THE CITY OF WINNIPEG

BILL AND HELEN NORRIE LIBRARY
15 POSEIDON BAY

TENDER NO. 542-2019

SPECIFICATIONS

ISSUED FOR CONSTRUCTION: JULY 10, 2019

VOLUME 1 of 2

GENERAL REQUIREMENTS SUBGROUP
FACILITY CONSTRUCTION SUBGROUP

VOLUME 1 of 2

Division 33 – Utilities

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END OF SECTION

Part 1 General

1.1 DISCLAIMER

.1 Following documents are provided solely for Bidder's convenience and does not relieve Bidder of responsibility to make proper site investigations, or to understand full nature of work, or for determining accuracy of information provided.

.2 Conditions noted and statements made are applicable only to specific locations, and times, at which investigations were made. Bidder to inquire of firm which prepared document, and may arrange with the City or Prime Consultant to make further explorations, to satisfy them self of particular conditions that they may wish to use in preparing their Bid.

.3 Data provided and opinions stated in following documents are sole responsibility of firms which prepared documents.

.4 Neither the City, nor Consultants, assumes any responsibility for content of following documents, nor for conclusions that Bidder may use in preparing their proposal.

1.2 EXISTING CONDITIONS

.1 Refer to B3 – Site Investigation, for instructions to examine site and to investigate local conditions and related work.

.2 Compare bid documents with work in place.

.3 Compensation will not be made because of failure to make proper site investigations or to understand full nature of work.

.4 Failure to report discrepancies will not relieve Contractor from performing work as intended, and at no cost to the City.

1.3 GEOTECHNICAL INVESTIGATION

.1 A copy of the following Geotechnical Investigation prepared by M. Block & Associates Ltd. is available upon request from the Prime Consultant.

.2 "Geotechnical Investigation for the Proposed One-Storey, Steel-Frame, 14,000 ft2 Bill & Helen Norrie Library to be Located at 25 Poseidon Bay in Winnipeg, Manitoba", dated November 8th, 2018.

1.4 ENVIRONMENTAL SITE ASSESSMENT

.1 A copy of the following Environmental Site Assessment prepared by M. Block & Associates Ltd. is available upon request from the Prime Consultant..

.2 "Phase 1 Environmental Site Assessment", dated December 13th, 2018.

Part 2 Products

Part 3 Execution

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 78 00 – Closeout Submittals.

.2 Section 01 79 00 – Demonstration and Training.

1.2 REFERENCES

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

.2 National Fire Protection Association (NFPA).

1.3 WORK COVERED BY CONTRACT DOCUMENTS

.1 The *Bill and Helen Norrie Library* project consists of consists of a new standalone 1,300 m^2 one storey library building on undeveloped land on the northwest corner of the grant park recreation campus. The new library building programmatically includes staff lounge and work areas, services counter, public washroom facilities, and an open library with tutorial rooms and multi-purpose room. The site will be developed to incorporate a new private approach and 40 new dedicated library parking stalls northwest of the existing pan-am pool.

.2 Construct project in accordance with contract documents including project manual and project drawings for Architectural, Mechanical and Electrical disciplines. Contractor and Subcontractors are responsible for co-ordination between trades. Distribution of documents by Contractor to their Subcontractors does not absolve Contractor or their Subcontractors from provisions stated in Division 01 – General Requirements of contract or co-ordination between parties.

.3 Part D – Supplemental Conditions, Part C – General Conditions for Construction, and Division 01 – General Requirements sections apply to technical specification sections found in Project Manual.

1.4 CODES AND STANDARDS

.1 Work to meet or exceed requirements of applicable standards, building code, fire code and other codes and referenced documents. In event of conflict between any provisions of authorities, most stringent provision applies.

.2 Safety of Work: perform work in accordance with current National Building Code of Canada and other applicable regulations and requirements of other authorities having jurisdiction.

.3 Fire Safety: comply with National Fire Protection Association (NFPA) codes and standards for fire safety.

.4 Construction Safety:

.1 Observe and enforce construction safety measures required by Canadian Construction Safety Code, Provincial Government Worker's Compensation Board, Workplace Safety and Health Act, Municipal Statutes and Authorities having jurisdiction.

1.5 SETTING OUT OF WORK

.1 Before commencing work, contact utility companies to establish location and extent of existing utility or service lines in area of work. Be absolutely certain of their origin and destination.

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

.2 Protect, relocate or maintain existing active services.

.3 Cap off services, when indicated, in manner approved by authority having jurisdiction.
.4 Where unknown services are encountered, immediately advise Consultant and confirm findings in writing.
.5 Record location of services in accordance with Section 01 78 00.

.2 Assume full responsibility for and execute complete layout of work to locations, lines and elevations indicated.
.1 Provide devices needed to lay out and construct work.
.2 Supply stakes and other survey markers required for laying out work.

1.6 DEMONSTRATION AND TRAINING

.1 Be responsible to provide comprehensive demonstration and training program to the City's personnel on operation and maintenance of Contractor supplied and installed equipment and systems in accordance with Section 01 79 00.

1.7 PLANNING OF WORK

.1 Upon award of contract, immediately commence off-site work (preparation of shop drawings, ordering of materials, preparation of requested documents, etc.). On-site work is expected to commence as soon as possible upon award of contract. Co-operate with the City in scheduling work.

.2 Plan work to ensure that emergency access and egress required by the City and by the authorities having jurisdiction are maintained, and all life safety and building occupancy requirements of all applicable codes and regulations are in force for construction areas and adjacent floor areas.

1.8 ACCESS TO WORK

.1 Allow the City, Contract Administrator or both access to work, or other places where work is being fabricated in connection with contract for purposes of inspection and examination of workmanship and materials.

.2 Maintain safety helmets on job site, ready for use, to be used in compliance with Workplace Safety and Health regulations.

1.9 BUILDING PERMIT

.1 The City shall pay for the building permit. The Consultant shall apply for the building permit on behalf of the City prior to bid closing. Upon award of Contract, the building permit shall be transferred to and become the responsibility of the Contractor.

.2 Consultant will apply for foundation permit in advance of full permit.

1.10 NO SMOKING POLICY

.1 Fully co-operate, respect and comply with Smoke-Free Workplace policy requirements established by the City throughout its facilities. Smoking is not permitted anywhere within the City's facilities or on the City's property.

.2 Smoke-free workplace policy applies to everyone who works in workplace and to visitors.

.3 During full term of contract, ensure that Contractors' employees, Subcontractors and Suppliers, performing work on site on Contractors' behalf, are instructed to comply with Smoke-Free Workplace policy requirements.

1.11 NO ENTERTAINMENT DEVICES

.1 Fully co-operate, respect, and comply with the City's request that no entertainment devices (e.g. portable radios, stereos, MP3 players, etc.) will be played on site at any time by Contractor's work force or sub-contractors.

1.12 OCCUPANCY BY THE CITY

.1 The City has right to enter and occupy building in whole or in part before substantial performance of work provided that, in opinion of Consultant, such entry and occupancy does not prevent or interfere with Contractor in completion of contract.

.2 Such occupancy by the City is not considered as acceptance of work and will not relieve Contractor from responsibility to complete contract or as acknowledgement of fulfillment of terms of contract.

Part 2 Products

Part 3 Execution

END OF SECTION

Part 1 General

1.1 CASH ALLOWANCES

.1 Total amount of cash allowance will be separated from contract price, by Consultant, with first Change in Work, and retained for sole purpose of paying for scheduled items of extra work when authorized by the City and as directed by Consultant in subsequent Change in Work.

.2 Contract price to include Contractor's overhead and profit in connection with cash allowances, rather than being included with cash allowance.

.3 Where costs under cash allowance exceed amount of allowance, Contractor will be compensated for any excess incurred and substantiated plus an amount for overhead and profit as set out in contract documents.

1.2 SCHEDULE OF ALLOWANCES

			(excluding GST)
.1	Concrete Testing		
.2	Concrete Base Compaction and Concrete Pavement Testing		
.3	Asphalt Base Compaction Testing		
.4	Asphalt Pavement Testing		
.5	Structural Steel Inspections		
.6	Pile/Soil Testing and Inspection		
.7	Planting Medium and Finished Grading Testing (up to 3 tests)		
.8	Roof Inspections		
.9	Air/Vapour Barrier Membrane Testing	*(Lines 1-9):*	$35,000.00
.10	Preserved Moss Installation (Final cost TBC)		$30,000.00
.11	Exterior Building Signage (2 locations)		$30,000.00
.12	Rooster Town Historical Features		
	.1 North Entry Beach Seating Concrete Text Relief		$5,000.00
	.2 North Entry Weathering Steel Feature		$15,000.00
.13	Manitoba Hydro Transformer Relocation		$25,000.00
	Total		**$140,000.00**

Part 2 Products

Part 3 Execution

END OF SECTION

Part 1 General

1.1 DEFINITIONS

.1 Alternate Prices.

.1 Alternate Price: a price required by this Section, to be added or deducted from the Stipulated Price (Bid Price) for the specified alternate work. Include all costs for co-ordination of the related work and modify surrounding work as required to complete the project under each alternate.

1.2 ALTERNATE PRICES

.1 Alternate Price No. 1.

.1 Base Bid Price: Provide Patio Trellis Structure (steel structure, cast-in-place concrete wall, weathering steel canopy panels and associated foundation including piles) as shown at East building face.

.2 Alternate Price: Delete Patio Trellis Structure and all associated costs.

.2 Alternate Price No. 2.

.1 Base Bid Price: Provide Electric Vehicle Charging Station at south parking lot as indicated on drawings, including all conduit, breakers, wiring and terminations, refer to E1.1.

.2 Alternate Price: Delete Electric Vehicle Charging Station at south parking lot, including all associated conduit, breakers, wiring and terminations, and all associated costs.

.3 Alternate Price No. 3.

.1 Base Bid Price: Provide Custom Steel Framed Play Houses (3 total) in Children's Area 1:17 as shown on A2.1 and detailed on AP8 series of drawings.

.2 Alternate Price: Delete Custom Steel Framed Play Houses (3 total) and all associated costs.

Part 2

Part 3 Execution

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 11 00 – Summary of Work.

.2 Section 01 33 00 – Submittal Procedures.

.3 Section 01 78 00 – Closeout Submittals.

1.2 CONSTRUCTION SCHEDULE

.1 Refer to D24 – Job Meetings, in Supplemental Conditions.

.2 Affix copy of construction schedule to wall of construction office during construction period and keep up to date and reviewed at each progress meeting.

1.3 START-UP MEETING

.1 After award of Contract, but before start of Work, convene a start-up meeting to discuss and resolve administrative procedures and responsibilities.

.2 Senior representatives of the Consultant, the City, Contractor, major Subcontractors are to attend.

.1 Agenda:

.1 Appointment of official representatives of participants in the work.
.2 Schedules of work, progress scheduling.
.3 Schedule of submission of shop drawings, product data, samples, test reports,
.4 Schedule for provision of mock-ups and field samples.
.5 Requirements for temporary utilities, temporary barriers and controls, construction facilities, site sign and other temporary construction.
.6 Record drawings.
.7 Maintenance Manuals.
.8 Take-over procedures, acceptance, warranties.
.9 Monthly progress claims, administrative procedures, holdbacks.
.10 Sustainable requirements.
.11 Commissioning.

.3 Establish time and location of meeting and notify all concerned parties within five (5) Working Days of meeting.

.4 Chair meeting, record minutes, and distribute minutes to all attending parties within four (4) Working Days after meeting.

1.4 CONSTRUCTION PROGRESS MEETINGS

.1 Schedule and administer project meetings once every week throughout progress of work. Provide physical space for meetings.

.2 Contractor, Subcontractors involved in work, Consultant and the City are to be in attendance.

.3 Person attending meetings to be empowered to act on behalf of organizations they represent.

.4 Prepare agenda and record minutes of meetings and circulate to attending parties and affected parties not in attendance within four (4) days after meeting.

.5 Meeting agenda to include following:

.1 Review, approval of minutes of previous meeting.
.2 Review of work progress since previous meeting.
.3 Field observations, problems, conflicts.
.4 Significant proceedings and decisions. Identify action by parties.
.5 Problems which impede construction schedule.

.6 Review of off-site fabrication delivery schedules.
.7 Corrective measures and procedures to regain projected schedule.
.8 Revision to construction schedule.
.9 Progress schedule, during succeeding work period.
.10 Review submittal schedules: expedite as required.
.11 Maintenance of quality standards.
.12 Review proposed changes for effect on construction schedule and on completion date.
.13 Construction Safety.
.14 New business.

1.5 ON-SITE DOCUMENTS

.1 Maintain at job site, one copy of each of following:
.1 Contract Drawings.
.2 Project Manual
.3 Addenda
.4 Reviewed shop drawings
.5 Proposed change notices
.6 Change orders
.7 Other modifications to contract
.8 Field test reports
.9 Copy of approved work schedule
.10 Manufacturers' installation and application instructions

1.6 JOB LOG

.1 Keep permanent, written record on site of progress of work. Make record available for inspection by Consultant and the City. Show dates of commencement and completion of all trades and parts of work, particulars regarding daily weather conditions, changes in work, field instructions, major deliveries, as well as number of employees of various trades involved.

1.7 REQUEST FOR INTERPRETATION PROCESS

.1 General:
.1 Immediately on discovery of the need for interpretation of the Contract Documents, Contractor shall prepare and submit an RFI to the Consultant in the form specified.
.2 Consultant will return RFIs submitted to Consultant by other entities controlled by Contractor with no response. The RFI will then be considered closed.
.3 Co-ordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.
.4 For RFIs submitted electronically, include project name and RFI number in subject line of email.

.2 Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:
.1 Project name (including building number).
.2 Project number.
.3 Date.
.4 Name of Contractor.
.5 Name of Consultant.
.6 RFI number, numbered sequentially. (eg: RFI-001)
.7 RFI subject.
.8 Specification Section number, title and related paragraphs, as appropriate.
.9 Drawing number and detail references, as appropriate.
.10 Field dimensions and conditions, as appropriate.

.11 Contractor's suggested resolution. If Contractor's suggested resolution impacts the Contract Time or the Contract Price, Contractor shall state impact in the RFI.
.12 Contractor's signature.
.13 Attachments: Include sketches, descriptions, measurements, photos, product data, shop drawings, co-ordination drawings, and other information necessary to fully describe items needing interpretation.
.1 Include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments on attached sketches.

.3 RFI Forms: Contractor generated form including all content indicated in this Section.
.1 Form and attachments shall be electronic files in PDF format.

.4 Consultant's Action: Consultant will review each RFI, determine action required, and respond. Allow ten (10) Working Days for Consultant's response for each RFI. RFIs received by Consultant after 1:00 p.m. will be considered as received the following working day.
.1 The following Contractor-generated RFIs will be returned without action:
.1 Requests for approval of submittals.
.2 Requests for approval of substitutions.
.3 Requests for approval of Contractor's means and methods.
.4 Requests for approval of corrective actions for deficient work.
.5 Requests for co-ordination information already indicated in the Contract Documents.
.6 Requests for adjustments in the Contract Time or the Contract Sum.
.7 Requests for interpretation of Consultant's actions on submittals.
.8 Incomplete RFIs or inaccurately prepared RFIs.
.2 Consultant's action may include a request for additional information, in which case Consultant's time for response will date from time of receipt of additional information.
.3 If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Consultant in writing within 10 days of receipt of the RFI response. Failure to notify will result in the work being included as part of the contract.

.5 RFI Log: Prepare, maintain, and submit a tabular log of RFIs oragnized by the RFI number. Submit log with progress meeting minutes. Include the following:
.1 Project name.
.2 Name and address of Contractor.
.3 Name and address of Consultant.
.4 RFI number including RFIs that were returned without action or withdrawn.
.5 RFI description.
.6 Date the RFI was submitted.
.7 Date Consultant's response was received.

.6 On receipt of Consultant action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Consultant within ten (10) Working Days if Contractor disagrees with response.

1.8 LIFE SAFETY TESTING

.1 Refer to the City of Winnipeg Life Safety Tests in Buildings document. Arrange and carry out life safety test with City of Winnipeg in accordance with this document. Provide all necessary management and co-ordination. Arrange all necessary involvement from sub-trades. Prepare test procedures and submit for review six (6) weeks prior to test date.

.2 Arrange and carry out pre-'dry run' tests and submit written confirmation to Consultant that test has adhered to procedures and that the system is correctly operating.

.3 Arrange and conduct 'dry run' tests which will mimic the full life safety test. 'Dry run' test shall be conducted in presence of Contractor and Consultant only.

.4 Create procedures to demonstrate the operation of the life safety system. Procedures shall include, but shall not be limited to:
- .1 Emergency and exit lighting including measurements where applicable.
- .2 Operation of emergency power system.
- .3 Operation of fire alarm including demonstration of all controls and interfaces with other systems including, but not limited to operation of smoke control systems, fire pump and security systems.

.5 Demonstrate all systems under normal and essential power modes.

.6 Tests shall not commence until fire alarm system is verified and free of all defects. Submit final verification report to consultant five (5) working days prior to life safety test for review.

.7 Provide all fuel, personnel, communications equipment and attendance required.

1.9 SUBTRADE AND SUPPLIERS LIST

.1 Submit within three (3) Working Days after contract award, all addresses, phone, email, and name of person in charge of subtrades and suppliers used on this project.

1.10 CONSTRUCTION PHOTOGRAPHS

.1 Maintain and submit to Consultant visual record of construction progress in following formats:

.2 Use digital camera with capability of producing digital images at minimum 5.0 megapixels, uncompressed, saved in *.tif format.

.3 Copy (burn) each set of images onto a Windows formatted CD-Rom disc.

.4 Identify each CD disc with name and number of project, date of exposure, set number.

.5 Pre-Construction Photographs
- .1 Provide photographs of existing site and surface features prior to start of construction work.
- .2 Allow for approximately 25 images for each set.
- .3 Number of sets required: one.
- .4 Viewpoints:
  - .1 Panoramic view of site from each compass point.
  - .2 Close ups of specific site details and surface features in locations as determined by Consultant.

.6 Construction Progress Photographs
- .1 Provide photographs of construction during progress of the work, including site features.
- .2 Allow for approximately 50 images for each set.
- .3 Number of sets required (frequency): provide one set monthly with progress statement, plus one set of additional photograph as specified below.
- .4 In addition to monthly progress images provide additional sets of photographs for:
  - .1 Completion of major elements of the Work such as:
    - .1 Main floor construction.
    - .2 Structural framing.
    - .3 Mechanical and electrical services before concealment.
  - .2 During installation of specific elements of the Work, as determined by Consultant, including but not necessarily limited to:
    - .1 City Furnished Products (CFP).
    - .2 Major elements of interior work.
- .5 Number of viewpoints: interior and exterior viewpoints including close ups of specific details, in locations as determined by Consultant.

.7 Photographs of Mock Up Rooms
- .1 Provide photographs of each fully completed mock up room specified in Section 01 11 00.
- .2 Number of sets required: one for each mock-up room.
- .3 Allow for approximately 25 images of each set.
- .4 Number of viewports:
  - .1 Each interior elevation, including finishes on walls, floors and ceilings.
  - .2 Mechanical and electrical service outlets (gas, vacuum, switches, etc.)
  - .3 Equipment.
  - .4 Close ups of specific details and features, in locations as determined by Consultant.

.8 Final Photographs
- .1 Number of sets required: one.
- .2 Allow for approximately 100 images for each set.
- .3 Number of viewpoints:
  - .1 Exterior elevations of each building.
  - .2 Interior of rooms and finishes as determined by Consultant. Allow for approximately ten (10) photographs of each room.
  - .3 Close ups of specific details as determined by Consultant.
  - .4 Locations of viewpoints as determined by Consultant.

Part 2 Products

Part 3 Execution

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 11 00 – Summary of Work.

.2 Section 01 31 00 – Project Management and Co-ordination.

.3 Section 01 78 00 – Closeout Submittals.

1.2 ADMINISTRATIVE

.1 Submit to Consultant submittals listed for review. Submit with reasonable promptness and in orderly sequence so as not to cause delay in work. Failure to submit in ample time is not considered sufficient reason for an extension of contract time and no claim for extension by reason of such default will be allowed. Work affected by submittals to proceed only after review is complete.

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

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

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

.5 Review submittals prior to submission to Consultant. Stamp and sign submittals certifying review of submission. This review represents that necessary requirements have been checked and co-ordinated with requirements of work and contract documents. Submittals not stamped, signed, dated and identified as to specific project will be returned without being examined and considered rejected.

.6 Notify Consultant, in writing at time of submission, identifying deviations from requirements of contract documents stating reasons for deviations.

.7 Verify field measurements and affected adjacent work is co-ordinated.

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

.9 Contractor’s responsibility for deviation in submission from requirements of Contract Documents is not relieved by Consultant review.

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

1.3 REQUEST FOR INTERPRETATION PROCESS

.1 Contractor shall prepare and submit an RFI in accordance with Section 01 31 00.

1.4 SHOP DRAWINGS AND PRODUCT DATA

.1 Term “shop drawings” means drawings, diagrams, illustrations, schedules, performance charts, brochures and other data provided by Contractor to illustrate details of portion of work.

.2 Shop drawings that do not include the stamp, date, and signature of the person responsible for reviewing the shop drawings before submittal to the Consultant, will be rejected and returned without being examined.

.3 Submit shop drawings bearing stamp and signature of qualified professional engineer registered or licensed in Province of Manitoba, Canada where specifically requested in the specifications. Shop drawings not bearing the required Engineer's stamp will be rejected and returned without being examined.

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

.5 Submit one (1) printed copy and one (1) electronic copy (e.g. Adobe PDF format) of shop drawings for each requirement requested in specification sections and as the Consultant may reasonably request.

.6 Submit one (1) printed copy and one (1) electronic copy (e.g. Adobe PDF format) of product data sheets or brochures for requirements requested in specification Sections and as requested by Consultant where shop drawings will not be prepared due to standardized manufacture of product.

.7 Submit one (1) printed copy and one (1) electronic copy (e.g. Adobe PDF) of test reports for requirements requested in specification Sections and as requested by Consultant.

.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 three (3) years of date of contract award for project.

.8 Submit one (1) printed copy and one (1) electronic copy (e.g. Adobe PDF format) of certificates for requirements requested in specification Sections and as requested by Consultant.

.1 Statements printed on manufacturer's letterhead and signed by responsible officials of manufacturer of product, system or material attesting that product, system or material meets specification requirements.

.2 Certificates must be dated after award of project contract, complete with project name.

.9 Submit one (1) printed copy and one (1) electronic copy (e.g. Adobe PDF format) of manufacturers' instructions for requirements requested in specification Sections and as requested by Consultant.

.1 Pre-printed material describing installation of product, system or material, including special notices and Material Safety Data Sheets concerning impedances, hazards and safety precautions.

.10 Submit one (1) printed copy and one (1) electronic copy (e.g. Adobe PDF format) of Manufacturer's Field Reports for requirements requested in specification Sections and as requested by Consultant.

.1 Documentation of the testing and verification actions taken by manufacturer's representative to confirm compliance with manufacturer's standards or instructions.

.11 Allow minimum of ten (10) Working Days for Consultant's review of each submission or a reasonable longer period of time for large or complex submissions.

.12 For Contractors' use in preparation of drawings required under contract, Contractors may obtain from Consultant, electronic AutoCAD drawing files subject to following:

.1 Removal by Consultant of Consultants' professional seals from electronic drawing file; and

.2 Receipt of Licence Agreement prepared by Consultant and signed by Contractor(s) or user(s) of electronic files; and

.3 Receipt of payment to Consultant from each separate Contractor requesting an electronic drawing file, an amount of $250.00 for first electronic file or drawing sheet requested plus an additional $200.00 for each subsequent electronic file or drawing sheet requested at same time.

.13 Adjustments made on shop drawings by Consultant are not intended to change contract price. If adjustments affect value of work, state such in writing to Consultant prior to proceeding with work.

.14 Make changes in shop drawings as Consultant may require, consistent with contract documents. When resubmitting, notify Consultant in writing of any revisions other than those requested.

.15 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 samples.
- .5 Other pertinent data.
- .6 Identify on each shop drawing the related specification section (number and title) for which the product/material applies.

.16 Submissions to include:
- .1 Date and revision dates.
- .2 Project title and number.
- .3 Name and address of Subcontractor, Supplier, Manufacturer.
- .4 Contractor’s stamp, signed by Contractor’s authorized representative certifying approval of submissions, verification of field measurements and compliance with contract documents.
- .5 Details of appropriate portions of work as applicable:
  - .1 Fabrication.
  - .2 Layout, showing dimensions, including identified field dimensions, and clearances, relation to adjacent structure or materials.
  - .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 Relation to adjacent structure or materials.

.17 After Consultant’s review, distribute copies to subtrades as required.

.18 Delete information not applicable to project.

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

.20 If upon review by Consultant, no errors or omissions are discovered or if only minor corrections are made, 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.

.21 No extension of Contract Time will be allow for delays in the Work which may be caused for Consultant's rejection of shop drawings.

.22 Shop drawings which contain deviations from the Contract Documents which are not presented to the Consultant in writing, will rejected and returned without being examined.

1.5 SAMPLES

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

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

.3 Notify Consultant in writing, at time of submission of deviations in samples from requirements of contract documents.

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

.5 Adjustments made on samples by Consultant are not intended to change contract price. If adjustments affect value of work, state such in writing to Consultant prior to proceeding with work.

.6 Make changes in samples which Consultant may require, consistent with contract documents.

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

1.6 MOCK-UPS

.1 Erect mock-ups in accordance with Section 01 45 00.

1.7 CONSTRUCTION PHOTOGRAPHS

.1 Submit construction photographs in accordance with Section 01 31 00.

Part 2 Products

Part 3 Execution

END OF SECTION

Part 1 General

1.1 SECTION OVERVIEW

.1 Green Globes requirements and procedures

1.2 RELATED SECTIONS

.1 Section 31 25 00 - Temporary Erosion and Sediment Control

.2 Section 01 74 19 - Construction and Demolition Waste Management

.3 Section 01 81 19 - Indoor Air Quality Requirements

.4 Division 03 – Concrete

.5 Division 04 – Masonry

.6 Division 05 – Metals

.7 Division 06 – Carpentry and Millwork

.8 Division 07 – Thermal and Moisture Protection

.9 Division 08 – Doors and Windows

.10 Division 09 – Finishes

.11 Division 10 – Specialties

.12 Division 22 – Plumbing

.13 Division 23 – HVAC

1.3 DEFINITIONS

.1 Green Globes: A third-party verification online green building rating and certification tool.

.2 Recycled Content: The total percentage by mass (Post-Consumer + 0.5 Post Industrial) of recycled material that have been recovered or otherwise diverted from the solid waste stream, either after the manufacturing process (post-industrial) or after consumer use (post-consumer). In-house process recycled content will not be included.

.3 Post-Consumer Recycled Content: The percentage by mass of recycled material derived from previously used consumer products (i.e. aluminum and steel cans, glass and plastic bottles, asphalt from demolished sites, paper, carpet etc.)

.4 Post-Industrial Recycled Content: The percentage by mass of recycled material derived from outside industrial sources (i.e. sawmill dust used in MDF board, blast furnace slag in mineral wool insulation, coal fly ash in concrete mixes etc.)

.5 In-House Process Recycled Content: The percentage by mass of in-house material (i.e. trimmings, cutoffs, and scrap) that is returned to the production process as a part of internal housekeeping.

.6 CDPH Standard Method v1.1: California Department of Public Health (CDPH) Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from

Indoor Sources Using Environmental Chambers, v. 1.1–2010, for the emissions testing and requirements of products and materials.

.7 Chain-of-Custody (COC): A procedure that tracks a product form the point of harvest or extraction to its end use, including all successive stage of processing, transformation, manufacturing, a distribution.

.8 Volatile Organic Compounds (VOCs): Organic chemicals that produce vapors readily at room temperature and normal atmospheric pressure (e.g. gasoline, solvents, etc.). VOCs react with sunlight and nitrogen to form ground-level ozone, a chemical that has detrimental effect on human health, agricultural crops, forests, soil, groundwater and ecosystems.

.9 Environmental Product Declaration (EPD): An independently verified report based on life-cycle assessment studies that have been conducted according to a set of common rules for each product category and peer-reviewed.

.1 Industry-Wide (Generic) EPD: Provide products with third-party certification (Type III), including external verification, in which the manufacturer is explicitly recognized as a participant by the program operator. EPD must conform to ISO 14025, 14040, 14044, and EN 15804 or ISO 21930 and have at least a cradle to gate scope.

.2 Product-Specific Declaration: A product with a publicly available, critically reviewed life-cycle assessment conforming to ISO 14044 that has at least a cradle to gate scope.

.3 Product-Specific Type III EPD: A product with a third-party certification, including external verification, in which the manufacturer is explicated recognized by the program operator. EPD must conform to ISO 14025, 14040, 14044, and EN 15804 or ISO 21930 and have at least a cradle to gate scope.

.10 Weatherproofing System: A system which protects the building from the exterior environment (wind and water) and is defined as the air barrier within the wall and roof assemblies.

.11 Total Materials Cost: Actual materials cost (excluding labor and equipment) from the divisions included for calculating the Green Globes Total Construction Cost. Project teams can apply a 45% factor to the Green Globes Total Construction Cost (including labor and equipment) to establish a Green Globes Total Materials Cost.

1.4 REFERENCES

.1 South Coast Air Quality Management District (SCAQMD) Amendment to South Coast Rule 1168, VOC Limits, effective January 7, 2005: South Coast Air Quality Management District http://www.aqmd.gov/rules/reg/reg11/r1168.pdf

.2 California Office of Environmental Health and Hazard Assessment (OEHHA) Indoor REL.

.3 American Society for Testing and Materials (ASTM) D6886-03 “Standard Test Method for Speciation of the Volatile Organic Compounds (VOCs) in Low VOC Contest and Waterborne Air-Dry Coatings by Gas Chromatography”.

.4 Green Seal Standard 36 (GS–36), effective October 19, 2000 http://www.greenseal.org/certification/standards/commercial_adhesives_GS_36.cfm

.5 Green Seal Standard GS–11: Paints
http://www.greenseal.org/certification/standards/paints_GS_11.pdf

.6 Green Seal Standard GC–03: Anti-Corrosive Paints
http://www.greenseal.org/certification/standards/anti-corrosivepaints.pdf

.7 FloorScore™ Program: Resilient Floor Covering Institute
http://rfci.com/index.php?option=com_content&view=article&id=80&Itemid=79

.8 California Department of Public Health (CDPH) Standard Method v1.1-2010.
http://www.cdph.ca.gov/programs/IAQ/Pages/default.aspx

.9 Energy Star: https://www.energystar.gov/index.cfm?c=ofc_equip.pr_office_equipment

.10 SCS Indoor Advantage Program. http://www.scsglobalservices.com/certified-indoor-air-quality

.11 UL Greenguard Gold Certification Program.
http://www.greenguard.org/en/CertificationPrograms/CertificationPrograms_childrenSchools.aspx

.12 EcoLogo (Paints & Adhesives) – Environmental Choice:

.1 EcoLogo Standard for Adhesives: CCD-046

.2 EcoLogo Standard for Paints: Architectural Surface Coatings CCD-047

.3 EcoLogo Standard for Recycled Paints: Architectural Surface Coatings – Recycled Water-bourne CCD-048

.13 GREENGUARD Children & Schools – GREENGUARD Environmental Institute:

.1 Program Manual For GREENGUARD Product Certification Programs, GG.PM.01 2009

.14 GREENGUARD Environmental Institute: Standard Method for Measuring and Evaluating Chemical Emissions From Building Materials, Finishes and Furnishings Using Dynamic Environmental Chambers (GGTM.P066.R8, 10/29/2008)

.15 Indoor Advantage Gold – Scientific Certification Systems:

.1 California Department of Health Services Standard Practice for the Testing Of Volatile Organic Emissions Sources Using Small Scale Environmental Chambers (CA/DHS/EHLB/R-174, JULY 15, 2004 with Addendum 2004-01)

.2 SCS - EC10.2 -2007, Environmental Certification Program—Indoor Air Quality Performance, May, 2007

.16 The Carpet and Rug Institute (CRI), Commercial Green Label / Green Label Plus:
http://www.carpet-rug.org/commercial-customers/green-building-and-the-environment/green-label-plus/

.17 GREENGUARD Gold – UL Environment:

.1 UL 2821, "GREENGUARD Certification Program Method for Measuring and Evaluating Chemical emissions from Building Materials, Finishes and Furnishings," March 2013, Table 2 Office Model and Section 34.1 Allowable Limits for GREENGUARD Certification Gold.

.2 UL 2818, "GREENGUARD Certification Program for Chemical Emissions for Building Materials, Finishes and Furnishings," March 2013.

1.5 OBJECTIVES

.1 Construct a building that uses land, water, energy and material resources appropriately and efficiently and provides a safe, comfortable and productive indoor environment for building occupants in accordance with Green Globes requirements.

.2 Be responsible, either in whole or in part, for the following Green Globes credits targeted for this Project with regards to coordination, training, verification and execution:

.1 1.1.2.1: Environmental Management Systems (EMS)

.2 1.1.2.3: Mold Mitigation During Construction

.3 1.1.2.4: IAQ During Construction

.4 1.1.3: Commissioning

.5 1.2.2.1: Site Disturbance and Erosion

.6 1.5.4.1: Construction Waste

.7 1.7.2.1: Volatile Organic Compounds

.8 1.1.2.1: Mold Mitigation During Construction

.9 1.1.2.2: IAQ During Construction

.10 1.1.4: Commissioning

.11 1.4.2.1: Construction Waste

.12 1.4.4: Recycled Content

.13 1.6.2.1: Volatile Organic Compounds

.3 Source and select materials that meet sustainable criteria detailed herein

.1 No single manufacturer, fabricator, or subcontractor can fulfill the total requirements for Green Globes certification for the project. Green Globes certification requires the cooperation and diligence of all project participants for a successful application and acceptance for Green Globes certification.

.2 Failure to provide products or methods of construction contributing towards Green Globes credits will result in the City achieving a Certification less than that specified or none at all. The City reserves the right to seek compensation where failure to achieve Certification is a result of direct neglect or misrepresentation of any material or construction method.

1.6 DESCRIPTION OF WORK

.1 A Green Globes Champion (site superintendent or other individual designated by the Contractor) shall be responsible for coordinating all construction activities associated with Green Globes certification.

.1 Green Globes coordination activities shall include:

.2 Coordinate with subcontractors and ensuring the successful implementation of Green Globes strategies, programs and plans

.3 Report construction activity progress to the Consultant as it relates to the Green Globes aspects of the Project

.4 Supply the Green Globes documentation and submittals outlined within this specification and related sections to the Consultant to demonstrate that Green Globes requirements have been met

.5 Other duties as detailed in the related Sections listed in Paragraph 1.2 Related Sections

.2 The Green Globes requirements in this section and the related sections under Paragraph 1.2 Related Sections shall apply to all Sections and Work for this Project, whether specifically indicated or not.

.3 Compliance with requirements needed to obtain Green Globes credits will be used as one criterion to evaluate requests for substitutions or alternates.

1.7 GREEN GLOBES KICK-OFF MEETING

.1 Prior to mobilization on-site, the Contractor and the Green Globes Champion shall hold a kick-off meeting with the Consultant to review the Green Globes requirements. This meeting shall include a review of:

.1 Green Globes certification and performance objectives

.2 Green Globes requirements and procedure

.3 Green Globes documentation and submittals

1.8 GREEN GLOBES COORDINATION MEETING

.1 Prior to start of construction, the Contractor and the Green Globes Champion shall hold a coordination meeting with the construction team to explain the Green Globes requirements to the Sub-Contractors. This meeting shall include a review of:

.1 Green Globes certification and performance objectives

.2 Green Globes requirements and procedures

.3 Green Globes documentation and submittals

.2 The Contractor shall ensure that the appropriate Sub-Contractors attend this meeting. If Sub-Contractors are unable to attend this meeting, the Contractor shall make arrangements to host additional Green Globes Coordination Meetings to suit.

1.9 SUBMITTALS

.1 General Contractor to provide a Green Globes Action Plan a minimum of 14 days prior to the start of construction to the Consultant, a preliminary plan outlining the contribution of each trade to credits listed under Paragraph 1.5.2.

.1 The plan shall be based on projected materials and budgets

.2 The plan shall include the following:

.1 Temporary Erosion and Sediment Control Plan as required in Section 31 25 00

.2 Construction and Demolition Waste Management Plan as required in Section 01 74 19

.3 Indoor Air Quality Management Plan as required in Section 01 81 19

.4 Green Globes total construction cost

.5 Material costs based on specification division

.2 General Contractor to provide a Green Globes Progress Report to the Consultant at the end of each month that includes the following items:

.1 Photographs specified in the sections 31 25 00 and 01 81 19. All photos taken for Green Globes documentation purposes shall conform to the following requirements:

.1 Date Stamp: Standard indicating Year, Month and Day

.2 Provide a brief description (a sentence(s) or points) for each photo identifying how Green Globes requirements are met

.2 Temporary Erosion and Sediment Control inspection logs/reports as required in Section 31 25 00, conducted on a weekly basis or as directed by the Consultant

.3 Construction Waste Diversion report as required in Section 01 74 19, including the respective Disposal Tickets indicating weight or volume of materials removed from the site.

.4 Indoor Air Quality inspection logs/reports as required in Section 01 81 19, conducted on a bi-weekly basis or as directed by the Consultant

.3 General Contractor to provide documentation following the elements below as part of their Environmental Management System (EMS) to the Consultant:

.1 General Contractor's Environmental Policy: This is a statement by the General Contractor's organization that outlines intentions and principles regarding its overall environmental performance. It provides the overall directive and basis to set environmental objectives and targets, and develop action plans. It must be communicated to all employees and sub-contractors and displayed on notice boards throughout the construction sites. It should also be available to the public.

.2 Regulatory Compliance and Training: The Contractor should keep copies of regulatory requirements as well as records showing that training has been provided for relevant regulatory requirements.

.3 Environmental Risk Assessment that shows sensitive environmental areas and ranks potential risks that may arise from the construction: There should be documentation that identifies sensitive environmental areas; and possible risks on the environment and adjacent land from construction in terms of: air, natural waterways, topography, vegetation, noise and pollution. Ranking is a function of probability and severity of impact.

.4 Environmental Risk Management Strategies: Risk management options should be selected in order of preference in terms of avoiding risk wherever possible; and where this is not possible reducing risk; or, as a last resort, controlling risk. Major control structures should be shown (e.g. erosion control, site run-off measures, spill response, tree protection). Installation of control structures should occur before other construction activities commence.

.5 Environmental Management Roles, Responsibilities and Reporting Structure for the construction phase: Outline the Reporting Structure for Environmental Management at the Construction Phase. List the roles of the: i) Client's Project Environmental Manager, ii) the Contractor's Project Environmental Manager, iii) the Contractors Site Environmental Representative, and iv) the Site Foreman.

