stress, S_u (kPa)
240	2.91	6.0960	4.40	0.004229	108.9	25.75	12.87
250	2.95	6.3500	4.58	0.004237	110.9	26.17	13.09
260	3.00	6.6040	4.77	0.004245	113.4	26.72	13.36
270	3.08	6.8580	4.95	0.004253	117.4	27.61	13.81
280	3.12	7.1120	5.13	0.004261	119.5	28.03	14.02
290	3.16	7.3660	5.32	0.004270	121.5	28.45	14.22
300	3.19	7.6200	5.50	0.004278	123.0	28.75	14.37
310	3.23	7.8740	5.68	0.004286	125.0	29.16	14.58
320	3.26	8.1280	5.87	0.004295	126.5	29.46	14.73
330	3.29	8.3820	6.05	0.004303	128.0	29.75	14.88
340	3.32	8.6360	6.23	0.004311	129.5	30.04	15.02
350	3.35	8.8900	6.42	0.004320	131.0	30.34	15.17
360	3.37	9.1440	6.60	0.004328	132.1	30.51	15.25
370	3.39	9.3980	6.78	0.004337	133.1	30.68	15.34
380	3.42	9.6520	6.97	0.004345	134.6	30.97	15.48
390	3.44	9.9060	7.15	0.004354	135.6	31.14	15.57
400	3.47	10.1600	7.33	0.004363	137.1	31.43	15.71
410	3.51	10.4140	7.51	0.004371	139.1	31.82	15.91
420	3.52	10.6680	7.70	0.004380	139.6	31.88	15.94
430	3.54	10.9220	7.88	0.004389	140.6	32.04	16.02
440	3.54	11.1760	8.06	0.004397	140.6	31.98	15.99
450	3.54	11.4300	8.25	0.004406	140.6	31.92	15.96
460	3.55	11.6840	8.43	0.004415	141.1	31.97	15.98
470	3.57	11.9380	8.61	0.004424	142.1	32.13	16.06
480	3.58	12.1920	8.80	0.004433	142.6	32.18	16.09
490	3.59	12.4460	8.98	0.004442	143.1	32.23	16.11
500	3.60	12.7000	9.16	0.004451	143.6	32.28	16.14

APPENDIX – B

**HAZARDOUS MATERIALS INVENTORY
(SEPTEMBER 2024)**

ASBESTOS INVENTORY CONTROL



Assets & Project Management Department
Municipal Accommodations Division
4th Floor - 185 King Street • Winnipeg, MB • R3B 1J1

Building Name:	Old Exhibition Arena	Inspection Date:	September 26, 2024
Building Code:	AR-09	Inspected By:	A. Brodbeck / N. Richardson
Building Address:	80 Sinclair Street	Construction Date:	1961 /addition-1967 /Zamboni addition-1985

NOTES:

- Asbestos inspections and inventory updates are conducted annually.
- There may be asbestos containing materials present that were not located during asbestos inspections.
- Floor tile and sheet flooring installed before 1990 may contain asbestos and must be treated as an asbestos containing material.
- Vermiculite insulation may contain pockets of asbestos. All vermiculite insulation must be treated as an asbestos containing material.
- For asbestos related inquiries, call Central Control at 986-2382

AR-09

Material Location	Material Description	Dwg Label	Material Condition	Testing Status	Lab Report #	Date M/Y	Test %	Est. %
	Asbestos containing Drywall Joint Compound on Drywall - locations as noted							3-5
	Lighting Above Fluorescents may have asbestos fabric heat shields.							70
	Any material suspected to contain asbestos must be treated as containing asbestos until further analysis can prove otherwise.							
	Pipe Fitting Insulation contains asbestos							3-50
Main Floor - South Portion								
	12x12 Floor Tile	F12	Removed'18	TESTED	170946	May'16	1	
	12x12 Floor Tile - Blue Specs (mastic + 0%)		Removed	TESTED	104094	Sep'10	0	
	Pipe Wrap with Insulation - Fibreglass							0
	Vermiculite Interior Lobby Concrete block wall (previously old exterior wall) - see plan for location	VE	Good	TESTED	269490	Mar'22	<1	
Main Area - Lobby	Asphalt Plank Flooring 1' x 4'	APF	Good	TESTED	117888	Sep'12	3	
	Drywall Joint Compound - Ceiling	DC	Good	TESTED				3-5
	Pipe Fitting Insulation	PF	Good					3-50
Furnace Room &	Drywall Compound - Ceiling	DC	Good					3-5
Front Storage Room	Pipe Fitting Insulation	PF	Good					3-50
Men's Washroom East	Drywall Compound - Ceiling	DC	Good	TESTED	231785	Jan'20	3-5	
	Asbestos Fabric - Inside Lights	AF	Removed'20					
Women's Washroom East	Asbestos Fabric - Possible Inside Lights	AF	Good					70
	Drywall Compound - Ceiling	DC	Good					3-5
Office	12x12 Floor Tile (Mastic 0%)(under black paint)	F12	Good	TESTED	92318	Oct'10	2	
	12x12 Floor Tile (under black paint)	F12	Good	TESTED	117888	Sep/'12	2	