.6 Site and Work Instructions for site personnel outlining environmental procedures during construction: These should describe, in general terms, the required site best practices, and provide detailed instructions to deal with environmental incidents, adverse weather conditions and complaints. The Site Instructions should relate to the Environmental Inspection Checklists.

.7 Environmental Inspection Checklists: These serve to establish compliance with the documented procedures contained in the Site and Work Instruction, identify departure from procedures, and record corrective steps that are being taken.

.8 Records of Compliance: These records show that inspections have taken place and that corrective measures have occurred as necessary. They provide a record of site conditions and activities and provide a mechanism by which the Contractor can establish the effectiveness of its Environmental Management Plan.

.4 Submit **Schedule S1 – Material Information Data Sheet** and supporting documentation (letters from suppliers, MSDSs, product literatures etc.) for all products / materials listed in this Section and as requested by the Consultant

.1 Submit completed schedules and supporting product literature to the Consultant for review at subcontractor contract award

.2 The Contractor shall provide vendor invoices, as material is ordered, for all wood-based products (Forest certified or not) purchased by the project contractor and subcontractor.

.1 Each vendor invoice must include the following with the exceptions under 1.5.2:

.1 Each wood product must be identified on a line-item basis

.2 FSC, SFI, or ATFS products must be identified as such on a line-item basis

.3 The dollar value of each line item must be shown

.4 The vendor's COC certificate number must be shown on any invoice that includes FSC products

.2 In rare instances, it may not be practical for a vendor to invoice wood products on a line-item basis because the invoice would be dozen of pages long. In such cases, the invoice should indicate the aggregate value of wood products sold by the vendor. This compliance path must be approved by the Consultant. If the wood products are FSC certified, comply with the following requirements.

.1 The vendor's COC number must be shown on the invoice (if applicable)

.2 The invoice must be supplemented by a letter from the vendor stating that the products invoiced are FSC, SFI, or ATFS certified.

1.10 PENALTIES

.1 The City reserves the right to withhold Progress Payments pending the submission of documentation or completion of actions required in the Sections listed under Paragraph 1.2 Related Sections.

Part 2 Products

1.1 SECTION OVERVIEW

.1 Product requirements for attempting Green Globes credits under Section 1.6.2.

2.2 ENVIRONMENTAL PRODUCT DECLARATIONS

.1 Use materials and products (including finishes and furnishings) that (based upon cost - a minimum of 10% is necessary to be awarded points) have:

.1 **Industry-wide (generic) EPD**. Products with third-party certification (Type III), including external verification, in which the manufacturer is explicitly recognized as a participant by the program operator are valued as one half (1/2) of a product for purposes of credit achievement calculation.

.2 **Product-specific Type III EPD.** Products with third-party certification (Type III), including external verification in which the manufacturer is explicitly recognized as the participant by the program operator are valued as one whole product for purposes of credit achievement calculation.

.3 **Life-Cycle Assessment.** Products with a publicly available, critically reviewed life-cycle assessment conforming to ISO 14044 that have at least a cradle to gate scope are valued as one quarter (1/4) of a product for the purposes of credit achievement calculation.

.4 **Third Party Certifications.** Third-party certifications that are based upon a multiple attribute standard(s) developed by a consensus based process from an approved standard development organization? Examples include NSF sustainability assessment standards, UL Environment sustainability standards, sustainable forestry certifications, and other consensus-based assessment standards that are multiple attribute and life cycle based.

.2 Submit supporting documents as per 1.9.4 for each product or material listed above or used to meet credit requirements

2.3 INTERIOR adhesives AND sealants

.1 All wet-applied interior adhesives and sealants applied on site products must comply with the following criteria:

Product Type	Reference Standard	VOC Limit (g/L)
ADHESIVES		
Indoor Carpet Adhesives	SCAQMD 1168, 2005	50
Carpet Pad Adhesives	SCAQMD 1168, 2005	50
Wood Flooring Adhesives	SCAQMD 1168, 2005	100
Rubber Flooring Adhesives	SCAQMD 1168, 2005	60
Subfloor Adhesives	SCAQMD 1168, 2005	50
Ceramic Tile Adhesives	SCAQMD 1168, 2005	65
VCT & Asphalt Adhesives	SCAQMD 1168, 2005	50
Drywall & Panel Adhesives	SCAQMD 1168, 2005	50
Cove Base Adhesives	SCAQMD 1168, 2005	50
Multipurpose Construction Adhesives	SCAQMD 1168, 2005	70
Structural Glazing Adhesives	SCAQMD 1168, 2005	100

PVC Welding	SCAQMD 1168, 2005	510
CPVC Welding	SCAQMD 1168, 2005	490
ABS Welding	SCAQMD 1168, 2005	325
Plastic Cement Welding	SCAQMD 1168, 2005	250
Adhesive Primer for Plastic	SCAQMD 1168, 2005	550
Contact Adhesive	SCAQMD 1168, 2005	80
Special Purpose Contact Adhesive	SCAQMD 1168, 2005	250
Structural Wood Member Adhesive	SCAQMD 1168, 2005	140
Sheet Applied Rubber Lining Operations	SCAQMD 1168, 2005	850
Top & Trim Adhesive	SCAQMD 1168, 2005	250
Metal to Metal	SCAQMD 1168, 2005	30
Plastic Foams	SCAQMD 1168, 2005	50
Porous Material (except wood)	SCAQMD 1168, 2005	50
Wood	SCAQMD 1168, 2005	30
Fiberglass	SCAQMD 1168, 2005	80
Metal to Metal	SCAQMD 1168, 2005	30
SEALANTS		
Architectural	SCAQMD 1168, 2005	250
Non-membrane Roof	SCAQMD 1168, 2005	300
Roadway	SCAQMD 1168, 2005	250
Single-ply Roof Membrane	SCAQMD 1168, 2005	450
Other	SCAQMD 1168, 2005	420
SEALANT PRIMERS		
Architectural, nonporous	SCAQMD 1168, 2005	250
Architectural, porous	SCAQMD 1168, 2005	775
Other	SCAQMD 1168, 2005	750

.2 Alternatively, adhesives and sealants will meet the criterion if they have third-party certifications showing compliance to predetermined indoor air quality standards as listed in ANSI/GBI 01-2010:

.1 EcoLogoM (Paints & Adhesives) – Environmental Choice

.1 EcoLogo Standard for Adhesives – CCD-046

.2 EcoLogo Standard for Paints – Architectural Surface Coatings CCD-047

.3 EcoLogo Standard for Recycled Paints – Architectural Surface Coatings – Recycled Water-bourne CCD-048

.2 Green Seal® (Paints & Adhesives)

.1 Green Seal Environmental Standard for Paints and Coatings, GS-11

.2 Green Seal Environmental Standard for Commercial Adhesives, GS-36

.3 GREENGUARD Children & Schools – GREENGUARD Environmental Institute

.1 "Program Manual For GREENGUARD Product Certification Programs" GG.PM.01 2009

.2 GREENGUARD Environmental Institute: Standard Method for Measuring and Evaluating Chemical Emissions From Building Materials, Finishes and Furnishings Using Dynamic Environmental Chambers (GGTM.P066.R8, 10/29/2008)

.4 Indoor Advantage Gold TM – Scientific Certification Systems

.1 California Department of Health Services Standard Practice for the Testing Of Volatile Organic Emissions Sources Using Small Scale Environmental Chambers (CA/DHS/EHLB/R-174, JULY 15, 2004 with Addendum 2004-01)

.5 SCS - EC10.2 -2007, Environmental Certification Program—Indoor Air Quality Performance, May, 2007

.3 Submit supporting documentation as per 1.9.4 for each product / material listed above

2.4 INTERIOR PAINTS

.1 All wet-applied interior paints applied on site products must comply with the following criteria:

Product Type	VOC Limit (g/L)
PAINTS	
Paints – Interior Latex Coatings Flat	50
Paints – Interior Latex Coatings Non Flat	150
Untreated Masonry or Concrete	N/A

.2 Alternatively, paints and coatings will meet the criterion if they have third-party certifications showing compliance to predetermined indoor air quality standards as listed in ANSI/GBI 01-2010:

.1 EcoLogoM (Paints & Adhesives) – Environmental Choice

.1 EcoLogo Standard for Adhesives – CCD-046

.2 EcoLogo Standard for Paints – Architectural Surface Coatings CCD-047

.3 EcoLogo Standard for Recycled Paints – Architectural Surface Coatings – Recycled Water-bourne CCD-048

.2 Green Seal® (Paints & Adhesives)

.1 Green Seal Environmental Standard for Paints and Coatings, GS-11

.2 Green Seal Environmental Standard for Commercial Adhesives, GS-36

.3 GREENGUARD Children & Schools – GREENGUARD Environmental Institute

.1 "Program Manual For GREENGUARD Product Certification Programs" GG.PM.01 2009

.2 GREENGUARD Environmental Institute: Standard Method for Measuring and Evaluating Chemical Emissions from Building Materials, Finishes and Furnishings Using Dynamic Environmental Chambers (GGTM.P066.R8, 10/29/2008)

.4 Indoor Advantage Gold TM – Scientific Certification Systems

.1 California Department of Health Services Standard Practice for the Testing Of Volatile Organic Emissions Sources Using Small Scale Environmental Chambers (CA/DHS/EHLB/R-174, JULY 15, 2004 with Addendum 2004-01)

.5 SCS - EC10.2 -2007, Environmental Certification Program—Indoor Air Quality Performance, May, 2007

.3 Submit supporting documentation as per 1.9.4 for each product / material listed above

2.5 FLOORING & Other interior products

.1 Flooring and other interior products (insulation, wall coverings and acoustical ceilings) will meet the criterion if they have third-party certifications showing compliance to predetermined indoor air quality standards as listed in ANSI/GBI 01-2010:

.1 Green Label Plus® (Carpet & Carpet Adhesive) – Carpet and Rug Institute

.1 Carpet Policy & Procedure Manual – GLCm_071809Ver0

.2 Adhesive Policy & Procedure Manual – GLAm_062509Ver0

.2 Green Label® (Carpet Cushion) – Carpet and Rug Institute

.3 FloorScore® (Resilient Flooring) – Resilient Floor Covering Institute

.1 California Department of Health Services Standard Practice for the Testing Of Volatile Organic Emissions Sources Using Small Scale Environmental Chambers (CA/DHS/EHLB/R-174), JULY 15, 2004 with Addendum 2004-01

.2 SCS - EC10.2 -2007, Environmental Certification Program—Indoor Air Quality Performance. May, 2007

.4 GREENGUARD Children & Schools – GREENGUARD Environmental Institute

.1 "Program Manual For GREENGUARD Product Certification Programs" GG.PM.01 2009

.2 GREENGUARD Environmental Institute: Standard Method for Measuring and Evaluating Chemical Emissions from Building Materials, Finishes and Furnishings Using Dynamic Environmental Chambers (GGTM.P066.R8, 10/29/2008)

.5 Indoor Advantage Gold TM – Scientific Certification Systems

.1 California Department of Health Services Standard Practice for the Testing Of Volatile Organic Emissions Sources Using Small Scale Environmental Chambers (CA/DHS/EHLB/R-174, JULY 15, 2004 with Addendum 2004-01)

.2 SCS - EC10.2 -2007, Environmental Certification Program—Indoor Air Quality Performance, May, 2007

Part 3 Execution

3.1 NOT USED

END OF SECTION

Complete for all permanently installed products in Divisions 03-10, 31, and 32 as well as 11, 21-28.
Submit to Consultant 14 days prior to ordering product/material.

Contractor Name:		Contractor Contact:	
Manufacturer:		Product Use:	
Product Name:		Material Cost*:	

** cost excluding labour, including overhead and profit. Material cost is required.*

Environmental Product Declarations: complete for all materials.

Environmental Product Declaration:	☐ Yes ☐ No	Classification:	☐ Industry-Wide ☐ Product Specific Type III ☐ Life-Cycle Assessment ☐ Third Party Certification

☐ I have attached a copy of the Environmental Product Declaration

Recycled Content and Certified Wood: complete for all materials.

Pre-Consumer Recycled Content (%):		Post-Consumer Recycled Content (%):	
FSC, SFI or ATFS Content (%):		FSC Chain of Custody Number (if applicable):	

☐ I have attached supporting Manufacturer's documentation confirming all information completed above.

☐ I have attached supporting invoices confirming certified wood content, COC number (if applicable), and cost.

Adhesives, Sealants, Paints, Coatings, Ceilings, Walls, and Acoustic and Thermal Insulation: complete for products applied within the weatherproofing membrane.

Product Classification:	Wet-Applied Products: ☐ Adhesive ☐ Sealant ☐ Paint ☐ Coating	Solid Products: ☐ Ceiling Product ☐ Wall Product ☐ Acoustic Insulation ☐ Thermal Insulation
General Emissions Evaluation Reported Using:	☐ EcoLogoM (Paints & Adhesives) – Environmental Choice 1. EcoLogo Standard for Adhesives – CCD-046 2. EcoLogo Standard for Paints – Architectural Surface Coatings CCD-047 3. EcoLogo Standard for Recycled Paints – Architectural Surface Coatings – Recycled Water-bourne CCD-048 ☐ Green Seal® (Paints & Adhesives) 1. Green Seal Environmental Standard for Paints and Coatings, GS-11 2. Green Seal Environmental Standard for Commercial Adhesives, GS-36	☐ GREENGUARD Children & Schools – 1. "Program Manual For GREENGUARD Product Certification Programs" GG.PM.01 2009 2. GREENGUARD Environmental Institute: Standard Method for Measuring and Evaluating Chemical Emissions From uilding Materials, Finishes and Furnishings Using Dynamic Environmental Chambers (GGTM.P066.R8, 10/29/2008) ☐ Indoor Advantage Gold TM – Scientific Certification Systems 1. California Department of Health Services Standard Practice for the Testing Of Volatile Organic Emissions Sources 2. SCS - EC10.2 -2007, Environmental Certification Program—Indoor Air Quality Performance, May, 2007

For Wet-Applied Products, VOC Content (g/L):		For Wet-Applied Products, Estimated Volume (L):	

☐ I have attached supporting Manufacturer's documentation confirming VOC content for wet-applied products.

☐ I have attached a copy of the General Emission Evaluation Report noted above.

Flooring: complete for all flooring products.

General Emissions Evaluation Reported Using:	☐ Green Label Plus® (Carpet & Carpet Adhesive) – Carpet and Rug Institute 1. Carpet Policy & Procedure Manual – GLCm_071809Ver0 2. Adhesive Policy & Procedure Manual – GLAm_062509Ver0 ☐ Green Label® (Carpet Cushion) – Carpet and Rug Institute	☐ FloorScore® (Resilient Flooring) – Resilient Floor Covering Institute 1. California Department of Health Services Standard Practice for the Testing Of Volatile Organic Emissions Sources 2. SCS - EC10.2 -2007, Environmental Certification Program—Indoor Air Quality Performance. May, 2007

☐ I have attached a copy of the General Emission Evaluation Report noted above.

Furniture and Furnishings: complete for all new furniture and furnishing products.

New Furniture and Furnishings:	☐ ANSI/BIFMA Standard Method M7.1-2011 ☐ UL Greenguard Certified ☐ UL Green Guard Gold ☐ SCS Indoor Advantage - Furniture	☐ SCS Indoor Advantage Gold - Furniture ☐ Intertek ETL Environmental VOC+ ☐ MAS Certified Green ☐ TUVRheinland Green Product Mark Furniture
Classroom Furniture	☐ Emissions Certificate, completed using the CDPH Standard Method v1.1-2010	

☐ I have attached a copy of the evaluations report noted above.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 11 00 – Summary of Work.

.2 Section 01 31 00 – Project Management and Co-ordination.

.3 Section 01 33 00 – Submittal Procedures.

1.2 REVIEW AND INSPECTION OF THE WORK

.1 Refer to C11 Inspection of General Conditions for Construction.

1.3 INDEPENDENT INSPECTION AGENCIES

.1 Independent Inspection/Testing Agencies will be engaged by Consultant for purpose of inspecting and/or testing portions of work as identified in specification sections, and be paid for by cash allowance.

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

.3 Employment of inspection/testing agencies does not relieve Contractors of their responsibility to perform work in accordance with contract documents.

.4 If defects are revealed during inspection and/or testing, appointed agency will request additional inspection and/or testing to ascertain full degree of defect. Contractor to correct defect and irregularities as advised by Consultant, at no cost to the City, and pay costs for retesting and re-inspection.

1.4 ACCESS TO WORK

.1 Allow inspection/testing agencies access to the Work, offsite manufacturing, and fabrication plants.

.2 Co-operate to provide reasonable facilities for such access.

1.5 PROCEDURES

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

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

.3 Provide labour and facilities to obtain and handle samples and materials on site. Provide sufficient space to store and cure test samples.

1.6 REPORTS

.1 Submit four (4) copies of inspection and test reports promptly to the Consultant.

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

1.7 TESTS AND MIX DESIGNS

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

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

1.8 MOCK-UPS AND SAMPLE WORK

.1 Prepare mock-ups and sample work specifically requested in specifications.

.2 Construct mock-ups and sample work at locations acceptable to Consultant.

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

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

.5 Unless noted, approved mock-ups and sample work may remain as part of work.

.6 When reviewed and approved, mock-ups and sample work become standard of workmanship, appearance, and materials approved for similar areas throughout project.

1.9 MILL TESTS

.1 Submit mill test certificates as required of the specification Sections and as may be requested.

1.10 EQUIPMENT AND SYSTEMS

.1 Submit four (4) copies of adjustment and balancing reports for mechanical, electrical building equipment and systems.

Part 2 Products

Part 3 Execution

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 11 00 – Summary of Work.

.2 Section 01 31 00 – Project Management and Co-ordination.

.3 Section 01 61 00 – Common Product Requirements.

.4 Section 01 74 00 – Cleaning and Waste Management.

1.2 REFERENCES

.1 Canadian Standards Association (CSA).
- .1 CSA O121-08 (R2013), Douglas Fir Plywood.
- .2 CAN/CSA S269.2-M87 (R2003), Access Scaffolding for Construction Purposes.
- .3 CAN/CSA Z321-96 (R2006), Signs and Symbols for the Workplace.

1.3 TEMPORARY WORK

.1 Temporary Electricity and Lighting.
- .1 Provide and pay for temporary power required during construction for temporary lighting and the operating of power tools.
- .2 Arrange for connection with appropriate utility company. Pay all costs for installation, maintenance and removal.
- .3 Temporary power for electric cranes and other equipment requiring in excess of the supply required for temporary lighting and power tools is the responsibility of Contractor.
- .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 Consultant provided that guarantees are not affected. Make good damage to electrical system caused by use under this Contract. Replace lamps which have been used for more than three (3) months.
- .6 All permanent fluorescent, metal halide, and LED lighting utilized for temporary lighting shall have 100 hours continuous burn in time.
- .7 Turn over a minimum of 5% of fluorescent and metal halide lamps at end of project. Submit to Consultant for his review and approval a list of each type of lamp and their quantities prior to turn over.
- .8 Clean permanent lights after final painting and flooring is complete in each room or area.
- .9 Be responsible for co-ordination of any required utility disruption or relocation.

.2 Temporary Fire Protection.
- .1 Provide and maintain temporary fire protection equipment during performance of work required by insurance companies having jurisdiction, and governing codes, regulations and bylaws.

.3 Temporary Heating and Ventilation.
- .1 Arrange, pay for, operate and maintain temporary heat and ventilation and shelters used during construction, including costs of installation, fuel, operation, maintenance and removal of equipment to keep work that requires protection from cold adequately warm and sheltered from elements.
  - .1 Acceptable temporary heaters to consist of warm forced air type, operated in well ventilated location and vented to exterior.

.2 Use of direct-fired heaters discharging waste products into work areas will not be permitted.
.3 Provide protection on floors and adjacent surfaces to prevent damage.

.2 Temporary heating and ventilation, shelters, fuel and fuel storage: satisfactory to authorities having jurisdiction.

.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 requirements for safe working environment.

.4 Maintain minimum temperature of 10°C (or higher where specified) during construction.

.5 Ventilating.
.1 Prevent hazardous accumulations of dust, fumes, mists, vapours or gasses 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 completion of work to assure removal of harmful contaminants.

.6 Maintain strict supervision of temporary heating and ventilating equipment to:
.1 Conform to applicable codes and standards.
.2 Enforce safe practices.
.3 Prevent abuse of services.
.4 Prevent damage to finishes.
.5 Vent direct-fired combustion units to outside.

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

.4 Permanent HVAC Heating Systems

.1 Permanent HVAC heating systems of buildings may be used for temporary heating during construction subject to the requirements specified in Section 23 05 01, Section 01 81 19, or other requirements listed throughout the specifications.

.2 Pay for utility charges at prevailing rates.

.3 Permanent HVAC systems may be used only after the following criteria are met:
.1 Consultant has provided written authorization to use HVAC systems.
.2 Building shell is closed in (exterior walls and roofs are fully insulated complete with air/vapour barriers; exterior doors, windows, and curtain walls are installed with glazing).
.3 Major elements of interior work is complete including, but not necessarily limited to, taping and sanding of gypsum board.
.4 Major dust generating activities are complete.

.5 Temporary Telephone Service.
.1 Arrange, pay for and maintain temporary telephone service used during construction in accordance with authorities having jurisdiction. Provide at least one phone in Contractor's field office available for use by the City, Contractor, Subcontractors and Consultants.

.6 Temporary Digital Co-ordination.
.1 Provide on-site lap top computer with internet access and digital camera to permit emailing of correspondence and photos of construction issues to Consultant(s) for prompt co-ordination and response.

.7 Temporary Water Supply.
.1 Arrange, pay for and maintain temporary water supply used during construction in accordance with authorities having jurisdiction.
.2 Arrange for connection with appropriate utility company as required and pay costs for installation, maintenance and removal.

1.4 CONSTRUCTION FACILITIES

.1 Contractor Site Offices
.1 Provide office heat, lighted and ventilated, of sufficient size to accommodate site meetings and furnished with drawing lay down table.
.2 Provide a clearly marked and fully stocked first-aid case in a readily available location.
.3 Subcontractors may provide their own offices as necessary. Direct location of these offices.
.4 Offices within building:
.1 When usable space is available within the project building and if approved by the the City, the site office may be located within the building, utilizing rooms therein.
.2 Such areas may be used contingent upon there being no delay in completion of the work and there being no damages to material or finishes.
.5 Personal Protective Equipment:
.1 Provide and store within site office personal protective equipment for use of the City's personnel visiting the site.
.2 Provide twelve (12) each of the following:
.1 Hard hats.
.2 Protective eyewear (eyeglass type – not goggles for sanitary reasons).
.3 Earmuff hearing protection. Ear plugs are not acceptable for sanitary reasons.
.4 Hi-Visibility Safety vests.
.5 Safety shoes – either rubber boots with steel toes or strap-on type steel toe guards. Provide in several adult shoe sizes.

.2 Consultant's Site office
.1 Provide temporary site office for Consultant.
.2 Consultant's office shall be separate from the Contractors Site Office and may be in the same trailer/building but must have its own separate, lockable, entrance.
.3 Inside dimensions minimum 3.6 m long x 3 m wide x 2.4 m high, with floor 0.3 m above grade, complete with four (4) 50% opening windows and one lockable door.
.4 Insulate building and provide heating system to maintain 22°C inside temperature at -20°C outside temperature.
.5 Finish inside walls and ceiling with plywood or wallboard and paint in selected colours, or finish with prefinished hardboard. Finish floor with 19 mm thick plywood.

.6 Install electrical lighting system to provide min 750 lx using surface mounted, shielded commercial fixtures with 10% upward light component.
.7 Provide private washroom facilities adjacent to office complete with flush or chemical type toilet, lavatory, and mirror and maintain supply of paper towels and toilet tissue.
.8 Equip office with 1 x 2 m table, four (4) chairs, 6 m of shelving 300 mm wide, one (1) three drawer filing cabinet, one (1) plan rack and one (1) coat rack and shelf.
.9 Maintain in clean condition. Provide periodic housekeeping.

.3 Construction Equipment, Tool, and Material Storage.
.1 Refer to Section 01 61 00.
.2 Provide and maintain, in clean orderly condition, adequate lockable, weather tight trailers for storage of materials, tools, and equipment which are subject to damage by weather. Co-ordinate location(s) with the City.
.3 Confine work and operations of employees by Contract Documents. Do not unreasonably encumber premises with products.
.4 Do not load or permit to load any part of Work with a weight or force that will endanger the Work.

.4 First Aid.
.1 Provide and maintain clearly marked and fully stocked first-aid case in readily available location.

.5 Sanitary Facilities.
.1 Provide sufficient sanitary facilities for work force in accordance with authorities having jurisdiction.
.2 Keep area and premises in sanitary condition. Service sanitary facilities at least weekly and more frequently if required.
.3 Post notices and take such precautions as required by local health authorities.
.4 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 Consultant.

1.5 PROTECTION AND MAINTENANCE OF TRAFFIC

.1 Provide and maintain adequate access to project site.

.2 Build and maintain temporary roads, sidewalk crossings, ramps, and construction runways to maintain access, and snow removal during period of Work.

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

.4 Conform to requirements of governing authorities when required and, when necessary, make arrangements with adjacent property owners.

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

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

.7 Limited parking will be permitted on site, in locations designated by the City, and provided it does not disrupt performance of Work.

.8 Provide snow removal during period of Work.

1.6 PROTECTION FOR OFF-SITE AND PUBLIC PROPERTY

.1 Protect adjacent private and public property from damage during the performance of work.

.2 Be responsible for all damage incurred.

1.7 CONSTRUCTION AIDS

.1 Construction Hoists and Cranes.

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

.2 Operate hoists and cranes using qualified personnel.

.2 Scaffolding and Platforms.

.1 Construct and maintain scaffolding, ramps, ladders, swing staging, platforms and temporary stairs in rigid, secure and safe manner in accordance with CAN/CSA S269.2.

.2 Erect scaffolding and platforms independent of walls. Remove promptly when no longer required.

1.8 TEMPORARY BARRIERS AND ENCLOSURES

.1 Site Enclosure.

.1 Erect temporary site enclosure to separate construction area from adjacent streets, property, and to protect public, workers, public and private property from injury or damage. At a minimum, provide chain link fence 2.4 m high minimum. Provide lockable gates as require for access to site by workers and vehicles.

.2 Provide snow fencing or other similar barriers around trees, natural features, bench marks, utility lines, etc. designated to remain. Protect from damage.

.2 Weather Enclosures.

.1 Provide temporary weather tight enclosures and protection for exterior openings until permanently enclosed.

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

.3 Close off floor areas where walls are not finished; seal off other openings; enclose building interior work for temporary heat.

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

.3 Protection of Building Finishes and Equipment.

.1 Provide protection for finished and partially finished building finishes and equipment during the performance of work.

.2 Provide necessary screens, covers and hoardings.

.3 Confirm locations and installation with Consultant at least 3 days prior to installation.

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

.4 Site Storage and Over Loading.

.1 Refer to Section 01 61 00.

.2 Confine Work and operations of workforce to limits indicated by Contract Documents. If Work must be performed in another area, notify and obtain permission from the City.

.3 Do not unreasonably encumber site with material or equipment.

.4 Move stored products or equipment interfering with operations of the City.

.5 Do not load or permit to be loaded any part of Work with weight or force that will endanger Work.

.6 Obtain and pay for use of additional storage or work areas needed for operations or for delivered equipment or materials not required immediately on site.

.7 Repair all existing site conditions damaged by use of site to match pre-construction conditions.

.5 Guard Rails and Barricades.

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

.2 Construct in accordance with requirements of authorities having jurisdiction.

.6 Security Measures.

.1 In addition to requirement herein, provide hoarding and enclosures of sufficient strength and dimension to prevent unauthorized entry of all persons.

.2 Maintain at site, at all times, names and telephone numbers of all Contractor's and Subcontractor's representatives, available to hand for use in event of need for immediate response in emergency situations.

1.9 TEMPORARY CONTROLS

.1 Dewatering.

.1 Provide temporary drainage and pumping facilities to keep excavations and site free from standing water while work is in progress.

.2 Dispose of water in accordance with Section 01 74 00 and in manner not detrimental to public and private property, or any portion of work completed or under construction.

.2 Shoring, Underpinning and Bracing.

.1 Conduct condition survey, including photographs of adjacent buildings before commencing excavation and investigate foundations to determine underpinning, etc., required.

.2 Take every precaution against any movement or settlement of existing and new construction, utilities, streets, paving, walks, lighting standards, piping, conduit, etc.

.3 Engage services of qualified professional engineer with demonstrated competence in work, registered in Province of Manitoba to design and inspect shoring, bracing and underpinning as required for work.

.1 Submit design and supporting data at least two (2) weeks prior to commencing work.

.2 Design and supporting data submitted to bear stamp and signature of qualified professional engineer registered in Province of Manitoba.

.4 Provide bracing, shoring, sheeting, sheet piling, underpinning and other retaining structures as required by aforementioned engineer and authorities having jurisdiction to assure horizontal and vertical support of adjacent areas.

.5 Assume responsibility for strength, adequacy, safety, and support of retaining structures, utilities, etc. with respect to any movement, settlement or drainage; liability for injury resulting from inadequate shoring, bracing, and underpinning; responsibility for repair of damage caused.

1.10 SITE SIGNS AND NOTICES

.1 Site Signs and Notices: signs and notices for safety or instruction to be in English language, or commonly understood graphic symbols to CAN/CSA Z321.

.2 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 Consultant.

.3 Maintain sign in clean condition throughout duration of project.

.4 No other signs or advertisements, other than warning signs, are permitted on site, except by specific written permission by the City.

.5 Signs and notices for safety and instruction shall be in both official languages Graphic symbols shall conform to CAN3-Z321.

.6 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 Consultant.

Part 2 Products

Part 3 Execution

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 31 00 – Project Management and Co-ordination.

.2 Section 01 33 00 – Submittal Procedures.

.3 Section 01 50 00 – Temporary Facilities and Controls.

.4 Section 01 74 00 – Cleaning and Waste Management.

1.2 SECTION INCLUDES

.1 Product quality, availability, storage, handling, protection, and transportation.

.2 Procedures for product substitution.

.3 Manufacturer's instructions.

.4 Quality of Work, co-ordination and fastenings.

.5 Co-ordination:

.1 Contractor shall co-ordinate the exact location of mechanical and electrical fixtures, outlets, switches, panels, etc. which are located in architectural wall and ceiling finishes (e.g. linear wood ceilings) with Consultant prior to rough-in and cutting of openings and recesses.

.2 Contractor shall be responsible for all costs associated with relocation of mechanical and electrical devices (including replacement of damaged wood veneer paneling, linear wood ceilings and other architectural finishes) resulting from failure to co-ordinate with Consultant prior to rough-in.

1.3 LABOUR AND PRODUCTS

.1 Products, material and equipment used to contain no asbestos fibre.

1.4 REFERENCE STANDARDS

.1 B8 – Substitutes, of the Bidding Procedures.

.2 Within text of each specifications section, reference may be made to reference standards.

.3 Conform to these reference standards, in whole or in part as specifically requested in specifications.

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

.5 Cost for such testing will be born by the City in event of conformance with Contract Documents or by Contractor in event of non-conformance.

.6 Conform to latest date of issue of referenced standards in effect on date of submission of Bids, except where specific date or issue is specifically noted.

1.5 AVAILABILITY

.1 Immediately upon signing Contract, review product delivery requirements and anticipate foreseeable supply delays in any items. If delays in supply of products are foreseeable, notify Consultant of such, in order that substitutions or other remedial action may be authorized in ample time to prevent delay in performance of work.

.2 In event of failure to notify Consultant at commencement of work and should it subsequently appear that work may be delayed for such reason, Consultant reserves right to substitute more readily available products of similar character, at no increase in contract price or contract time.

1.6 QUALITY AND CONFORMANCE

.1 When material or equipment is specified by standard or performance specifications, upon request of Consultant, obtain from manufacturer an independent testing laboratory report, stating that material or equipment meets or exceeds specified requirements.

.2 Products, materials, equipment and articles (referred to as products throughout specifications) incorporated in Work shall be new, not damaged or defective, and of best quality (compatible with specifications) for purpose intended. If requested, furnish evidence as to type, source and quality of products provided.

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

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

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

1.7 STORAGE, HANDLING AND PROTECTION

.1 Handle and store products in manner to prevent damage, contamination, 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 seals 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 as specified in Section 01 50 00.

.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 construction materials 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 Consultant.

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

.10 Cleaning and Waste Management in accordance with Section 01 74 00.

1.8 TRANSPORTATION

.1 Pay costs of transportation of products required in performance of work.

.2 Transportation costs of products supplied by the the City will be paid for by the City, unless specified otherwise. Unload, handle and store such products, unless otherwise specified.

1.9 MANUFACTURER'S INSTRUCTIONS

.1 Unless otherwise indicated in specification, 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 Consultant in writing, of conflicts between specifications and manufacturer's instructions, so that Consultant may establish course of action.

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

1.10 QUALITY OF WORK

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

.2 Enforce discipline and good order among workers.

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

.4 Decisions as to standard or fitness quality of work in cases of dispute rest solely with Consultant, whose decision is final.

1.11 CO-ORDINATION

.1 Ensure co-operation of workers in laying out Work. Maintain efficient and continuous supervision.

.2 Ensure Work of various Subcontractors does not conflict or create interference.

.3 Be responsible for the proper co-ordination and placement of openings, sleeves, and accessories.

.4 Supply all items required to be built in as and when required, together with templates, measurements and shop drawings.

.5 Ensure all workers examine the drawings and specifications covering the Work of others that may affect the performance of their own Work. Examine the Work of others and report to the Consultant, in writing, any defects, or deficiencies that may affect the Work. In the absence of any report, the Contractor shall be held to have waived all claims for damage to or defects in such Work.

.6 Ensure that components requiring foundations or openings that are required for the installation of Work is co-ordinated. Furnish the necessary information to the Sections concerned in ample time to permit allowance for such items. Failure to comply with this requirement does not relieve the party at fault of the cost of cutting or drilling at a later date and subsequent patching.

.7 Electrical Subcontractor shall prepare interference co-ordination drawings, in accordance with Section 01 33 33, showing all major feeders, conduits, and central junction boxes for review by Consultant prior to rough-in.

.8 Extras to the Contract where architectural, structural, or mechanical work requires relocation or modifications due to the failure of the Electrical Subcontractor to co-ordination the work and provide interference co-ordination drawings will not be accepted.

1.12 CONCEALMENT

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

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

1.13 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.

1.14 LOCATION OF FIXTURES

.1 Consider location of fixtures, outlets, and mechanical and electrical items indicated as approximate. Consultant may move these up to 3m from position indicated, at no cost to the City, provided notice is given before related work has commenced.

.2 Inform Consultant of conflicting installation. Submit field drawings to indicated relative position of various services and equipment when required by Consultant. Install as directed.

.3 Locate equipment, fixtures and distribution systems to provide minimum interference and maximum usable space and in accordance with manufacturer's recommendations for safety, access and maintenance.

.4 The locations of all mechanical and electrical devices mounted in the following locations to be co-ordinated with Consultant before commencing installation of service rough-ins and cutting of openings for outlets, fixtures and equipment.

.1 Stone veneer walls.
.2 Quartz surfaced walls.
.3 Plastic-laminate faced wood paneled walls and ceilings.
.4 MDF paneled walls and ceilings.
.5 Linear wood ceilings.

.5 Contractor shall be responsible for all costs associated with relocation of mechanical and electrical devices (including replacement of damaged stone veneer cladding and wood paneling) resulting from failure to co-ordinate with Consultant prior to rough-in.

1.15 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 request 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 minimum, space evenly and install neatly.

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

1.16 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.

1.17 PROTECTION OF WORK IN PROGRESS

.1 Protect Work completed or in progress.

.2 Prevent overloading of any part of the building. Do not cut, drill, or otherwise sleeve any load bearing structural member unless specifically indicated on drawings or in Specifications without written approval of the Consultant.

Part 2 Products

2.1 PRODUCT OPTIONS

.1 Products specified by reference standards or by description only: any product meeting those standards or description is acceptable for use.

.2 Products specified by naming one or more manufacturers: submit request for substitution for any manufacturer not named.

2.2 SUBSTITUTIONS

.1 Refer to Section 01 33 00 and B8 – Substitutes, of Bidding Procedures.

.2 The Work is based on the Materials and methods specified in the specifications.

.3 Should substitutions be required because of unavailability the Consultant will consider proposals to substitute specified products/materials with alternate products/materials.

.4 Substitutions are not allowed unless application has been made to and prior approval has been granted by the Consultant in writing.

.5 Each proposal must:

.1 Include sufficient information in the form of product data, specifications, drawings, and other manufacturer's data to enable the Consultant to properly evaluate the proposal.

.2 Identify changes required in the applicable Work which would become necessary to accommodate the substitute.

.6 The Consultant reserves the right to accept or reject any proposal without prejudice for any reason whatsoever and reserves the right to disclose or not to disclose their reasons for such rejection.

.7 In submittal of a request for substitution it is hereby understood that the person or entity submitting the request is certifying that the proposed substitute will fully perform the functions called for by the general design, be of equal or superior substance to that specified, is suited to the same use and capable of performing the same function as that specified and can be incorporated into the Work, strictly in accordance with the proposed work schedule.

Part 3 Execution

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Work of this Section consists of the supply and installation of City Furnished Products (CFP) as indicated.

.2 In addition to other responsibilities identified in this Section, the City will purchase new equipment under a separate supply and delivery contract with a Vendor, for installation by Base Bid Contractor or Vendor as identified by Planning Codes.

1.2 RELATED SECTIONS

.1 Section 01 31 00 – Project Management and Co-ordination.

.2 Section 01 33 00 – Submittal Procedures.

.3 Section 01 61 00 – Common Product Requirements.

.4 Section 01 74 00 – Cleaning and Waste Management.

1.3 DEFINITIONS

.1 Planning Codes:

.1 Planning Code A: New City Furnished Products (CFP-A), Contractor Installed.

.2 Planning Code B: New City Furnished Products (CFP-B), Vendor Installed (under contract to the City), Contractor Co-ordinated.

.2 Contractor: as defined in C1 – Definitions of the General Conditions for Construction.

.3 Vendor: equipment manufacturer or equipment manufacturer's authorized installation representative.

.4 Assemble or Assembly: fitting together of multiple components and accessories in accordance with manufacturer's printed instructions/manuals, and specifications.

.5 Install or Installation: providing structural support and/or blocking, placing into position, anchorage and adjusting of CFP as indicated by drawings, specifications and manufacturer's printed installation instructions/manuals.

.6 Connect or Connection: providing mechanical and electrical services and/or architectural and structural elements as indicated and required to interface with building services for proper operation, as indicated by drawings, specifications and manufacturer's printed installation instructions/manual.

1.4 SUBMITTALS

.1 Shop Drawings.

.1 The City to obtain and issue to Contractor, one (1) printed copy and one (1) electronic copy (when available), of manufacturer's product/equipment data, shop drawings, electrical and mechanical connections, installation instructions, O & M Manuals, and all other relevant information for each CFP to assist Contractor with his work.