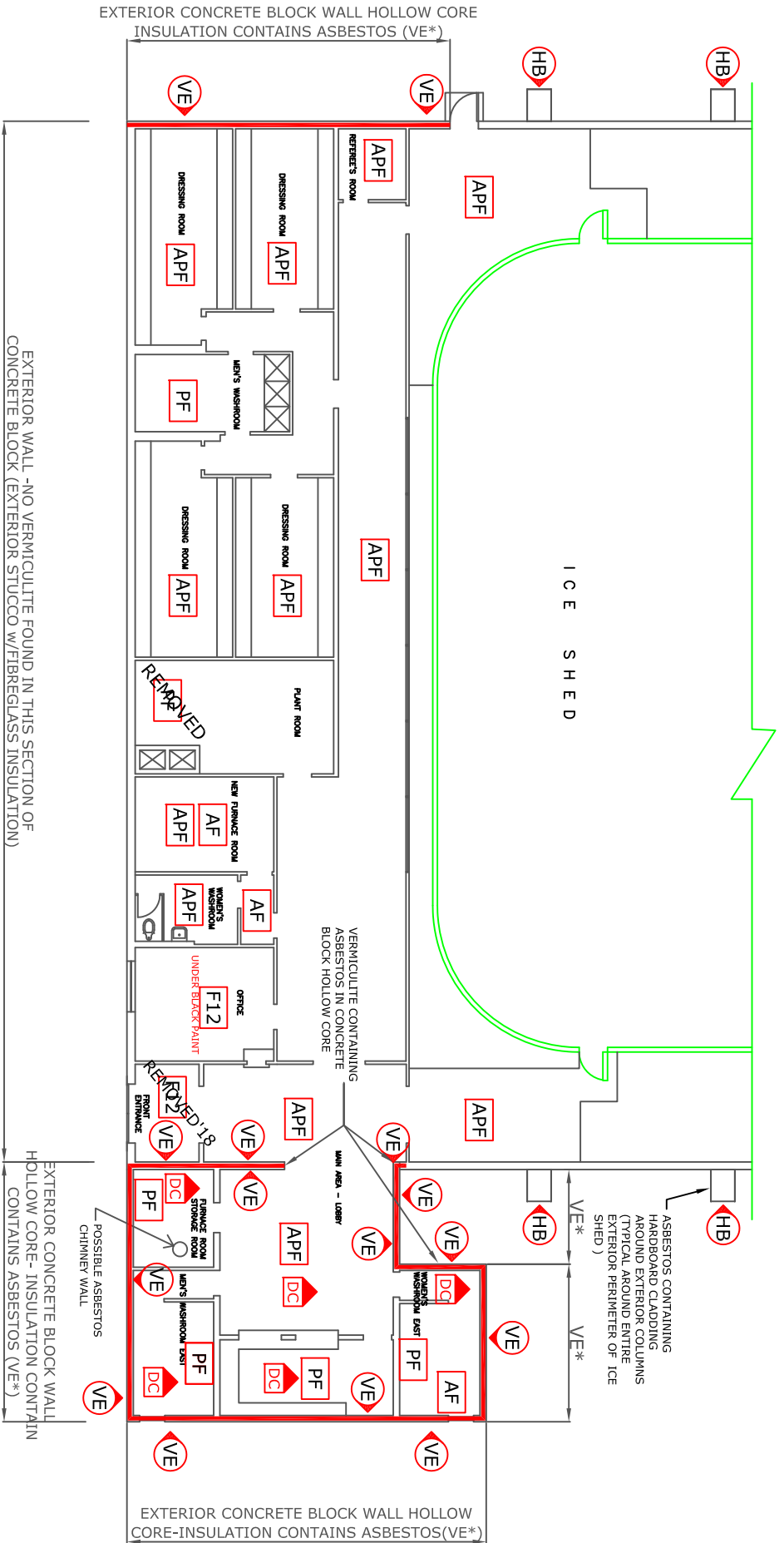
Material Location	Material Description	Dwg Label	Material Condition	Testing Status	Lab Report #	Date M/Y	Test %	Est. %
Women's Washroom	Asphalt Plank Flooring 1' x 4'	APF						3
	Pipe Fitting Insulation (Wall / Ceiling)	PF						3-50
	Asbestos Fabric - Possible Inside Lights	AF						70
New Furnace Room and Corridor	Asphalt Plank Flooring 1' x 4'	APF						3
	Stucco - Ceiling	ST	Good	TESTED	68941	Oct/'09	0	
Plant Room	Plaster and Scratch coat - Ceiling (2 samples)	PL	Good	TESTED	270069	Mar'22	0	
	Pipe Fitting Insulation	PF	Removed'17	TESTED	169439	May'17	1-5	
Referee Room	Asphalt Plank Flooring 1' x 4'	APF	Good					
Interior wall between Lobby and Ice Shed	Plywood / Insulation and paper with black mastic	MA	Good	TESTED	269490	Mar'22	0	
Dressing Rooms and Men's Washroom	Asphalt Plank Flooring 1' x 2'	APF	Good					
	Pipe insulation (possible in walls/ceiling)	PF						3-50
Exterior Block Walls - see plan	Vermiculite	VE	Good	TESTED				<1
	Refer to Asbestos Location Drawing for vermiculite insulation.							
Ice Shed								
	Asphalt Plank Flooring (see plan)	APF	Good	TESTED	117888	Sep'12	3	
Ice Shed / Corridors / Entry	Rubber Mat Floor and Mastic		Good	TESTED	117888	Sep'12	0	
	Randomly Inspected & Appear To Be Empty (Do Not Contain Vermiculite Insulation)							
Exterior Block Walls								
	Exterior Block Walls Randomly Inspected & Appear To Be Empty (Does Not Contain Vermiculite Insulation)							
Zamboni Room (Tractor Room) (Built approx., 1985)								
	Drywall Compound - Ceiling (3 samples)	DC	Good	TESTED	324525	Oct'24	0	
	Exterior Stucco - Pebble Finish (yellow insulation foam = 0%)	ST	Good	TESTED	213118	Dec'18	0	
Building Exterior								
Exterior Block Walls in South Section of building - see plan for vermiculite (ACM) locations		VE	Good	TESTED	269490	Mar'22	<1	

Material Location	Material Description	Dwg Label	Material Condition	Testing Status	Lab Report #	Date M/Y	Test %	Est. %
South Exterior Main Floor Wall - stucco section as noted on plan for location	Concrete block behind Stucco finish - some areas hollow - see plan	ST	Good	TESTED	213118	Dec'18	0	
		ST	Good	TESTED	269901	Mar'22	0	
Upper South Exterior Gable-end Wall	Hardboard (under metal cladding/finish)	HB	Good					15
Exterior Columns - Cladding (Ice Shed Perimeter)	Hardboard	HB	Needs Repair	TESTED	269901	Mar'22	15	
Flat Roof	Replaced in 2007							
Ice Shed Roof	Asphalt Shingles (3 samples)		Needs Repair	TESTED	324525	Oct'24	0	

NOTES:

1. Asbestos inspections and inventory updates are conducted annually.
2. There may be asbestos containing materials present that were not located during asbestos inspections.
3. Floor tile and sheet flooring installed before 1990 may contain asbestos and must be treated as an asbestos containing material.
4. Vermiculite insulation may contain pockets of asbestos. All vermiculite insulation must be treated as an asbestos containing material.
5. For asbestos related inquiries, call Central Control at 986-2382

AR-09



FLOOR PLAN

SCALE: NTS

- NOTES - DRYWALL COMPOUND WHERE NOTED CONTAINS ASBESTOS.
- POSSIBLE LIGHTING FABRIC ABOVE FLUORESCENTS LIGHTS MAY CONTAIN ASBESTOS.
 - ALL PIPE FITTING INSULATION CONTAINS ASBESTOS
 - ASBESTOS CONTAINING HARDBOARD MAYBE LAYERED UNDER MAIN FLOOR FRONT EXTERIOR FINISH. USE CAUTION TO REMOVE STUCCO/PLYWOOD.