.2 Contractor to review shop drawings and forward to Consultant in accordance with Section 01 33 00.

.2 Closeout Submittals.
- .1 The City to obtain and issue to Contractor, operating and maintenance instructions, parts lists, wiring diagrams, installation instructions/manuals, etc. for each CFP for incorporation into Operations and Maintenance Manual provided by Contractor as specified in Section 01 78 00.
- .2 Contractor to turn over to the City, spare parts, maintenance materials, maintenance manuals, etc. included with product delivery in accordance with Section 01 78 00.

.3 Certificates of Insurance.
- .1 Contractor to issue to the City, confirmation of insurance carried on CFP.

.4 Record Drawings.
- .1 Contractor to incorporate CFP into Project Record Drawings as specified in Section 01 78 00.

1.5 QUALITY ASSURANCE

.1 Vendor or Vendor's authorized representative to specialize in work of transporting in place, assembling and installing CFP identified, and have a minimum of 3 years documented experience and written approval from Vendor.

.2 Contractor to submit proof of Vendor or the Vendor's authorized representative qualifications to the City for approval.

1.6 DELIVERY, STORAGE AND HANDLING

.1 The City to arrange and pay for delivery of CFP in accordance with Contractor's construction schedule. Contractor to provide the City with delivery and packing slips accompanying deliveries.

.2 The City to inspect CFP delivered to site jointly with Contractor, and jointly record shortages and damaged or defective CFP. The City to submit claims for transportation damage of CFP, and arrange for replacement of damaged, defective, or missing CFP.

.3 Contractor to receive, unload, inventory, unpackage, transport, and set in place in designated room, CFP in accordance with Section 01 61 00.

.4 Contractor to be responsible for temporary storage in heated, secure, off-site facility including delivery charges for CFP that arrive to site but are not ready for installation due to Contractor's failure to conform to mutually agreed-upon schedule for the Work, or for delays Contractor is responsible.

1.7 SCHEDULING

.1 Contractor to provide the City with dates required for receipt of submittals as specified in this Section, and for required delivery dates of CFP to site for incorporation into project. Contractor to incorporate CFP installation dates into construction schedule.

.2 Contractor to be responsible for safety and overall co-ordination of CFP installed by Vendor or Vendor's authorized installation representative within overall project schedule, and ensure their attendance at regular project safety and toolbox meetings.

1.8 WARRANTY

.1 The City to obtain and issue to Contractor, copy of manufacturer's standard warranty documents for each City Furnished Product (CFP) for incorporation into Operations and Maintenance Manual by Contractor as specified in Section 01 78 00.

1.9 INSURANCE

.1 Contractor to include value of all new and existing City Furnished Products (CFP) under the Contract insurance policy.

.2 Insurance coverage for all new CFP shall commence on the date CFP is delivered to the Site and has been accepted by the City and Contractor.

.3 Insurance coverage for all existing CFP shall commence on the date the Contractor commences removal of the CFP from the existing location for incorporation into the location.

1.10 COMMISSIONING

.1 The City to arrange and pay for commissioning and certification of all installed CFP as required.

1.11 MAINTENANCE

.1 The City to obtain and pay for replacement parts and accessories and/or maintenance service as may be required to ensure existing CFP functions properly.

Part 2 Products

2.1 MANUFACTURED UNITS AND EQUIPMENT

.1 Automated self-check in: CFP-B

.2 Smart Lockers: CFP-A.

.3 CCTV/AV Equipment: CFP-B

Part 3 Execution

3.1 PREPARATION

.1 Contractor to develop and co-ordinate project schedule with the City and Vendor as applicable.

.2 Contractor to allow Vendor access to the site, and co-ordinate the work performed by the Vendor.

.3 Contractor to obtain from the City, manufacturer's shop drawings for CFP including mechanical and electrical requirements relating to details of service connections or rough-ins, and co-ordinate with Vendor as applicable.

.4 Contractor to provide necessary rough-ins for CFP including but not limited to, blocking, backing, supports, conduits, wiring, electrical boxes, piping, inserts, depressions, trimming, openings, drains, canting and core drilling as indicated on shop drawings and as directed by CFP Vendor.

3.2 INSTALLATION

.1 Planning Code: New City Furnished Products (CFP-A), Contractor Installed.

- .1 Contractor to receive, unload, inventory, unpackage, transport, and set new CFP in designated rooms.
- .2 Contractor to assemble, install and connect new CFP to architectural and/or structural elements and mechanical and/or electrical services as required. Anchor fixed components firmly, square, level, and plumb.
- .3 Contractor to co-ordinate final locations of services and equipment as shown on reviewed shop drawings and Contract Documents. Report any discrepancies to Consultant.

.4 Contractor to install new CFP including supplied trim pieces as applicable in strict accordance with manufacturer's printed instructions/manuals.

.5 Contractor to clean, lubricate, and perform initial start-up and testing to ensure proper function.

.6 Contractor to participate as required in the City arranged commissioning and certification.

.7 Contractor to repair or replace new CFP damaged by own forces on site (under Contractor control).

.2 Planning Code B: New City Furnished Products (CFP-B), Vendor Installed (under Contract to the City), Contractor Co-ordinated.

.1 Contractor to be responsible for preparation and co-ordination as described in item 3.1 Preparation.

.2 The City to employ the servicers of a Vendor for the installation of new CFP classified as Planning Code B.

.3 Installation costs for new CFP classified as Planning Code B are not included in Building Contract. Installation costs have been included in a separate Vendor contract with the City.

.4 Unless the Contractor and Vendor mutually agree otherwise, the Vendor shall:

.1 Receive, unload, inventory, unpackage, transport, and set new CFP in designated rooms.

.2 Assemble, install and connect new CFP to architectural and/or structural elements and mechanical and/or electrical services as required. Anchor fixed components firmly, square, level, and plumb.

.3 Clean, lubricate, and perform initial start-up and testing to ensure proper function.

.4 Install CFP including supplied trim pieces as applicable in strict accordance with manufacturer's printed instructions/manuals.

.5 Contractor and Vendor shall co-ordinate final locations of services and equipment as shown on reviewed shop drawings and Contract Documents. Report any discrepancies to Consultant.

.6 Clean, lubricate, adjust, and do initial start-up and testing to ensure proper function.

.7 Contractor and Vendor shall participate as required in City arranged commissioning and certification.

3.3 FIELD QUALITY CONTROL

.1 Manufacturer's Field Services.

.1 Contractor or Vendor (based on who is responsible for installation) to arrange for manufacturer's field services representative to co-ordinate mechanical and electrical rough-ins prior to and during installation and connection of CFP.

.2 Site Tests, Inspection.

.1 Contractor or Vendor (based on who is responsible for installation) to perform initial start-up of CFP with the City and manufacturer's representative present.

.2 Contractor to request inspection of installations as required by Authorities Having Jurisdiction.

3.4 ADJUSTING

.1 Contractor or Vendor (based on who is responsible for installation) to adjust and recalibrate components to assure proper alignment and operation, in accordance with the manufacturer's requirements.

.2 Repair (if acceptable to the City), or replace worn or damaged parts or improperly operating items with replacement parts supplied by the City.

3.5 CLEANING

.1 Contractor or Vendor (based on who is responsible for installation) to clean surfaces immediately after installation and adjustment to remove marks, soil and foreign matter.

.2 Prior to Substantial Completion, recheck components and perform required additional cleaning.

3.6 DEMONSTRATION

.1 The City will arrange for demonstration and maintenance instruction of CFP to facility personnel.

3.7 PROTECTION

.1 Contractor to provide protection from damage for all CFP.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 74 19 – Waste Management and Disposal.

1.2 REFERENCES

.1 American Society for Testing and Materials (ASTM).
- .1 ASTM E1971-05(2011), Standard Guide for Stewardship for the Cleaning of Commercial and Institutional Buildings.

.2 Canadian Federal Legislation.
- .1 Canadian Environmental Protection Act (CEPA).
- .2 Canadian Environmental Assessment Act (CEAA).
- .3 Transportation of Dangerous Goods Act (TDGA).
- .4 Motor Vehicle Safety Act (MVSA).

.3 Refer to C6 – Responsibilities of Contractor, in General Conditions for Construction.

1.3 QUALITY ASSURANCE

.1 Ensure all work is performed in compliance with CEPA, CEAA, TDGA, MVSA, and all applicable federal and provincial regulations.

.2 Except for items specifically noted, waste or abandoned materials and equipment are Contractor's property and must be promptly removed from site.

.3 Equipment and re-useable items remain property of the City and must be stored as directed.

1.4 POLLUTION CONTROL

.1 Maintain pollution control features installed under this contract.

.2 Ensure proper disposal procedures as indicated herein are maintained throughout project.

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

.4 Prevent sanding dust and other extraneous materials from contaminating air beyond application area by providing temporary enclosures.

1.5 FIRES

.1 Fires and burning of rubbish on site not permitted

1.6 WASTE MANAGEMENT

.1 Refer also to Section 01 74 19.

.2 Provide on-site covered commercial waste containers for collection of non-hazardous waste materials and debris. Keep containers covered to minimize spread of dust or other contaminants. Deposit waste in containers as work progresses and at end of each working day.

.3 Place materials defined as hazardous, volatile, or toxic waste in special metal containers designated for hazardous waste and dispose of at end of each working day.

.4 Waste Management and Disposal.
- .1 Separate and recycle packaging and waste materials to maximum extent economically possible.
- .2 Collect and separate plastic, paper packaging, and corrugated cardboard in designated areas for recycling as work proceeds and at completion of the work.

.3 Separate wood waste and place in designated areas in following categories for disposal or recycling: solid wood/softwood/hardwood, and treated, painted, or contaminated wood.
.4 Set aside damaged wood and dimensional lumber off-cuts for approved alternative uses (e.g. blocking).
.5 Collect, package and store partially used or unused containers of asphalt, sealing compound, primer and roofing felts for recycling.
.6 Place materials defined as hazardous or toxic waste in designated containers.
.7 Use least toxic sealants, adhesives, sealers, and finishes necessary to comply with requirements of this Section.
.8 Close and seal tightly, all partly used sealant containers and store protected in well ventilated fire-safe area at moderate temperature.
.9 Place used sealant tubes and other containers in areas designated for hazardous materials.
.10 Unused paint, caulking, and sealing compound materials must be disposed of at an official hazardous material collections site in accordance with legislation and authorities having jurisdiction. Do not dispose into sewer system, onto ground or in other location where it will pose health or environmental hazard.
.11 Ensure all emptied containers are sealed and stored safely for disposal.
.12 Fold up metal banding, flatten, and place in designated area for recycling.
.13 Plan and co-ordinate insulation work to minimize generation of waste.
.14 Designate on-site location for containers which facilitate recyclable materials without hindering daily operations.

1.7 DISPOSAL OF NON-HAZARDOUS WASTE

.1 Do not sell or bury rubbish on site.

.2 Obtain approval and pay for use of off-site municipal collection or local dump or sanitary landfill sites, depending upon materials involved in accordance with authorities having jurisdiction.

.3 Where recycling is available, collect waste by type and co-ordinate pickup or delivery to recycling or collection facility.

1.8 DISPOSAL OF HAZARDOUS WASTE

.1 Obtain legislation governing disposal of hazardous and toxic materials, and pay for disposal of these materials in accordance with this legislation and authorities having jurisdiction and requirements of contract documents.

.2 Do not dispose of water or volatile materials such as: mineral spirits, oil, petroleum based lubricants, or toxic cleaning solutions into watercourses, storm or sanitary sewers.

1.9 DRAINAGE

.1 Do not pump water containing suspended material into waterways, sewer or drainage systems.

.2 Control disposal of water containing suspended material or other harmful substances in accordance with local authority requirements.

Part 2 Products

Part 3 Execution

3.1 PROGRESSIVE CLEANING

.1 Maintain cleanliness of work and surrounding site to comply with federal, provincial, and local fire and safety laws, ordinances, codes, and regulations.

.2 Co-ordinate cleaning operations with disposal operations to prevent accumulation of dust, dirt, debris, rubbish, and waste materials that will create hazardous conditions.

.3 Vacuum clean interior areas prior to start of finish work, and maintain areas free of dust and other contaminants during finishing operations. Continue vacuum cleaning on an as-needed basis until building is ready for substantial completion or occupancy.

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

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

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

3.2 FINAL CLEANING

.1 When work is Substantially Performed, remove surplus products, tools, construction machinery and equipment not required for performance of remaining work. Conduct inspection of sight exposed interior and exterior surfaces.

.2 Leave the work 'broom clean' before the inspection process commences.

.3 Clean and polish glass, mirrors, hardware, wall tile, stainless steel, chrome, porcelain enamel or baked enamel. Replace broken, scratched or disfigured glass.

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

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

.6 Vacuum clean and dust building interiors, behind grilles, louvers and screens.

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

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

.9 Clean equipment and fixtures to a sanitary condition, clean or replace filters of mechanical equipment.

.10 Inspect finishes, fitments and equipment and ensure proper workmanship and operation.

.11 Broom clean and wash exterior walks, steps and platforms.

.12 Broom clean parking lots, pads and paving accessible to vehicle traffic.

.13 Remove dirt and other disfigurations from exterior surfaces.

.14 Clean and sweep roofs, gutters, areaways, sunken wells.

.15 Sweep and wash clean paved areas. Rake clean other surfaces of grounds.

END OF SECTION

Part 1 General

1.1 SECTION OVERVIEW

.1 Work in this Section includes, but is not limited to, requirements for Construction and Demolition Waste Management during construction, which forms the Contractor's commitment for Green Globes credit 1.5.4.1 – Construction Waste

.2 Waste Management Plan that provides guidance on a logical progression of tasks and procedures to be followed in a pollution prevention program to reduce or eliminate the generation of waste, the loss of natural resources, and process emissions through source reduction, reuse, recycling, and reclamation.

.3 Monthly Progress Reports indicating cumulative totals representing progress towards achieving a minimum of 50% diversion of waste materials from landfill, including at least three waste diversion streams.

.4 Identifying any special programs, landfill options or alternatives to landfill.

.5 The City has established that this Project shall generate the least amount of waste possible and that processes that ensure the generation of as little waste as possible due to error, poor planning, breakage, mishandling, contamination, or other factors be employed by the Contractor.

.6 The City recognizes that waste in any project is inevitable, but indicates that as much of the waste materials as economically feasible shall be reused, salvaged, or recycled in order to divert materials away from landfill.

1.2 RELATED SECTIONS

.1 01 33 29 General Green Globes Requirements

1.3 DEFINITIONS

.1 **Waste Streams.** A waste stream can be either of the following:

.1 A specific material category that is diverted in a specific way (plastic, metals, etc.); or

.2 A mixture of several material categories that are diverted in a specific way (materials sent to reuse markets, commingled waste sent to mixed waste recycling facility, source separation where each material is sent to a specific facility, manufacturers or suppliers take-back of materials, and reuse of deconstructed materials on site).

1.4 REFERENCES

.1 Canadian Construction Association Standard Construction Document :

.1 CCA 27-1997: A Guide on Construction Environmental Management Planning.

.2 CCA 81-2001: A Best Practices Guide to Solid Waste Reduction.

.2 **Canada. Public Works and Government Services Canada.** 2002 National Construction Renovation and Demolition Non-Hazardous Solid Waste Management Protocol.

1.5 GENERAL

.1 Minimize the amount of solid waste (including land-clearing debris) generated by construction, renovation and demolition (CRD) activities.

.2 Meet the requirements by writing a Construction and Demolition Waste Management Plan and issuing a Total Construction Waste Report.

.3 Of the inevitable solid waste (including land-clearing debris) that is generated by CRD activities, divert more than 50% from landfill using at least three different waste steams

.4 Comply with all applicable local environmental regulations related to waste management and pollution control.

.5 Comply with Canadian Construction Association's "Code of Practice" outlined in Standard Construction Document CCA 27-1997 to encourage improved waste management practices. Prevent loss of soil during construction by stormwater runoff and/or wind erosion, including protecting topsoil by stockpiling for reuse.

Part 2 Description of Work

2.1 GENERAL

.1 A Green Globes Champion (site superintendent or other individual designated by the Contractor) shall be responsible for coordinating all aspects of Green Globes coordination (during construction) related to construction waste management and disposal

.2 Construction Waste Management activities shall include:

.1 Arranging waste management service agreements with waste haulers and waste receiving facilities

.2 Supervising on-site waste management activities on a daily basis

.3 Coordinating waste management tasks with subcontractors to ensure timely and orderly progress of the work

.4 Preparing waste management documentation and submittals to summarize all shipments of waste materials from the project site

.5 Reporting waste management progress to the Consultant

Part 3 Submittals

3.1 CONSTRUCTION AND DEMOLITION WASTE MANAGEMENT PLANNING:

.1 Submit a Construction and Demolition Waste Management Plan to the Consultant for approval a minimum of 14 days prior to construction

.2 The plan shall include the following:

.1 Establish waste diversion goals for the project by identifying at least five materials (both structural and nonstructural) targeted for diversion. Include an approximation of the overall project waste that these materials represent.

.1 Specify whether materials will be separated on site or comingled

.2 Describe the diversion strategies planned for the project and account for all materials, including land-clearing debris, alternate daily cover, and other materials.

.3 Describe specifically to which facility diverted materials will be taken and how the recycling facility will process the materials. Include letters for each receiving facility confirming the end use of the materials.

.4 Describe methods for safe removal and disposal of hazardous materials. Hazardous materials must be tracked separately and not included in the projects total waste.

.5 If there are existing on-site materials that are suitable for re-use, reuse existing on-site materials for site development or landscaping (e.g. crushing concrete for aggregate base or drain rock, shredding vegetative materials for mulch, etc.)

.3 Submit a final Total Construction Waste Report detailing all major waste streams generated, including disposal and diversion rates

3.2 CONSTRUCTION AND DEMOLITION WASTE MANAGEMENT TRACKING:

.1 Submit the following on a monthly basis to track waste diversion performance throughout construction

.1 Waybills, invoices, letters and other documentation that clearly indicates the receiving facility, end use (reused, recycled or landfill) and quantity of waste for each shipment of waste generated on the project site. Record each shipment using the Waste Tracking Log

.2 Submit an up-to-date copy of the Waste Tracking Log, including records of each waste shipment and the following associated information:

.1 Date of shipment

.2 Waste hauler

.3 Recycling Receiving Facility

.4 Waybill and/or invoice number with corresponding landfilled Mass and/or recycled material mass. Materials are to be recorded by type (ex. Gypsum, wood, concrete, plastic, metal, cardboard, etc.)

.5 Total mass of each recycled material type and landfilled mass

.6 Calculated diversion rate

Part 4 Products

4.1 NOT USED

Part 5 Execution

5.1 WASTE MANAGEMENT PLAN IMPLEMENTATION

.1 Waste Reduction

.1 Encourage Suppliers and Subcontractors to retrieve/retain packaging (i.e. skids, plastic wrap, etc.) for reuse

.2 Suppliers and sub-contractors must provide a letter stating the item(s) will be reused and documenting the quantity removed from the site

.3 Prevent damage of materials due to mishandling, improper storage, and contamination

.4 Where possible, use prefabricated assemblies built at a central facility to avoid waste generation at the site

.5 Contact local salvaging/recycling facilities and arrange for recycling/reuse services. At a minimum, the proposed facilities must recycle/reuse the following waste materials that will be generated throughout construction:

.1 Land clearing debris

.2 Asphalt

.3 Concrete/masonry/stone

.4 Steel and other metals

.5 Wood

.6 Gypsum

.7 Cardboard

.8 Plastic

.6 Exclude excavated soil, land-clearing debris, and alternative daily cover (ADC).

.7 Include wood waste converted to fuel (biofuel) in the calculations; other types of waste-to-energy are not considered diversion for this credit.

.8 Provide a Construction and Demolition Waste Management Plan to the Consultant for approval a minimum of 14 days prior to construction

.9 Contractor shall distribute copies of the Construction and Demolition Waste Management Plan to the Job Site Foreman and each Subcontractor

.2 If there are existing on-site materials that are suitable for re-use, reuse existing on-site materials for site development or landscaping (e.g. crushing concrete for aggregate base or drain rock, shredding vegetative materials for mulch, etc.)

.3 Contractor shall provide on-site instruction of appropriate separation, handling, and recycling, salvage, reuse, composting and return methods to be used by all parties at the appropriate stages of the Project.

.4 Contractor shall layout and label a specific area to facilitate separation of materials for potential recycling, salvage, reuse, composting and return. Recycling and waste bin areas are to be kept neat and clean and clearly marked in order to avoid contamination of materials.

.5 Hazardous wastes shall be separated, stored, and disposed of according to local regulations.

.6 Complete and submit Waste Tracking Log along with waybills, invoices, letters and other documentation to the Consultant on a monthly basis, as outlined in Paragraph 3.2.

.7 Conduct daily inspections of material separation bins to check for and remedy cross-contamination

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 31 00 – Project Management and Co-ordination.

.2 Section 01 33 00 – Submittals Procedures.

1.2 ADMINISTRATIVE REQUIREMENTS

.1 Refer to D31 – Warranty, of Supplemental Conditions and C13 – Warranty, of General Conditions for Construction.

.2 Pre-warranty Meeting:

- .1 Convene meeting one (1) week prior to contract completion with Contractor's representative, the City and Consultant:
  - .1 Verify Project requirements.
  - .2 Review manufacturer's installation instructions and warranty requirements.
- .2 Consultant 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 INFORMATION SUBMITTALS

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

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

.3 Submit one (1) electronic copy in Adobe PDF format, plus one (1) hard copy to Consultant for his review prior to submitting final copies. One (1) copy will be returned after final review, with Consultant's comments.

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

.5 Submit to Consultant, two (2) weeks prior to Substantial Performance of the Work, final revised copies of operating and maintenance manuals, in English, consisting of one (1) electronic copy in PDF format, plus three (3) hard copies.

.6 Ensure spare parts, maintenance materials and special tools provided are new, undamaged or defective, and of same quality and manufacture as products provided in Work.

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

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

.9 Pay costs of transportation.

1.4 AS-BUILT DOCUMENTS AND SAMPLES

.1 Maintain, in addition to requirements in General Conditions, at the site for Consultant one record copy of:

- .1 Contract Drawings.
- .2 Specifications.

.3 Addenda.
.4 Change Orders and other modifications to the Contract.
.5 Reviewed shop drawings, product data, and samples.
.6 Field test records.
.7 Inspection certificates.
.8 Manufacturer's certificates.

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

.3 Label record documents and file in accordance with Section number listings in List of Contents of this Project Manual. Label each document "PROJECT RECORD" in neat, large, printed letters.

.4 Maintain record documents in clean, dry and legible condition. Do not use record documents for construction purposes.

.5 Keep record documents and samples available for review by Consultant.

1.5 PROJECT RECORD DOCUMENTS

.1 Maintain at construction site, three sets of white prints for record drawing purposes. Mark one set "FIELD DRAWINGS" and use to record initial data when field measurements are made. Mark other two sets "RECORD DRAWINGS".

.2 Store record drawings in field office apart from other documents used for construction. Maintain record drawings in clean, dry and legible condition. Do not use record drawings for construction purposes.

.3 Record "as-built" information in red ink, accurately and concurrently with construction progress. Do not conceal work until required information is recorded.

.4 Legibly mark each item to record actual construction, including:
.1 Measured depths of elements of foundation in relation to finish first floor datum.
.2 Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
.3 Measured locations of internal utilities and appurtenances, referenced to visible and accessible features of construction.
.4 Field changes of dimension and detail.
.5 Changes made by Addenda, Change Order and Field Instruction.
.6 Details not on original Contract Drawings.
.7 References to related shop drawings and modifications.

.5 Specifications: legibly mark each item to record actual construction, including:
.1 Manufacturer, trade name, and catalogue number of each product actually installed, particularly optional items and substitute items.
.2 Changes made by Addenda and change orders.

.6 Other Documents: maintain manufacturer's certifications, inspection certifications, field test records, required by individual specifications sections.

.7 Provide digital photos, if requested, for site records.

.8 At completion of project and prior to final review, neatly transfer "as-built" notations to second and third set of white prints and submit to Consultant along with field drawings. In addition, submit AutoCAD disks of project with all changes relined to reflect "as-built" conditions. Drawings must be generated in most current AutoCAD version, and consistent with Bid Documents prepared in AutoCAD 2019.
.1 For Contractors' use in preparation of "as-built" drawings required under this contract, Contractors may purchase from Consultant, electronic AutoCAD drawing files in accordance with Section 01 33 00.

1.6 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 all items.
  - .1 Submit inventory listing to Consultant.
  - .2 Include approved listings in Maintenance Manual.
- .5 Obtain receipt for delivered products and submit prior to final payment.

.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 all items.
  - .1 Submit inventory listing to Consultant.
  - .2 Include approved listings in Maintenance Manual.
- .5 Obtain receipt for delivered products and submit prior to final payment.

.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 all items.
  - .1 Submit inventory listing to Consultant.
  - .2 Include approved listings in Maintenance Manual.

.4 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 to satisfaction of Consultant.

1.7 OPERATION AND MAINTENANCE MANUALS

.1 Prepare Operation and Maintenance Manuals for each Architectural, Mechanical and Electrical component of project.

.2 Format.
- .1 Organize data in form of an instructional manual.
- .2 Binders: vinyl, hard covered, 3 “D” ring, loose leaf spine and fact pockets.
- .3 When multiple binders are used, correlate data into related consistent groupings. Identify contents of each binder on spine.
- .4 Cover: Identify each binder with printed title “Operation and Maintenance Manual”; list title of project and identify subject matter of contents.
- .5 Arrange content under Section numbers and sequence of Table of Contents.
- .6 Provide tabbed fly leaf for each separate product and system, with typed description of product and major component parts of equipment.
- .7 Text: Manufacturer’s printed data, or typewritten data.
- .8 Drawings: provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pates.

.3 Contents (each volume).
- .1 Table of Contents: provide title of project; date of submission; names, addresses, and telephone numbers of Consultant and Contractor with name of responsible parties; schedule of products and systems, indexed to content of volume.
- .2 For each product of system; list names, addresses and telephone numbers of subcontractors and suppliers, including local source of supplies and replacement arts.
- .3 Product Data; Mark each sheet to clearly identify specific products and component parts and data applicable to installation; delete inapplicable information.
- .4 Drawings: supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams.
- .5 Typewritten Text: as required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions specified.

.4 Equipment and Systems.
- .1 Panel board circuit directories: provide electrical service characteristics, controls, and communications.
- .2 Include installed colour coded wiring diagrams.
- .3 Operating Procedures: Include complete list of equipment and parts list. Indicate nameplate information such as make, size, capacity, serial number. Provide written explanation of operation of each system with instructions for trouble shooting of operational failures. Include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.
- .4 Maintenance Requirements: Include routine procedures and guide for trouble-shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.
- .5 Provide servicing and lubrication schedule, and list of lubricants required.
- .6 Include manufacturer's printed operation and maintenance instructions.
- .7 Include sequence of operation by controls manufacturer.
- .8 Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.
- .9 Provide installed control diagrams by controls manufacturer.
- .10 Provide Contractor's co-ordination drawings, with installed colour coded piping diagrams.
- .11 Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.
- .12 Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.
- .13 Include test and balancing reports as specified.
- .14 Additional requirements: including one complete set of final reviewed and stamped shop drawings; cop of hardware and paint schedules; requirements specified in individual specification sections.

.5 Materials and Finishes.
- .1 Building Products, Applied Materials and Finishes: include product data, with catalogue number, size, composition, and colour and texture designations. Provide information for re-ordering custom manufactured products as applicable.
- .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.

1.8 EQUIPMENT AND SYSTEMS

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

.2 Panel board circuit directories: provide electrical service characteristics, controls, and communications.

.3 Include installed colour coded wiring diagrams.

.4 Operating Procedures: include start-up, break-in, and routine normal operating instructions and sequences.
  .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 co-ordination 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.

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

1.9 CONSTRUCTION PHOTOGRAPHS

.1 Submit construction photographs as specified in Section 01 31 00.

1.10 WARRANTIES AND BONDS

.1 Refer to D31 – Warranty, of Supplemental Conditions and C13 – Warranty, of General Conditions for Construction.

.2 Develop warranty management plan to contain information relevant to Warranties.

.3 Submit warranty management plan, 30 days before planned pre-warranty conference, to Consultant approval.

.4 Warranty management plan to include required actions and documents to assure that Consultant receives warranties to which it is entitled.

.5 Provide plan in narrative form and contain sufficient detail to make it suitable for use by future maintenance and repair personnel.

.6 Submit, warranty information made available during construction phase, to Consultant for approval prior to each monthly pay estimate.

.7 Assemble approved information in binder, submit upon acceptance of work and organize binder as follows:
- .1 Separate each warranty or bond with index tab sheets keyed to Table of Contents listing.
- .2 List subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.
- .3 Obtain warranties and bonds, executed in duplicate by subcontractors, suppliers, and manufacturers, within ten (10) Working 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.

.8 Include information contained in warranty management plan as follows:
- .1 Roles and responsibilities of personnel associated with warranty process, including points of contact and telephone numbers within the organizations of Contractors, subcontractors, manufacturers or suppliers involved.
- .2 Listing and status of delivery of Certificates of Warranty for extended warranty items, to include roofs, HVAC balancing, pumps, motors, transformers, and commissioned systems such as fire protection, alarm systems, sprinkler systems, lightning protection systems, .
- .3 Provide list for each warranted equipment, item, feature of construction or system indicating:
  - .1 Name of item.
  - .2 Model and serial numbers.
  - .3 Location where installed.
  - .4 Name and phone numbers of manufacturers or suppliers.
  - .5 Names, addresses and telephone numbers of sources of spare parts.
  - .6 Warranties and terms of warranty: include one-year overall warranty of construction. Indicate items that have extended warranties and show separate warranty expiration dates.
  - .7 Cross-reference to warranty certificates as applicable.
  - .8 Starting point and duration of warranty period.
  - .9 Summary of maintenance procedures required to continue warranty in force.
  - .10 Cross-Reference to specific pertinent Operation and Maintenance manuals.
  - .11 Organization, names and phone numbers of persons to call for warranty service.
  - .12 Typical response time and repair time expected for various warranted equipment.
- .4 Contractor's plans for attendance at four (4) and nine (9) month post-construction warranty inspections.
- .5 Procedure and status of tagging of equipment covered by extended warranties.
- .6 Post copies of instructions near selected pieces of equipment where operation is critical for warranty and/or safety reasons.

.9 Respond in timely manner to oral or written notification of required construction warranty repair work.

.10 Written verification to follow oral instructions:
- .1 Failure to respond will be cause for the Consultant to proceed with action against Contractor.

.11 Warranty Tags
- .1 Tag, at time of installation, each warranted item. Provide durable, oil and water resistant tag approved by Consultant.
- .2 Attach tags with copper wire and spray with waterproof silicone coating.

.3 Leave date of acceptance until project is accepted for occupancy.
.4 Indicate following information on tag:
  .1 Type of product/material.
  .2 Model number.
  .3 Serial number.
  .4 Contract number.
  .5 Warranty period.
  .6 Inspector's signature.
  .7 Construction Contractor.

Part 2 Products

Part 3 Execution

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 64 00 – City Furnished Products.

.2 Section 01 78 00 – Closeout Submittals.

1.2 DESCRIPTION

.1 Provide comprehensive demonstration and training program to the City's personnel on operation and maintenance of all Contractor supplied and installed equipment and systems. This program to commence two (2) weeks prior to date of Substantial Performance of the Work.

.2 The City will provide list of personnel to receive demonstration and training, and will co-ordinate their attendance at agreed-upon times.

.3 Schedule demonstration and training sessions by manufacturer's authorized representative, and provide manufacturer produced training manuals and CD's if available for demonstration purposes.

.4 In event that manufacturer produced training CD's are not available, video record demonstration and training sessions digitally recorded on CD in following formats: Real Player, Windows Media Player, and Quicktime.

1.3 SUBMITTALS

.1 Submit proposed schedule of time and date for demonstration and training of each item of equipment and each system prior to designated dates, for the City's approval.

.2 Submit report within one week after completion of each demonstration and training session, that session has been satisfactorily completed. Identify time and date of each session, including list of the City's personnel present.

1.4 CONDITIONS FOR DEMONSTRATION AND TRAINING

.1 Equipment and systems have been reviewed by Consultant.

.2 Testing, adjusting, and balancing has been performed and equipment and systems are fully operational.

.3 Provide copies of completed operation and maintenance manuals and test reports for use in demonstrations and instructions.

1.5 DEMONSTRATION AND TRAINING

.1 Demonstration and training to include start-up, operation, control, adjustment, trouble-shooting, servicing and maintenance of each item of equipment at scheduled times, at equipment location.

.2 Instruct the City's personnel in all aspects of operation and maintenance of equipment and systems referencing manufacturer's operation and maintenance manuals.

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

.4 Perform demonstration and training program provided under Contract to the City's satisfaction by quality persons knowledgeable in operation and maintenance of installed equipment and systems, and for duration acceptable to the City.

Part 2 Products

Part 3 Execution

END OF SECTION

Part 1 General

1.1 SECTION OVERVIEW

.1 Work in this Section includes, but is not limited to, requirements for Indoor Air Quality (IAQ) Management during construction, which forms the Contractor's commitment for Green Globes Credits 1.1.2.3 Mold Mitigation During Construction, 1.1.2.4 IAQ During Construction and 1.7.2.9 Other Indoor Pollutants as follows:

.1 Contractor's responsibilities for development and implementation of an IAQ Management Plan.

.2 Contractor's responsibilities to confirm compliance with IAQ Management Plan before building occupancy by testing air quality or providing a building flush using 100% fresh air.

1.2 RELATED SECTIONS

.1 01 33 29 General Green Globes Requirements

1.3 REFERENCES

.1 **American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE):** ANSI/ASHRAE 52.2-2007 Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size.

.2 **American Society for Testing and Materials (ASTM):**

.1 ASTM D5197–09e1 Standard Test Method for Determination of Formaldehyde and Other Carbonyl Compounds in Air (Active Sampler Methodology).

.2 ASTM D5149–02(2008) Standard Test Method for Ozone in the Atmosphere: Continuous Measurement by Ethylene Chemiluminescence.

.3 **California Department of Public Health**, Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources using Environmental Chambers, v1.1–2010.

.4 **ISO - International Organization for Standardization**

.1 ISO 16000-3, Indoor air–Part 3: Determination of formaldehyde and other carbonyl compounds in indoor air and test chamber air—Active sampling.

.2 ISO 16000-6, Indoor air–Part 6: Determination of volatile organic compounds in indoor and test chamber air by active sampling on Tenax TA sorbent, thermal desorption and gas chromatography using MS or MS-FID.

.3 ISO 4224 Ambient air—Determination of carbon monoxide—Nondispersive infrared spectrometric method.

.4 ISO 7708 Air quality—Particle size fraction definitions for health-related sampling.

.5 ISO 13964 Air quality—Determination of ozone in ambient air—Ultraviolet photometric method.

.5 **Sheet Metal and Air Conditioning Contractors National Association (SMACNA):** SMACNA IAQ Guidelines for Occupied Buildings under Construction 2nd Edition 2007, ANSI/ SMACNA 008-2008 (Chapter 3)

.6 **CCA 82-2004:** Mould Guidelines for the Canadian Construction industry http://www.cca-acc.com/documents/electronic/cca82/cca82.asp

.7 **U.S. EPA United States Environmental Protection Agency**

.1 U.S. EPA Compendium of Methods for the Determination of Air Pollutants in Indoor Air, IP-1: Volatile Organic Compounds, IP-3: Carbon Monoxide and Carbon Dioxide, IP-6: Formaldehyde and other aldehydes/ketones, IP-10 Volatile Organic Compounds

.2 U.S. EPA Compendium of Methods for the Determination of Inorganic Compounds in Ambient Air, TO-1: Volatile Organic Compounds, TO-11: Formaldehyde, TO-15: Volatile Organic Compounds, TO-17: Volatile Organic Compounds.

1.4 GENERAL

.1 If parts of the building will be occupied during construction, meet or exceed the recommended Design Approaches of the Sheet Metal and Air Conditioning Contractors National Association 2nd Edition 2007, ANSI / SMACNA 008-2008, Chapter 3.

.2 Protect construction workers and future building occupants from indoor air quality problems resulting from construction activities.

.3 Reduce the production and circulation of pollutants during construction.

.4 Protect equipment and absorptive materials stored and installed on-site from moisture, dust and dirt accumulation during construction.

.5 Prepare the building for occupancy following construction and prior to occupancy.

1.5 DESCRIPTION OF WORK

.1 A Green Globes Champion (site superintendent or other individual designated by the Contractor) shall be responsible for coordinating all aspects of Green Globes coordination (during construction) related to indoor air quality.

.2 Indoor Air Quality Management activities shall include:

.1 Identifying, implementing and documenting measures to achieve the indoor air quality management objectives

.2 Supervising on-site indoor air quality management activities on a daily basis

.3 Coordinating indoor air quality management tasks with subcontractors to ensure timely and orderly progress of the work

.4 Conducting indoor air quality management inspections and making necessary repairs

.5 Maintaining an indoor air quality inspection log to document observations, deficiencies and corrective actions

.6 Preparing indoor air quality management documentation and submittals as detailed herein

.7 Reporting indoor air quality management progress to the Consultant

1.6 SUBMITTALS

.1 Submit an Indoor Air Quality Management Plan to the Consultant for approval a minimum of 14 days prior to construction. The plan shall include the following:

- .1 Specify procedures for protecting stored and installed absorptive materials from moisture damage.
- .2 Highlight the non-smoking policy. Prohibit the use of tobacco products inside the building and within 7.5 meters, or more if required by the local jurisdiction, of the building entrance at all times and provide signage at all building entrances.
- .3 If parts of the building will be occupied during construction, outline approach to all five SMACNA Guidelines and measures that will be in place to ensure guidelines are met.
  - .1 HVAC Protection
  - .2 Source Control
  - .3 Pathway Interruption
  - .4 Housekeeping
  - .5 Scheduling
- .4 Building flush-out and/or indoor air quality testing procedures prior to occupancy.
- .5 Best-practices to protect building materials and control mold.
- .6 Inspections and reporting procedures.

.2 Submit completed Schedule I1 – Indoor Air Quality Inspection Log on a monthly basis.

- .1 Inspections shall commence when building is enclosed or duct work installation starts and carry through to building turnover.
- .2 The inspection log shall be completed for each weekly inspection and document:
  - .1 Indoor air quality management measures implemented on site
  - .2 Condition of each measure
  - .3 Deficiencies and corrective actions taken to remedy the deficiencies
  - .4 Three different photos are to be provided for each measure listed on the inspection log.
    - .1 Photos are to be provided in .jpeg format
    - .2 Photos are to be date stamped, indicating Year, Month, and Day
- .3 Submit completed inspection logs to the Consultant on a monthly basis.

Part 2 Products

2.1 NOT USED

Part 3 Execution

3.1 INDOOR AIR QUALITY MANAGEMENT PLAN IMPLEMENTATION

.1 Develop and implement an Indoor Air Quality Plan in accordance with Submittals section 1.6.1 above, including the five SMACNA Indoor Air Quality Management Practices as follows:

.1 Source Control

.1 Identify potential sources of indoor air pollutants on construction site.

.1 Any construction activity or material producing odour and/or dust is considered a source of air pollutant. Pollutant sources include but are not limited to:

Odour Emitting Products	Dust Creating Products
Paints	Concrete
Caulking	Insulation
Stain	Acoustic
Fuels	Ceiling Tile
Sealants	Wood Products
Grouts	Gypsum Board
Pesticides	Ceramic Tile
Epoxy Flooring	
Coatings	
Solvents	
Adhesives	
Cleaning Products	
Combustion/Odour Emitting Equipment	**Pollutant Disrupting Activities**
Generators	Demolition
Vehicles	Repair
Torches / Welders	Renovation
Soldering Guns	Exterior Site Work
Compressors	Standing Water
Portable Heaters	Tobacco Smoke

.2 Minimize pollutants generated inside building from sources identified in 3.1 using following measures:

.1 Prohibiting the use of tobacco products (smoking, e-cigarettes, chewing tobacco, etc.) inside building and within 7.5m of all building entrances at all times during construction

.2 Fueling up equipment outside building

.3 Storing gasoline or solvents outside building

.4 Restricting outdoor vehicular/equipment traffic and operation where emissions can enter building

.5 Reducing on-site emissions by using equipment that burns propane/natural gas or is powered by electricity

.6 Exhausting pollutant sources directly outside using temporary or permanent ventilation equipment. Where exhaust is not feasible, locally re-circulate air through a portable air cleaner

.7 Collecting and bagging sawdust from woodworking tools

.8 Covering and/or sealing indoor sources of odour and dust

.9 Using painting techniques minimizing odour (e.g roller instead of spraying)

.10 Using cleaning practices minimizing dust (e.g. vacuum instead of sweeping)

.11 Using cleaning Products minimizing pollution, fumes, VOC's, etc.

.2 Pathway Interruption

.1 Prevent movement of pollutants from sources identified under "Pollutant Source Identification" to other areas in building using following measures:

.2 When possible, perform pollutant generating activities outside building

.3 Move equipment, work and other pollutant sources to locations where they will have minimum impact on indoor air quality

.4 Setup small, contained, designated work areas to contain pollutants

.5 Avoid open areas and areas with high drafts

.6 Erect dust curtains and barriers

.7 Depressurize areas using temporary or permanent ventilation equipment.

.8 Use portable fans to exhaust pollutants (e.g. gas engine exhaust) to exterior through windows, doors, etc. Ensure adjacent windows, doors, etc. will not allow pollutants to re-enter building

.9 Close windows and doors adjacent to pollutant sources (e.g. dust, vehicle emissions, etc.) outside of building. If windows and doors have not been installed, temporarily seal exterior openings with plastic, wood, etc.

.10 Pressurize occupied or completed areas of building using temporary or permanent ventilation equipment

.11 Prohibiting burning of garbage.

.3 Housekeeping

.1 Prevent accumulation of moisture, dust and dirt in building from sources identified under "Pollutant Source Identification" using following measures:

.2 Frequently cleaning interior surfaces to minimize dust and dirt accumulation by:

.3 Dusting with damp rags

.4 Wet mopping

.5 Sweeping using wetting agents and sweeping compounds

.6 Vacuuming with equipment containing HEPA filtration and/or a wet scrubber

.7 Localized cleaning should occur immediately after a construction activity is completed and/or at end of each Day. Perform a full building clean-up at least once a week.

.8 Close exterior windows and doors or create temporary enclosures using plastic or wood to prevent moisture accumulation indoors.

.9 Immediately remove any water accumulated indoors to protect interior surfaces and materials.

.10 Cover, seal and protect materials stored and installed on-site from moisture, dust and dirt accumulation.

.11 Elevate materials stored on-site off ground to protect from moisture and dirt accumulation.

.12 Do not install materials with evidence of moisture damage or excessive moisture accumulation.

.13 If necessary, use ventilation/dehumidification to control humidity levels within the building.

.14 Promptly clean spills (fuels, lubricants, paints, adhesives, etc.).

.15 Clean or remove excess application of solvent-containing Products.

.4 HVAC Protection

.1 Before and during Installation:

.1 Cover (with plastic) and elevate (off ground) ductwork, fittings, insulation, acoustic lining and equipment stored on site during construction.

.2 Seal supply, return and exhaust openings as well as temporary ductwork openings not under immediate work (e.g. open ends in ductwork runs) with plastic. Seal openings immediately after installation in areas that will no longer be under work.

.3 Close or cover hatches and access doors in HVAC equipment that will not be under work.

.4 Seal HVAC equipment openings (e.g. inlets or outlets of air handlers, fans, VAV boxes, etc.) with plastic until ductwork is connected.

.5 Do not use mechanical rooms to store or collect construction waste materials.

.6 Install ceiling tiles and seal openings into plenum with plastic prior to final cleaning.

.2 After Installation (select Option 1 or Option 2 for each HVAC system):

.1 Option 1: HVAC Equipment Not Used During Construction (Recommended):

.1 Do not operate any permanent HVAC equipment or systems during construction.

.2 Seal openings in HVAC systems, ductwork and plenums.

.3 If HVAC system protection measures are not implemented, or if system is operated during construction, Contractor must provide duct cleaning services, plus necessary access doors, at no extra cost to Contract.

.4 After construction and final cleaning work is complete Contractor shall:

.5 Remove HVAC protection measures.

.6 Install new filters in air handling equipment.

.7 Start-up systems.

.8 Prepare systems for Testing, Adjusting and Balancing Contractor and Commissioning Agent.

.2 Option 2: HVAC Equipment Used During Construction:

.1 Install new filters in air handling equipment before any HVAC system is operated. Provide a duct-mounted filter (external to equipment) if necessary.

.2 Install new filters with a minimum efficiency reporting value (MERV) of 8 at each return air grille and return or transfer duct inlet opening such that there is no bypass around the filtration media.

.3 Temporarily shut down return and exhaust side of HVAC systems during heavy construction or demolition.

.4 Permanently close off return and exhaust side of HVAC systems in areas with high dust levels. Cover duct openings with plastic in these areas.

.5 If HVAC system is operated without above protection measures in place, Contractor must provide duct cleaning services, plus necessary access doors, at no extra cost to Contract.

.3 After construction and final cleaning work is complete Contractor shall:

.1 Remove HVAC protection measures.

.2 Start-up systems.

.3 Prepare systems for Testing, Adjusting and Balancing Contractor and Commissioning Agent

.4 Immediately before occupancy, replace all filtration media with the final design filtration media.

.5 Scheduling

.1 Schedule construction activities to minimize amount of VOC's, odours and fumes absorbed by porous materials (e.g. ceiling tiles, carpet, etc.).

.2 Complete applications of wet and odorous materials such as paints, sealants and coatings before installing absorbent "sink" materials such as ceiling tiles, carpets and fabric-covered furnishings.

.3 Store fuels

.4 Allow for Testing, Adjusting and Balancing to be carried out following construction and before occupancy (refer to HVAC Protection Measures).

.5 Allow for corrective work related to general deficiencies, Testing, Adjusting and Balancing, and Commissioning to be carried out following construction and before occupancy.

.6 Mold Mitigation

.1 Submit an Indoor Air Quality Management Plan to the Consultant for approval a minimum of 14 days prior to construction which includes measures to achieve the indoor air quality management objectives in accordance with CCA 82-2004: Mould Guidelines for the Canadian Construction industry http://www.cca-acc.com/documents/electronic/cca82/cca82.asp and address the following:

.1 Building materials made of organic material or those that could absorb moisture are protected in transit and at the construction site from contact with moisture and from collecting organic matter such as leaves, soil or insects.

.2 The building envelope will be weather-tight and permitted to dry before installation of interior walls, wood floors, ceilings or HVAC systems.

.7 Inspections and Maintenance

.1 Inspect indoor air quality management measures and remedy any deficiencies on a weekly basis.

.2 Record inspections in I1 (1.5.2) IAQ Management Inspection Log and denote measures implemented at time of inspection, any deficiencies as well as corrective actions taken

.3 Provide photos as specified by I2 (1.5.3) Photo Documentation Checklist) at various occasions during construction to prove continuous compliance

.4 Pollutant containment, housekeeping and HVAC protection measures will be reviewed by the Consultant during each site visit

.5 Deficiencies identified by Consultant must be remedied and documented in I1 (1.5.2) IAQ Management Inspection Log within 48 hours of notification

.6 Clean or replace any equipment or materials incorrectly stored or improperly protected at no extra cost to Contract.

3.2 INDOOR AIR QUALITY ASSESSMENT

.1 Conduct an building flush-out prior to occupancy

.1 After all construction, final cleaning and Testing, Adjusting and Balancing work is complete, and prior to building occupancy, conduct a building flush-out by:

.1 Building to be flushed with 100% outdoor air for 14 consecutive days prior to occupancy.

.2 Maintaining a temperature of at least 15C (60F) but not higher than 27C (80F) and,

.3 Where mechanical cooling is operated, maintaining a relative humidity no higher than 60%.

.2 Perform all corrective work related to general deficiencies, Testing, Adjusting and Balancing, and Commissioning prior to commencing the building flush-out.

.3 Install new MERV 13 filters in all air handling equipment prior to commencing the building flush-out

.4 Replace all filtration media in air handling equipment with new filters after the building flush-out and immediately prior to occupancy. Filtration media is to be replaced at the expense of the Contractor.

3.3 REMOVAL OF PROTECTION MEASURES

.1 Remove Products/materials installed as a part of indoor air quality management measures prior to building turnover. Any remedial work required as a result of removing measures is responsibility of Contractor.

END OF SECTION

Complete weekly, submit to Consultant monthly. Include three photo references for each measure listed (as applicable), photos are to be date stamped and submitted to the Consultant as .jpeg files.

Company Name:		Inspection Date:	

IIAQ Inspection

Control Measure	Inspected	Condition	Notes / Corrective Action Taken	Photo Reference (attached as .jpeg)		
HVAC Protection						
All stockpiled HVAC equipment is stored on skids and sealed/covered to prevent dust accumulation.	☐ Yes ☐ N/A	Choose an item.				
All installed open duct ends are sealed. Ducts with excessive dust accumulation will be cleaned prior to occupancy.	☐ Yes ☐ N/A	Choose an item.				
All installed registers, diffusers, and returns are sealed.	☐ Yes ☐ N/A	Choose an item.				
Materials are not stored in mechanical rooms.	☐ Yes ☐ N/A	Choose an item.				
MERV 8 filters are installed when HVAC is running (as applicable).	☐ Yes ☐ N/A	Choose an item.				
Source Control						
Low-VOC materials are used, wet-applied materials are kept sealed when not in use.	☐ Yes ☐ N/A	Choose an item.				
Exhaust fumes (idling vehicles, equipment, etc.) are prevented from entering the building.	☐ Yes ☐ N/A	Choose an item.				
Stockpiled and installed materials are protected from moisture.	☐ Yes ☐ N/A	Choose an item.				
Materials that have been exposed to moisture have been replaced to prevent mould.	☐ Yes ☐ N/A	Choose an item.				
Pathway Interruption						
Designated cutting rooms are used to contain dust.	☐ Yes ☐ N/A	Choose an item.				
Dust guards and collectors used on tools.	☐ Yes ☐ N/A	Choose an item.				
Finished areas are physically separated from areas with dust generating activates.	☐ Yes ☐ N/A	Choose an item.				
Housekeeping						
General housekeeping conducted to maintain a clean site.	☐ Yes ☐ N/A	Choose an item.				

Wetting agents or dust compounds used for dust control. Vacuums with HEPA filters are used.	☐ Yes ☐ N/A	Choose an item.				
Coils, air filters, fans and ductwork kept clean.	☐ Yes ☐ N/A	Choose an item.				
Materials are kept organized.	☐ Yes ☐ N/A	Choose an item.				
Waste bins provided throughout the building for storage of construction waste. Waste is stored away from mechanical equipment.	☐ Yes ☐ N/A	Choose an item.				
Scheduling						
Absorptive materials installed after wet-applied materials have fully cured.	☐ Yes ☐ N/A	Choose an item.				
New HVAC filters installed before occupancy.	☐ Yes ☐ N/A	Choose an item.				
Smoking						
Tobacco products are prohibited inside the building and within 25ft (7.5m) of the building entrance at all times during construction. Signage posted.	☐ Yes ☐ N/A	Choose an item.				

Other Observations

I hereby certify that the information provided above is complete and correct

Name, Title	Phone Number	Signature

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'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 contractors.

.2 Proper performance of equipment and systems is documented.

.3 O&M documentation left on site is complete.

.4 The City's operating personnel 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 retesting of systems.

1.4 COORDINATION

.1 The following are members of the commissioning team:

- .1 The City's Representative
- .2 Commissioning Authority (CxA)
- .3 Project Manager
- .4 Architect and Sub-consultants
- .5 General Contractor (Contractor)
- .6 Mechanical Contractor
- .7 Electrical Contractor
- .8 TAB representative
- .9 Controls Contractor
- .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 General 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 General Contractor will provide adequate time for Cx activities prescribed in technical sections and commissioning sections including:

- .1 Component verification completion
- .2 Startup and pre-functional activities
- .3 Functional testing dates
- .4 Owner training
- .5 Seasonal or deferred testing.

.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, Occupancy and Daylighting Control
Plumbing
Recirculation Pumps
Expansion Tanks
Sump Pumps

Domestic Hot water heating

HVAC
Energy Recovery Ventilators
Electric Force Flow Heaters
Radiant Infoor Manifolds (Heating and Cooling)
Heat Recovery Ventilators
Electric Unit Heaters
Electric Humidifier
Air Cooled Chiller
Boilers
Fan Coils
Hydronic Heating & Cooling Coils
Transfer Fan
Hydronic Pumps
Recovery Heat Pipe
Radiant Panels
Active Chilled Beams
Variable Air Volume boxes
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 Contractors.

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 Contractors. Contractors 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 Contractors shall respond to issues and ensure correction.

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1.11 SAMPLE COMPONENT VERIFICATION FORM

Project Name — Component Verification Form

Owner
City, Province

Unit Tag: **AHU-1**
Equipment Type: Air Handling Unit
System: HVAC
Location: Mech Rm
Area Serviced: Open Office

This box for IDI use only.
CxA reviewer: _____
Form Audited? YES ☐ NO ☐

Contractor (include company and print name)	Signature	Date
Mechanical:		
Electrical:		
Controls:		
General:		

IDI Audit Verification

Nameplate Data	Submitted	Installed *note any changes*	Installer Verify	IDI Audit Verification
Manufacturer	AHU Maker		☐	☐
Model	AHU 12AB-34CD		☐	☐
Supply fan flow [cfm]	5000		☐	☐
Supply Fan Motor HP	5		☐	☐
Return fan flow (cfm)	5000		☐	☐
Exhaust Fan Motor HP	5		☐	☐
Motor Volts	575/3/60		☐	☐
Glycol Cooling Coil (# coils, # Rows)	1, 8		☐	☐
Glycol Heating Coils (# coils, # rows)	1, 2		☐	☐

Details/Notes:
Sample AHU unit

Inspection Items	Comments	Installer Verify	IDI Audit Verification
General Installation & Cleanliness			
Equipment is clean and free of debris		☐	☐
Equipment is properly mounted and vibration isolation equipment is installed on motors		☐	☐
Service hatches & filter access is not hindered by surrounding equipment		☐	☐
Record the MERV rating of the filters in the unit		☐	☐
Shipping mounts are removed		☐	☐
Duct Installation			
Duct layout matches drawings and duct connections are sealed		☐	☐
Smoke and fire dampers are properly installed according to contract documents		☐	☐
Electrical Installation			
Verify that overload breakers are installed and sized correctly		☐	☐
Local disconnects are installed and labelled		☐	☐
VFDs for fans installed per contract documents		☐	☐
Controls Installation			
Controls wiring complete and electical connections are tight		☐	☐
Control actuators and sensors labelled per contract documents		☐	☐
Insulation & Labelling			
Thermal Insulation complete as per contract documents		☐	☐
Unit is correctly labelled		☐	☐
Ducts and piping are labelled per contract documents and direction of flow is indicated		☐	☐

1.12 SYSTEM START-UP

.1 Start-up Plan. The General 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 Contractors 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 Consultant 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, Boilers, Chillers, Heat Pumps, etc.)

.2 Piping pressure tests

.3 Sprinkler verification reports

.4 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

.2 CO/NOx sensor calibration reports

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 Contractors.

.4 The CVFs for a given systems equipment must be completed prior to the functional test.

.5 The Contractors 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 Contractors 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

Functional Testing for AHU-1, ERV-1 and Reheat

Line #	Test	Expectation	First Test Status	Re-Test Status	Completed By	Date
AHU-1.F01	System Off	BMS commands system off during unoccupied mode - unit dampers close to outdoor air, supply fan is off. Verify by operational check.				
AHU-1.F02	Startup	When in occupied mode, BMS commands dampers to full return position, supply fans starts. Verify by operational check and trends.				
AHU-1.F03	Occupancy Schedule	Verify schedule with Owner. *Occupied schedule should be same for ERV-1, except for morning warm up periods, tests below.*				
AHU-1.F04	Morning Warm Up/Cool Down	AHU will operate in a warm up/cool down mode to bring the space under temperature control prior to occupancy. AHU will operate on full return in this mode, with ERV-1 off.				
AHU-1.F05	Supply Air Temperature Control: Heating	Hydronic Heating coil and modulating valve heat supply air when called to control zone temperature. Verify by operational check and trends.				
AHU-1.F06	Supply Air Temperature Control: Free Cooling	When OAT allows, free cooling mode on the AHU is enabled to maintain supply temperature at setpoint. Outdoor air damper modulates open to control supply air temperature. This sequence is to be staged and integrated with ERV-1 free-cooling. Relief Damper to open during this mode. Verify by operational check and trends.				
AHU-1.F07	Supply Air Temperature Control: Hydronic Cooling	Hydronic Cooling coil and modulating valve cool supply air when called to control zone temperature. Verify by operational check and trends.				
AHU-1.F08	Zone Temperature Control	Verify that AHU adequately controls *average* zone temperature to setpoint, nominally 72°F (22°C), adjustable.				
AHU-1.F09	Zone Temperature Control: Unoccupied Mode	Verify that AHU adequately controls *average* zone temperature on fields to setpoint, nominally 78°F (25.5°C), adjustable, in cooling mode. Unoccupied heating mode setpoint to be 60°F (15.5°C), adjustable.				
AHU-1.F10	Graphics & Trends	Verify graphics indicate space temperature and setpoint, AHU enable status, AHU fan status and speed, heating/cooling valve positions, mixed air temperature, OA and return air enthalpy, supply temp SP, and supply air temperature. Trends to be enabled on all points.				

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Functional Testing for AHU-1, ERV-1 and Reheat

Line #	Test	Expectation	First Test Status	Re-Test Status	Completed By	Date
AHU-1.F11	Alarms	BMS to alarm on: - supply fan failure (x2) - supply air temperature differential from setpoint - high filter differential pressure (nominal 0.7"wc, adjustable) - freezestat alarm with shutdown at 40°F (4.4°C), heating valve opens fully, requiring manual restart				
ERV-1.F01	System Off	BMS commands system off during unoccupied mode - unit dampers close to outdoor air, supply and exhaust fans are off. This includes morning warmup periods. Verify by operational check.				
ERV-1.F02	Startup	When in occupied mode, BMS commands dampers open, supply and exhaust fans start (constant speed fans). Verify by operational check and trends.				
ERV-1.F03	Supply Air Temperature Control: Free Cooling	When OAT allows, and in sequence with AHU-1 free cooling, free cooling mode on the ERV is enabled by BMS. Dampers remain fixed during this mode, switching only once every 3 hours.				
ERV-1.F04	Supply Air Temperature Control: Heat Recovery	When OAT allows, and in sequence with AHU-1, heat recovery mode on the ERV is enabled by BMS. Dampers operate routinely during this mode, reversing flow every 2 minutes. Verify by operational check and trends.				
ERV-1.F05	Graphics & Trends	Verify graphics indicate space temperature and humidity, ERV enable status, ERV mode command, supply and exhaust fan status, heating valve positions, supply temp SP, supply temperature, and exhaust air temperature.				
ERV-1.F06	Alarms	BMS to alarm on: - supply fan failure - exhaust fan failure - supply air temperature differential from setpoint - high filter differential pressure (nominal 0.7"wc, adjustable)				

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 Contractors 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 Contractors 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 Contractors shall respond to issues and ensure correction.

1.17 ISSUE TRACKING LOG

.1 Contractors shall respond to issues noted on the issue tracking log within 7 days indicating the corrective action taken.

.2 CxA may request the contractor demonstrate successful resolution of items noted on the tracking log.

1.18 OWNER 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.

.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 exercises with attendance sheets and implementation of training surveys.

.16 A training evaluation form has been attached (Section 1.19) for bid purposes.

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1.19 SAMPLE TRAINING EVALUATION FORM

integrated DESIGNS
Commissioning Project Management Services

420 – 70 Arthur St.
Winnipeg, MB, R3B 1G7
Tel: 204.669.6818
Fax: 204.944.1123
www.i-designs.ca

Sample Project Name
City, Province

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

Partnering for a sustainable advantage *Page 1 of 1*

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 permit.

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 Consultant 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 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 the window, wall, and roof systems.

1.2 REFERENCES

.1 American Society for Testing and Materials (ASTM).
- .1 ASTM D4541-02 Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers.
- .2 ASTM E783-02 Standard Test Method for Field Measurement of Air Leakage Through Installed Exterior Windows and Doors.
- .3 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.
- .4 ASTM E1186-03 Standard Practices for Air Leakage Site Detection in Building Envelopes and Air Barrier Systems.

.2 Canadian Standards Association (CSA).
- .1 CAN/CSA-A440, Windows.

.3 Canadian General Standards Board (CGSB).
- .1 CAN/CGSB 149.10-M86, Determination of the Airtightness of Building Envelopes by the Fan Depressurization Method.

.4 National Building Code of Canada (2010), including Manitoba Amendments.

1.3 QUALITY ASSURANCE

.1 Contractor will notify the Consultant 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 company identified by the Building Envelope Commissioning Authority.

.2 Inspection/Testing Frequency:
- .1 On-Site Mock-Up Inspection and Testing: of curtain wall, punched windows, air/vapour barrier.
  - .1 Inspect the mock-ups at completion milestones.
  - .2 Provide a minimum of 24 hours notice for air barrier application to be reviewed by Building Envelope Commissioning Authority.
- .2 On-Site Quality Assurance Inspection and Testing: of curtain wall, punched windows, air/vapour barrier.
  - .1 Visual review and testing of the installed envelope components, including wall and window systems and roof systems, may be periodically completed at the discretion of the Building Envelope Commissioning Authority.
  - .2 Provide a minimum of 24 hours notice for air barrier application to be reviewed by Building Envelope Commissioning Authority.

.3 The manufacturer for each component of the building envelope, including but not necessarily limited to all fenestration, roof and wall components, shall provide written verification that the proposed material and system types will meet the minimum requirements specified in the Project Manual.

Part 2. PRODUCTS

2.1 NOT APPLICABLE

Part 3. EXECUTION

3.1 PROJECT START-UP

.1 Prior to any building envelope components being installed, a start-up meeting is to be organized by the Contractor on-site, attended by the Building Envelope Commissioning Authority, Architect, and Commissioning Consultant to review systems and details. A record of the meeting and any design/installation issues and/or decisions to be disseminated to all relevant parties.

3.2 CURTAIN WALL PERFORMANCE VERIFICATION AND TESTING

.1 With the bid submission, the curtain wall manufacturer shall provide a letter of assurance verifying that the proposed system is in conformance with the specification requirements outlined in the Project Manual.

.2 Curtain wall systems shall not be supplied and installed to the site until verification of performance requirements is confirmed.

.3 Prior to full system installation, the Contractor shall supply and install a mock-up of a complete curtain wall system at locations identified by the Building Envelope Commissioning Authority. The mock-up installation shall be used to verify that the visual appearance and performance, in accordance with specified testing, conforms to the specifications.

.4 Qualitative air leakage testing of curtain wall shall be completed via artificially induced pressure differential and smoke tracker pencil.

.1 The test area will utilize a chamber constructed around a section of the curtain wall and rough opening and sealed to the perimeter. A pressure differential will be artificially induced via fan assembly.

.2 Air leakage through the rough opening shall be qualitatively determined via smoke tracer pencil. The installer, with the assistance of the manufacturer, shall install terminations in the curtain wall framing to prevent extraneous leakage through the interior components which may affect the results.

.5 Quantitative water penetration testing of curtain wall and punched windows shall be completed in accordance with ASTM E1105-00.

.1 "Pass" criteria shall be defined as no water penetration inboard of the air barrier plane, and rapid drainage resulting in no retained water in the wall cavities outboard of the air barrier plane. The minimum test pressure difference across the wall system shall be established by the Architect.

.6 The Contractor shall supply and install the test chamber, as directed by the Building Envelope Commissioning Authority. Chamber dimensions and configuration will be reviewed on site with the designated testing company, the Building Envelope Commissioning Authority, and the Contractor.

3.3 PUNCHED WINDOW PERFORMANCE VERIFICATION AND TESTING

.1 With the bid submission, the punched window manufacturer shall provide a letter of assurance verifying that the proposed system is in conformance with the specification requirements outlined in the Project Manual.

.2 Punched window systems shall not be supplied and installed to the site until verification of performance requirements is confirmed.

.3 Prior to full system installation, the Contractor shall supply and install a mock-up of a complete punched window system at locations identified by the Building Envelope Commissioning Authority. The mock-up installation shall be used to verify that the visual appearance and performance, in accordance with specified testing, conforms to the specifications.

.4 Qualitative and quantitative air leakage testing of punched windows shall be completed in accordance with ASTM E783-02.

.1 The test area will utilize a chamber constructed around the curtain wall rough opening and sealed to the perimeter. If necessary, the test shall be completed twice in order to differentiate between curtain wall component leakage and the rough opening leakage. The components may be required to be sealed to eliminate air leakage through the frame and glazing components in order to evaluate the rough opening air leakage alone.

.2 Air leakage through the rough opening shall be qualitatively determined. The installer, with the assistance of the manufacturer, shall install terminations in the curtain wall framing to prevent extraneous leakage through the interior components which may affect the results.

.5 Quantitative water penetration testing of curtain wall and punched windows shall be completed in accordance with ASTM E1105-00.

.1 "Pass" criteria shall be defined as no water penetration inboard of the air barrier plane, and rapid drainage resulting in no retained water in the wall cavities outboard of the air barrier plane. The minimum test pressure difference across the wall system shall be established by the Architect.

.6 The Contractor shall supply and install the test chamber, as directed by the Building Envelope Commissioning Authority. Chamber dimensions and configuration will be reviewed on site with the designated testing company, the Building Envelope Commissioning Authority, and the Contractor.

3.4 AIR BARRIER SHEET MEMBRANE VERIFICATION AND TESTING

.1 Contractor to submit product data sheet confirming that air/vapour barrier membrane complies with Project Specifications.

.2 Prior to full system installation, the Contractor shall supply and install a mock-up of the air/vapour barrier membrane (roof and walls), at locations identified by the Building Envelope Commissioning Authority. The mock-up installation shall be used to verify that the visual appearance and performance, in accordance with specified testing, conforms to the specifications.

.3 Adhesion testing on the fully cured air barrier membrane shall be completed in in accordance with ASTM D4541 Elcometer, using a 4" diameter disk.

.1 Three pull tests shall be completed on each substrate type.

.2 The minimum standard of acceptance for the bond test installation, for the building overall, shall be the mean minus one standard deviation calculated from the mock-up and compared to manufacturer's requirements. In the event of a deficit, the manufacturer shall be consulted for direction.

.4 Air- leakage testing shall be completed at the cladding support system anchorage penetrations in accordance with ASTM E1186-03.

.1 Standard of acceptance is no observable air leakage at the penetrations.

3.5 THERMOGRAPHIC SCAN

.1 Upon completion of the entire wall sections on all four elevations, the Building Envelope Commissioning Authority shall complete a thermographic scan of the full height of the building.

3.6 ANALYSIS AND CORRECTIVE PROCEDURES.

.1 Airtightness and water penetration testing will identify locations of air leakage in curtain wall and air barrier membrane penetrations, and will be reported in writing to the Contractor for correction. Contractor shall re-seal and otherwise correct all leakage sites as identified and as may be required.

.2 Re-testing, if required due to failure of initial installation will be at the cost of the contractor.

.3 Following air/water leakage corrections, the test area will be re-tested if deemed necessary.

.4 Do not cover any membrane until the Building Envelope Commissioning Authority provides a written acceptance report.

.5 Should the sub-contractor fail to meet the on-site specification requirements, all re-testing required due to deficient work and/or testing procedures will be carried out at the sub-contractor's sole cost. The sub-contractor shall implement the necessary repairs to the rough opening in order to meet the specification requirements for rough opening air/water leakage at no cost to the City. Re-testing shall be completed to verify that the specification requirements have been obtained.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 74 00 – Cleaning and Waste Management.

1.2 REFERENCES

.1 Canadian Federal Legislation.
- .1 Canadian Environmental Protection Act (CEPA).
- .2 Canadian Environmental Assessment Act (CEAA).
- .3 Transportation of Dangerous Goods Act (TDGA).
- .4 Motor Vehicle Safety Act (MVSA).

.2 Canadian Standards Association (CSA).
- .1 CSA S350-M1980 (R2003), Code of Practice for Safety in Demolition of Structures.

.3 National Building Code of Canada (NBCC), current edition.
- .1 NBCC Division B Part 8, Safety Measures at Construction and Demolition Sites.

1.3 QUALITY ASSURANCE

.1 Regulatory Requirements.
- .1 Ensure all work is performed in compliance with CEPA, CEAA, TDGA, MVSA, and all applicable Provincial regulations.
- .2 Comply with Workplace Safety and Health Act, Workplace Safety Regulation, Manitoba with regards to 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.

1.4 SITE CONDITIONS

.1 Existing Services.
- .1 Before commencing work, establish location and extent of service lines in area of work. Be absolutely certain of their origin and destination.
- .2 Where unknown services are encountered, immediately advise Consultant and confirm findings in writing.
- .3 Record locations of maintained, rerouted and abandoned service lines on project record documents in accordance with section 01 78 00.

.2 Site Environmental Requirements.
- .1 Perform all work in accordance with Section 01 74 00.
- .2 Provide temporary drainage and pumping as necessary to keep excavations and site free from water.
- .3 In all circumstances ensure that site demolition work does not adversely affect adjacent watercourses, groundwater and wildlife, or contribute to excess air and noise pollution.
- .4 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 project.
- .5 Do not pump water containing suspended materials into watercourses, storm or sanitary sewers or onto adjacent properties.
- .6 Control disposal or runoff of water containing suspended materials of other harmful substances in accordance with local authorities.

1.5 SCHEDULING

.1 Co-ordinate demolition and removal of debris to ensure minimal disruption to existing site and adjacent buildings.

.2 Execute work with least possible interference, inconvenience or disturbance to occupants, public and normal use or premises. Keep noise and dust to minimum.

Part 2 Products

2.1 EQUIPMENT

.1 Meet or exceed all applicable emission requirements and operate equipment and heavy machinery in compliance with MVSA.

Part 3 Execution

3.1 PREPARATION

.1 Prevent movement, settlement, or damage to adjacent buildings, utilities, walks, paving, trees, landscaping, and adjacent grades. In the event of damage to such items, immediately replace or make repairs to approval of Consultant and at no cost to the City.

.2 Protect existing trees and shrubs where indicated to remain on site and on adjacent properties.

.3 Notify and obtain approval of utility companies before starting site demolition.

3.2 DEMOLITION

.1 In removal of pavements and curbs, square up adjacent surfaces to remain in place by saw cutting or other method approved by Consultant. Protect adjacent joins and load transfer devices. Protect underlying and adjacent granular materials.

.2 Cover or wet down dry materials and rubbish to prevent blowing dust and debris.

3.3 WASTE MANAGEMENT AND DISPOSAL

.1 Remove stockpiled excavation material and demolition rubbish materials from site.

.2 When work is substantially performed, remove remaining waste materials, tools, equipment, machinery and surplus materials not required for performance of remaining work.

.3 Cleaning and Waste Management in accordance with Section 01 74 00.

3.4 PROTECTION

.1 Conduct site demolition operations to prevent injury to people and damage to adjacent buildings. Ensure safe passage of people around demolition 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

.3 CW 3110 – R19 - Sub-grade, Sub-base and Base Course Construction

1.2 REFERENCES

.1 American Society for Testing and Materials International (ASTM)
- .1 ASTM C117-04, Standard Test Method for Materials Finer than 0.075 mm (No. 200) Sieve in Mineral Aggregates by Washing.
- .2 ASTM C136-05, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
- .3 ASTM D698-07 Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400ft-lbf/ft3) (600 kN-m/m3).

.2 Canadian Standards Association (CSA International)
- .1 CSA-A23.1-04/A23.2-04, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.

1.3 SUBMITTALS

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

.2 Inform Contact Administrator of proposed source of materials and provide access for sampling at least 2 weeks prior to commencing work.

.3 If materials have been tested by independent testing laboratory within previous month and have passed tests equal to requirements of this specification, submit test certificates from testing laboratory showing suitability of materials for this project.

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: in accordance with Section 03 20 00 - Concrete Reinforcing.

.3 Joint filler in accordance with Section 03 30 00 - Cast-in-Place Concrete.

.4 Granular base: material to CW 3110 – R19 - Sub-grade, Sub-base and Base Course Construction
.5 and following requirements:
- .1 Crushed stone or gravel.
- .2 Gradations: within limits specified when tested to ASTM C136 and ASTM C117. Sieve sizes to CAN/CGSB-8.1.

.6 Non-staining mineral type form release agent: chemically active release agents containing compounds that react with free lime to provide water-soluble soap.

.7 Fill material: to Section 31 22 13 - Rough Grading and following requirements:
- .1 Type 1 clean fill: excavated material from site or approved equal in accordance with B6
- .2 Crushed stone or gravel.
- .3 Gradations: within limits specified when tested to ASTM C136 and ASTM C117. Sieve sizes to CAN/CGSB-8.1.

Part 3 Execution

3.1 GRADE PREPARATION

.1 Do grade preparation work in accordance with CW 3110 – R19 - Sub-grade, Sub-base and Base Course Construction

.2 Place fill in maximum 150mm layers and compact to at least 95% of maximum dry density to ASTM D698.

3.2 GRANULAR BASE

.1 Obtain Contract Administrator's approval of subgrade before placing granular base.

.2 Place granular base material to lines, widths, and depths as indicated.

.3 Compact granular base in maximum 150 mm layers to at least 100% of maximum density to ASTM D698.

3.3 FORMING

.1 Obtain Contract Administrator's approval of forming prior to installing concrete.

3.4 CONCRETE

.1 Obtain Contract Administrator's approval of granular base and reinforcing steel prior to placing concrete.

.2 Arrange for concrete testing per Section 01 21 00 – Allowances.

.3 Do concrete work in accordance with Section 03 30 00 - Cast-in-Place Concrete.

.4 Determine broom finish locations and directions on site with Contract Administrator prior to pouring concrete.

.5 Immediately after floating, give sidewalk surface uniform broom finish to produce regular corrugations not exceeding 2mm deep, by drawing broom in direction normal to centre line perpendicular to the general path of travel.

.6 Provide edging where indicated on the drawings with 25mm radius edging tool.

3.5 TOLERANCES

.1 Finish surfaces to within 3mm in 3m as measured with 3m straightedge placed on surface.

3.6 EXPANSION AND CONTRACTION JOINTS

.1 Install tooled transverse contraction joints after floating, when concrete is stiff, but still plastic, as shown on drawings.

.2 Install expansion joints at maximum 6m as shown on drawings.

.3 When sidewalk is adjacent to curb, make joints of curb, gutters and sidewalk coincide.

3.7 ISOLATION JOINTS

.1 Install isolation joints around manholes and catch basins and along length adjacent to concrete curbs, catch basins, buildings, or permanent structure.

.2 Install joint filler in isolation joints in accordance with Section 03 30 00 - Cast-in-Place Concrete.

.3 Seal isolation joints with clear silicone sealant approved by Contract Administrator's.

3.8 CURING

.1 Cure and protect concrete in accordance with CSA-A23.1.

.2 Apply curing and sealing compound evenly to form continuous film, in accordance with manufacturer's requirements and to ASTM C309.

.3 Cover newly poured concrete during curing period if inclement weather or cold weather conditions are imminent.

3.9 BACKFILL

.1 Allow concrete to cure for 7 days prior to backfilling.

.2 Backfill to designated elevations with material as shown on the drawings.
.1 Compact and shape to required contours as shown on the drawings.

3.10 DEFECTIVE WORK

.1 Remove and re-pour area showing checking, slumping, cracking or honeycombing.

.2 If honeycombing is minimal parge concrete as directed by Contract Administrator

3.11 CLEANING

.1 Proceed in accordance with Section 01 74 00 – Cleaning and Waste Processing.

.2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment. Leave site clean.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 American Society for Testing and Materials (ASTM).
- .1 ASTM C109/C109M-16a, Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or [50-mm] Cube Specimens).
- .2 ASTM C156-17, Standard Test Method for Water Loss [from a Mortar Specimen] Through Liquid Membrane-Forming Curing Compounds for Concrete.

.2 Workplace Hazardous Materials Information System (WHIMIS).

1.2 SUBMITTALS

.1 Product Data.
- .1 Submit product data including manufacturer's product specifications, installation and maintenance instructions including maintenance procedures and materials, procedures for stain removal and surface repair, and recommended schedule for cleaning.
- .2 Submit WHMIS MSDS - Material Safety Data Sheets acceptable to Labour Canada and Health and Welfare Canada. Indicate VOC content.

.2 Closeout Submittals.
- .1 Provide maintenance data for incorporation into Operation and Maintenance Manual.

1.3 QUALITY ASSURANCE

.1 Qualifications.
- .1 Skilled tradesman to be employed by specialty company recognized and trained as approved installer by manufacturer, normally engaged in this type of work with minimum three (3) years' successful experience on projects of similar size, requirements and complexity.

.2 Mock-ups.
- .1 Prepare mock-up of concrete surface hardener/sealer installation.
- .2 Locate mock-up installation on site as part of final installation. Mock-up will be reviewed for workmanship and overall appearance.
- .3 Once approved, mock-ups will set standard of acceptance for remaining installations.

1.4 DELIVERY, STORAGE, AND HANDLING

.1 Deliver all material to site in manufacturer's original unopened packaging with labels clearly identifying product name and manufacturer.

.2 Store materials in a dry, enclosed area protected from exposure to moisture, construction activity, and direct sunlight in strict accordance with manufacturer's recommendations.

.3 Handle all products with appropriate precautions and care as stated manufacturer's instructions.

1.5 SITE CONDITIONS

.1 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of hazardous materials.