LEGEND

GENERAL LABELS	ON CEILING	ABOVE CEILING	UNDER FLOORING	WALL DETAIL	ENCAPSULATED ASBESTOS
??	??	??	??	??	??

AF: ASBESTOS FABRIC	FS: SHEET FLOORING	RD: ROOF DRAIN
APF: ASPHALT PLANK FLOOR	F9: 9X9 FLOOR TILE	SC: STIPPLE CEILING
BR: BOILER REFRACTORY	F12: 12X12 FLOOR TILE	SO: SPRAY ON
CA: CAULKING	HB: HARDBOARD	ST: STUCCO
C12: 12X12 CEILING TILE	MA: MASTIC	TT: TANK INSULATION
C24: 24X24 CEILING TILE	PF: PIPE FITTING	TP: TRANSITE PIPE
C48: 24X48 CEILING TILE	PI: PIPE INSULATION	VE: VERMICULITE
DC: DRYWALL COMPOUND	PL: PLASTER	
DI: DUCT INSULATION		

- NOTES:
1. THERE MAY BE ASBESTOS CONTAINING MATERIALS PRESENT THAT WERE NOT LOCATED DURING BUILDING INSPECTIONS
 2. REFER TO THE ASBESTOS INVENTORY SURVEY SHEET FOR MORE INFORMATION.
 3. DO NOT DISTURB ASBESTOS. FOR HANDLING PROCEDURES CALL CENTRAL CONTROL AT 986-2382

ASBESTOS LOCATIONS

BUILDING:	Old Exhibition Arena
REVISED BY:	AB
DATE:	NOVEMBER 27, 2024
SCALE:	N.T.S.
SHEET #:	1/2

CITY OF WINNIPEG
 ASSETS & PROJECT MANAGEMENT
 DEPARTMENT

Winnipeg
 MUNICIPAL ACCOMMODATIONS DIVISION

4th FLOOR - 185 KING STREET
 WINNIPEG, MANITOBA R3B 1J1
 PHONE: (204) 986-7266
 FAX: (204) 986-7311

Embrace the Spirit - Under Support

LEGEND	GENERAL LABELS	ON CEILING	ABOVE CEILING	UNDER FLOORING	WALL DETAIL	ENCAPSULATED ASBESTOS																		
?? =	??	??	??	??	??																			
AF: ASBESTOS FABRIC	APF: ASPHALT PLANK FLOOR	BR: BOILER REFRACTOR	CA: CAULKING	C12: 12X12 CEILING TILE	C24: 24X24 CEILING TILE	C48: 24X48 CEILING TILE	DC: DRYWALL COMPOUND	DI: DUCT INSULATION	FS: SHEET FLOORING	F9: 9X9 FLOOR TILE	F12: 12X12 FLOOR TILE	HB: HARDBOARD	MA: MASTIC	PF: PIPE FITTING	INSULATION	PI: PIPE INSULATION	PL: PLASTER	RD: ROOF DRAIN	SC: STIPPLE CEILING	SO: SPRAY ON	ST: STUCCO	TI: TANK INSULATION	TP: TRANSITE PIPE	VE: VERMICULITE

NOTES:
1. THERE MAY BE ASBESTOS CONTAINING MATERIALS PRESENT THAT WERE NOT LOCATED DURING BUILDING INSPECTIONS
2. REFER TO THE ASBESTOS INVENTORY SURVEY SHEET FOR MORE INFORMATION
3. DO NOT DISTURB ASBESTOS. FOR HANDLING PROCEDURES CALL CENTRAL CONTROL AT 986-2382

ASBESTOS LOCATIONS	
BUILDING:	Old Exhibition Arena AR-09 80 Sinclair Street Winnipeg, Manitoba
REVISED BY:	AB
DATE:	NOVEMBER 27, 2024
SCALE:	N.T.S.
SHEET #:	2/2

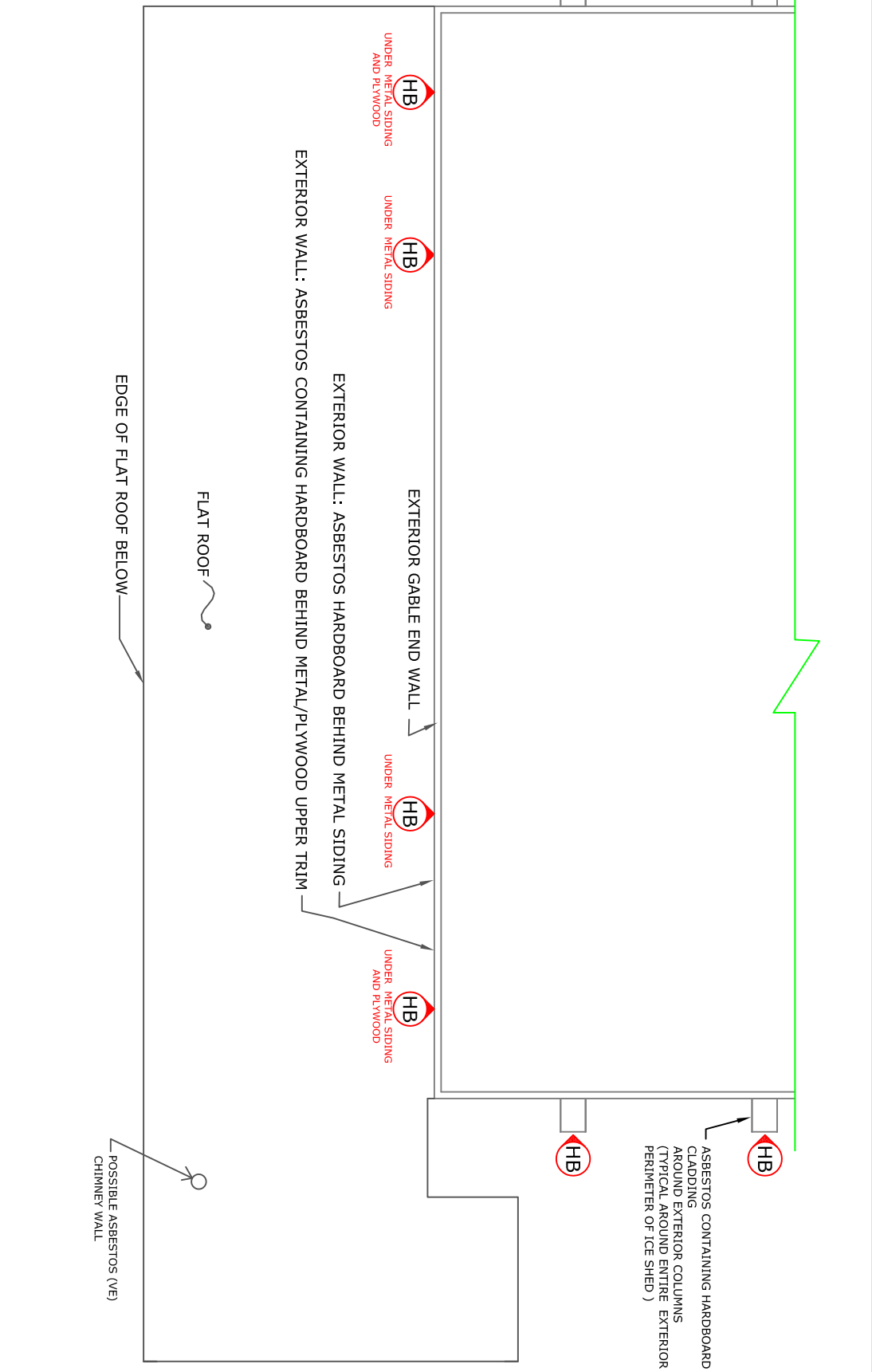
Winnipeg
MUNICIPAL ACCOMMODATIONS DIVISION
4th FLOOR - 185 KING STREET
WINNIPEG, MANITOBA R3B 1J1
PHONE: (204) 986-7266
FAX: (204) 986-7311

CITY OF WINNIPEG
ASSETS & PROJECT MANAGEMENT
DEPARTMENT

Embrace the Spirit • Unite People



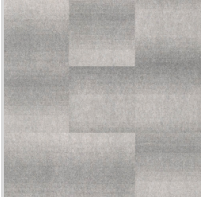
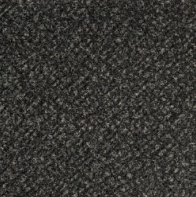

UPPER GABLE END SOUTH EXTERIOR WALL
SCALE: DO NOT SCALE



APPENDIX – C



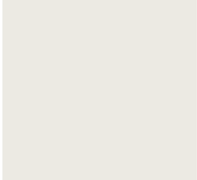

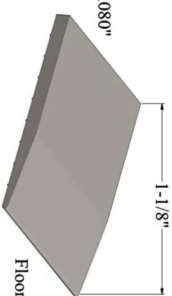
MATERIAL SCHEDULE

MATERIAL FINISH SCHEDULE

ABBREVIATION	DESCRIPTION/LOCATION	MANUFACTURER/PRODUCT NAME	COLOUR/SIZE	DIGITAL SAMPLE*
FLOORING				
CPT-1	CARPET TILE OPEN OFFICE	PATCRAFT DICHROIC 24 " x 24 " , 10675	COLOUR: #00120 GRANITE SIZE: 24 " x 24 " INSTALLATION METHOD: BRICK	
CPT-2	WALK-OFF ENTRY SYSTEM CARPET TILE W/ RUBBER GRID	MILLIKEN OBEX GRID (CLOSED) W/ CUTX TILE	COLOUR: CUTX FIZZ, GREY FZX5-27	
RBF-1	RUBBER TILE FLOOR MPR (FIELD)	TARKETT, COLOR SPLASH 2mm, 24 " x 24 "	COLOUR: DUSTY PALOUSE VE6 SIZE: 24 " x 24 " SURFACE TEXTURE: HAMMERED FINISH	
RBF-2	RUBBER TACTILE WARNING SURFACE	TARKETT, SAFE SENSE TACTILE WALKING SURFACE INDICATOR TWI- 27, ATTENTION TILE 24 " x 24 "	COLOUR: TA4 GATEWAY SIZE: 24 " x 24 " SURFACE TEXTURE: ATTENTION TILE	
RSF-1	RESILIENT SHEET FLOORING CANTEEN & STORAGE	TARKETT, IQ OPTIMA	COLOUR: BELUGA 886	

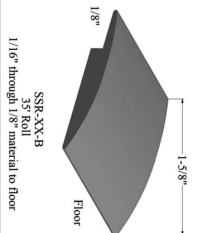
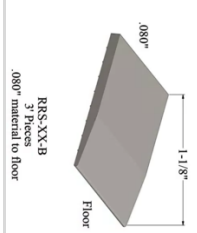
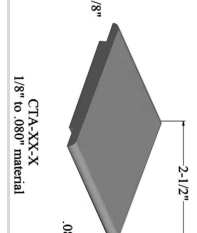

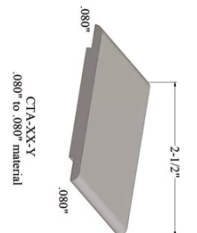
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MATERIAL FINISH SCHEDULE