.2 Conform to manufacturer's recommended temperatures, relative humidity, and substrate moisture content for application and curing, including special conditions governing use.

.3 Provide continuous ventilation during and after installation. Run ventilation system 24 hours per day during installation and provide continuous ventilation and for 48 to 72 hours after installation.

Part 2 Products

2.1 MATERIALS

.1 Concrete Surface Hardener/Sealer (CSH).

.1 Water-soluble, inorganic, silicate-based curing, hardening, sealing and dustproofing compound specifically designed for incorporation into the surface of freshly placed and finished concrete and in renovation of aged concrete, VOC content: none, colour: clear.

Part 3 Execution

3.1 INSTALLATION

.1 Concrete Surface Hardener/Sealer (CSH).

.1 Apply concrete surface hardener/sealer in accordance with manufacture's printed instructions.

.2 Apply undiluted product to finished damp concrete surface with low pressure sprayer after all surface water has evaporated and surface is hard and will not be marred or damaged by application procedures. Keep the treated surface area wet with product for 30 minutes by spraying additional product and/or brooming excess material from low areas to saturate dry spots. Do not allow dry spots to occur. Prevent any drying of surface for 20-30 minutes.

.3 As product begins to penetrate and react, mist the surface lightly with clean water and brush, broom or power scrub with non-aggresive brush or pad into surface to aid penetration/reaction.

.4 Flush the surface with water and squeegee the surface to remove excess material and all impurities present on the surface. Rinse with generous amounts of water to enhance product performance. Finish with a damp mop.

3.2 PROTECTION

.1 Prohibit finished surface from damage by traffic or trades until sufficiently hardened in accordance with manufacturer's printed instructions.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Canadian Standards and Association (CSA).
- .1 CSA A23.4-16, Precast Concrete - Materials and Construction.
- .2 CSA A231.1-14/A231.2-14, Precast Concrete Paving Slabs/Precast Concrete Pavers.

1.2 DELIVERY, STORAGE, AND HANDLING

.1 Handle all products with appropriate precautions and care as stated in manufacturer's printed instructions.

.2 Cleaning and Waste Management in accordance with Section 01 74 00.

Part 2 Products

2.1 MANUFACTURED UNITS

.1 Precast Concrete Sump Pit.
- .1 Interlocking minimum 900 mm inside diameter x 100 mm wall thickness x modular lengths as indicated, complete with precast rungs on interior face.

.2 Precast Concrete Slabs.
- .1 Finish: diamond face
- .2 Size: 610 x 610 x 45 mm thick
- .3 Colour: Natural

.3 Precast Concrete Splash Pads.
- .1 Size: 368 mm wide x 1295 mm long x 127 mm high.
- .2 Colour: Natural.

2.2 FABRICATION

.1 Fabricate manufactured units to CSA A23.4 and CSA A231.1/A231.2

Part 3 Execution

3.1 INSTALLATION

.1 Precast Concrete Sump Pit.
- .1 Excavate for sump pit in accordance with Section 31 23 10. Provide compacted granular base.
- .2 Install and level section of concrete pipe on granular base.
- .3 Stack additional concrete pipe sections on base section of modular lengths as required to suit depth of sump pit.
- .4 Cast-in-place concrete slab in accordance with Structural, inside precast pipe to elevation as indicated.
- .5 Co-ordinate installation of drain inlets in accordance with Section 33 46 13.
- .6 Backfill around concrete pipe in accordance with Section 31 23 10. Do not damage drain pipe.
- .7 Cast-in-place concrete pad around top of pipe in accordance with Structural.

.8 Inspect sump pit to ensure drain line inlets are clean and free of obstructions. Remove any debris from base of sump pit.

.9 Install sump pit cover in accordance with Section 05 50 00.

.2 Precast Concrete Slabs.

.1 Install precast concrete slabs in crawlspace as indicated. Install slabs level, true to grade and free of movement. Joints and lippage not to exceed 3 mm between slabs.

.3 Precast Concrete Splash Pads.

.1 Install precast concrete splash pads where indicated on drawings.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 06 10 00 – Rough Carpentry.

.2 Section 09 90 00 – Painting and Coating.

1.2 REFERENCES

.1 American Society for Testing and Materials (ASTM).
- .1 ASTM A123/A123M-17, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
- .2 ASTM A500/A500M-18, Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
- .3 ASTM A780/A780M-09(2015), Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.
- .4 ASTM F1554-18, Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength.
- .5 ASTM F3125/F3125M-15a, Standard Specification for High Strength Structural Bolts, Steel and Alloy Steel, Heat Treated, 120 ksi (830 MPa) and 150 ksi (1040 MPa) Minimum Tensile Strength, Inch and Metric Dimensions.

.2 Canadian Institute of Steel Construction (CISC)/Canadian Paint Manufacturer's Association (CPMA).
- .1 CISC/CPMA 1-73a, A Quick-drying One-coat Paint for Use on Structural Steel.

.3 Canadian Standards Association (CSA).
- .1 CSA G40.20-13/G40.21-13 (R2018), General Requirements for Rolled or Welded Steel/Structural Quality Steels.
- .2 CSA S16-14, Design of Steel Structures.
- .3 CSA W48-18, Filler Metals and Allied Materials for Metal Arc Welding.
- .4 CSA W55.3-08 (R2018), Certification of Companies for Resistance Welding of Steel and Aluminum.
- .5 CSA W59-18, Welded Steel Construction (Metal Arc Welding).

.4 National Building Code of Canada, 2010 (NBCC).

.5 Steel Structures Painting Council (SSPC).
- .1 SSPC Painting Manual, Volume 2, 2012 Edition, SSPC-SP 2 Hand Tool Cleaning Surface Preparation Standard.

1.3 DESIGN CRITERIA

.1 Details and specifications are intended to indicate the general character and extent of metal fabrications and do not attempt to indicate all methods of construction.

.2 Fabricate and install metal fabrications to withstand all stresses encountered in normal use. Unless specified or noted otherwise, all imposed live loads shall be in accordance with NBCC.

1.4 SUBMITTALS

.1 Make all submittals in accordance with requirements of Section 01 33 00.

.2 Shop Drawings.
- .1 Indicate materials, core thicknesses, finishes, connections, joints, method of anchorage, number of anchors, supports, reinforcement, design loading, details, and accessories.

.2 All fabricator designed assemblies, components and connections, and drawings to be stamped and signed by qualified Professional Engineer licensed in jurisdiction at Place of Work.

1.5 QUALITY ASSURANCE

.1 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three (3) years' documented experience. Submit proof of experience upon Consultant's request.

.2 Welders' Certificates: Submit to Section 01 33 00, certifying welders employed on the Work, verifying qualification within the previous 12 months to CSA-W55.3.

Part 2 Products

2.1 MATERIALS

.1 Angle and Channel and Steel Plate Sections: to CSA G40.20/G40.21, Grade 300W.

.2 Steel Sections: to CSA G40.20/G40.21, Grade 350W.

.3 Steel Plate: to CSA G40.20/G40.21, Grade 300W.

.4 Structural Hollow Sections: to CSA G40.20/G40.21, Grade 350, Class C.

.5 Steel Pipe: to ASTM A53/A53M standard weight, schedule 40.

.6 Steel Tubing: to CSA G40.20/G40.21, Grade 350W, sizes and dimensions as indicated; large diameter tube to A500/A500M, Grade C.

.7 Safety Grating Stair Treads: 51 mm deep x 255 wide (unless noted otherwise), 14-gauge safety grating planks manufactured from one piece pre-galvanized steel material with serrated edges on top and bottom of diamond shaped openings.

.8 Safety Ladder Rungs: 29 mm deep x 41 mm wide, one-piece, 13-guage, pre-galvanized steel channel, with 3 rows of slip resistant openings on top of channel (3% open area).

2.2 ACCESSORIES

.1 Welding Materials: to CSA W59.

.2 Welding Electrodes: to CSA W48 Series.

.3 Bolts and Anchor Bolts: to ASTM F1554.

.4 High Strength Bolts: to ASTM F3125/F3125M.

.5 Shop Paint Primer: fast dry alkyd metal shop coat primer (grey) to CISC/CPMA Standard 1-73a.

.6 Galvanizing: hot dipped galvanizing with minimum zinc coating of 600 g/m^2 to ASTM A123/A123M.

.7 Galvanizing Primer: zinc rich, ready mix to ASTM A780/A780M.

.8 Grout: non-shrink, non-metallic, flowable, 24h, MPa 15, pull-out strength 7.9 MPa.

2.3 FABRICATION

.1 Review Contract Documents and provide all metal fabrications indicated.

.2 Notify Consultant of any proposed member substitutions and changed connection details.

.3 Fabricate work square, true, straight and accurate to required size, with joints closely fitted and properly secured.

.4 Verify all dimensions prior to fabrication.

.5 Use self-tapping shake-proof countersunk flat headed screws on items requiring assembly by screws or as indicated.

.6 Where possible, fit and shop assemble work, ready for erection.

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

.8 Seal exterior steel fabrications to provide corrosion protection in accordance with CAN/CSA S16.

.9 Provide bolt holes where required for fastenings.

.10 Provide holes by drilling, not burning; free of burrs and rough edges. Provide countersunk holes for field installation of fabricated items to accept flat-head fasteners. All welds minimum 6 mm all around fillet welds unless otherwise noted on drawings.

.11 Welding.
- .1 Perform to CSA W59. All seams continuously welded and free from any slag or splatter.
- .2 Grind welds smooth and flush with adjacent surface prior to hot-dip galvanizing, except hidden welds.

2.4 FINISHES

.1 Shop Applied Priming.
- .1 Clean, prepare surfaces and shop prime metal fabrications in accordance with SSPC SP-2 prior to site paint finish where specified.
- .2 Clean all members of loose mill scale, rust, oil, dirt, slag, flux deposits, and other foreign matter by scraping, wire brushing, or other effective approved methods.
- .3 Apply one coat of grey primer in shop to all steel surfaces to achieve minimum dry film thickness of not less than 1 mil, except:
  - .1 Galvanized steel.
  - .2 Surfaces to be encased in concrete.
  - .3 Surfaces and edges to be field welded.
- .4 Apply primer under cover, on dry surfaces when surface and air temperatures are above 5°C.
- .5 Maintain dry condition and 5°C minimum temperature until primer is thoroughly dry.
- .6 Strip paint from bolts, nuts, sharp edges and corners before prime coat is dry.
- .7 Provide

.2 Galvanizing.
- .1 Hot dip galvanize steel where indicated to ASTM A123/A123M, minimum zinc coating of 600 g/m^2.
- .2 Touch up field cut, welded and/or damaged galvanized surfaces with zinc rich paint in accordance with ASTM A780/A780M.
- .3 Provide smooth galvanizing coating to surfaces of all steel items installed outdoors, free of blisters, lumpiness and runs.

Part 3 Execution

3.1 INSTALLATION

.1 Erect metal work square, plumb, straight, and true, accurately fitted, with tight joints and intersections.

.2 Install serrated metal stairs square, plumb, straight, and true, accurately fitted, with tight joints and intersections, and in accordance with NAAMM AMP 510 and ANSI/NAAMM AMP 521.

.3 Provide suitable means of anchorage acceptable to Consultant, such as dowels, anchor clips, bar anchors, expansion bolts and shields, toggles.

.4 Exposed fastening devices to match finish and be compatible with material through which they pass.

.5 Provide components for building by other sections in accordance with shop drawings and schedule.

.6 Make field connections with bolts to CAN/CSA S16.1, or weld.

.7 Hand items over for casting into concrete or building into masonry to appropriate trades together with setting templates.

.8 Touch-up field welds, bolts and burnt or scratched surfaces after completion of erection with suitable primer.

.9 Touch up field cut, welded and/or damaged galvanized surfaces with zinc rich paint in accordance with ASTM A780/A780M.

3.2 CLEANING

.1 Clean up rubbish and debris promptly as work proceeds and at conclusion of work. Remove from site.

3.3 SCHEDULES

.1 Children's Play House.
- .1 Fabricate from steel HSS as indicated.
- .2 Finish: shop coat prime paint and site painted by Section 09 90 00.

.2 Low Partition Stiffener.
- .1 Stiffener: 89 x 89 x 6 mm steel angle welded.
- .2 Base plate: 89 x 6 mm x length to suit, drilled to accept floor anchors, welded to stiffener.
- .3 Gusset: 6 mm thick, triangular size to suit, welded to base plate and stiffener.
- .4 Finish: shop coat prime paint.

.3 Metal Stairs.
- .1 Structure: fabricate from galvanized steel, profiles and sections to sizes as indicated.
- .2 Treads: safety grating stair treads as specified.
- .3 Pipe Railings: fabricate from galvanized steel (unfinished), profiles and sections to sizes as indicated.
- .4 Finish: galvanized.

.4 Perimeter Trim Angles in Living Room Panels.
- .1 Fabricate from steel angles as indicated.
- .2 Finish: shop coat prime paint and site painted by Section 09 90 00.

.5 Reception/Service Desk Supports.
- .1 Fabricate from steel HSS and angles as indicated.
- .2 Finish: shop coat prime paint and site painted by Section 09 90 00.

.6 Rung Ladders.
- .1 Rungs: safety ladder rungs as specified.
- .2 Stringers: 64 x 64 mm angle.
- .3 Brackets: as indicated and to suit application, to set ladder minimum 150 mm clear of wall, spaced 1500 mm on-centre on both stringers.
- .4 Finish: galvanized.

.7 Steel Lintels.
- .1 Steel angles: galvanized in sizes as indicated for openings. Provide 150 mm minimum bearing at ends.
- .2 Weld or bolt back-to-back angles to profiles as indicated.
- .3 Finish: galvanized (interior: site painted by Section 09 90 00).

.8 Sump Pit Cover and Frame.
- .1 Fabricate from 6 mm thick steel checker plate set in 38 x 38 x 6 mm steel angle frame. Include anchors as indicated for embedding in concrete and lift ring recessed into plate.
- .2 Finish: galvanized.

.9 Truss Collars.
- .1 Fabricate from steel shapes as indicated.
- .2 Finish: shop coat prime paint and site painted by Section 09 90 00.
- .3 Provide sealant finish at joint between collar and wall finish.

.10 Vanity Support.
- .1 Fabricate from steel HSS as indicated.
- .2 Finish: shop coat prime paint and site painted by Section 09 90 00.

.11 Wire Mount at Service Desk.
- .1 Fabricate from steel channel as indicated.
- .2 Finish: shop coat prime paint and site painted by Section 09 90 00.

END OF SECTION

Part 1 General

1.1 DESCRIPTION

.1 This specification shall cover the fabrication and installation of the garbage bin enclosure.

1.2 RELATED SECTIONS

.1 Section 06 10 00 - Exterior Site Carpentry.

1.3 REFERENCES

.1 American Society for Testing and Materials International, (ASTM)

- .1 ASTM A53/A53M-02, Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Steamless.
- .2 ASTM A269-02, Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.
- .3 ASTM A307-02, Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.

.2 Canadian General Standards Board (CGSB).

- .1 CAN/CGSB-12.1-M90, Tempered or Laminated Safety Glass or latest.

.3 Canadian Standards Association (CSA International)

- .1 CAN/CSA-G40.20/G40.21-98, General Requirements for Rolled or Welded Structural Quality Steel.
- .2 CAN/CSA-G164-M93(R1998), Hot Dip Galvanized or Irregularly Shaped Articles, or latest.
- .3 CAN/CSA-S16.1-01, Limit States Design of Steel Structures.
- .4 CSA W48-01, Filler Metals and Allied Materials for Metal Arc Welding (Developed in co-operation with the Canadian Welding Bureau).
- .5 CSA W59-1989, R2001,Welded Steel Construction, Metal Arc Welding, Imperial Version.

.4 Painting for Exterior Applications:

- .1 SSPC – Steel Structures Painting Councils.
- .2 CAN/CGSB-1.40-97, Anti-corrosive Structural Steel Alkyd Primer.
- .3 CAN/CGSB-1.181-92, Ready-mix, Organic Zinc-rich Coating.

1.4 SUBMITTALS

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

.2 Submit product data for:

- .1 Paint product: two (2) copies of WHMIS MSDS – Material Safety Data Sheets.

.3 Submit samples for:

- .1 Steel bar
- .2 Steel round tubing
- .3 Steel ‘L’ Angles
- .4 Steel rectangular tubing

.4 Submit shop drawings for:

.1 Garbage Bin Enclosure.

.2 C.I.P. Concrete and Timber Bench.

.5 Use construction Drawings as reference only. Field verify as-built conditions and dimensions. Report any discrepancies to Contract Administrator if as-built conditions are significantly different from Drawings.

.6 Clearly indicate materials, sizes, assembly, welds, connections, joints, anchorage, fastener type and fastening method, finishes etc. and installation details.

.7 Provide a list of hardware and miscellaneous items.

.8 Provide templates, patterns, fixing diagrams, as required.

.9 Indicate related, adjacent materials, and connections.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver materials to site, suitably packaged, clearly marked with identification symbols and/or information. Do not deliver materials long before they are required on site. Cause no delays to scheduling.

.2 Temporarily store materials in storage areas as directed by the Construction Manager.

.3 Store materials in a dry location off the ground, and prevent damage.

.4 Materials that have been damaged or deemed unfit for use during delivery or storage shall be immediately replaced at no cost to The City.

1.6 SITE CONDITIONS

.1 Make a careful examination of the site conditions and investigate all matters relating to the nature of the work to be undertaken, the means of access and egress, the rights and interests which may be interfered with during the construction of the work.

.2 Report any discrepancies or omissions to the Contract Administrator, who will issue written clarification. Oral interpretations or instructions are not acceptable.

1.7 QUALITY ASSURANCE

.1 Painter shall be trained and qualified industrial metal painting professionals with more than five (5) years of experience. Shop must be ISO certified and fully equipped to prepare, prime and paint large scale structural metal members and deliver them to site for field erection.

.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 this specification will be enforced. 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. The Contract Administrator reserves the right to reject any materials or works that are not in accordance the requirements of this specification.

Part 2 Products

2.1 STEEL BAR

.1 10mm bar, steel, semi-gloss black enamel finish.

2.2 STEEL ROUND TUBING

.1 89mm Ø HSS round tubing, steel, semi-gloss black enamel finish.

2.3 STEEL 'L' ANGLES

.1 63.5 x 63.5 x 3mm Plate, flat black finish.

2.4 STEEL RECTANGULAR TUBING

25 x 51mm rectangular tubing, steel, flat black finish.

2.5 FASTENERS

.1 Stainless steel.

2.6 ACCESSORIES

.1 Welding materials: to CSA W59.

.2 Welding electrodes: to CSA W48 Series.

.3 Paint: Tremclad Flat Black.

.4 Paint: Tremclad Semi-glass Black.

.5 Anchor bolts: see structural.

.6 Grout: see structural.

Part 3 Execution

3.1 FABRICATION

.1 Obtain approval of samples and shop drawings prior to ordering materials and commencing fabrication.

.2 Preparation priming and painting of members shall be completed in the controlled environment of a paint shop if at all possible. If painting operations must occur in the field obtain Contract Administrators to review the Work that is to be completed in the field, prior to proceeding.

.3 Debur and degrease metal surfaces using products approved by the paint manufacturer.

.4 Conduct abrasive blasting to fully clean the metal.

.5 Pressure wash metal in accordance with all Federal, Provincial and local water consumption and disposal regulations. Contact Contract Administrator for review and approval of prepared surface.

.6 Paint shall be stored, thinned, handled, mixed and applied in accordance with SSPC-PA 1, Shop Field and Maintenance Coating of Steel, and per the express written specifications of the manufacturer.

.7 Apply paint coats only when temperatures can be controlled or predicted to be within the manufacturers acceptable window. When there is a drop in temperature after the coating is applied adjust recoat time period per manufacturers specifications.

.8 Paint shall be applied within twenty-four (24) hours of completion of surface preparation.

.9 Use spray gun system for main application and brushes of suitable size for field touch ups. Point spray gun at outside edges coating edges and seams thoroughly prior to coating remaining areas.

.10 Touch-up runs and snags immediately while paint application is in progress.

.11 Application related failures shall be corrected prior to the application of a subsequent coat.

.12 Where excessive coating thickness produces 'Mud Cracking' coating shall be scraped back to bare metal, and sanded to a soundly bonded coating layer then reapplied to the specified thickness.

.13 Apply as many coats as necessary to ensure even and proper coating of metal, to be reviewed and approved by the Contract Administrator.

3.2 DELIVERY TO SITE

.1 Allow all shop painted members to fully cure before preparing for shipment.

.2 Once fully cured wrap members in cellophane plastic or bubble wrap designed to protect finished surfaces without scratching or marring them during transport. Secure wrappings with appropriate tape or adhesives that are sturdy but can easily be removed at the site.

.3 Deliver to site with equipment suitable for carrying steel loads and capable of hoisting steel members over other features into their final locations.

3.3 INSTALLATION

.1 Erect metal work square, plumb, straight and true, accurately fitted, with tight joints and intersections.

.2 Provide suitable and acceptable means of anchorage, such as dowels, anchor clips, bar anchors, expansion bolts and shields, and toggles.

.3 Exposed fastening devices to match finish and be compatible with material through which they pass, as per the drawings.

.4 Do welding work in accordance with CSA W59, unless specified otherwise.

.5 Make field connections with high tensile bolts, or weld to CSA S16.1-M (latest).

.6 Touch up rivets, field welds, bolts and burnt or scratched surfaces after erection.

3.4 PAINT TOUCH-UPS

.1 Ensure all welding work and mechanical fasteners are wiped clean and free of oil, debris and grit.

.2 Apply touch-ups with appropriately sides brushes to get into all grooves and voids

.3 Thickness of touch-ups shall match thickness of adjacent paint

.4 Once all touch-ups are complete contact Contract Administrator for review and approval of metal work and coating.

3.5 ACCEPTANCE

.1 Work will be accepted only if it is erected true to the design intent in conformation with shop drawings and site instructions.

.2 Products shall be accepted if they meet the performance standards of the product supplier and match the sample accepted as the standard of performance at the commencement of painting.

.3 Painted surfaces shall be warrantied against corrosion, peeling and general failure for two (2) years after date of total performance.

3.6 CLEANING

.1 Upon completion of installation, remove construction and accumulated environmental dirt, surplus materials, rubbish, tools and equipment barriers in accordance with section 01 74 00 – Cleaning and Waste Processing.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 06 10 00 – Rough Carpentry.

.2 Section 06 40 00 – Architectural Woodwork.

1.2 REFERENCES

.1 American Society for Testing and Materials (ASTM).
- .1 ASTM A269/A269M-15a, Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.
- .2 ASTM A276/A276M-16a, Standard Specification for Stainless Steel Bars and Shapes.
- .3 ASTM A480/A480M-16b, Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip.
- .4 ASTM A632-04(2014), Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing (Small-Diameter) for General Service.

.2 American Welding Society (AWS).
- .1 AWS D1.6/D1.6M-2007 - Structural Welding Code - Stainless Steel.

.3 Canadian Standards Association (CSA).
- .1 CSA W48-14, Filler Metals and Allied Materials for Metal Arc Welding.
- .2 CSA W59-13, Welded Steel Construction (Metal Arc Welding).

1.3 SUBMITTALS

.1 Shop Drawings.
- .1 Submit shop drawings in accordance with Section 01 33 00.
- .2 Indicate materials, core thicknesses, profiles, sizes, finishes, connections, joints, method of anchorage, number of anchors, supports, reinforcing, details, fasteners, and accessories.
- .3 Indicate welded connections using standard welding symbols.

1.4 QUALITY ASSURANCE

.1 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three (3) years' documented experience. Submit proof of experience upon Consultant's request.

.2 Welders' Certificates: Submit in accordance with Section 01 33 00, certifying welders employed on the Work, verifying qualification within the previous 12 months to CSA-W55.3.

.3 Welded Stainless Steel Construction: AWS D1.6/D1.6M.

Part 2 Products

2.1 MATERIALS

.1 Stainless Steel Material.
- .1 Stainless Steel Sections and Plates: to ASTM A480/A480M and ASTM A276/A276M, Type 304 with #4 finish, commercial grade, seamless welded.
- .2 Stainless Steel Tubing: to ASTM A269/A269M and A632, Type 304 with #4 finish, commercial grade, seamless welded.

2.2 ACCESSORIES

.1 Welding Materials: to CSA W59.

.2 Welding Electrodes: to CSA W48 Series.

.3 Fasteners for Stainless Steel: stainless steel of a size, type, quantity and length to meet the load requirements.

2.3 FABRICATION GENERAL

.1 Do not fabricate prior to receipt of reviewed shop drawings.

.2 Fabricate work square, true, straight and accurate to required size, with joints tightly fitted and properly secured. Verify all dimensions prior to fabrication.

.3 Fit and shop assemble items in largest practical sections for delivery to site.

.4 Deburr, smooth and round off raw edges prior to forming. Remove and grind smooth burrs, filings, sharp protrusions, and other projections from metal fabrications to prevent possible injury. Correct dangerous or potentially harmful installations.

.5 Use self-tapping shake-proof flat headed screws on items requiring assembly by screws or as indicated.

.6 Welding: sound, non-porous, and free from imperfections.
- .1 Weld metal to be colour matched to, and be as corrosion-resistant as parent metal.
- .2 Spot welds, if any, to be minimum 3.0 mm diameter and have full penetration.
- .3 Grind exposed welds smooth and polish to match parent metal.
- .4 Grind other welds smooth and flush.
- .5 Welding and finishing is not to impair corrosion resistance of finished article.
- .6 Welds, except spot welds, shall be continuous unless otherwise indicated.

.7 Fabricate components with concealed fastening only. Exposed fastening not permitted.

.8 Fabrication Tolerances.
- .1 Squareness: 2 mm maximum difference in diagonal measurements.
- .2 Maximum Offset Between Faces: 1.6 mm.
- .3 Maximum Misalignment of Adjacent Members: 1.6 mm.
- .4 Maximum Bow: 3 mm in 1.2 m.
- .5 Maximum Deviation from Plane: 1.6 mm in 1.2 m.

2.4 STAINLESS STEEL FABRICATION

.1 Fabricate work square, true, straight, to fit conditions and as indicated. Design is to afford maximum sanitary conditions and is not to have any areas where disease causing bacteria may accumulate. Close hollow sections by continuous welding. Cove intersections of horizontal and vertical sheet metal surfaces on 16 mm radius minimum.

.2 Welding to be sound, non-porous and free from imperfections. Weld metal to be colour matched, and be as corrosion resistant as parent metal. Spot welds, if any, to be minimum 3 mm diameter and have full penetration. Grind exposed welds, and smooth and polish to match parent metal. Grind other welds smooth. Welding or finishing is not to impair corrosion resistance of finished article. Welds, except spot welds, shall be continuous unless otherwise indicated.

.3 Make field connections by continuous welding. Grind smooth and polish to match adjacent surfaces.

.4 Fastening and sealing: where stationary or fixed and matching items butt against one another, join with concealed stainless steel fasteners. Seal joints. Where joints cannot be sealed with single pass, use stainless steel filler strip in conjunction with sealant. Where items are against or through walls or partitions seal resultant joint.

2.5 FINISHES

.1 Stainless Steel Finish:
- .1 No. 4 brushed finish, except where other finish is specified by item.
- .2 Grind and polish to uniform finish, with no visible welds and free of cross scratches.
- .3 When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces clean.

Part 3 Execution

3.1 EXAMINATION

.1 Verify that field conditions are acceptable and are ready to receive work.

.2 Verify dimensions, tolerances, and method of attachment with other work.

.3 Exposed fastening devices to match finish and be compatible with material through which they pass.

3.2 INSTALLATION

.1 Install work square, plumb, straight, and true, accurately fitted, with tight joints and intersections.

.2 Provide suitable means of anchorage acceptable to Consultant.

.3 Obtain Consultant's approval prior to site cutting or making adjustments not scheduled.

.4 Exposed fastening devices to match finish and be compatible with material through which they pass.

.5 Provide components for building by other sections in accordance with shop drawings and schedule.

.6 Hand items over for casting into concrete or building into masonry to appropriate trades together with setting templates.

.7 Touch-up field welds, bolts and burnt or scratched surfaces after completion of erection with suitable primer.

3.3 CLEANING

.1 Clean up rubbish and debris promptly as work proceeds and at conclusion of work. Remove from site.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 08 11 00 – Metal Doors and Frames.

.2 Section 08 41 13 – Aluminum-Framed Entrances and Storefronts.

.3 Section 09 22 16 – Non-Structural Metal Framing.

.4 Section 09 29 00 – Gypsum Board.

1.2 REFERENCES

.1 American Society for Testing and Materials (ASTM).
- .1 ASTM A153/A153M-16a, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
- .2 ASTM A653/A653M-17, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- .3 ASTM D5456-17e1, Standard Specification for Evaluation of Structural Composite Lumber Products.

.2 American Wood Protection Association (AWPA).
- .1 AWPA Book of Standards, 2017.
- .2 AWPA M2-16, Standard for Inspection of Treated Wood Products.

.3 Canadian Standards Association (CSA).
- .1 CAN/CSA O80 SERIES-15, Wood Preservation.
- .2 CSA O86-14, Engineering Design in Wood.
- .3 CSA O121-17, Douglas Fir Plywood.
- .4 CSA O141-05(R2014), Softwood Lumber.
- .5 CSA O151-17, Canadian Softwood Plywood.
- .6 CSA O153-13(R2017), Poplar Plywood.
- .7 CSA O325-16, Construction Sheathing.

.4 National Building Code of Canada, 2010 (NBCC).

.5 National Lumber Grades Authority (NLGA)
- .1 NLGA SPS 1 Special Products Standard for Fingerjoined Structural Lumber, 2017.
- .2 NLGA Standard Grading Rules for Canadian Lumber, 2017.

.6 Underwriters Laboratories of Canada (ULC).
- .1 CAN/ULC S102-10, Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.

1.3 QUALITY ASSURANCE

.1 Lumber identification: by grade stamp of agency certified by Canadian Lumber Standards Accreditation Board.

.2 Plywood identification: by grade mark in accordance with applicable CSA standards.

1.4 DELIVERY, STORAGE, AND HANDLING

.1 Deliver all material to site in manufacturer’s original unopened packaging with labels clearly identifying product name and manufacturer.

.2 Store materials in a dry, enclosed area protected from exposure to moisture, construction activity, and direct sunlight in strict accordance with manufacturer's recommendations.

.3 Handle all products with appropriate precautions and care as stated manufacturer's instructions.

.4 Cleaning and Waste Management in accordance with Sections 01 74 00.

Part 2 Products

2.1 LUMBER MATERIAL

.1 Lumber: unless specified otherwise, softwood, S4S, moisture content 19% or less in accordance with CSA O141 and NLGA Standard Grading Rules for Canadian Lumber.

.2 Machine stress-rated lumber: acceptable for all purposes.

.3 Glued end-jointed (finger-jointed) lumber is not acceptable.

.4 Structural Composite Lumber (SCL) in accordance with ASTM D5456.

.5 Framing and board lumber: in accordance with NBCC.

.6 Furring, blocking, nailing strips, grounds, rough bucks, cants, curbs, panel and soffit backing:
- .1 Use S2S or S4S material.
- .2 Board sizes: "Standard" or better grade.
- .3 Dimension sizes: "Standard" light framing or better grade.
- .4 Post and timber sizes: "Standard" or better grade.

.7 Pressure Treated Dimension Lumber: vacuum pressure impregnated Alkaline Copper Quaternary (ACQ) treated lumber to CSA O80. Minimum moisture content at treatment in accordance with CAN/CSA O80. Minimum retention for above ground use 4.0 kg/m^3 and for ground contact 6.4 kg/m^3. All wood to be free of defects. Any warped, checked or bent materials will be rejected.

2.2 PANEL MATERIAL

.1 Construction Sheathing: to CSA O325.

.2 Plywood Standards: type, grade and thickness as indicated and in accordance with following standards:
- .1 Douglas fir plywood (DFP): to CSA O121, standard construction.
- .2 Canadian softwood plywood (CSP): to CSA O151, standard construction.
- .3 Poplar plywood (PP): to CSA O153, standard construction.

.3 Fire Retardant Treated Plywood: type, grade and thickness as indicated and in accordance with following standards:
- .1 Douglas Fir Plywood: pressure-treated with fire retardant chemicals to meet CAN/ULC S102, Class A Fire Retardant, made with binder containing no added urea-formaldehyde, moisture content 15% or less.

2.3 ACCESSORIES

.1 Fasteners for Exterior Work and Pressure Treated Wood: hot-dipped galvanized steel to ASTM A153/A153M (for hot-dip fastener products) and ASTM A653/A653M (G-185 coating designation for hot-dip connector and sheet products).

.2 Fasteners for Fire Retardant Treated Lumber and Plywood: hot-dipped galvanized steel to ASTM A153/A153M (for hot-dip fastener products) and ASTM A653/A653M (G-185 coating designation for hot-dip connector and sheet products).

.3 Bolts: 12.5 mm diameter unless indicated otherwise, galvanized, complete with nuts and washers.

.4 Proprietary Fasteners: galvanized toggle bolts, expansion shields and lag bolts, screws and lead or inorganic fibre plugs, explosive actuated fastening devices, recommended for purpose by manufacturer.

.5 Surface-applied Wood Preservative: as recommended by pressure impregnated material manufacturer in accordance with CAN/CSA O80.

Part 3 Execution

3.1 INSTALLATION

.1 Install members true to line, levels and elevations, square and plumb.

.2 Construct continuous members from pieces of longest practical length.

.3 Install spanning members with "crown-edge" up.

.4 Install furring and blocking as required to space-out and support door frames, casework, cabinets, wall and ceiling finishes, washroom accessories, and other work as required.

.5 Treat surfaces of ACQ treated lumber exposed by field cutting, trimming or boring with liberal application of wood preservative before installation. Apply preservative by dipping, or by brush to completely saturate and maintain wet film on surface for minimum 3-minute soak on lumber and one-minute soak on plywood.

.6 Use only hot-dipped galvanized steel fasteners with all ACQ pressure treated lumber.

.7 Install fascia backing, nailers, curbs and other wood supports as required and secure using galvanized fasteners.

.8 Install rough bucks, nailers and linings to rough openings as required to provide backing for frames and other work.

.9 Provide wood blocking where required to provide support for wall or ceiling mounted items specified or detailed including wall mounted door stops. Fasten wood blocking securely to steel studs on each side with minimum of two (2) screws on each stud.

.10 Provide backboards for mounting electrical equipment as required. Use 19 mm thick DFP or CSP on 19 x 38 mm furring around perimeter and at maximum 300 mm intermediate spacing. Paint both sides of backboards in accordance with Section 09 90 00 before installation.

.11 Frame, anchor, fasten, tie and brace members to provide necessary strength and rigidity.

.12 Countersink bolts where necessary to provide clearance for other work.

3.2 CLEANING

.1 Upon completion of work of this section remove all surplus material and debris and leave installation clean.

END OF SECTION

Part 1 General

1.1 DESCRIPTION

.1 This specification shall cover the fabrication and installation of the garbage bin enclosure, C.I.P. concrete and timber bench, and thermally modified wood deck.

1.2 RELATED SECTIONS

.1 Section 05 50 01 - Exterior Metal Fabrications

1.3 REFERENCES

.1 American Wood-Preservers' Association (AWPA)

- .1 AWPA M2, Standard for Inspection of Treated Wood Products.
- .2 AWPA M4, Standard for the Care of Preservative-Treated Wood Products.

.2 American Society for Testing and Materials International, (ASTM)

- .1 ASTM A53/A53M, Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Steamless.
- .2 ASTM A269, Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.
- .3 ASTM A307, Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.

.3 Canadian Standards Association (CSA International)

- .1 CSA B111, Wire Nails, Spikes and Staples.
- .2 CSA O141 Softwood Lumber.
- .3 CSA O80, Wood Preservation.
- .4 CSA O80.20, fire-retardant treatment of lumber by pressure processes.
- .5 CAN/CSA-G40.20/G40.21, General Requirements for Rolled or Welded Structural Quality Steel.
- .6 CAN/CSA-G164, Hot Dip Galvanizing of Irregularly Shaped Articles.
- .7 CAN/CSA-S16.1, Limit States Design of Steel Structures.

1.4 SUBMITTALS

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

.2 Submit product data and samples of the following to Contract Administrator: thermally modified lumber, pressure treated lumber, and stainless steel lag screws locking pins, heavy duty gate latch, wheels etc.

.3 Submit shop drawings for:

- .1 Garbage bin enclosure, C.I.P. concrete and timber bench, and thermally modified wood deck. Indicate dimensions, sizes, assembly, anchorage and installation details. Use construction drawings as reference. Confirm existing conditions on site by taking as-built field measurements to prepare shop drawings. Clearly indicate materials, core thickness, finishes, connections, joints, method of anchorage, number and size of anchors, supports, reinforcement, details and accessories.

1.5 QUALITY ASSURANCE

.1 Carpentry shall be performed by trained and qualified craftspeople with demonstrable experience sourcing and work.

.2 Conduct a pre-installation meeting with Contract Administrator to verify project requirements.

.3 Lumber identification: by grade stamp of an agency certified by Canadian Lumber Standards Accreditation Board.

.4 For products treated with preservative by pressure impregnation, submit following information certified by authorized signing officer of treatment plant:

.1 Information listed in AWPA.M2 and revisions specified in CAN/CSA-080 Series, Supplementary Requirement to AWPA Standard M2 applicable to specified treatment.

.2 Moisture content after drying following treatment with water-borne preservative.

.5 All wood to be free of defects. Any warped, checked or bent materials will be rejected.

Part 2 Products

2.1 GENERAL

.1 All to be free of defects. Any warped, checked or bent materials will be rejected.

.2 Wood Material source and delivery: wood shall be from one supplier and shipped by rail.

2.2 CEDAR LUMBER

.1 Material: Cedar lumber, mill run grade, rot resistant and colour consistent, FSC certified with a planed texture for decking and bench plank.

2.3 HARDWARE

.1 Nails and spikes: to CAS B111, galvanized, for exterior works. Use spiral thread nails.

.2 Bolts nuts, washers, lag screws to be hot dipped galvanized, sizes to suit application.

.3 Lag screws: hot dipped, galvanized, sizes to suit application.

.4 Gate Wheels: 150mm dia. minimum, exterior grade metal.

Part 3 Execution

3.1 PREPARATION

.1 Handle and use material in a manner that will avoid damage or field fabrication causing alteration in original treatment. Verify and confirm all underground services have been installed and accepted prior to commencing site carpentry work.

3.2 INSTALLATION

.1 Construct all work as indicated on the Drawings using adequate fastening methods to ensure solid durable finished work suitable for the purpose intended.

.2 Do all nailing and fastening neatly, evenly and thoroughly. Frame, anchor, fasten, tie and brace members to provide necessary strength and rigidity. Install all members true to line, levels and elevations.

.3 Set plumb and space uniformly. Countersink bolts where necessary to provide clearance for other work.

3.3 CLEANING

.1 Upon completion of installation, remove construction and accumulated dirt, surplus materials, rubbish, tools and equipment barriers in accordance with section 01 74 00 – Cleaning and Waste Processing.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 05 50 00 – Metal Fabrications.