ABBREVIATION	DESCRIPTION/LOCATION	MANUFACTURER/PRODUCT NAME	COLOUR/SIZE	DIGITAL SAMPLE*
RB-1	RUBBER BASE	TARKETT, TRADITIONAL VINYL 1/8" (TYPE TV), 6" W/ TOE	COLOUR: TA5 COLONIAL GREY CG	
RB-2	RUBBER BASE	TARKETT, TRADITIONAL VINYL 1/8" (TYPE TV), 6" W/ TOE	COLOUR: TA4 GATEWAY	
RB-3	RUBBER BASE	TARKETT, TRADITIONAL VINYL 1/8" (TYPE TV), 6" W/ TOE	COLOUR: TG1 SNOWBOUND	
GR-CONC	CONCRETE	N/A	N/A	
TR-1	TRANSITION STRIP, REDUCER, RUBBER FLOOR TO CONCRETE	TARKETT, VINYL REDUCER, RRS-XX-B	COLOUR: GREY HAZE WG	

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MATERIAL FINISH SCHEDULE

ABBREVIATION	DESCRIPTION/LOCATION	MANUFACTURER/PRODUCT NAME	COLOUR/SIZE	DIGITAL SAMPLE*
TR2	TRANSITION STRIP, REDUCER, CARPET TILE TO CONCRETE	TARKEETT, VINYL REDUCER, SSR-XX-B	COLOUR: TBD	 <p>SSR-XX-B 3/8" Roll 1/16" through 1/8" material to floor</p>
TR3	TRANSITION STRIP, REDUCER, SHEET VINYL TO CONCRETE	TARKEETT, VINYL REDUCER, RRS-XX-B	COLOUR: TBD	 <p>RRS-XX-B 3" Pieces .080" material to floor</p>
TR4	TRANSITION STRIP, SHEET VINYL TO CARPET TILE	TARKEETT, VINYL REDUCER, CTA-XX-X	COLOUR: TBD	 <p>CTA-XX-X 1/8" to .080" material</p>
CFB-1	COVE FLASH BASE CANTEEN, JANITOR'S CLOSET	TARKEETT, IO OPTIMA, W/ FLASH COVE CAP & FILLER	FLOOR COLOUR: BELUGA 886 Tarkett CFS-00 COVE FILLER STRIP Tarkett SCC-TA4-D COVE CAP	
TR8	TRANSITION STRIP, RUBBER TILE TO SHEET VINYL	TARKEETT, VINYL REDUCER, CTA-XX-Y	COLOUR: 24 GREY HAZE WG	 <p>CTA-XX-Y .080" to .080" material</p>

TILING

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MATERIAL FINISH SCHEDULE

ABBREVIATION	DESCRIPTION/LOCATION	MANUFACTURER/PRODUCT NAME	COLOUR/SIZE	DIGITAL SAMPLE*
CT-1	CERAMIC WALL TILE WASHROOMS	OLYMPIA TILE, COLOUR & DIMENSIONS, 4" x 16"	COLOUR: ARCTIC WHITE, MATTE	
CT-2	CERAMIC WALL TILE WASHROOMS	OLYMPIA TILE, COLOUR & DIMENSIONS, 4" x 16"	COLOUR: CITRON, BRIGHT	
CT-3	CERAMIC WALL TILE UTR/ACCESSIBLE WASHROOM STALL ACCENT TILE	OLYMPIA TILE, COLOUR & DIMENSIONS, 4" x 16"	COLOUR: DARK GREY, MATTE	
GR-1	GROUT, EPOXY WASHROOMS	MAPEI	COLOUR: 27 SILVER	
TR-5	TILE EDGE, COVE BASE TRIM	SCHLUTER, DILEX-AHKA	SATIN ANODIZED	

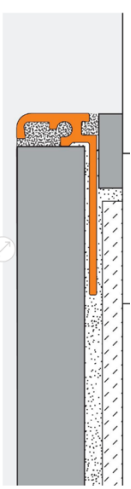
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MATERIAL FINISH SCHEDULE

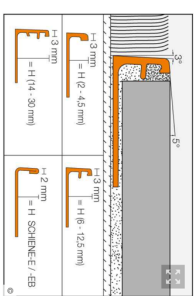
ABBREVIATION DESCRIPTION/LOCATION MANUFACTURER/PRODUCT NAME COLOUR/SIZE

DIGITAL SAMPLE*

TR-6 TILE EDGE, OUTSIDE CORNERS SCHLUTER, JOLLY SATIN ANODIZED



TR-7 METAL EDGE FLOOR STRIP SCHLUTER, SCHIENE, HEIGHT TO MATCH CARPET TILE (CPT-2) STAINLESS STEEL



CEILING

HPL LOBBY, VESTIBULE TRESPA, PURA SIDING, WOOD DECORS ROMANTIC WALNUT PU08, MATTE, 7.32" x 120"



ACT-1 OFFICES ARMSTRONG, ULTIMA, TEGULAR, HIGH NRC 24" x 24", WHITE

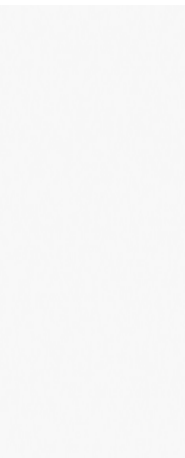
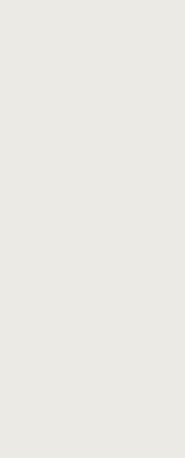


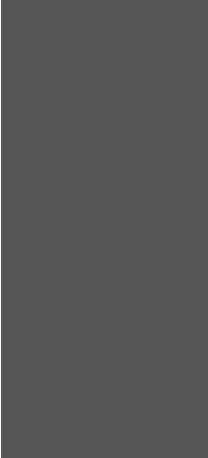


ACT-2 CANTEEN, UTR ARMSTRONG, ULTIMA HEALTH ZONE, TEGULAR, HIGH NRC 24" x 24", WHITE



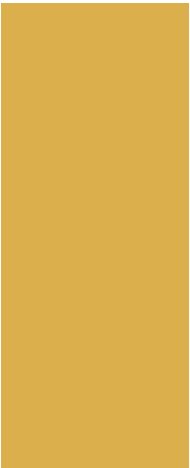
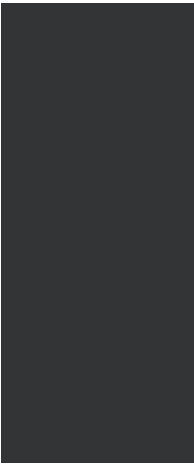

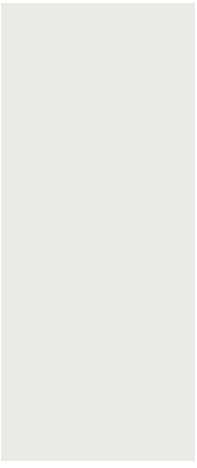
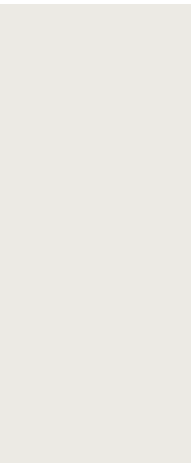
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MATERIAL FINISH SCHEDULE

ABBREVIATION	DESCRIPTION/LOCATION	MANUFACTURER/PRODUCT NAME	COLOUR/SIZE	DIGITAL SAMPLE*
PT-7	GWB CEILINGS	SHERWIN WILLIAMS, FLAT	HIGH REFLECTIVE WHITE SW 7757	
WALLS				
PT-1	MAIN WALL COLOUR	SHERWIN WILLIAMS, SATIN	SNOWBOUND SW 7004	
PT-2	ACCENT WALL COLOUR 1	BENJAMIN MOORE, SATIN	IRON MOUNTAIN 2134-30	
PT-3	DOOR & FRAME COLOUR	SHERWIN WILLIAMS, SEMI-GLOSS	ELLIE GRAY SW 7650	
PT-4	DOOR & FRAME COLOUR	BENJAMIN MOORE, SEMI-GLOSS	IRON MOUNTAIN 2134-30	



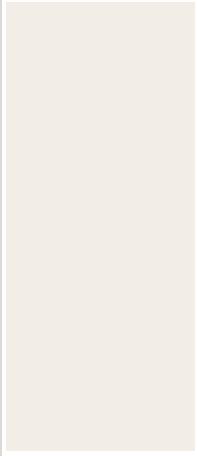

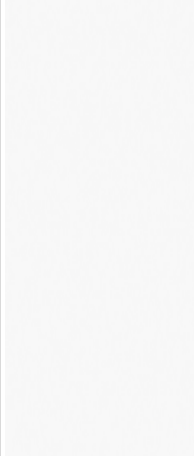
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MATERIAL FINISH SCHEDULE

ABBREVIATION	DESCRIPTION/LOCATION	MANUFACTURER/PRODUCT NAME	COLOUR/SIZE	DIGITAL SAMPLE*
PT-5	DOOR COLOUR 2	SHERWIN WILLIAMS, SEMI-GLOSS	NUGGET SW 6697	
PT-8	DOOR COLOUR 3	BENJAMIN MOORE, SEMI-GLOSS	BLACK SATIN 2131-10	
PT-9	EXPOSED STEEL STRUCTURE	BENJAMIN MOORE, SEMI-GLOSS	IRON MOUNTAIN 2134-30	
PT-10	DOOR FRAME COLOUR	SHERWIN WILLIAMS, SEMI-GLOSS	SNOWBOUND SW 7004	
EP-1	EPOXY PAINT, MAIN WALL COLOUR	SHERWIN WILLIAMS, EPOXY PAINT	SNOWBOUND SW 7004	






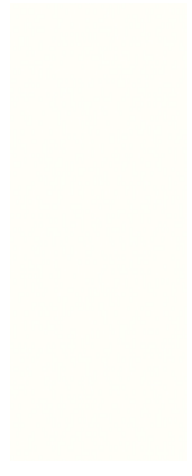
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MATERIAL FINISH SCHEDULE

ABBREVIATION	DESCRIPTION/LOCATION	MANUFACTURER/PRODUCT NAME	COLOUR/SIZE	DIGITAL SAMPLE*
EP-2	EPOXY PAINT, ACCENT COLOUR 2	BENJAMIN MOORE, EPOXY PAINT	IRON MOUNTAIN 2134-30	
BRK-1	BRICK CLADDING, EXTERIOR / LOBBY INTERIOR	ENDICOTT CLAY PRODUCTS	MANGANESE IRONSPOT VELOUR MODULAR, 2-1/4" X 7-5/8"	
CG-1	CORNER GUARD, ON WALLS PAINTED (PT-1)	INPRO, 160 HIGH IMPACT CORNER GUARD	FEATHER 0238	
CG-2	WALL CAP, FULL HEIGHT	INPRO, STAINLESS STEEL SURFACE MOUNT END WALL PROTECTOR, 2" WING SIZE	STAINLESS STEEL	
VF-1	VINYL FILM ON ALL FULL HEIGHT GLAZING	LLUMAR SPECIALTY SERIES	WHITE, NRMW PS3	



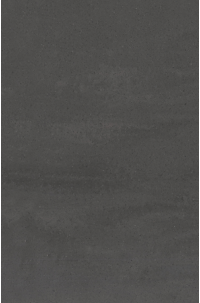


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MATERIAL FINISH SCHEDULE

ABBREVIATION	DESCRIPTION/LOCATION	MANUFACTURER/PRODUCT NAME	COLOUR/SIZE	DIGITAL SAMPLE*
BPG	BACKPAINTED GLASS WALL CLADDING	GOLDRAY GLASS SOLID COLOUR+	TO MATCH PT-5 (YELLOW)	 
MILLWORK				
PL-1	LOWER CABINETS	FORMICA, PLASTIC LAMINATE	MOUSE 928-58, MATTE FINISH	
PL-2	UPPER CABINETS	NEVAMAR, PLASTIC LAMINATE	MARIGOLD FIELDS SY9250	
PL-3	COUNTERTOPS OFFICE MILLWORK	ARBORITE, PLASTIC LAMINATE	INUKSHUK CARBON P346 RM	
ML-1	MELAMINE, CABINET INTERIOR	TAFISA, THERMALLY FUSED LAMINATE	FROTH OF SEA, L080 (C)	

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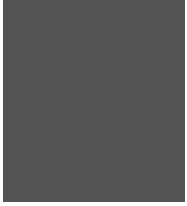
MATERIAL FINISH SCHEDULE