.2 Section 05 50 02 – Stainless Steel Fabrications.

.3 Section 06 10 00 – Rough Carpentry.

.4 Section 06 61 16 – Solid Surfacing Fabrications.

.5 Section 07 42 13 – Metal Wall Panels.

.6 Section 07 92 00 – Joint Sealants.

.7 Section 08 14 00 – Wood Doors.

.8 Section 08 06 10 – Door Schedule.

.9 Section 08 80 00 – Glazing.

.10 Section 09 06 00.13 – Room Finish Schedule.

.11 Section 09 54 00 – Linear Wood Ceilings.

.12 Section 09 90 00 – Painting and Coating.

.13 Division 22 – Plumbing.

.14 Division 26 – Electrical.

1.2 WORK OF OTHER SECTIONS

.1 On-site supply and installation of transparent or semi-transparent finish to all exposed wood surfaces by Section 09 90 00 in accordance with North American Architectural Woodwork Standards (NAAWS).

.2 On-site supply and installation of opaque paint finish to all exposed designed saw-cuts and other narrow reveals that expose substrate or core material by Section 09 90 00. Colour to be selected by Consultant.

1.3 REFERENCES

.1 American Society for Testing and Materials (ASTM).

- .1 ASTM A480/A480M-16, Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip.
- .2 ASTM D638-14, Standard Test Method for Tensile Properties of Plastics.
- .3 ASTM D1037-12, Standard Test Methods for Evaluating Properties of Wood-Base Fiber and Particle Panel Materials.
- .4 ASTM D3453-12, Standard Specification for Flexible Cellular Materials - Urethane for Furniture and Automotive Cushioning, Bedding, and Similar Applications.
- .5 ASTM D3574-17, Standard Test Methods for Flexible Cellular Materials-Slab, Bonded, and Molded Urethane Foams.
- .6 ASTM E84-18a, Standard Test Method for Surface Burning Characteristics of Building Materials.
- .7 ASTM G21-15, Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi

.2 American National Standards Institute (ANSI)/National Particleboard Association (NPA).

- .1 ANSI/NAP A208.1-2016, Particleboard.

.3 American National Standards Institute/Builders Hardware Manufacturers Association (ANSI/BHMA).
- .1 ANSI/BHMA A156.9-2015, Cabinet Hardware.
- .2 ANSI/BHMA A156.11-2014, Cabinet Locks.
- .3 ANSI/BHMA A156.28-2013, Master Keying Systems

.4 Architectural Woodwork Manufacturers Association of Canada (AWMAC) / Woodwork Institute (WI).
- .1 North American Architectural Woodwork Standards (NAAWS), Edition 3.1, 2017.

.5 Canadian Standards Association (CSA).
- .1 CSA O121-17, Douglas Fir Plywood.
- .2 CSA O141-05(R2014), Softwood Lumber.
- .3 CSA O151-17, Canadian Softwood Plywood.
- .4 CSA O153-13(R2017), Poplar Plywood.
- .5 CSAW48-06 (R2011), Filler Metals and Allied Materials for Metal Arc Welding.

.6 Canadian General Standards Board (CGSB).
- .1 CAN/CGSB-12.12-M90, Plastic Safety Glazing Sheets.
- .2 CAN/CGSB-19.13-M87, Sealing Compound, One-Component, Elastomeric, Chemical Curing.
- .3 CAN/CGSB-71.20-M88, Adhesive, Contact, Brushable.

.7 National Electric Manufacturer's Association (NEMA).
- .1 ANSI/NEMA LD 3-2005, High-Pressure Decorative Laminates.

.8 National Lumber Grades Authority (NLGA).
- .1 NLGA Standard Grading Rules for Canadian Lumber, 2017.

.9 National Hardwood Lumber Association (NHLA).
- .1 NHLA Rules for Measurement and Inspection of Hardwood and Cypress, 2015.

.10 National Fire Protection Association (NFPA).
- .1 NFPA 260, Standard Methods of Tests and Classification System for Cigarette Ignition Resistance of Components of Upholstered Furniture, 2013.

.11 Underwriters Laboratories of Canada (ULC).
- .1 CAN/ULC S102-10, Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.

1.4 DEFINITIONS

.1 Identification of millwork components and related products by surface visibility.
- .1 Open Interiors: any open storage unit without solid door or drawer fronts.
- .2 Closed Interiors: any closed storage unit behind solid door or drawer fronts.
- .3 Exposed Ends: any storage unit exterior side surface that is visible after installation.
- .4 Other Exposed Surfaces: faces of doors and drawers when closed, and tops of cabinets less than 1830 mm above finished floor.
- .5 Semi-Exposed Surfaces: interior surfaces which are visible, bottoms of wall cabinets and tops of cabinets 1830 mm or more above finished floor, bottoms of raised gables.
- .6 Concealed Surfaces: any surface not visible after installation.

1.5 SUBMITTALS

.1 Make all submittals in accordance with requirements of Section 01 33 00.

.2 Shop Drawings.
- .1 Submit shop drawings in accordance with Section 01 33 00.

.2 Indicate construction details including typical and special installation conditions, materials being supplied and all connections, attachments, anchorage and location of exposed fastenings, as applicable.

.3 Indicate dimensions, description of materials and finishes, material thicknesses, general construction, specific modifications, component connections, anchorage methods, hardware, and installation procedures, plus the following specific requirements:

.1 Include section drawings of typical and special millwork, work surfaces and accessories.

.2 Indicate locations of plumbing and electrical service field connection by others.

.4 Submit manufacturer's descriptive literature of specialty items not manufactured by Contractor.

.3 Samples.

.1 Submit duplicate samples of laminated plastic joints, edging, cutouts, and postformed profiles.

.2 Provide duplicate 625 cm² finished samples of each finish to be applied at factory.

.3 Submit samples of each type of hardware specified in accordance with Section 01 33 00, when requested by Consultant. Identify each sample by label indicating applicable specification paragraph number, brand name and number, finish and hardware package number.

.4 When approved, samples serve as standard for workmanship and appearance for similar items throughout project.

.4 Closeout Submittals.

.1 Submit operation and maintenance data for incorporation into Operations and Maintenance Manual specified in Section 01 78 00.

1.6 QUALITY ASSURANCE

.1 Qualifications.

.1 Manufacturer: minimum of five (5) years' experience in manufacturing architectural woodwork for similar types of projects, and adequate facilities and personnel required to perform on this project.

.2 **Installer: Manufacturer to perform installation. Any installer other than manufacturer is prohibited, unless pre-approved by the City and Design Consultant.**

.2 Regulatory Requirements.

.1 Comply with NAAWS for grades of raw materials (lumber and wood veneers) and sawing/slicing as specified.

.2 Perform work of this Section to specified standards for quality of workmanship, materials, installation and execution of the design intent in accordance with NAAWS.

.3 Notify Consultant of conflicts between NAAWS and this Section.

.3 Mock-ups.

.1 Construct mock-ups in accordance with Section 01 45 00.

.2 Shop prepare the following mock-ups:

.1 One (1) typical wood veneer panel (WVP) and one (1) moss panel in designated location.

.3 Co-ordinate mock-up review by Consultant during a regular site visit before proceeding with work of this Section.

.4 When accepted, mock-up will demonstrate minimum standard for this work. Mock-up may remain as part of finished work.

1.7 DELIVERY, STORAGE, AND HANDLING

.1 Maintain relative humidity during fabrication, storage and installation of architectural woodwork between 25% and 55% at 21°C in order to keep unfinished interior wood at satisfactory moisture level.

.2 Transport, handle or store assembled architectural woodwork and/or their component parts in manner to preclude damage of any kind.

.1 Cover plastic laminate surfaces with heavy kraft paper or put in cartons during shipment.

.2 Do not subject items to abnormal heat, extreme dryness, humid conditions, sudden changes in temperature, or direct sunlight.

.3 Store items on level surface in area with proper humidity control and ventilation to prevent wetting and/or other damage.

.3 Woodwork which is damaged in any way or does not comply with these specifications will be rejected by the Consultant and must be removed from the job site and replaced with acceptable materials.

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

.5 Cleaning and maintenance in accordance with Section 01 74 00.

1.8 WARRANTY

.1 Provide an extended warranty for Work of this Section for a period of three (3) years from date of Substantial Performance of the Work. Contractor hereby warrants that architectural woodwork including doors will not warp, twist, show core lines, split, delaminate, sag, and these or other observed defects and deficiencies will be repaired or replaced to the satisfaction of the Consultant and the City, and at no expense to the City.

Part 2 Products

2.1 MANUFACTURERS

.1 Acceptable Products.

.1 Slatwall.

.1 Marlite, Slatwall 2000 Series, with vinyl colorsnaps.

.2 Requests for substitutions will be considered subject to specified requirements and in accordance with Bidding Procedures B8.

.3 Supply similar products from single manufacturer.

2.2 WOOD MATERIALS

.1 Softwood Lumber: “Premium Grade” softwood lumber, S4S, moisture content 4-9% or less in accordance with following standards:

.1 CSA O141.

.2 NLGA Standard Grading Rules for Canadian Lumber.

.2 Hardwood Lumber (W): “Premium Grade” white oak, rift cut, to NAAWS, no mineral streaks or black flecks accepted, make careful consideration for colour and grain consistency, moisture content 4-9% or less in accordance with following standards:

.1 NAAWS North American Architectural Woodwork Standards.

.2 NLGA Standard Grading Rules for Canadian Lumber.

.3 NHLA Rules for Measurement and Inspection of Hardwood and Cypress

2.3 SHEET MATERIAL

.1 Softwood Plywood.
- .1 Douglas Fir Plywood: to CSA O121, standard construction.
- .2 Canadian Softwood Plywood: to CSA O151, standard construction.
- .3 Poplar Plywood: to CSA O153, standard construction.

.2 Wood Particleboard: medium density industrial grade (40-50 lb/ft3) to ANSI/NAP A208.1-M-2 (up to 22 mm thick), high density (>50 lb/ft3) to ANSI/NAP A208.1-M-3 (25 mm thick and thicker), manufactured from 100% recycled wood fiber, made with binder containing no added urea-formaldehyde, flame spread 150 or less to CAN/ULC S102, ASTM E84 and ASTM D1037.

.3 Medium Density Fiberboard (MDF): 46-47 lb/ft3 (up to 22 mm thick) to ANSI/NPA A208.2, manufactured from 100% recycled wood fiber, made with binder containing no added urea-formaldehyde, flame spread 150 or less to CAN/ULC S102, ASTM E84 and ASTM D1037.

.4 Melamine Component Panels (MCP): high-wear resistant melamine resin impregnated decorative paper VGS 0.7 mm (.028") in accordance with NEMA Test LD3 (equal or exceeding 400 cycles) thermally fused to industrial grade particleboard core of thickness indicated which meets or exceeds ANSI/NAP A208.1, manufactured from 100% recycled wood fiber, made with binder containing no added urea-formaldehyde, flame spread 150 or less to CAN/ULC S102, ASTM E84 and ASTM D1037. Colour: white unless otherwise noted.

.5 Slatwall: 19 mm thick industrial grade MDF panels to ANSI A208.2, pre-engineered and machined with T-grooves for use with retail display hardware. No added urea-formaldehyde. Provide slatwall in single panel cut to required size for direct fastening to substrate.
- .1 Finish: Primed ready for shop finishing.
- .2 Grooves: 76 mm on-centre spacing by nominal 13 mm deep.
- .3 Groove insert: vinyl strip, colour selected by Consultant from manufacturer's standard colour range.
- .4 Edge Trim: PVC at top and bottom edges.

.6 Weathering Steel Panel: refer to Section 07 42 13.

.7 Adhesives for Sheet Materials.
- .1 Ensure low VOC content of adhesives, sealants, and sealant primers.
- .2 Core materials and adhesives to contain no added urea-formaldehyde.

.8 Wood Veneer Paneling (WVP).
- .1 Construction: 3 ply, MDF core, wood veneer faced.
- .2 Components.
  - .1 Core: 19 mm Class A/Class 1 fire-rated medium density fibreboard (MDF) core in accordance with ANSI/NAP A208.2-M-2.
  - .2 Face Veneer: "Premium Grade" white oak, rift cut, book matched and in accordance with NAAWS, no mineral streaks or black flecks accepted, make careful consideration for colour and grain consistency
  - .3 Balancing Veneer: mill option back, sealed in accordance with manufacturer's recommended sealer.
  - .4 Exposed Edging: veneer edging, species & cut to match face veneer and in accordance with NAAWS.
  - .5 Steel and Stainless steel reveals; Refer to details for profiles and sizes.

2.4 LAMINATE MATERIALS

.1 Plastic Laminate (PL).
- .1 High-Pressure Decorative Laminate HGS, 1.2 mm (.048") to ANSI/NEMA Test LD 3, decorative surface papers, impregnated with melamine resins, bonded under heat and pressure to kraft papers impregnated with phenolic resins.
- .2 High-Pressure Backer BKH, 1.2 mm (.048") to ANSI/NEMA Test LD3.
- .3 Colour and Finish: Up to six (6) colours and/or patterns will be selected by Consultant from manufacturer's full range, including all woodgrains.

.2 Adhesives for Plastic Laminate.
- .1 Ensure low VOC content of adhesives, sealants, and sealant primers.
- .2 Laminating adhesives to contain no added urea-formaldehyde.

2.5 STEEL MATERIALS

.1 Refer to Section 05 50 00 – Metal Fabrications. All steel components part of architectural woodwork to be supplied by Section 05 50 00, but installed by work of this Section.

2.6 STAINLESS STEEL MATERIALS

.1 Refer to Section 05 50 02 – Stainless Steel Fabrications. All stainless steel components part of architectural woodwork to be supplied by Section 05 50 02, but installed by work of this Section.

2.7 WEATHERING STEEL

.1 Refer to Section 07 42 13 – Metal Wall Panels. All weathering steel components part of architectural woodwork to be supplied by Section 07 42 13, but installed by work of this Section.

2.8 GLAZING

.1 Refer to Section 08 80 00 – Glazing. All glazing as part of architectural woodwork to be supplied by Section 08 80 00, but installed by work of this Section.

2.9 ACCESSORIES

.1 Joint Sealants: in accordance with Section 07 92 00.

.2 Sealer: water resistant sealer or glue acceptable to laminate manufacturer.

.3 Slatwall Accessories: Clear acrylic brochure, and magazine holders. Confirm compatibility of holders with slatwall panel.
- .1 Brochure holders: suitable for tri-fold brochures, 105 mm wide x 150 mm high x 32 mm deep with integral bracket for inserting in slatwall groove.
  - .1 Quantity: 6.
- .2 Magazine holder: suitable for magazines and letter-size literature; 218 mm wide x 200 mm high x 50 mm deep with integral bracket for inserting in slatwall groove.
  - .1 Quantity: 6.

.4 Upholstered Cushions.
- .1 Upholstery Fabric.
  - .1 Contents: 100% Vinyl.
  - .2 Backing: Knit, Polyester.
  - .3 Weight: 946 g/lm.
  - .4 Finish: BeautyGard Supreme.
  - .5 Width: 1370 mm.
  - .6 Repeat: 476 mm V x 457 mm H.

.7 Flammability: in accordance with NFPA 260.
.8 Basis of Design Product.
.1 DesignTex Catalyst 3352, colour to be selected from manufacture's entire selection.

.2 High Density Foam: polyurethane foam to ASTM D3453 and ASTM D3574, fire-retardant, non-hardening, non-oxidizing, and having high resistance to moisture, mildew, and tearing. Indentation load deflection not to exceed 25% for 50 mm thickness under load of 172.5 kPa.

2.10 HARDWARE

.1 Hardware Basis of Design Products.

.1 Hinges: to ANSI/BHMA A156.9, concealed (European) hinge, self-closing hinge with 3-dimensional adjustment, attached with, height adjustable mounting plate, nickel finish, 107° opening angle and closing braking system. Provide hinge limiters for all cabinet doors that are adjacent to a wall.
.1 Blum Clip Top with Blumotion.
.2 Doors 1220 mm and over in height require four (4) hinges per door.

.2 Pulls: to ANSI/BHMA A156.9, 125 mm centre to centre, satin nickel finish. Provide bolts of sufficient length to pass through total thickness of door front
.1 Richelieu 21021.

.3 Shelf Supports: to ANSI/BHMA A156.9.
.1 Shelf Clips: metal shelf support, 6 mm diameter, nickel plated finish.
.1 Richelieu 5833180.

.4 Pencil and Small Box Drawer (up to 140 mm high, maximum 406 mm wide) Slides: to ANSI/BHMA A156.9, medium-duty, 100 lb. load capacity.
.1 Side-Mounted Full-Extension Drawer Slides - ball bearing, easy close action, finish to be selected By Consultant.
.1 Accuride 3832EC – Overtravel.

.5 Standard Box Drawer (141 to 260 mm high, maximum 610 mm wide) Slides: to ANSI/BHMA A156.9, medium-duty, 100 lb. load capacity.
.1 Side-Mounted Full-Extension Drawer Slides – steel ball bearing, finish to be selected by Consultant.
.1 Accuride 7434 – Overtravel.

.6 Door and Drawer Bumpers: to ANSI/BHMA A156.9.
.1 Door and Drawer Bumpers: 7 mm diameter (nominal) install in pairs, clear.
.1 3M model SJ5302.
.2 Bumper Specialties BS-27.
.3 Knape & Vogt 2680 CL.
.4 Mepla-Alfit 630.000.03.07.

.7 Cabinet Cam Locks: to ANSI/BHMA A156.11.
.1 Acceptable Products.
.1 CompX National #C8103-101-26D.
.2 Ilco Wafer Cam Lock.

.8 Horizontal Cable Guide (under self-check countertop and service desk): 89 mm wide removable aluminum flap system screw fastened to millwork to hold cables in position, black finish.
.1 Richelieu Horizontal Cable Guide #1689090.

.9 Grommet: zinc, 76 mm x 76 mm overall width, satin aluminum finish.
.1 Richelieu 767610

.10 Closet rod and end flange: for installation parallel to opening, steel tube, 25 mm diameter (nominal), end and centre support flanges, chrome finish.
.1 Häfele 801.12.205 rail, 803.51.757 end supports, 802.02.250 centre support.
.2 Knape & Vogt 770-1 rail, 760 ANO centre support, 734 CHR end supports.

.11 Concealed Z-Clips.
.1 Monarch Metal Fabrication, MF 375 Z-Clip with 3/8" Lift Off.

.12 Dots Coat Hook
.1 Round wood hooks in four (4) different sizes.
.2 Supply four (4) sets (of five). Co-ordinate locations with Consultant.
.1 Muuto, Dots Coat Hook, Set of 5, Oak (EU), as distributed by First Avenue Office Furnishings.

.13 Display Case Hardware.
.1 Glass shelves and doors: Refer to Section 08 80 00.
.2 Glass Shelf Supports.
.1 Pilaster Standards: 16 mm wide x 10.3 mm deep, 16-gauge steel construction, vertical slot adjustability, anochrome finish.
.2 Brackets: 406 mm deep, 16-gauge steel construction, anochrome finish.
.1 Knape & Vogt 80 Series Standards.
.2 Knape & Vogt 180 Series Brackets.
.3 Glass Door Rails.
.1 Door Rail (top of each glass door).
.1 CR Laurence #SP25BS12C (without lock) Door Rail complete with #1NT803 top pivot insert and #9040WBP centre-hung top pivot; matching finish cladding and end caps, brushed stainless steel.
.2 Door Rail (bottom of each glass door).
.1 CR Laurence #SP35BS12CR (with lock) Door Rail complete with #1NT801 bottom pivot insert , #1NT402 free swing bottom pivot and #AMR208BN dust proof keeper; matching finish cladding and end caps, brushed stainless steel.
.4 Glass Channel.
.1 25 mm x 15 mm channel with 19 mm opening to accept glass, brushed stainless anodized finish.
.1 CR Laurence #WU3BSASL.

.14 End Display Panel.
.1 Steel Stand-off: 12 mm long x 25 mm diameter base complete with matching diameter, low profile cap, brushed stainless steel finish.
.1 C R Laurence, SOB1012BS standoff with CAP1BS Standoff Cap Assembly.
.2 Plastic Glazing: 10 mm thick acrylic to CAN/CGSB-12.12
.3 Applied Graphic: Glazing surface Film (GSF3); Refer to Section 08 87 00.

.2 Requests for substitutions will be considered subject to specified requirements and in accordance with Bidding Procedures B8.

2.11 FASTENINGS

.1 Bolts, Nuts, Washers, Lags, Pins, Screws, Splines, Expansion Shields and other Fastening Devices: of size and type to suit application; stainless steel finish in both concealed and exposed locations, except exposed fastening devices for attachment of hardware to match finish of hardware, and unless otherwise noted.

.2 Concealed Joint Fasteners: threaded steel.

.3 Joint Connection Screws: marakoshi joint connection screw, decorative head, nickel finish.
- .1 Richelieu Joint Connection Screws.

.4 All fasteners to be compatible with material through which they pass.

2.12 KEYING

.1 Key cabinet locks to ANSI/BHMA A156.28, keyed alike by room/area or common function. Co-ordinate with the City and submit keying schedule for approval.

.2 Provide two keys to each independent lock.

.3 Prior to Substantial Performance, Contractor to turn over all individual keys to the City.

.4 Do not leave keys in keyway or cabinet.

2.13 FABRICATION – GENERAL

.1 General
- .1 Fabricate architectural woodwork in accordance with NAAWS.
- .2 Obtain site dimensions before fabricating items which are to accommodate or abut appliances, equipment and other materials.
- .3 Set and secure all materials and components in place, rigid plumb and square.
- .4 Set finishing nails to receive filler. Where screws are used to secure members, countersink screw in round cleanly cut hole and plug with wood plug to match material being secured. Sand smooth and leave ready to receive finish.
- .5 Dado or lock joint, and glue all drawer joints.
- .6 Adhere laminate to core material in accordance with laminate manufacturer's instructions.
  - .4 Where use of PVA, resorcinol or contact adhesives are recommended by manufacturer, use only PVA or resorcinol adhesive for all work, except contact adhesive may be used for portions of work that cannot be pressed (curved surfaces) or must be assembled prior to receiving laminate finish. Where contact adhesive is used apply PVA, formulated for non-press work, in continuous band at perimeter of laminate work and at all joints. Apply PVA after contact adhesive has set and in accordance with PVA manufacturer’s instructions. Ensure full contact using pinch or J-roller.
  - .5 If fabricator does not have press equipment, contact adhesive with PVA band as described above may be used with Consultant’s approval.
  - .6 Where use of PVA, resorcinol or contact adhesives are NOT recommended, use adhesive recommended by manufacturer.
  - .7 All adhesives to containing no urea-formaldehyde.
- .7 Ensure core and laminate profiles coincide to provide continuous support and bond over entire surface.
- .8 Ensure adjacent parts of continuous laminate work match in colour and pattern.
- .9 Use continuous lengths up to 3660 mm. Keep joints minimum 610 mm away from sink cutouts. No seams in counter tops unless indicated on plan.

.10 Use PVC edging to cover exposed edge of core material, except use straight self-edging laminate strip for flatwork. Chamfer exposed edges uniformly at approximately 20 degrees. Do not mitre laminate edges.
.11 Apply laminate backing sheet to non-exposed reverse side of core of plastic laminate work.
.12 Shelving to cabinetwork to be adjustable unless otherwise indicated.
.13 Provide cutouts for plumbing fixtures, inserts, appliances, outlet boxes and other fixtures.
.14 Shop assemble work for delivery to site in size easily handled and to ensure passage through building openings.
.15 Provide heavy duty fixture attachments for wall mounted cabinets.
.16 Millwork blind framing to be 19 x 64 mm wood members.
.17 Provide intermediate base gables under floor cabinets at 610 mm on-centre maximum.
.18 Shop install cabinet hardware for doors, shelves and drawers.
.19 Allow for scribing of cabinets fitting against walls.

.2 Casework

.1 Fabricate MCP and plastic laminate faced casework to "Custom Grade" standards for materials and workmanship in accordance with NAAWS with direction of all laminate wood grain running vertical unless otherwise indicated and as follows:

.1 Front and Back Stretcher Rails: 19 mm thick softwood lumber for base unit top horizontal and back stretcher rail, stretcher rails of intermediate frame below drawers
.2 Horizontal Back Support Rail (Anchor Strip): 19 mm thick particleboard, dado and glued to cabinet ends.
.3 Lower Cabinet Bottoms (closed): 19 mm thick MCP, dadoed and glued into cabinet ends and clamped under pressure during assembly.
.4 Upper Cabinet Bottoms (closed): 19 mm thick MCP, plastic laminate covered on exposed faces including plastic laminate to underside of cabinet bottom.
.5 Lower Cabinet Backs (closed): 6 mm thick MCP.
.6 Upper Cabinet Backs (closed): 13 mm thick MCP, recessed 19 mm and set into ends.
.7 Lower Cabinet Bottoms (open): 19 mm thick particleboard core, plastic laminate faces.
.8 Upper Cabinet Tops and Bottoms (open): 19 mm thick particleboard core, plastic laminate faces, including plastic laminate to underside of cabinet bottom, to match cabinet fronts unless otherwise noted.
.9 Lower Cabinet Backs (open) 13 mm thick particleboard core, plastic laminate faces.
.10 Upper Cabinet Backs (open): 13 mm thick particleboard core, plastic laminate faces.
.11 Toe Space: separate base, 13 mm thick veneer core softwood plywood, closed to cabinet bottom, 100 mm high x 75 mm deep unless noted, reinforced with securing blocks.
.12 Cabinet Gables and Gable Ends (open): 19 mm thick particleboard, plastic laminate faces.
.13 Cabinet Gables and Gable Ends (closed): 19 mm thick MCP, except plastic laminate faces on all exposed end gables
.14 Cabinet Doors: 19 mm thick particleboard core, plastic laminate faces.
.15 Shelves, exposed and semi-exposed: particleboard core, plastic laminate faced (to match interior cabinet colour), unless noted, thickness as follows:
.1 25 mm thick particleboard core, plastic laminate faced.

.2 Clear spans 915 mm and over not allowed without intermediate support and when provided thickness of core as indicated above.

.16 Cabinet Drawer Fronts: 19 mm thick particleboard core, plastic laminate faces on 13 mm thick MCP drawer box front. Glue both pieces together and bolt door pulls through drawer fronts and drawer box to ensure secure attachment.

.17 Cabinet Drawer Sides and Backs: 13 mm thick MCP, complete with 13 mm edge below drawer bottom, dadoed, glued and clamped under pressure during assembly.

.18 Cabinet Drawer Bottoms: 13 mm thick MCP, captured three (3) sides.

.19 Countertops and Backsplashes:

.1 Solid Surfacing: Refer to Section 06 61 16.

.20 Edge Trim: 1mm PVC, unless otherwise indicated, on all visible and non-visible ends in exposed and semi-exposed areas, as defined in Section 10 of the Architectural Woodwork Standards, including all four (4) edges of adjustable shelving; Colour to match panel face unless noted; Unfinished ends or exposed core material in all exposed and semi-exposed (visible and non-visible) areas is not permitted. Colour to match face panel, to be confirmed with Consultant prior to fabrication.

.21 Cabinet Closure Panels/Filler Panels: 19 mm thick particleboard core, plastic laminate faces.

.3 Wood Veneer Paneling (WVP).

.1 Fabricate wood veneer paneling in accordance with NAAWS to profiles indicated and from hardwood lumber to NAAWS “premium grade”.

.2 All exposed edges of WVP to be veneer faced.

.3 Consultant to select flitches for exposed faces. Provide backing grade veneer for concealed faces.

.4 Run grain direction as indicated on drawings.

.5 Slip match adjacent panels and component sets.

.6 Install as indicated. Secure panelling and perimeter trim using concealed fasteners. Do not face fasten.

.7 Adjacent pieces of veneer to be slip matched with grain run horizontal, except where otherwise indicated.

.8 Custom stain(s) and finish(s) in accordance with Section 09 90 00. Allow for two (2) custom colours to be slected. Confirm with Consultants samples.

.4 Standing and Running Trim.

.1 Fabricate from hardwood lumber to “Premium Grade” standards for materials and workmanship in accordance with NAAWS to profiles indicated, with kerfed backs.

.2 Butt and cope internal joints of trim to make snug and tight. Cut right angle intersections with mitred joints.

.3 Fit backs snugly to wall surfaces to eliminate cracks at junction with walls.

.4 Make joints in trim where necessary using 45° scarfed type joint.

.5 Custom stain and finish in accordance with Section 09 90 00.

.5 Interior Frames.

.1 Fabricate interior frames and stops in accordance with NAAWS to profiles indicated and from hardwood lumber to NAAWS “premium grade”. Corners to be mitred with edges exposed.

.2 Prep for wood doors and glazing where required.

.3 Custom stain and finish in accordance with Section 09 90 00.

.6 Slatwall.

.1 Cut slatwall panel to required dimensions. Sand edges smooth.

.2 Install inserts into grooves before fastening.
.3 Predrill holes through insert and grooves.

Part 3 Execution

3.1 PREPARATION

.1 Co-ordinate and verify, by measurement at job site, all dimensions affecting work.

.2 Report, in writing, any defects in work of other Sections and any other unsatisfactory site conditions. Starting work in particular area of building implies acceptance of conditions and surfaces in that area only.

.3 Where units or members are required to be fitted neatly into finished walls or openings, fabrication from drawing information are supplemented with actual job site dimensions.

.4 Where dimensions are not available before fabrication is commenced, coordinate agreement between various Sections.

.5 Examine drawings, specifications, and site to ascertain fabrication and installation procedures so that work may be completed with minimum of job site cutting and fitting.

.6 Ensure that all components are manufactured in size such that they can be transported to proper job site location.

3.2 INSTALLATION

.1 Install architectural woodwork, plumb, level, true and straight with no distortions. Shim as required. Where laminate clad casework abuts other finished work, scribe and cut to accurate fit.

.2 Fit hardware accurately and securely in accordance with manufacturer's instructions.

.3 Adjust casework and hardware so that doors and drawers operate smoothly without warp or bind.

.4 At junction of decorative laminate countertops and backsplash and adjacent wall finish, apply continuous bead of sealant.

.5 Repair minor damage per plastic laminate manufacturer’s recommendations. Replace other damaged cabinets or materials.

.6 Fasten and anchor casework securely. Provide heavy duty fixture attachments for wall mounted cabinets.

.7 Use draw bolts and splines in countertop joints. Maximum spacing 450 mm on-centre, 75 mm from edge. Make flush hairline joints.

.8 Provide cutouts for inserts, grilles, outlet boxes, and other penetrations. Round internal corners, chamfer edges and seal exposed core.

.9 Apply water resistant building paper over wood framing members in contact with masonry or cementitious construction.

.10 Install door and drawer pulls to all upper and lower cabinets unless otherwise indicated.

.11 Screw fasten slatwall panel to substrate with colour-matched screws through pan

3.3 FINISHING

.1 Fill all exposed job-made nail and screw holes, refinish raw surfaces from job fitting, repair job-inflicted scratches and marks.

.2 Apply plastic laminate to all exposed surfaces, except hardwood or where specifically noted otherwise.

.3 Supply and installation of transparent or semi-transparent finish to all exposed and semi-exposed hardwood and hardwood veneer surfaces by Section 09 90 00 in accordance with NAAWS.

.4 Supply and installation of opaque paint finish to all exposed designed saw-cuts and other narrow reveals that expose substrate or core material to be by Section 09 90 00.

3.4 CLEANING

.1 Vacuum cabinets inside and out. Wipe off fingerprints, pencil marks, and surface soil etc.

.2 Remove and dispose of all packing materials and related construction debris.

3.5 PROTECTION

.1 Protect installed architectural woodwork and plastic laminate work from damage until final inspection.

3.6 SCHEDULES

.1 Refer to Section 09 06 00.13.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 06 10 00 – Rough Carpentry.

.2 Section 06 40 00 – Architectural Woodwork.

.3 Section 07 92 00 – Joint Sealants.

.4 Division 22 – Plumbing

1.2 REFERENCES

.1 American Society for Testing and Materials (ASTM).
- .1 ASTM E84-18b, Standard Test Method for Surface Burning Characteristics of Building Materials.
- .2 ASTM G21-15, Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.

.2 Underwriters Laboratories of Canada (ULC).
- .1 CAN/ULC S102-18, Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.

1.3 SUBMITTALS

.1 Make all submittals in accordance with requirements of Section 01 33 00.

.2 Shop Drawings.
- .1 Manufacturer to prepare shop drawings and submitted to Consultant for approval.
- .2 Indicate piece sizes, quantities, and co-ordination with adjacent work. Shop drawings shall show all solid surfacing required, giving all overall piece size, sections through each condition and seam locations.
- .3 Where required, full sized sections shall be drawn to show curved or molded sections.
- .4 Each solid surface shall be numbered on shop drawings. No fabrication shall begin until shop drawings are reviewed by Consultant. Deviations from Bid Documents shall be clearly noted on shop drawings.

.3 Samples.
- .1 Minimum of two (2) each, 200 mm x 200 mm in size, in each colour and finish specified shall be submitted for Consultant's approval. Sufficient number of samples shall be submitted to show full range of colour and markings to be expected. If necessary, colour photographs may accompany sample submittals.
- .2 If samples are rejected, new samples shall be submitted until approved. No fabrication shall begin until all samples are approved by Consultant.

.4 Closeout Submittals
- .1 Provide closeout submittals in accordance with Section 01 78 00.
- .2 Provide manufacturer’s care and maintenance information for incorporation in operation and maintenance manual.
- .3 Provide one maintenance kit with instructions.

1.4 QUALITY ASSURANCE

.1 Installer Qualifications: Engage an experienced installer who has completed work similar in material, design, and extent to that indicated for project that has resulted in construction, with a record of successful in-service performance.

.2 Qualifications:
.1 Shop that employs skilled workers who custom fabricate products similar to those required for this project and whose products have a record of successful in-service performance.

.3 Fabricator/installer qualifications:
.1 Work of this section shall be by a certified fabricator/installer, certified in writing by the manufacturer.

.4 Fire Test Response Characteristics: Provide components that meet CAN/ULC-S102: Flame Spread Rating 25 or less, Smoke Developed Classification 50 or less.
.1 Materials provided shall be identical to materials tested.

1.5 DELIVERY, STORAGE, AND HANDLING

.1 Finished solid surface shall be carefully packed and loaded for shipment using all reasonable care and customary precautions against damage in transit. No material which may cause staining or discolouration shall be used for blocking or packing.

.2 Do not commence installation until ambient and surface temperatures at the site are within manufacturer's recommendations.

.3 Maintain ambient temperature between manufacturer's recommendations for 48 hours prior to and after installation.

.4 Cleaning and Waste Management in accordance with Sections 01 74 00.

1.6 WARRANTY

.1 Provide manufacturer's completed warranty against defects in materials and workmanship for ten years.
.1 Warranty shall provide material to repair or replace defective materials.
.2 Damage caused by physical or chemical abuse or damage from excessive heat will not be warranted.

Part 2 Products

2.1 MANUFACTURERS

.1 Solid Surfacing Material (SSM): homogenous sheet material composed of acrylic resins, fire-retardant filler materials, and colouring agents.
.1 Basis of Design Products.
.1 Avonite Surfaces, Studio A.
.2 Corian Solid Surface, Group 6-7.
.3 Formica Classic, Signature Series.
.4 Or approved equal.
.2 Nominal sheet thickness.
.1 Countertop: 13 mm, up to three (3) colours/patterns to be selected by Consultant.

.2 Requests for substitutions will be considered subject to specified requirements and in accordance with Bidding Procedures B8.

.3 Supply similar products from single manufacturer.

2.2 ACCESSORIES

.1 Joint adhesive: manufacturer's standard adhesive to create inconspicuous, nonporous joints, with a chemical bond.

.2 Wood substrate: in accordance with Section 06 40 00.
  .1 Ensure plastic laminate finish to all exposed surfaces and edges of substrates.

.3 Sealant: mildew resistant silicone as specified in Section 07 92 00 - Joint Sealing.

2.3 FABRICATION

.1 Fabricate components in shop to greatest extent practical to size and shape indicated, in accordance with reviewed shop drawings and manufacturer's published requirements.

.2 Countertops and other components detailed with core substrate shop fabricated and laminated to core. Fabrication tolerance between solid surfacing and substrate shall be zero and precisely flush fit.

.3 Form joints between components using manufacturer's standard joint adhesive. Make joints inconspicuous in appearance and without voids. Attach 100 mm wide reinforcing strip under joints.

.4 Provide holes and cutouts for plumbing, bath accessories, and other components.

.5 Rout and finish component edges to a smooth, uniform finish. Rout cutouts and sand edges smooth. Repair or reject defective or inaccurate work.

.6 Finish surfaces to uniform finish.

.7 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 138°–163°C during forming.
  .6 Prevent blistering, whitening or cracking of material during forming.

.8 Provide screw anchors or inserts at location requiring screw fasteners. Direct screw fastening into cast plastic material is not permitted.

Part 3 Execution

3.1 EXAMINATION

.1 Examine substrates to receive solid surfacing. Identify conditions detrimental to proper or timely installation and provide written report to Contractor. Do not commence installation until conditions have been corrected.

.2 Verify measurements and tolerances and report in writing to Consultant, conditions that are not correct.

3.2 PREPARATION

.1 Furnish shop drawings to other trades for co-ordination.

.2 Precondition solid surfacing in accordance with manufacturer's printed installation instructions.

3.3 INSTALLATION

.1 Install components plumb and level, in accordance with reviewed shop drawings, project installation details and manufacturer's printed instructions.

.2 Form joints using manufacturer's approved adhesive, with joints inconspicuous in finished work.

.3 Adhere under mount sinks/bowls to countertop using manufacturer's recommended joint adhesive.

.4 Attach top securely to base unit or support brackets in accordance with manufacturer's printed instructions.

.5 Seal between wall and component with silicone sealant.

.6 Adhere top mount sinks/bowls to countertop using manufacturer's recommended adhesive/silicone sealant.

.7 Provide backsplashes and end splashes as indicated. Adhere to countertops using manufacturer's recommended silicone sealant.

.8 Remove excessive adhesive and sealants.

.9 Co-ordinate plumbing installation with plumbing Subcontractor.

3.4 PROTECTION

.1 Protect surfaces from damage until date of Substantial Performance of the Work.

.2 Repair or replace to Consultant's satisfaction any solid surface counter not properly fitted or counter found to be broken, stained or chipped.

3.5 MAINTENANCE

.1 Solid surface fabricator shall supply instructions indicating recommended cleaning and maintenance of installed work of this section.

.2 Catalogs and cuts from producers of recommended cleaning and maintenance materials shall be included in maintenance manual.

.3 Manual shall include information regarding cleaning methods, stain removal methods and sealers.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 American Society for Testing and Materials (ASTM).
- .1 ASTM D41/D41M-11(2016), Standard Specification for Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing.
- .2 ASTM D449/D449M-03(2014)e1, Standard Specification for Asphalt Used in Dampproofing and Waterproofing.
- .3 ASTM D2399-12(2017)e1, Standard Practice for Selection of Cutback Asphalts.