ABBREVIATION	DESCRIPTION/LOCATION	MANUFACTURER/PRODUCT NAME	COLOUR/SIZE	DIGITAL SAMPLE*
SSC-1	PORCELAIN COUNTERTOP, CANTEEN	SILESTONE, EARTHIC	FFFROM 03 SUEDE	
SSC-2	SOLID SURFACE, WASHROOMS	CORIAN, SOLID SURFACE	GLACIER WHITE	
SSC-3	SOLID SURFACE, WASHROOMS	CORIAN, SOLID SURFACE	CARBON CONCRETE	
HDW-1	CANTEEN & OFFICE MILLWORK	RICHELIEU, MODERN METAL PULL 873	BRUSHED NICKEL, 202mm LENGTH	
WP-1	WALL PROTECTION MPR (RM 133/134) & 141	FIR PLYWOOD PANEL, G1S, CLEAR SHOP SPRAY APPLIED FINISH WOOD GRAIN TO RUN VERTICALLY	N/A	

WASHROOM ACCESSORIES

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MATERIAL FINISH SCHEDULE

ABBREVIATION	DESCRIPTION/LOCATION	MANUFACTURER/PRODUCT NAME	COLOUR/SIZE	DIGITAL SAMPLE*
PRT-1	TOILET PARTITIONS, FULL HEIGHT	BOBRICK, DURALINE, SOLID PHENOLIC LAMINATE	PARTITION STILE COLOUR:CHARCOAL 0077 FH PARTITION DOOR COLOUR: BRUSHED ALUMINUM 0328 FH	 

MISC.

BL-1	ROLLER BLIND FABRIC	ALTEX SERIES, 3% OPENNESS	COLOUR: 10103-04 LIGHT GREY	
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APPENDIX – D

**CITY OF WINNIPEG
STANDARD CONSTRUCTION SPECIFICATIONS
(NORTH YARD LOW FENCING DETAILS)**

Notes:

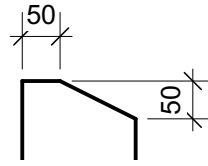
1. Install fence members square, plumb, level & true.
2. Backfill limestone in 150 mm lifts, tamp ea. lift thoroughly.
3. Posts to follow natural contour of land except for small undulations that would reduce aesthetic appearance of finished project.
4. Treat cuts and damages to timber surface in field w/ suitable preservative for outdoor use.
5. A combination of brown and green PT timber will not be accepted, unless approved in writing by Contract Administrator.
6. Surplus material to be legally dispose of off site.

Drawing Title:

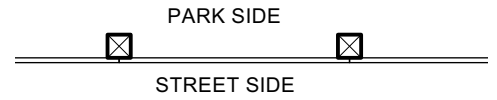
POST AND WOOD FENCING

Drawing No:

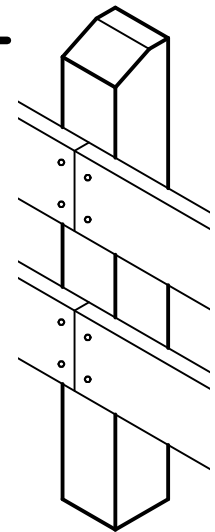
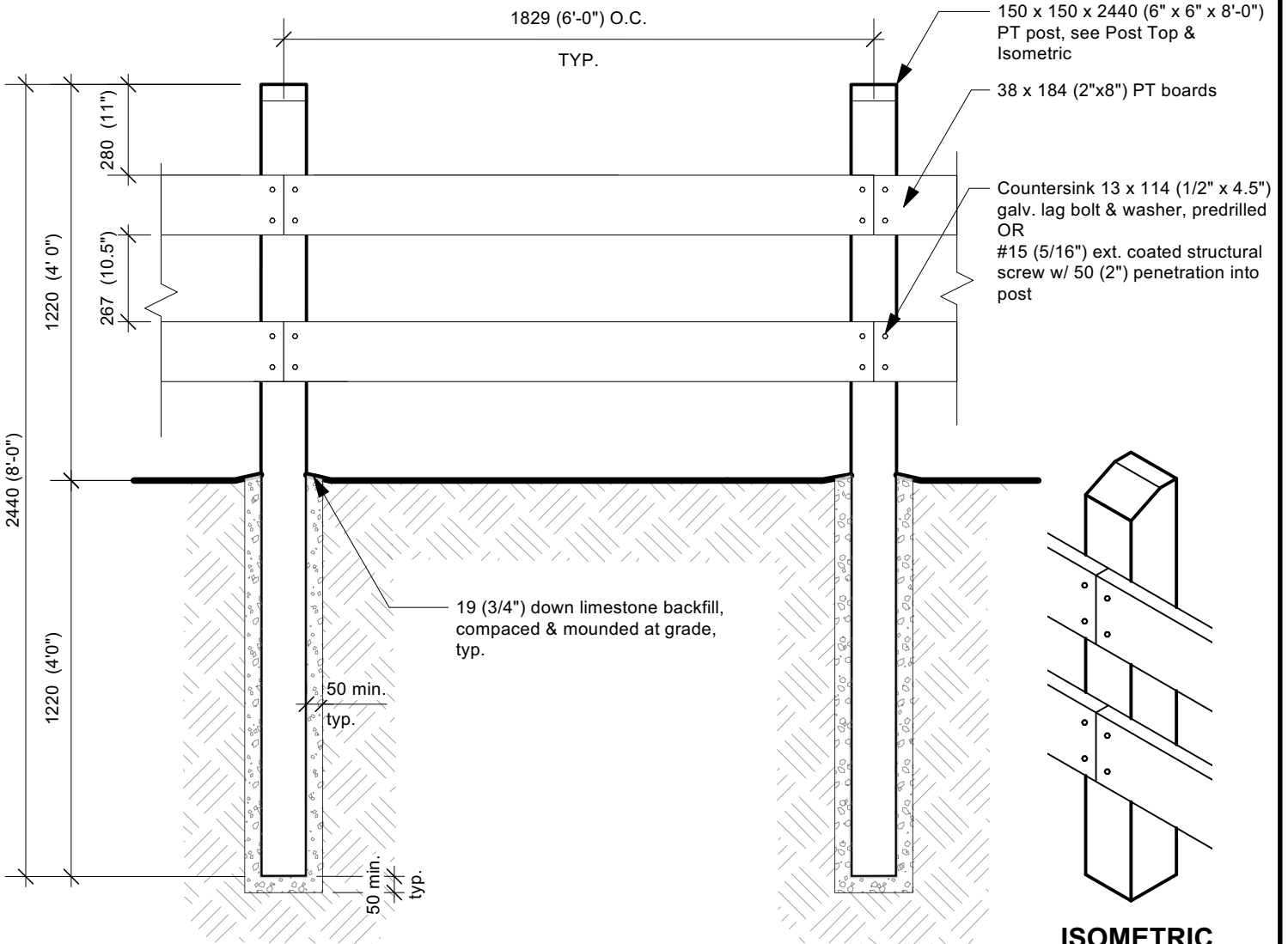
SCD-105F