.2 Canadian Standards Association (CSA).
- .1 CAN/CSA A123.4-04 (R2013), Asphalt for Constructing Built-Up Roof Coverings and Waterproofing Systems.

.3 Workplace Hazardous Materials Information System (WHMIS).

1.2 DELIVERY, STORAGE, AND HANDLING

.1 Deliver all material to site in manufacturer’s original unopened packaging with labels clearly identifying product name and manufacturer.

.2 Store materials on pallets in a dry, enclosed area protected from exposure to moisture, construction activity, and direct sunlight in strict accordance with manufacturer's recommendations.

.3 During cold weather, store materials for at least 24 hours in area kept at 20ºC and remove for application with as little exposure to cold as possible. Remove only in quantities required for same day use.

.4 Store all solvent based material in a well ventilated area away from flames and sparks and keep protected from the elements.

.5 Handle all products with appropriate precautions and care as stated manufacturer's instructions.

.6 Waste Management and Disposal: in accordance with Sections 01 74 00.

1.3 ENVIRONMENTAL REQUIREMENTS

.1 Apply primer and 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°C for 24 hours before, during and 24 hours after installation.

.4 Do not apply primer and dampproofing in wet weather.

.5 Provide forced air circulation during installation and curing periods for enclosed applications.

.6 Comply with requirements of WHMIS regarding use, handling, storage, and disposal of asphalt, sealing compounds, primers and caulking materials.

Part 2 Products

2.1 MATERIALS

.1 Asphalt Primer: in accordance with ASTM D41.

.2 Asphalt: in accordance with ASTM D449.

.3 Sealing Compound: plastic cutback asphalt cement in accordance with ASTM D2399.

Part 3 Execution

3.1 WORKMANSHIP

.1 Keep hot asphalt below its flash point, at or below its final blowing temperature, within its equiviscous temperature range at place of application.

3.2 PREPARATION

.1 Surfaces: firm and free from loose particles, cracks, grease, oil and other foreign matter. Surface must be free from frost, snow and ice.

.2 Before applying dampproofing, seal cracks, snap ties, holes around pipes and other services, exterior joints between foundation walls and footings, joints between concrete floor slab and foundation and around penetrations through dampproofing with sealing compound applied in accordance with manufacturer's instructions.

3.3 APPLICATION

.1 Apply primer and dampproofing material in accordance with manufacturer’s instruction and applicable ASTM application standards.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 31 23 10 – Excavation, trenching and Backfilling

.2 Section 33 46 13 – Foundation Drainage Piping.

1.2 REFERENCES

.1 American Society for Testing and Materials (ASTM).
- .1 ASTM D1709-16ae1, Standard Test Methods for Impact Resistance of Plastic Film by the Free-Falling Dart Method.
- .2 ASTM D2103-15, Standard Specification for Polyethylene Film and Sheeting.
- .3 ASTM D4833/D4833M-07(2013)e1, Standard Test Method for Index Puncture Resistance of Geomembranes and Related Products.
- .4 ASTM E84-18b, Standard Test Method for Surface Burning Characteristics of Building Materials.
- .5 ASTM E96/E96M-16, Standard Test Methods for Water Vapor Transmission of Materials.

.2 National Fire Protection Association (NFPA).
- .1 NFPA 701: Standard Methods of Fire Tests for Flame Propagation of Textiles and Films, 2019 Edition.

1.3 DELIVERY, STORAGE, AND HANDLING

.1 Deliver all material to site in manufacturer's original unopened packaging with labels clearly identifying product name and manufacturer.

.2 Store roll materials on end, on pallets in a dry, enclosed area protected from exposure to moisture, construction activity, and direct sunlight in strict accordance with manufacturer's recommendations.

.3 Cleaning and Waste Management in accordance with Section 01 74 00.

Part 2 Products

2.1 MATERIALS

.1 Sheet Dampproofing Membrane: 14 mil thickness fire-retardant laminate with two layers of multi-axially oriented, linear low-density polyethylene in accordance with NFPA 701, ASTM D2103, and ASTM E84, water/vapour permeance in accordance with ASTM E96/E96M, impact resistance in accordance with ASTM D1709, puncture resistance in accordance with ASTM D4833/D4833M.

.2 Sheet Dampproofing Tape: manufacturer's purpose made fire retardant pressure sensitive tape. Minimum roll width 100 mm.

Part 3 Execution

3.1 EXAMINATION

.1 Confirm that crawlspace has been backfilled and properly graded prior to commencing work of this Section. Ensure surface beneath sheet damproofing is smooth level and compacted, with no sharp projections.

3.2 INSTALLATION

.1 Install sheet dampproofing on floor of crawlspace as indicated in accordance with manufacturer's printed instructions.

.2 Lap edges minimum 150 mm and tape with manufacturer's purpose made tape.

.3 Wrap perimeter of sheet damproofing membrane around continuous pressure treated wood nailing strip and secure to concrete grade beam as detailed.

.4 Cut a slit around concrete piles and any other penetrations to place the initial layer of sheet dampproofing. Then cut a piece of sheet dampproofing minimum width of 610 mm with "fingers" cut half the width of the sheet. Wrap sheet dampproofing around penetration and securely strap with steel banding and completely tape fingers to the bottom layer of sheet dampproofing.

.5 Seal punctures in dampproofing membrane. Use patching material at least 150 mm larger than puncture and seal.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 06 10 00 – Rough Carpentry.

.2 Section 07 11 13 – Bituminous Dampproofing.

.3 Section 07 26 00 – Air/Vapour Barrier Membrane – Self Adhesive.

.4 Section 07 42 13 – Metal Wall Panels.

.5 Section 07 61 13 – Standing Seam Sheet Metal Roofing.

.6 Section 09 22 16 – Non-Structural Metal Framing.

.7 Section 09 24 33 – Cement Parging.

.8 Section 09 29 00 – Gypsum Board.

1.2 REFERENCES

.1 American Society for Testing and Materials (ASTM).

- .1 ASTM A653/A653M-18, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by Hot-Dip Process.
- .2 ASTM C203-05a (2017), Standard Test Methods for Breaking Load and Flexural Properties of Block-Type Thermal Insulation.
- .3 ASTM C518-17, Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
- .4 ASTM C578-18, Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation.
- .5 ASTM C612-14, Standard Specification for Mineral Fiber Block and Board Thermal Insulation.
- .6 ASTM D1621-16, Standard Test Method for Compressive Properties Of Rigid Cellular Plastics.
- .7 ASTM D2126-15, Standard Test Method for Response of Rigid Cellular Plastics to Thermal and Humid Aging.
- .8 ASTM D2842-12, Standard Test Method for Water Absorption of Rigid Cellular Plastics.
- .9 ASTM D4833/D4833M-07(2013)e1, Standard Test Method for Index Puncture Resistance of Geomembranes and Related Products.
- .10 ASTM E84-18b, Standard Test Method for Surface Burning Characteristics of Building Materials.
- .11 ASTM E96/E96M-16, Standard Test Methods for Water Vapor Transmission of Materials.
- .12 ASTM E423-71(2014), Standard Test Method for Normal Spectral Emittance at Elevated Temperatures of Nonconducting Specimens.

.2 Underwriters Laboratories of Canada (ULC).

- .1 CAN/ULC-S102-18, Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.
- .2 CAN/ULC-S114-18, Standard Method of Test for Determination of Non-combustibility in Building Materials.
- .3 CAN/ULC-S701.1-17, Standard for Thermal Insulation, Polystyrene, Boards.
- .4 CAN/ULC S702.1-14, Standard for Mineral Fibre Thermal Insulation for Buildings, Part 1: Material Specification.
- .5 CAN/ULC-S702.2-15, Standard for Mineral Fibre Thermal Installation for Buildings, Part 2: Installation.

.6 CAN/ULC-S704.1-17, Standard for Thermal Insulation, Polyurethane and Polyisocyanurate Boards, Faced.

.7 CAN/ULC S770-15-Rev1, Standard Test Method for Determination of Long-Term Thermal Resistance of Closed-Cell Thermal Insulating Foams.

1.3 DELIVERY, STORAGE, AND HANDLING

.1 Deliver all material to site in manufacturer's original unopened packaging with labels clearly identifying product name and manufacturer.

.2 Store materials in a dry, enclosed area protected from exposure to moisture, construction activity, and direct sunlight in strict accordance with manufacturer's recommendations. Remove only in quantities required for same day use.

.3 Handle all products with appropriate precautions and care as stated manufacturer's instructions.

.4 Cleaning and Waste Management in accordance with Section 01 74 00.

Part 2 Products

2.1 MATERIALS

.1 Rigid Board Insulation (grade beam/below grade) - Mechanically Attached: rigid cellular extruded polystyrene to ASTM C518, ASTM C578 and CAN/ULC-S701.1, Type 4, RSI (R) value of 0.87 (5.0) per 25 mm (1"), compressive strength 210 kPa (30 psi), 600 m wide x 2400 mm length board size, factory pre-grooved to accept thermostud channel fastening system at minimum 600 mm on-centre, shiplapped edge unless indicated otherwise, CFC free and HCFC free. Note - horizontal below grade insulation without thermostud channel fastening system.

.2 Rigid Board Insulation - Mechanically Attached: rigid cellular extruded polystyrene to ASTM C518, ASTM C578 and CAN/ULC-S701.1, Type 3, RSI (R) value of 0.87 (5) per 25 mm (1"), compressive strength 170 kPa (25 psi), 600 mm width x 2400 mm length board sizes for easy application in cavity walls, butt edge unless indicated otherwise, CFC free and HCFC free.

.3 Rigid Board Roof Insulation (Metal Roof Panels): rigid cellular extruded polystyrene to ASTM C578 and CAN/ULC-S701.1 Type 2, RSI (R) value of 0.88 (5) per 25 mm (1"), compressive strength 116 kPa (16 psi), 600 mm width x 2400 mm length board sizes, butt edge unless indicated otherwise, CFC free and HCFC free.

.4 Batt Insulation: non-combustible, lightweight mineral wool insulation board formed with a thermosetting resin into flexible semi-rigid boards 1220 mm long x width to suit, to CAN/ULC-S102 Type 1, provides fire resistance to CAN/ULC-S114 and sound control to ASTM E423, thickness as indicated.

.5 Foamed-In-Place Insulation: self-contained, factory pressurized, two-component polyurethane foam insulation.

.6 Protection Board (below grade): to ASTM D6506, Class A, multi-ply, mineral-fortified semi-rigid asphalt core between two asphalt-impregnated reinforced mat outside layers.

2.2 ACCESSORIES

.1 Thermal Sub-Girts: factory punched "Z" girts to reduce thermal bridge by impeding heat conduction through sub-girt, minimum 1.6 mm (16-gauge) thick galvanized steel to ASTM A653/A653M Grade 230 with Z275 coating, sub-girt depth to suit specified insulation thickness, profile to accept finish system with structural attachment to wall/roof structure.

.2 Fasteners for Wall Insulation (grade beam/below grade): thermostud channels complete with 5 mm Tapcon fasteners with Climaseal finish at 406 mm on-centre maximum.

.3 Fasteners for Wall Insulation (above grade): screw and plate fastening system consisting of 75 mm diameter galvanized steel plate with self-drilling, high corrosive-resistant screws.

Part 3 Execution

.1 Rigid Board Insulation (grade beam/below grade).
- .1 Mechanically fasten insulation boards vertically to face of perimeter foundation walls and grade beams beginning at main floor elevation and extending down as indicated.
- .2 Mechanically fasten rigid insulation boards with thermostud channel fastening system at minimum 610 mm on-centre. Install fasteners through insulation to substrate.
- .3 Apply continuous bead of insulation adhesive on edges of all butt joints prior to mechanically fastening.
- .4 Seal all openings and protrusions with foamed-in-place insulation.
- .5 Extend horizontal below grade insulation boards out from perimeter foundation grade beams as indicated. Lay boards on smoothed compacted fill.

.2 Rigid Insulation.
- .1 Install rigid board insulation in two (2) equal layers to maintain continuity of thermal protection to building elements and spaces.
- .2 Fit insulation tight around electrical boxes, plumbing and heating pipes, ducts, doors and window frames and other protrusions in or passing through insulation.
- .3 Cut and trim insulation boards neatly to fit spaces. Butt all edges tightly. Offset vertical and horizontal joints. Use only insulation boards free from chipped or broken edges. Use largest possible dimensions to reduce number of joints.
- .4 Install sub-girts to suit wall finish installation.
- .5 Mechanically fasten insulation boards with screw and plate fastening system specified. Install screw and plate fasteners through insulation to substrate. Fasteners to be spaced in accordance with manufacturer's written instructions. Ensure all insulation boards are securely fastened and bear tight against and flush with the surface of the substrate.
- .6 In cavity wall assemblies, supplement masonry tie insulation supports with screw and plate fastening system to ensure all boards are securely fastened and bear tight against and flush with the surface of the substrate. Fasteners to be spaced in accordance with manufacturer's written instruction.
- .7 Seal all openings and protrusions with foamed-in-place insulation.
- .8 Co-ordinate installation of insulation with work of other trades.
- .9 Do not cover insulation until it has been reviewed by Consultant.

.3 Batt Insulation.
- .1 Install insulation to maintain continuity of fire and/or acoustic protection to building elements and spaces. Fit insulation closely around electrical boxes, plumbing and heating pipes, ducts, doors and window frames and other protrusions in or passing through insulation. Do not compress batts insulation to fit into spaces.
- .2 Ensure batt insulation blankets fill space between studs. Run continuously from floor to ceiling of structure, over door frames and openings and around corners.
- .3 Ensure insulation is packed around cut openings in gypsum board, behind outlet boxes, around plumbing, heating or structural items passing through and at abutting walls.
- .4 Keep insulation minimum 75 mm from heat emitting devices such as recessed light fixtures.
- .5 Do not enclose insulation until it has been inspected and approved by Consultant.

.4 Foamed-In-Place Insulation.

.1 Apply foamed-in-place insulation in accordance with manufacturer's instructions.

.5 Protection Board (below grade).

.1 Install as per manufacturer’s written instructions.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 American Society for Testing and Materials (ASTM).
- .1 ASTM D4541-17, Standard Test Method for Pull Off Strength of Coatings Using Portable Adhesion Testers.
- .2 ASTM D5147/D5147M-18, Standard Test Methods for Sampling and Testing Modified Bituminous Sheet Material.
- .3 ASTM E96/E96M-16, Standard Test Methods for Water Vapour Transmission of Materials.
- .4 ASTM E283-04(2012), Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
- .5 ASTM E330/E330M-14, Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.
- .6 ASTM E331-00(2016), Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference.
- .7 ASTM E783-02 (2018), Standard Test Method for Field Measurement of Air Leakage Through Installed Exterior Windows and Doors.
- .8 ASTM E1186-17, Standard Practices for Air Leakage Site Detection in Building Envelopes and Air Barrier Systems.

.2 Canadian Construction Materials Centre (CCMC).
- .1 Air/vapour Barrier Systems for Exterior Walls of Low-Rise Buildings: Performance and Assessment.

.3 Canada Mortgage and Housing Corporation (CMHC).
- .1 Guidelines for Delivering Effective Air/vapour Barrier Systems.

.4 National Building Code of Canada 2010, (NBCC).

1.2 SUBMITTALS

.1 Shop Drawings.
- .1 Submit shop drawings in accordance with Section 01 33 00.
- .2 Include air/vapour barrier membrane installation details at typical joints and junctions between assemblies, and at all penetrations through membrane.
- .3 Include manufacturer's technical data sheets.

1.3 QUALITY ASSURANCE

.1 Qualifications.
- .1 Provide entire wall surface air/vapour barrier membrane by one trade only, and approved and trained in installation procedures by the membrane manufacturer.
- .2 Each installer must be thoroughly trained and experienced in the installation of air/vapour barrier specified, and can supervise a maximum of two apprentices. Applicators must perform or directly supervise all air/vapour barrier work on the project.
- .3 Assign one applicator as "Designated Applicator" for this project who is to assume overall responsibility for installing and pre-testing all air/vapour barrier membranes on the project prior to inspection and testing by independent testing agency.

.2 Regulatory Requirements.

.1 Comply with all safety precautions, manufacturers' instructions, Workplace Hazardous Material Information System, and WCB requirements for materials handling, storage, application and disposal and regarding labeling and provision of material safety data sheets.

.3 Testing.

.1 The Designated Applicator and the Installers/Apprentices will be expected to routinely inspect and test their work as they proceed. The result of their testing and inspection efforts to be recorded in worksheets by the Applicator on the crew and confirmed by the Designated Applicator. These worksheets are to be kept on site and be available for routine inspection by the City, Consultant, or independent testing agency. A copy of the worksheets to be submitted to Consultant on a weekly basis. The cost of these requirements is to be borne by the air/vapour barrier membrane trade.

.2 The Designated Applicator will pre-inspect/test all membranes and make all necessary repairs immediately prior to inspection and testing by independent testing agency. He will document repairs made and approvals given.

.3 The Designated Applicator will co-operate with the independent testing agency by making construction drawings and records available to him, including the air/vapour barrier worksheets, and providing him with other information as requested. The Designated Applicator will assist the air/vapour barrier inspection agency in the performance of his duties by providing him access to scaffolding, swingstages, etc.

.4 Documentation.

.1 Maintain jobsite records including dates on which membrane was installed, wall areas covered on those dates, name of the Applicator(s) and apprentices, the types and lot numbers of materials used, environmental and substrate conditions including at a minimum temperature, humidity and cleanliness during installation, variations from drawings or specifications, and results of any testing or inspections done by the installation crew. The Designated Applicator's worksheets must identify all areas of substrate for which he has approved application of air/vapour barrier membrane. A copy of these worksheets shall be submitted to Consultant on a weekly basis.

.5 Mock-ups.

.1 Mock-up critical air/vapour barrier locations and connection details.

.2 Locate mock-up on site as part of final installation. Mock-up to be installed for review of construction, co-ordination with work of other Sections, and testing by independent testing agency.

.3 Once tested and approved, the mock-up will set a standard of acceptance for remaining installations.

.4 Mock-up the following locations and connection details.

.1 Fiberglass faced gypsum board wall surfaces.

.2 Masonry tie connections.

.3 Roof/wall intersection.

.4 Tie-in between aluminum window framing and air/vapour barrier membrane.

.5 Service penetrations.

.6 Pre-installation Meeting.

.1 Hold pre-installation meeting prior to commencement of the air/vapour barrier membrane installation work with air/vapour barrier membrane trade in attendance. Purpose of the meeting is to discuss the quality of workmanship expected, and to ensure that Designated Applicator and the Installers/Apprentices are fully aware of the mock-ups required and testing procedures that will be undertaken on their work to ensure that the quality of workmanship is met. The independent testing agency will be in attendance to identify testing procedures that will be used on the project and to answer any questions.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver all materials to site in the manufacturer's original packaging and standard commercial containers. Packaging to contain manufacturer's name, product name and identification number and other related information.

.2 Provide and maintain dry, off-ground weatherproof storage. Store roll materials on end, and protect materials from direct sunlight, extreme temperatures, moisture conditions, chemicals, solvents, etc., as per manufacturer's recommendations. Remove only in quantities required for same day use.

.3 Cleaning and Waste Management in accordance with Section 01 74 00.

1.5 SITE CONDITIONS

.1 Prior to installation, inspect areas to receive air/vapour barrier membrane to ensure they are clean, dry, sound, smooth and continuous.

.2 Apply primer and air/vapour barrier membrane in dry weather conditions where ambient temperatures are in accordance with manufacturer's instructions. No installation work may be performed on surfaces exposed to inclement weather or when there is threat of precipitation.

.3 Control exterior environmental conditions (hording and heating) for air/vapour barrier membrane installation occurring during the winter months to ensure that moisture does not condense on the structural backup. Use of propane or natural gas burners is not acceptable.

.4 Do not install solvent based curing sealants or vapour release adhesive materials in enclosed spaces without ventilation.

1.6 SEQUENCING

.1 Co-ordinate work of this Section with all other applicable Sections to ensure continuity of the building envelope.

1.7 WARRANTY

.1 Provide an extended warranty for Work of this Section for a period of two (2) years from date of Substantial Performance of the Work. Contractor hereby warrants that membrane work will maintain air and water seal and will not lose adhesion or cohesion, and these or other observed defects and deficiencies will be repaired or replaced to the satisfaction of the Consultant and the City, and at no expense to the City.

Part 2 Products

2.1 MANUFACTURERS

.1 Basis of Design Products.

.1 Self Adhesive Air/vapour Barrier Membrane, Primer, Sealer, Liquid Membrane, Flashing Membrane, Surface Conditioner.

.1 Bakor Blueskin SA.
.2 Carlisle CCW-705.
.3 IKO Aquabarrier AVB.
.4 Meadows Air-Shield.
.5 Soprema Sopraseal Stick 1100.
.6 W.R. Grace Perm-A-Barrier System 4000.

.2 Self Adhesive Air/vapour Barrier Membrane Primer (for use with fibreglass-faced gypsum board, ie. Dens-Glass Gold):

.1 Bakor Blueskin Primer (solvent based) or Aquatac Primer (water based).
.2 IKO Aquabarrier Primer (solvent based) or Aquabarrier WB Primer (water based).
.3 Meadows Mel-Prime (solvent & water based).
.4 W.R. Grace Perm-A-Barrier System WB Primer.

.3 Self-Adhesive Air/Vapour Barrier Membrane (Roof Surface).

.1 Bakor Blueskin Roof RF200.
.2 IKO MVP.
.3 Soprema SOPRAVAP'R.

.2 Requests for substitutions will be considered subject to specified requirements and in accordance with Bidding Procedures B8.

.3 Supply all products from a single manufacturer.

2.2 MATERIALS

.1 Self-Adhesive Air/vapour Barrier Membrane and Membrane Flashing: 1 mm thick self-adhering membrane composed of bitumen modified with thermoplastic polymers and high density polyethylene film, 914 mm width. The under face is self-adhesive covered by a silicone release paper. Primer as recommended by manufacturer.

.2 Self-Adhesive Air/Vapour Barrier Membrane (Roof Surface): min. 0.8 mm thick self-adhesive air/vapour barrier composed of Styrene-Butadiene-Styrene (SBS) modified bitumen and a non-slip tri-laminated woven polyethylene top surface.

2.3 ACCESSORIES

.1 Primer: blend of elastomeric bitumen (or synthetic rubber), volatile solvents, adhesive enhancing additives and resins used to prime substrate to enhance the adhesion of the self-adhesive membrane in varying outdoor temperatures as recommended by the membrane manufacturer.

.2 Sealer: jointing mastic compatible with bituminous materials.

.3 Liquid Membrane: two-component high performance polyurethane sealant, 100% solids in content.

.4 Tapes: self-adhering type, maintaining a minimum thickness of 0.8 mm (30 mil), shall be provided in rolls of dimensions 100 mm and 150 mm.

2.4 SOURCE QUALITY CONTROL

.1 Membrane materials must be approved by the manufacturer for use on the substrate to which it is being applied and for both the conditions during installation and for long-term operating conditions of the building.

.2 Accessory products including primers, sealers, tapes, etc. that are in direct contact with or form part of the air/vapour barrier systems must be chemically and physically compatible with the materials to which they are being applied and must be approved for that use by their manufacturer and the manufacturers of the air/vapour barrier materials they contact.

Part 3 Execution

3.1 EXAMINATION

.1 Prior to commencement of work, examine all areas to receive sheet air/vapour barrier membrane.

.2 Ensure that the air/vapour barrier material is structurally supported in all areas including transition areas according to the requirements of the National Building Code. The material must transfer all applicable loads to the appropriate structure support which can carry all the required loads.

.3 Report in writing to the Consultant, dynamic cracking in the substrate, cracking of greater than 3 mm in width, and any other defects in surfaces or conditions that may adversely affect the performance of products installed under this Section.

3.2 PREPARATION

.1 Smooth, monolithic surfaces are required for proper membrane adhesion. Surfaces must be dry, and free of voids and sharp protrusions. Clean surface with a broom, vacuum cleaner, or compressed air to remove dust, and debris.

.2 For applications onto cast-in-place concrete or concrete block, the surfaces should be adequately cured prior to application of air/vapour barrier membrane. Carry out an adhesion test before the installation of the membrane.

.3 Apply primer in 2-coat application over exterior fiberglass faced gypsum board by means of a roller or spray at a coverage of 0.30 litres/m² in accordance with manufacturer's instructions. Allow primer to thoroughly dry before applying the self-adhesive membrane.

.4 Prime only the area which will be covered with membrane in a working day. Areas not covered with membrane in 24 hours must be reprimed. Dry primed surfaces should be covered immediately where contaminants from the air are accumulating on the surface.

3.3 INSTALLATION

.1 Self-Adhesive Air/Vapour Barrier Membrane.

- .1 Apply air/vapour barrier membrane and all other materials in accordance with manufacturer’s written instructions.
- .2 Detail work must be carefully carried out to ensure the air/vapour barrier membrane creates a continuous seal at all construction elements such as foundations, roofs and walls, and at junctures of different materials or construction types. Where installation cannot be carried out using the primary membrane materials, select other materials which may suit the application.

.3 Install the membrane onto the primed surface by peeling back the paper on the underside and adhering the membrane to the surface. Apply hand pressure over the surface of the membrane in order to remove any trapped air beneath the membrane followed by pressure with a hand roller over entire surface to ensure perfect adhesion of the membrane to the surface.

.4 Where masonry anchors are already in place prior to the membrane installation, install the membrane horizontally beginning from the bottom of the wall area and work in an upwards direction along the wall surface. At the top of the membrane, strip bend a 50 mm width, and place the lower edge of the membrane strip onto the row of masonry ties below. Start applying hand pressure onto the membrane at its centre, working outwards lengthwise to its extremities, taking care to avoid trapping air beneath the membrane. At the top edge of the membrane strip, where the membrane has been folded back, neatly slit the membrane from the point of contact with the masonry ties outwards towards its edge. Press and adhere the membrane to the wall surface at either side of the masonry ties. Seal all masonry ties at their contact with the membrane with bituthene mastic.

.5 Subsequent sheets applied above must overlap the sheet below minimum of 50 mm. End laps in the membrane shall maintain a minimum overlap of 50 mm. Stagger vertical joints minimum 300 mm. Apply pressure with a roller over the entire membrane surface to ensure perfect adhesion.

.6 Carefully install membrane around openings in the wall in such a manner as to prevent air leak at these areas. Install air/vapour barrier membrane to create a continuous seal at construction elements and at junctures of different materials or construction types.

.7 Double cover all inside and outside corners with initial strip of membrane minimum 300 mm wide, centred on axis of corner. Cover this strip completely with regular application of membrane. Outside corners must be free of sharp edges. Inspect surfaces adjacent to all corners and repair if necessary to provide smooth dense surface.

.8 Co-ordinate installation of the air/vapour barrier membrane with the roofing trade to ensure continuity of the wall air/vapour barrier membrane with the roofing system vapour barrier.

.9 At the end of each working day, if the wall area has been only partially covered, apply a bead of mastic along the top edge of the membrane to prevent vertical drainage of precipitation from running in behind the membrane.

.10 Before covering the membrane with the cavity insulation, inspect and repair as necessary any damaged areas. Cavity insulation shall follow as closely as possible the installation of the membrane.

.11 Apply transition membrane to prepared surfaces as indicated on the drawings and as required by site conditions. Follow manufacturer’s recommendations when installing air/vapour barrier membranes across unsupported openings (e.g., around windows, below edge beams, etc.).

.2 Self-Adhesive Air/Vapour Barrier Membrane (Roof Surface).

.1 Apply primer in accordance with manufacturer's printed instructions.

.2 Beginning at the bottom of the slope, without adhering the membrane, unroll onto the substrate for alignment. Do not immediately remove the silicone release sheet.

.3 Peel back one end of the silicone release sheet and adhere this part of the membrane to the substrate. Peel back the remaining release sheet at a 45º angle to avoid wrinkles in the membrane.

.4 If the membrane is not properly aligned, do not try to adjust it. Instead, cut the roll and start again, making sure that it is properly aligned and that it overlaps the end of the misaligned piece by 150 mm.

.5 Overlap adjacent membranes by 75 mm. Overlap end laps by 150 mm. Stagger end laps by at least 300 mm.

.6 Extend roof air/vapour barrier membrane beyond edge of roof surface minimum 150 mm to tie into wall air/vapour barrier.

3.4 REPAIR

.1 Patch and repair misaligned or inadequately lapped seams, tears, punctures or fishmouths to the satisfaction of the independent testing agency and Consultant.

.2 Patch defects by bonding an additional layer of air/vapour barrier membrane extending minimum 150 mm in all directions from defect and make air tight. Seal around its edges with mastic.

3.5 FIELD QUALITY CONTROL

.1 Commissioning (including site inspection and testing) of air/vapour barrier membrane installation will be carried out by independent testing agency approved by the City and Consultant.

.2 Testing procedures of air/vapour barrier mockup to include:

.1 Air tightness testing in substantial conformance with the procedures found in ASTM E783. Acceptable criteria - maximum air leakage: 0.05L/sec/m² @ 75 pa.

.2 Adhesion testing in substantial conformance with the procedures found in ASTM D4541. FIXED-ALIGNMENT ADHESION TESTER, TYPE I to be used for ASTM D4541 membrane adhesion testing. (Com-Ten Portable Fastener Tester is acceptable under Type I). Minimum acceptable bond shall be ≥16 psi. Membrane shall retain 95% of original bond.

.3 Air tightness testing in substantial conformance with the procedures found in ASTM E1186.

.3 Once tested and approved by independent testing agency, mock-up will set a standard of acceptance for all other installations. Following this, review and testing will be performed at random areas during installation.

.4 Random field testing of air/vapour barrier membrane installation to include:

.1 Air tightness testing of membrane seams, lap joints, and seal to masonry ties and penetrations in substantial conformance with the procedures found in ASTM E1186.

.2 Adhesion testing in substantial conformance with the procedures found in ASTM D4541. FIXED-ALIGNMENT ADHESION TESTER, TYPE I to be used for ASTM D4541 membrane adhesion testing. (Com-Ten Portable Fastener Tester is acceptable under Type I). Minimum acceptable bond shall be ≥16 psi. Membrane shall retain 95% of original bond.

.5 Air/vapour barrier trade will be responsible for all re-testing costs associated with return visits by the independent testing agency as a result of work that has failed inspection or testing procedures.

.6 Assist independent testing agency with the performance of his duties by providing him access to scaffolding, swing stages, etc.

3.6 PROTECTION

.1 Protect finished work from damage after installation.

.2 Once approved by independent testing agency, cover membrane with building insulation as soon as possible protect the membranes from weather, excessively high temperatures, and damage by other trades.

3.7 CLEANING

.1 Clean up rubbish, debris, and packaging as work proceeds and at completion of the work. Remove from job site in accordance with Section 01 74 00.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 06 10 00 – Rough Carpentry.

.2 Section 07 21 00 – Thermal Insulation.

.3 Section 07 26 00 – Air/Vapour Barrier Membrane - Self Adhesive.

.4 Section 07 61 13 – Standing Seam Sheet Metal Roofing.

.5 Section 07 62 00 – Sheet Metal Flashing and Trim.

.6 Section 07 92 00 – Joint Sealants.

.7 Section 08 41 13 – Aluminum-Framed Entrances and Storefronts.

1.2 REFERENCES

.1 American Association of Textile Chemists and Colorists (AATCC).
- .1 AATCC 127-2017, Water Resistance: Hydrostatic Pressure Test.

.2 American Society for Testing and Materials (ASTM).
- .1 ASTM A588/A588M-15, Standard Specification for High-Strength Low-Alloy Structural Steel, up to 50 ksi [345 MPa] Minimum Yield Point, with Atmospheric Corrosion Resistance.
- .2 ASTM A606/A606M-09a, Standard Specification for Steel, Sheet and Strip, High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, with Improved Atmospheric Corrosion Resistance.
- .3 ASTM A653/A653M-18, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- .4 ASTM A792/A792M-10(2015), Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.
- .5 ASTM D5796-10(2015), Standard Test Method for Measurement of Dry Film Thickness of Thin Film Coil-Coated Systems by Destructive Means Using a Boring Device.
- .6 ASTM E96/E96M-16, Standard Test Methods for Water Vapor Transmission of Materials.

.3 Canadian Standards Association (CSA).
- .1 CSA S136-16, North American Specification for the Design of Cold-Formed Steel Structural Members.

.4 National Building Code of Canada, 2010 (NBCC).

1.3 SUBMITTALS

.1 Shop Drawings.
- .1 Submit shop drawings in accordance with Section 01 33 00.
- .2 Indicate dimensions, profiles, sub-girt attachment methods, trims and closure pieces, exterior building elevations indicating compartmentalization, window jamb and sill details, accommodation for thermal movement, isolation details, and related work.
- .3 Show anchorage details and connections for all component parts.

1.4 QUALITY ASSURANCE

.1 Assemble to accommodate thermal movement caused by normal ambient temperature range without causing deterioration of panels. Such variation in temperature must not cause buckling or stress on enclosed or adjoining materials and fasteners, or in any way impair performance or appearance of wall panel system. Subgirt system to be designed to incorporate grid lock in order to eliminate rocking of Z-bars on exterior gypsum board or other support sub-wall systems.

.2 Details of assembly and support to provide sufficient strength and stiffness to resist distortion of finished surface.

.3 Fasten assembly to building structure in manner which transmits all loads to main structure without exceeding capacity of any fastener.

.4 Ensure fastening systems connecting steel wall panels to back-up walls does not compromise performance of modified bituminous sheet air/vapour barrier specified in Section 07 26 00 with respect to air leakage and water penetration.

.5 Mock-up area of typical Weathering Steel Panel assembly as directed by Consultant, including supports and typical fasteners, and trim.
- .1 Mock-ups to be full size panel located on site as part of final installation.
- .2 Install mock-up for review of assembly, co-ordination with work of other Sections and overall appearance.
- .3 Once approved, mock-up will set standard of acceptance for remaining installations.

1.5 DELIVERY, STORAGE, AND HANDLING

.1 Deliver all material to site in manufacturer's original unopened packaging with labels clearly identifying product name and manufacturer.

.2 Store materials in a dry, enclosed area protected from exposure to moisture, construction activity, and direct sunlight in strict accordance with manufacturer's recommendations.

.3 Handle all products with appropriate precautions and care as stated manufacturer's instructions.

.4 Cleaning and Waste Management in accordance with Section 01 74 00.

Part 2 Products

2.1 MANUFACTURERS

.1 Basis of Design Products.

- .1 Metal Wall Panel.
  - .1 Same as Standing Seam Sheet Metal Roof Panel; Refer to Section 07 61 13.
- .2 Sub Framing Thermal Spacer (Sub-Girt).
  - .1 Northern Facades, ISO Clip Thermal Isolation Clip.

.2 Requests for substitutions will be considered subject to specified requirements and in accordance with Bidding Procedures B8.

.3 Supply similar products from single manufacturer.

2.2 MATERIALS

.1 Weathering Steel Panels (WSP): 11-gauge (unless noted otherwise), A606-4 weathering steel sheet to ASTM A606/A606M, with minimum corrosion-resistance index of 6.0 in accordance with ASTM G101, sizes as indicated on drawings complete-with 16-gauge trims and profiles (unless noted otherwise) to match, and as follows:
- .1 Sheet Cladding: weathering steel, sized appropriately to minimize waste cutoff based on shop drawings.
- .2 Perforated Metal Rainscreen: perforated weathering steel, western rib profile, 30.5% open area (.127" round holes with 7/32" stagger), sized appropriately to minimize waste cutoff based on shop drawings.
- .3 Sheet Metal Rainscreen: weathering steel, sized appropriately to minimize waste cutoff based on shop drawings.
- .4 Substructure: weathering steel bent plate angle/girts/bent plates, sizes as indicated on drawings. Furring locations to align to fastening system and spacing as per drawings.

.5 Adhesive: building adhesive to suit substrate conditions and recommended manufacturer's instructions and warranty.
.6 Fasteners to be stainless steel, self-drilling, self-tapping as indicated.
.7 Weathering steel flashings: weathering steel, minimum 22-gauge thickness.

.2 Joint Sealants: in accordance with Section 07 92 00.

.3 Touch-up paint: as recommended by panel manufacturer.

.4 Isolation coating: alkali resistant bituminous paint or epoxy resin solution.

2.3 COMPONENTS

.1 Exposed Trims: closures, drip flashings, inside corners, outside corners, exposed trims, reveals as detailed, accessories, etc. of same material and finish as adjacent metal panel material, shop cut and brake formed to right angles, concealed corner braces as required, hairline exposed joint, pop rivet connections with painted head to match metal panels.

.2 Fasteners.
.1 Fasteners of size, type, quantity and length to meet load requirements of steel wall panel and weathering steel panel assemblies in accordance with building code and all applicable local regulations, and to maintain weather-resistant installation. Refer to Structural and Architectural drawings for size and spacing of fasteners for weathering steel panels. Refer to interior elevations and details for interior applications
.2 Minimum 6 mm diameter, stainless steel (Type 301 minimum) purpose made screws, spaced minimum 406 mm on-centre, through Z-girts, incorporating neoprene washers.
.3 Exposed fasteners to consist of factory prefinished screws.
.1 Weathering Steel Panel: painted to match panel after weathering process.

.3 Thermal Sub-Girts.
.1 Sub-framing thermal spacer to consist of 14-gauge galvanized steel to ASTM A653/A653M Grade 230 with Z275 coating complete with integral HDPE thermal isolator pad, with adjustable depth to suit specified insulation thickness, profile to accept panel system with structural attachment to structure.
.2 Use isolation tape in locations where dissimilar metals come into direct contact with each other. Apply strip of isolation tape between components as recommended by prefinished metal panel manufacturer.

.4 Furring channels: 1.2 mm (18-gauge) thick minimum galvanized steel to ASTM A653/A653M Grade 230 with Z275 coating.

.5 Building Paper: textured, spunbonded polyolefin, non-woven, non-perforated, non-absorbing breathable membrane, basis weight: 2.7 oz./yd², air penetration resistance in accordance with ASTM E2178, water vapour transmission in accordance with ASTM E96/E96M, water penetration resistance in accordance with AATCC 127, surface burning characteristics: Class A in accordance with ASTM E84.

.6 Building Paper Tape: manufacturer's purpose made tape constructed of an oriented polypropylene film coated with a specially formulated permanent acrylic adhesive.

.7 Sheet Metal Cavity Closures: 0.6 mm (24-gauge) galvanized sheet metal cavity closures of profile shown on drawings.

.8 Rigid Board Insulation: in accordance with Section 07 21 00.

.9 Air/Vapour Barrier Membrane - Self Adhesive: in accordance with Section 07 26 00.

.10 Touch-Up Paint: as recommended by panel manufacturer.

Part 3 Execution

3.1 EXAMINATION

.1 Inspect work of others upon which work of this Section depends. Surfaces to receive panels to be even, smooth, sound, clean, dry and free from defects detrimental to work. Notify Consultant in writing of any defects or irregularities which would affect performance or appearance of work of this section.