POST TOP
NTS



PLAN VIEW
NTS



ISOMETRIC
NTS

STREET SIDE ELEVATION
NTS

DIMENSIONS SHOWN ARE IN MILLIMETRES UNLESS OTHERWISE SPECIFIED

REVISION: 3
 DATE: May 3/21
 SCALE: N.T.S
 DRAWN BY: IM/LL

The City of Winnipeg
 Planning, Property and Development Department
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 Unit 15 - 30 Fort Street, Winnipeg, MB, R3C 4X5



Notes:

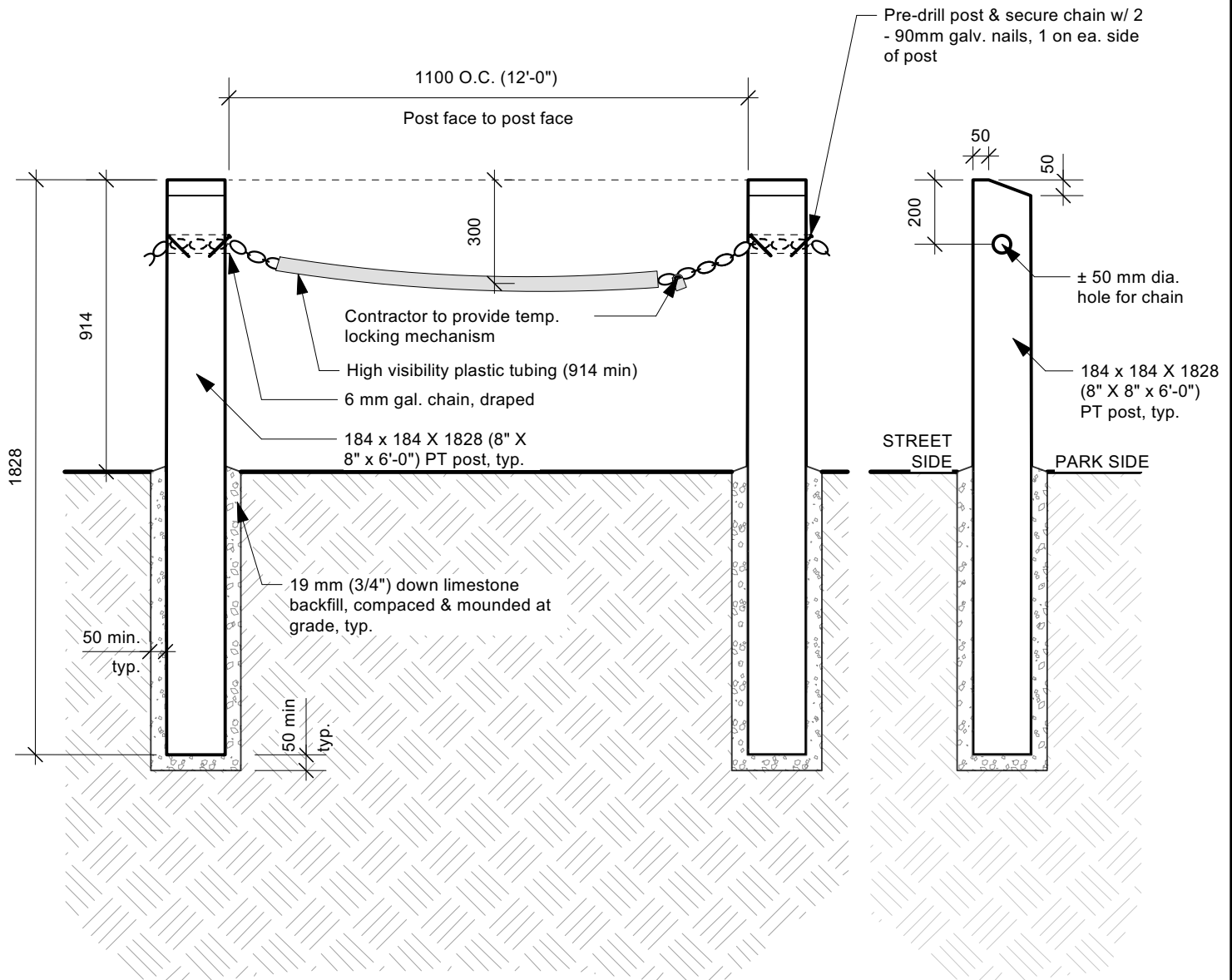
1. Secure chain to ea. post to prevent chain slipping.
2. Backfill limestone in 150 mm lifts, tamp ea. lift thoroughly.
3. Posts to follow natural contour of land except for small undulations that would reduce aesthetic appearance of finished project.
4. Treat cuts and damages to timber surface in field w/ suitable preservative for outdoor use.
5. A combination of brown and green timber will not be accepted, unless approved in writing by Contract Administrator.
6. Surplus material to be legally dispose of off site.

Drawing Title:

HEAVY DUTY SQUARE POST & CHAIN FENCING FOR VEHICLE ACCESS

Drawing No:

SCD-105G1



DIMENSIONS SHOWN ARE IN MILLIMETRES UNLESS OTHERWISE SPECIFIED

REVISION: 0
DATE: May 3/21
SCALE: N.T.S.
DRAWN BY: LL

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Urban Planning and Design Division
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