3.2 INSTALLATION

.1 Building Paper.
- .1 Install building paper to all surfaces as indicated which are to be covered with wall panel system.
- .2 Install in accordance with building paper manufacturer's instruction.
- .3 Install in continuous horizontal strips, lapping upper strips over lower strips. Lap over flashing. Seal overlap using tape supplied by building paper manufacturer.
- .4 Seal laps, holes, tears, and punctures in building paper with building paper tape as specified prior to installation of metal wall/soffit panels.

.2 Install all components of assembly plumb, level and true and in proper alignment and anchor securely in place in accordance with reviewed shop drawings and manufacturer's printed instructions. Maximum deviation from plane alignment of installed panels not to exceed 6 mm in 6 m.

.3 Install to accommodate thermal movement caused by normal ambient temperature range without causing deterioration of panels. Such variations in temperature not to cause buckling, stresses on enclosed or adjoining materials and fasteners or in any way impair performance or appearance or weatherproof performance of panel system. Details of assembly and support to provide sufficient strength and stiffness to resist distortion of finished surface.

.4 Fasten assembly to girts in manner which transmits all loads to main structure without exceeding capacity of any fastener. Consult panel manufacturer for location, type, and frequency of fasteners.

.5 Conform to manufacturer's instructions for installation of concealed fasteners.

.6 Install inside and outside corners, closure panels, sill flashings, and exposed trim as detailed.

.7 Install brake formed exposed trim and reveals as detailed.

.8 Maintain joints in exterior panels, true to line, tight fitting, hairline joints.

.9 Attach components in manner not restricting thermal movement.

.10 Install joint sealant at junctions with adjoining work in accordance with Section 07 92 00.

.11 Touch up any minor paint abrasions with factory provided matching paint.

3.3 CLEANING

.1 Promptly clean all surfaces with dry wipe as installation progresses to remove all stains and marks caused during installation in accordance with recommendations of manufacturer.

.2 Wipe finished surfaces of filings caused by drilling or cutting to prevent discoloration or rust stains resulting from the installation process.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 06 10 00 – Rough Carpentry.

.2 Section 07 42 13 – Metal Wall Panels.

.3 Section 07 62 00 – Sheet Steel Flashing and Trim.

1.2 REFERENCES

.1 American Association of Textile Chemists and Colorists (AATCC).
- .1 AATCC 127-2014, Water Resistance: Hydrostatic Pressure Test.

.2 American Society for Testing and Materials (ASTM).
- .1 ASTM E84-19a, Standard Test Method for Surface Burning Characteristics of Building Materials.
- .2 ASTM E96/E96M-15, Standard Test Methods for Water Vapor Transmission of Materials.
- .3 ASTM E2357-11, Standard Test Method for Determining Air Leakage of Air Barrier Assemblies.

.3 National Building Code of Canada, 2010 (NBCC).

.4 National Lumber Grades Authority (NLGA).
- .1 NLGA Standard Grading Rules for Canadian Lumber, 2014.

1.3 SUBMITTALS

.1 Shop Drawings.
- .1 Submit shop drawings in accordance with Section 01 33 00.
- .2 Include material type and thickness, elevations, sections, dimensions, type and location of thermal spacers and sub-girts, type of fasteners, fastener spacing, and specific details at trim boards (siding and soffit).

1.4 QUALITY ASSURANCE

.1 Lumber Identification: by grade stamp of agency certified by Canadian Lumber Standards Accreditation Board.

.2 Mock-ups.
- .1 Prepare mock-up of wood siding in accordance with Section 01 45 00.
  - .1 Mock-up to be full size located on site as part of final installation.
  - .2 Mock-up will be reviewed for quality of workmanship, co-ordination with work of other Sections and overall appearance.
  - .3 Once approved, mock-up will set standard of acceptance for remaining installations.

1.5 DELIVERY, STORAGE, AND HANDLING

.1 Deliver all material to site in manufacturer’s original unopened packaging with labels clearly identifying product name and manufacturer.

.2 Store materials in a dry, enclosed area protected from exposure to moisture, construction activity, and direct sunlight in strict accordance with manufacturer's recommendations.

.3 Handle all products with appropriate precautions and care as stated manufacturer's instructions.

.4 Cleaning and Waste Management in accordance with Section 01 74 00.

1.6 WARRANTY

.1 Manufacturer's Product Warranty: provide an extended warranty for Work of this Section for a period of 10 years from date of Substantial Performance of the Work. Manufacturer hereby warrants building paper to be free of manufacturing and material defects, and these or other observed defects and deficiencies will be repaired or replaced to the satisfaction of the Consultant and the City, and at no expense to the City.

Part 2 Products

2.1 MATERIALS

.1 Exterior Wood Siding/Soffit Boards: white oak lumber (mill run), sanded one (1) face, Select Merchantable Grade to NLGA Standard Grading Rules for Canadian Lumber, eased edges, unfinished, with following dimensions:
- .1 Thickness: 25 mm.
- .2 Length(s): 2440 mm to 3050 mm.
- .3 Face Width(s): 100 mm, 152 mm, and 203 mm (in random pattern or as indicated on drawings).

.2 Building Paper: textured, spunbonded polyolefin, non-woven, non-perforated, non-absorbing breathable membrane, basis weight: 2.7 oz./yd², air penetration resistance in accordance with ASTM E2178, water vapour transmission in accordance with ASTM E96/E96M, water penetration resistance in accordance with AATCC 127, surface burning characteristics: Class A in accordance with ASTM E84.

.3 Building Paper Tape: manufacturer's purpose made tape constructed of an oriented polypropylene film coated with a specially formulated permanent acrylic adhesive.

.4 Insect Screen: heavy duty 18 x 16 fiberglass screen mesh, black.

.5 Fasteners: of size, type, quantity and length to meet load requirements of wood siding in accordance with building code and to maintain weather-resistant installation.

Part 3 Execution

3.1 INSTALLATION

.1 Building Paper.
- .1 Install building paper to all wall surfaces as indicated which are to be covered with wood siding.
- .2 Install building paper with grooved surface pattern in vertical position.
- .3 Install building paper shingle lapped such that each successive course (starting from the bottom and going upward) overlaps the previous (lower) course for proper water drainage. Ensure proper shingling is maintained at all situations where any flashing, termination, or penetration exists above the building paper.
- .4 Seal laps, holes, tears, and punctures in building paper with building paper tape as specified prior to installation of wood siding.

.2 Exterior Wood Siding and Soffit.

.1 Install insect screen where indicated. Overlap joints, stretch screen tight, and securely staple to wood furring prior to installation of wood siding/soffit boards.

.2 Fasten wood siding/soffit boards to wood furring in straight aligned lengths, and in a manner which transmits all loads to substrate without exceeding capacity of any fastener.

.3 Install inside and outside trim boards and flashings as indicated or required.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 06 10 00 – Rough Carpentry.

.2 Section 07 21 00 – Thermal Insulation.

.3 Section 07 26 00 – Air/Vapour Barrier Membrane - Self Adhesive.

.4 Section 07 42 00 – Metal Wall Panels.

.5 Section 07 62 00 – Sheet Metal Flashing and Trim.

1.2 REFERENCES

.1 American Society for Testing and Materials (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 D1970/D1970M-18, Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection.
- .3 ASTM D5796-10(2015), Standard Test Method for Measurement of Dry Film Thickness of Thin Film Coil-Coated Systems by Destructive Means Using a Boring Device.
- .4 ASTM E96/E96M-16, Standard Test Methods for Water Vapour Transmission of Materials.

.2 National Research Council Canada (NRC).
- .1 NRC Report #NRCC-46299, Design Guidelines for Wind Uplift Resistance of Architectural Metal Roofing Systems, 2003.
- .2 NRC Report #NRCC-48133, New Design Procedure for Wind Uplift Resistance of Architectural Metal Roofing Systems, 2006.

.3 Roofing Contractors Association of Manitoba (RCAM).

.4 National Building Code of Canada, 2010 (NBCC).

1.3 SYSTEM DESCRIPTION

.1 Design standing seam sheet metal roof panel assembly to accommodate thermal movement caused by normal ambient temperature range without causing deterioration of panels. Such variations in temperature not to cause buckling, stresses on enclosed or adjoining materials and fasteners or in any way impair performance or appearance of panels.

.2 Design complete roof system to withstand dead loads, snow load and build-up, and wind loads including uplift, calculated in accordance with 2010 National Building Code of Canada and applicable local regulations, NRC Report #NRCC-46299 and #NRCC-48133 for place of work, and as shown on drawings.

.3 Accommodate movement in roof assembly and between roof panels and building structure caused by structural movements without permanent distortion, damage to infills, racking of joints, breakage of seals, or water penetration.

.4 Design members to withstand dead load and wind loads calculated in accordance with NBCC and applicable local regulations, to maximum allowable deflection of 1/180 of span.

.5 Provide for positive drainage (to exterior eavestrough) of condensation occurring within roof system and water entering at joints.

.6 Design roof systems to accommodate specified erection tolerances of structure.

1.4 SUBMITTALS

.1 Shop Drawings.
- .1 Submit shop drawings in accordance with Section 01 33 00.
- .2 Indicate arrangement of prefinished roof sheets and joints, types and location of support clips, fasteners and entire roof assembly.
- .3 Fully detail snow stops complete with fastening method, flashings, gutters, and all other components in roof assembly.
- .4 Submit shop drawings bearing the signature and stamp of qualified Professional Engineer registered in jurisdiction of Place of Work.

1.5 QUALITY ASSURANCE

.1 Qualifications.
- .1 Roofing Contractor: approved applicator by roofing materials manufacturer, member in good standing with RCAM, minimum five (5) years' experience installing roof system specified.
- .2 Workers: adequate number of skilled workers recognized and trained as approved applicator by roof panel manufacturer, with experience installing roof assembly specified and supervised at all times by at least one experienced superintendent.
- .3 Roofing Contractor must strictly comply with the roofing material manufacturer's current specifications and details.

1.6 DELIVERY, STORAGE, AND HANDLING

.1 Deliver all material to site in manufacturer's original unopened packaging with labels clearly identifying product name and manufacturer.

.2 Store materials in a dry, enclosed area protected from exposure to moisture, construction activity, and direct sunlight in strict accordance with manufacturer's recommendations. Store roll materials on end.

.3 Handle all products with appropriate precautions and care as stated manufacturer's instructions.

.4 Cleaning and Waste Management in accordance with Section 01 74 00.

Part 2 Products

2.1 MANUFACTURER

.1 Basis of Design Products.
- .1 Standing Seam Sheet Metal Roof Panels.
  - .1 Flynn Accu-Steel Standing Seam Roof Panels complete with seam tape in all standing seams.
- .2 Sub Framing Thermal Spacer (Sub-Girt).
  - .1 Northern Facades, ISO Clip Thermal Isolation Clip.

.2 Requests for substitutions will be considered subject to specified requirements and in accordance with Bidding Procedures B8.

.3 Supply similar products from single manufacturer.

2.2 MATERIALS

.1 Prefinished Standing Seam Metal Roof Panels: 22-gauge continuous hot-dip Z275 zinc coated (galvanized) steel to ASTM A653/A653M, 38 mm high x 406 mm panel width profile, factory or field roll formed in continuous lengths, continuous seam tape in all standing seams, factory finished to ASTM D5796 with factory applied Valspar WeatherX or Baycoat Perspectra Plus Series paint coating, Colour: to match Prefinished Metal Wall Panel MWP-1; Colour to be selected by Consultant.

.2 Roof Panel Support Clips: 16-gauge galvanized concealed fastener with Z275 zinc coating, purpose made thermally responsive clip system, designed to accommodate full thermal expansion and contraction of roof sheet. Size panel clips to lift underside of panel from surface minimum 10 mm for cross ventilation under panels.

2.3 ACCESSORIES

.1 Fasteners.

.1 Fasteners of size, type, quantity and length to meet load requirements of roof panel assembly in accordance with building code and all applicable local regulations, and to maintain weather-resistant installation.

.2 Exposed fasteners (where required) to consist of factory prefinished hex head Tek screws (colour to match roof panels) with neoprene-bonded metal washers.

.2 Exposed Trims/Flashings: closures, drip flashings, inside corners, outside corners, trims, accessories, etc., of same gauge material and finish as roof panel material, shop cut and brake formed to right angles.

.3 Thermal Sub-Girts.

.1 Sub-framing thermal spacer to consist of 14-gauge galvanized steel to ASTM A653/A653M Grade 230 with Z275 coating complete with integral HDPE thermal isolator pad, with adjustable depth to suit specified insulation thickness, profile to accept panel system with structural attachment to structure.

.2 Use isolation tape in locations where dissimilar metals come into direct contact with each other. Apply strip of isolation tape between components as recommended by prefinished metal panel manufacturer.

.4 Furring channels: 1.2 mm (18-gauge) thick minimum galvanized steel to ASTM A653/A653M Grade 230 with Z275 coating.

.5 Building Paper: textured, spunbonded polyolefin, non-woven, non-perforated, non-absorbing breathable membrane, basis weight: 2.7 oz./yd², air penetration resistance in accordance with ASTM E2178, water vapour transmission in accordance with ASTM E96/E96M, water penetration resistance in accordance with AATCC 127, surface burning characteristics: Class A in accordance with ASTM E84.

.6 Building Paper Tape: manufacturer's purpose made tape constructed of an oriented polypropylene film coated with a specially formulated permanent acrylic adhesive.

.7 Sheet Metal Cavity Closures: 0.6 mm (24-gauge) galvanized sheet metal cavity closures of profile shown on drawings.

.8 Rigid Board Insulation: in accordance with Section 07 21 00.

.9 Snow Fence: Refer to Section 07 62 00.

.10 Round rubber roof jack: flexible rubber with metal ring to seal rubber to metal roof surface.

.11 Joint Sealants: in accordance with section 07 92 00.

.12 Gutters and Downspouts: in accordance with Section 07 62 00.

2.4 FABRICATION

.1 Fabricate roof assembly components to comply with dimensions, profiles, gauges and details as shown on reviewed shop drawings and in accordance with manufacturer's printed instructions.

Part 3 Execution

3.1 INSTALLATION

.1 Building Paper.
- .1 Install building paper to all surfaces as indicated which are to be covered with wall panel system.
- .2 Install in accordance with building paper manufacturer's instruction.
- .3 Install in continuous horizontal strips, lapping upper strips over lower strips. Lap over flashing. Seal overlap using tape supplied by building paper manufacturer.
- .4 Seal laps, holes, tears, and punctures in building paper with building paper tape as specified prior to installation of metal wall/soffit panels.

.2 Prefinished Standing Seam Metal Roof Panels.
- .1 Install roof assembly in accordance with reviewed shop drawings and manufacturer's printed instructions.
- .2 Install panel support system to allow for temperature expansion/contraction movement without stress or bucking of panels or support clips. Attach roof panel support clips to substrate using fasteners of size and spacing as determined by manufacturer's design analysis and in accordance with engineered shop drawings to resist uplift and thermal movement forces.
- .3 Fasten panel assembly to building structure in manner which transmits all loads to main structure without exceeding capacity of any fastener.
- .4 Ensure panel side-laps are positively locked for full length of panel, and proper sheet coverage is maintained.
- .5 Install system true to line and plane and free of dents. Locate standing seams equidistant from gables.
- .6 Protect installed panels from abuse by other trades. Provide walk boards in heavy roofing traffic areas to prevent damage to panels.
- .7 Replace damaged panels and other components of work which cannot be repaired by finish touch-up or similar minor repair.
- .8 To prevent rust staining, remove immediately from finished surfaces any filings caused by drilling or cutting.
- .9 Wipe down each area after erection is complete for final acceptance.

.3 Prefinished Metal Flashing, Eavestrough and Downspouts.
- .1 Install metal flashings, eavestrough and downspouts in accordance with Section 07 62 00, details, reviewed shop drawings and manufacturer's printed instructions.
- .2 Install continuous seam tape to both top and bottom of perimeter trim flashings at roof edges.
- .3 Use concealed fasteners where appropriate. Exposed fasteners to be same colour as roofing panels.
- .4 Lock end joints and caulk to provide weatherproof seal.
- .5 Install rubber roof jacks at all round mechanical vent stacks penetrating roof surface.

3.2 ADJUSTING AND CLEANING

.1 Touch-up minor paint abrasions with touch-up paint provided by sheet metal roof panel manufacturer.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 07 42 13 – Metal Wall Panels.

.2 Section 07 61 13 – Standing Seam Sheet Metal Roofing.

1.2 REFERENCES

.1 American Society for Testing and Materials (ASTM).
- .1 ASTM A653/A653M-17, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by Hot-Dip Process.
- .2 ASTM A792/A792M-10(2015), Standard Specification for Steel Sheet, 55 % Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.
- .3 ASTM D1005-95(2013), Standard Test Method for Measurement of Dry-Film Thickness of Organic Coatings Using Micrometers.

.2 Canadian Roof Contractor's Association (CRCA).
- .1 CRCA Roofing Specification Manual, as amended to date.

.3 Canadian Standards Association (CSA).
- .1 CSA S136-12, PACKAGE North American Specification for the Design of Cold Formed Steel Structural Members and S136.1-12 - Commentary on North American specification for the design of cold-formed steel structural members, Includes Update No. 1 (2014), Update No. 2. (2014), Update No. 3 (2015).

1.3 DELIVERY, STORAGE, AND HANDLING

.1 Deliver all material to site in manufacturer’s original unopened packaging with labels clearly identifying product name and manufacturer.

.2 Store materials in a dry, enclosed area protected from exposure to moisture, construction activity, and direct sunlight in strict accordance with manufacturer's recommendations.

.3 Handle all products with appropriate precautions and care as stated manufacturer's instructions.

.4 Cleaning and Waste Management in accordance with Sections 01 74 00.

Part 2 Products

2.1 MANUFACTURER

.1 Basis of Design Products.
- .1 Snow Fence (Typical).
  - .1 S-5, DualGard Pipe Snow Retention +9+System.
- .2 Snow Fence (at weathering steel, as noted).
  - .1 S-5, VersaGard Pipe Snow Retention Clip System.

.2 Requests for substitutions will be considered subject to specified requirements and in accordance with Bidding Procedures B8.

.3 Supply similar products from single manufacturer.

2.2 MATERIALS

.1 Galvanized Sheet Steel: 16-gauge, 18-gauge, 22-gauge, continuous hot-dip Z275 zinc coated (galvanized) steel conforming to requirements of ASTM A653/A653M, regular spangle surface.

.2 Prefinished Sheet metal: 18-gauge, 22-gauge, 24-gauge, 26-gauge continuous hot-dip Z275 zinc coated (galvanized) steel, conforming to requirements of ASTM A653/A653M factory finished to ASTM D5796 with factory applied paint coating, colour(s) to match metal wall/roof panels at metal wall/roof panel installations, unless otherwise detailed.

.3 Snow Fence (typical).
- .1 Structural aluminum bracket with clamp system for securing to standing seam, complete with two (2) 27 mm diameter holes.
- .2 Two (2) 25 mm diameter aluminium rods, full length, gauge to suit application.
- .3 Colour: Custom colour system to match roofing system.

.4 Snow Fence (at weathering steel).
- .1 Structural aluminum bracket with factory-applied butyl at base, complete with two (2) 27 mm diameter holes.
- .2 Two (2) 25 mm diameter aluminium rods, full length, gauge to suit application.
- .3 Colour: Custom colour system to be confirmed with Consultant.

2.3 ACCESSORIES

.1 Joint Sealants: in accordance with Section 07 92 00.

.2 Cleats: of same material, and temper as sheet metal, minimum 50 mm wide.

.3 Exposed fasteners: stainless steel purpose made, head colour same as flashing.

.4 Washers: of same material as sheet metal, 1 mm thick with rubber packings.

.5 Touch-up paint: as recommended by prefinished material manufacturer.

2.4 FABRICATION

.1 Fabricate metal flashings including steel cap flashings, through wall steel flashings, steel closure strips, fascia, trims, and other sheet metal work to applicable CRCA FL series specifications and as detailed.

.2 Form pieces in 2400 mm maximum lengths. Make allowance for expansion at joints.

.3 Hem exposed edges on underside 12 mm. Mitre and seal corners with sealant.

.4 Form sections square, true and accurate to size, free from distortion and other defects detrimental to appearance or performance.

.5 Apply isolation coating to metal surfaces to be embedded in concrete or mortar.

.6 Eavestrough and Downspouts.
- .1 Eavestrough: indicated size and profile formed from 18-gauge galvanized sheet steel trough with 22-gauge prefinished sheet steel outer cover, 16-gauge galvanized bracing brackets at minimum 400 mm on-centre, minimize joints in length of eavestrough, colour(s) to match prefinished metal tile; confirm exact colour with Consultant.
- .2 Downspouts: indicated size and profile formed from 22-gauge prefinished steel sheet. Downspouts to be closed (4-sided) upper portion and (3-sided) open lower portion, prefinished material on all exposed surfaces, colour(s) to be selected buy Consultant.

Part 3 Execution

3.1 INSTALLATION

.1 Flashings and Trim.

.1 Install steel sheet metal flashings and trim as detailed. Install roof related flashings and trim in accordance with CRCA Specification Manual.

.2 Use concealed fastenings except where approved by Consultant before installation.

.3 Install steel sheet metal counter flashing over modified bitumen membrane flashings at intersections of roof with vertical surfaces and curbs. Form joints using S-lock connection with tight fit over hook strips. Lock end joints and caulk with sealant.

.4 Apply isolation coating to metal surfaces to be embedded in concrete, mortar, and other dissimilar metals.

.2 Eavestrough and Downspouts.

.1 Eavestrough and downspouts as detailed.

.3 Snow Fence.

.1 Install snow fence perpendicular to roof slope as indicated in accordance with reviewed shop drawings and manufacturer's printed instructions.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 03 30 00 – Cast-In-Place Concrete.

.2 Section 06 10 00 – Rough Carpentry.

.3 Section 09 29 00 – Gypsum Board.

.4 Mechanical Specifications

.5 Electrical Specifications.

1.2 REFERENCES

.1 American Society for Testing and Materials (ASTM).
- .1 ASTM C679-15, Standard Test Method for Tack-Free Time of Elastomeric Sealants.
- .2 ASTM D6904-03(2013), Standard Practice for Resistance to Wind Driven Rain for Exterior Coatings Applied on Masonry.
- .3 ASTM E84-17a, Standard Test Method for Surface Burning Characteristics of Building Materials.
- .4 ASTM E119-16a, Standard Test Methods for Fire Tests of Building Construction and Materials.
- .5 ASTM E595-15, Standard Test Method for Total Mass Loss and Collected Volatile Condensable Materials from Outgassing in a Vacuum Environment.
- .6 ASTM E814-13a(2017), Standard Test Method for Fire Tests of Penetration Firestop Systems.
- .7 ASTM E1966-15, Standard Test Method for Fire-Resistive Joint Systems.
- .8 ASTM E2174-14b, Standard Practice for On-Site Inspection of Installed Fire Stops.
- .9 ASTM E2307-15be1, Standard Test Method for Determining Fire Resistance of Perimeter Fire Barrier Systems Using Intermediate-Scale, Multi-story Test Apparatus.
- .10 ASTM E2393-10a(2015), Standard Practice for On-Site Inspection of Installed Fire Resistive Joint Systems and Perimeter Fire Barriers.
- .11 ASTM G21-15, Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.

.2 Firestop Contractors International Association (FCIA).
- .1 FCIA Manual of Practice (MOP).

.3 International Firestop Council (IFC).
- .1 IFC 401 Inspection Manual for Firestopped through Penetrations, Joints and Perimeter Fire Barrier Systems.

.4 National Building Code of Canada, 2010 (NBCC).

.5 National Fire Protection Association (NFPA).
- .1 2018 NFPA 101: Life Safety Code.

.6 National Research Council Canada.
- .1 Best Practice Guide on Fire Stops and Fire Blocks and their impact on Sound Transmission, June 2007.

.7 Underwriter's Laboratories (UL).
- .1 UL 1479-16, Standard for Fire Tests of Through-Penetration Firestops.
- .2 UL 2079-15, Standard for Tests for Fire Resistance of Building Joint Systems.

.8 Underwriter's Laboratories of Canada (ULC).
- .1 CAN/ULC S101-14, Standard Methods 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 S115-11(R2016), Standard Method of Fire Tests of Fire Stop Systems.
- .4 ULC FS-17, Firestop Systems and Components.

1.3 DEFINITIONS

.1 Firestopping and Smoke Seals: material or combination of materials used to retain integrity of fire-rated construction by maintaining effective barrier against spread of flame, smoke, and hot gases through penetrations in joints between fire-rated wall and floor assemblies.

.2 Through-penetration: opening or foreign material, pipes, conduits, ducts, cable trays, cable, wire, structural components or any other element passing completely through opening in fire-rated barrier/assembly such that full thickness of rated material(s) is breached either in total or in part.

.3 Membrane penetration: any penetration of fire-rated barrier that breaches one side but does not pass completely through to other side, including recessed electrical devices.

.4 System: combination of specific materials and/or devices, including penetrating item(s) required to complete firestop, as tested by independent third party test facility.

.5 Barrier/Assembly: wall, floor, ceiling or roof assembly or other partition with fire-smoke rating of 0,1,2,3 or up to 4-hours.

.6 Fire Resistive Joint: any joint or opening, whether static or dynamic, within or between adjacent sections of fire rated interior or exterior walls, floors, ceilings or roof decks.

.7 Fireblocking: building materials installed to resist the free passage of flame, smoke and toxic gases to other areas of building through concealed spaces.

.8 Perimeter Fire Barrier System: perimeter joint protection that provides fire resistance to prevent passage of fire from floor to floor within building at opening between exterior wall assembly and floor assembly.

.9 Intumescent: materials that expand with that to seal around objects threatened by fire.

.10 F-Rating: time firestop, penetration item, building, material, firestop material, can withstand direct flame without burn through as tested to CAN/ULC S115.

.11 T-Rating: amount of time through-penetration firestop limits temperature rise on cold side-outside test furnace - as tested to CAN/ULC S115.

.12 W-Rating Water Leakage Test: systems tested and listed in accordance with UL 1479.

.13 L-Rating: the amount of air that moves through an opening in cubic feet per minute per square foot of opening area, at ambient temperatures and 400F - as tested to CAN/ULC S115.

1.4 SYSTEM DESCRIPTION

.1 Provide firestopping as indicated and in accordance with NBCC and NFPA 101, composed of components that are compatible with each other, substrates forming openings, and items, if any, penetrating firestopping under conditions of service and application, as demonstrated by firestopping manufacturer based on testing and field experience.

.2 Provide components for each firestopping system that are needed to install fill material. Use only components specified by firestopping manufacturer and approved by qualified testing agency for designated fire-resistance-rated systems.

.3 Firestopping Materials are either “cast-in-place” (integral with concrete placement) or “post installed.” Provide cast-in-place firestop devices prior to concrete placement.

.4 Provide firestopping with mould and mildew resistance rating of ZERO in accordance with ASTM G21.

.5 Provide firestopping of smoke barrier penetrations with L-Rating not exceeding 5.0 cfm/sq. ft. of penetration opening at both ambient and elevated temperatures in accordance with CAN/ULC S115.

.6 Use only firestop products that have been ULC or cUL tested for specific fire-rated construction conditions conforming to construction assembly type, penetrating item type, annular space requirements, and fire-rating involved for each separate instance and as follows:

.1 Service penetrations for passage of duct, cable, cable tray, conduit, piping, electrical busways and raceways through new fire-rated vertical barriers (walls and partitions), horizontal barriers (floor/ceiling assemblies), and vertical service shaft walls and partitions.

.2 Openings between structurally separate sections of wall or floors.

.3 Joints (gaps) between top of walls and ceilings or roof assemblies.

.4 Wall-to-wall joints (gypsum board to concrete or concrete block walls or control/expansion joints for masonry, concrete or gypsum board).

.5 Joints between the bottom of walls (gypsum board to floor system).

.6 Control or expansion joints in walls and floors.

.7 Openings and penetrations in fire-rated partitions or walls containing fire doors.

.8 Openings around structural members which penetrate floors or walls.

.9 Systems installed to allow and be designed to accommodate movement (expansion) in all joints as indicated on architectural / structural drawings/specifications and plumbing pipes and sprinkler pipes that require movement during the activation of these systems.

.10 Openings around structural members, which penetrate horizontal and vertical fire separations and their fire resistant membranes.

.11 Fire-rated cable pathway devices.

.12 Marriage joints between fire rated duct wrap to fire rated floor and wall assemblies.

1.5 SUBMITTALS

.1 Submit Product Data: Manufacturer's specifications and technical data for each material including composition and limitations, documentation of ULC or cUL firestop systems to be used and manufacturer's installation instructions to comply with Section 01 33 00.

.2 Manufacturer's engineering judgment identification number and drawing details when no ULC or cUL system is available for application. Engineered judgment must include both project name and contractor’s name who will install firestop system as described in drawing.

.3 Submit material safety data sheets (MSDS) provided with product delivered to job-site. MSDS to include following:

.1 Technical data on out-gassing; off-gassing and age testing.

.2 Curing time.

.3 Chemical compatibility to other construction materials.

.4 Provide certification by manufacturer that products supplied comply with local regulations controlling use of volatile organic compounds (VOC's), are non-toxic to building occupants, and comply with following:

.1 ASTM E595.

.2 EPA Method 24.

.3 Volatile Content: below 250 g/l.

.4 Silicone firestop not permitted.

.5 Design system listings to show proposed material, including technical data, reinforcement, anchorage, fastenings and method of installation. Construction details to accurately reflect actual job conditions.

1.6 QUALITY ASSURANCE

.1 Installer Qualifications.

.1 Manufacturer to employ fire protection engineers having minimum 5 years' experience with manufacturers' design systems. Provide proof of experience upon Consultant's request.

.2 Fire protection engineer to oversee project, and provide engineered judgments as required to suit building conditions and Authorities Having Jurisdiction. All Engineered Judgments shall conform to IFC 401 and manufacturer shall be member in good standing with the IFC or FCIA. Provide proof of membership upon Consultant's request.

.3 Work is to be undertaken by experienced Site Supervisor in their trade of material or system being used with a minimum of five (5) working years of experience utilizing that material/system, and shall provide a list of not less than five (5) successfully completed projects of similar scale and type.

.4 Firestop Contractor shall be a member in good standings with FCIA for a minimum of two years, and who is certified, licensed, or otherwise qualified by firestop manufacturer as having necessary experience, staff, and training to install manufacture's products per specified requirements. Provide proof of membership and certification upon Consultant's request.

.5 Manufacturer/supplier's willingness to sell its firestopping products to Contractor or to installer engaged by Contractor does not in itself confer qualification on buyer.

.6 Installation Responsibility: assign installation of through-penetration firestop systems and fire-resistive joint systems in Project to a single sole source firestop specialty contractor.

.7 The work is to be installed by a contractor with at least one of the following qualifications:

.1 FM 4991 Approved Contractor

.2 UL Approved Contractor

.2 Regulatory Requirements.

.1 Firestop System installation must meet requirements of CAN/ULC S115 tested assemblies that provide fire rating as shown.

.2 Proposed firestop materials and methods to conform to applicable governing codes having local jurisdiction.

.3 For those firestop applications that exist for which no ULC or cUL tested system is available through manufacturer, manufacturer's engineering judgment derived from similar ULC or cUL system designs or other tests will be submitted to local authorities having jurisdiction for their review and approval prior to installation. Engineer judgment drawings must follow requirements set forth by IFC 401.

.3 Firestopping systems are not intended to reestablish structural integrity of load bearing partitions/assemblies, or support live loads and traffic. Consult Consultant prior to penetrating any load bearing assembly.

.4 Firestopping material to be free of asbestos, PCB and lead, and cannot incorporate nor require the use of hazardous solvents.

.5 Firestopping material must have visibly labeled expiration or packaging date and **must be within the manufacturer specified shelf life at time of installation**. Installation of firestopping material past its specified shelf life is strictly prohibited and will be rejected. Contractor to verify shelf life with Consultant prior to installation.

.6 Verify on-site to Consultant prior to firestopping installation on all phases of construction that firestopping material is not damaged or frozen or has not exceeded manufacturer's expiry date identified on product or packaging. All firestopping materials must be installed prior to expiration of shelf life.

.7 Mock-up a minimum of 25% of the proposed ULC or cUL system in accordance with Section 01 45 00.

.1 If required, include work by other trades to provide required finish work, such as steel stud / gypsum board trade framing out multi-penetrations openings.

.2 Reviewed mock-ups become standard of workmanship and material against which installed work will be checked. Reviewed and approved mock-ups may be used in final construction.

.3 Once mock-ups have been completed and materials have had adequate time to properly cure, notify Consultant to perform their review. Minimum 48 hours notice is required.

.8 Hold pre-installation meeting prior to commencement of firestop systems. Subcontractors that are affected, such as masonry, gypsum board/steel stud, mechanical and electrical subcontractors to attend. Review standard installation procedures, scheduling / sequencing of other work around or that affects outcome of installation, precautions, annular opening sizes, wall/floor service single and multi - preparations, joints and perimeter joints to ensure that all Subcontractors and Contractor understand full complexity of firestop installation, based on reviewed shop drawings.

1.7 DELIVERY, STORAGE, AND HANDLING

.1 Deliver materials undamaged in manufacturer's clearly labeled, unopened containers, identified with brand, type, and ULC or cUL label where applicable.

.2 Co-ordinate delivery of materials with scheduled installation date to allow minimum storage time at job-site.

.3 Store materials under cover and protect from weather and damage in compliance with manufacturer's requirements.

.4 Comply with recommended procedures, precautions or remedies described in material safety data sheets as applicable.

.5 Do not use damaged or expired materials.

.6 Cleaning and Waste Management in accordance with Sections 01 74 00.

1.8 SITE CONDITIONS

.1 Do not use materials that contain flammable solvents.

.2 Schedule installation of firestopping after completion of penetrating item installation but prior to covering or concealing of openings.

.3 Verify conditions and substrates before starting work. Correct unsatisfactory conditions before proceeding.

.4 Weather conditions: Do not proceed with installation of firestop materials when temperatures exceed manufacturer's recommended limitations for installation printed on product label and product data sheet.

.5 During installation, provide masking and drop cloths to prevent firestopping materials from contaminating any adjacent surfaces.

1.9 WARRANTY

.1 Manufacturer's Product Warranty: provide an extended warranty for Work of this Section for a period of two (2) years from date of Substantial Performance of the Work. Manufacturer hereby warrants firestopping products to be free of manufacturing defects, and these or other observed defects and deficiencies will be repaired or replaced to the satisfaction of the Consultant and the City, and at no expense to the City.

.2 Installation Contractor's Warranty: provide an extended warranty for Work of this Section for a period of two (2) years from date of Substantial Performance of the Work. Contractor hereby warrants that firestopping will remain as installed, free from any defects and deficiencies, and these or other observed defects and deficiencies will be repaired or replaced to the satisfaction of the Consultant and the City, and at no expense to the City.

Part 2 Products

2.1 PERFORMANCE REQUIREMENTS

.1 Provide firestopping composed of components that are compatible with each other, the substrates forming openings, and the items, if any, penetrating the firestopping under conditions of service and application, as demonstrated by the firestopping manufacturer based on testing and field experience.

.2 Provide components for each firestopping system that are needed to install fill material. Use only components specified by the firestopping manufacturer and approved by the qualified testing agency for the designated fire-resistance-rated systems.

.3 Firestopping Materials are either "cast-in-place" (integral with concrete placement) or "post installed." Provide cast-in-place firestop devices prior to concrete placement.

.4 Provide a round fire-rated cable management device whenever cables penetrate fire rated walls, where frequent cable changes and additions may occur. The fire-rated cable management device shall consist of a corrugated steel tube with zinc coating, contain and inner plastic housing, intumescent material rings, and inner fabric smoke seal membrane. The length of the sleeve shall be 12.4". The fire-rated cable management device shall contain integrated intumescent firestop wrap strip materials sufficient to maintain the hourly rating of the barrier being penetrated. The fire-rated cable management device shall contain a smoke seal fabric membrane or intumescent firestop plugs sufficient to achieve the L-Rating requirements of the barrier type. Install device per the manufacturer's published installation instructions.

.5 Penetrations in Fire Resistance Rated Walls: Provide firestopping with ratings determined in accordance with CAN/ULC-S115-11

.1 F-Rating: Not less than the fire-resistance rating of the wall construction being penetrated.

.6 Penetrations in Horizontal Assemblies: Provide firestopping with ratings determined in accordance with CAN/ULC-S115-11.

.1 F-Rating: Minimum of 1-hour rating, but not less than the fire-resistance rating of the floor construction being penetrated.

.2 T-Rating: when penetrant is located outside of a wall cavity, minimum of 1-hour rating, but not less than the fire-resistance rating of the floor construction being penetrated.

.3 W-Rating: Class 1 rating in accordance with water leakage test per UL 1479.

.7 Penetrations in Smoke Barriers: Provide firestopping with ratings determined in accordance with UL 1479 or ASTM E 814.

.1 L-Rating: Not exceeding 5.0 cfm/sq. ft. of penetration opening at both ambient and elevated temperatures.

.8 Mould Resistance: Provide penetration firestopping with mould and mildew resistance rating of 0 as determined by ASTM G21.

.9 Rain and water resistance: provide perimeter joint sealant tested in accordance with ASTM D 6904 with less than 1 hour tack free time as tested in accordance with ASTM C 679.

2.2 MATERIALS

.1 Cast-in place and pre-installed firestop devices for use with non-combustible and combustible plastic pipe (closed and open piping systems) penetrating concrete floors. Equivalent products listed in ULC Fire Resistance Directory – Volume III or UL Products Certified for Canada (cUL) Directory.

.2 Sealants or caulking materials for use with non-combustible items including steel pipe, copper pipe, rigid steel conduit and electrical metallic tubing (EMT). Equivalent products listed in ULC Fire Resistance Directory – Volume III or UL Products Certified for Canada (cUL) Directory.

.3 Sealants or caulking materials for use with sheet metal ducts. Equivalent products listed in ULC Fire Resistance Directory – Volume III or UL Products Certified for Canada (cUL) Directory .

.4 Sealants, caulking or spray materials for use with fire-rated construction joints and other gaps. Equivalent products listed in ULC Fire Resistance Directory – Volume III or UL Products Certified for Canada (cUL) Directory.

.5 Pre-formed mineral wool designed to fit flutes of metal profile deck (as backer for spray material).

.6 Intumescent sealants or caulking materials for use with combustible items (penetrants consumed by high heat and flame) including insulated metal pipe, PVC jacketed, flexible cable or cable bundles and plastic pipe. Equivalent products listed in ULC Fire Resistance Directory – Volume III or UL Products Certified for Canada (cUL) Directory.

.7 Foams, intumescent sealants, caulking or putty materials for use with flexible cable or cable bundles. Equivalent products listed in ULC Fire Resistance Directory – Volume III or UL Products Certified for Canada (cUL) Directory.

.8 Non curing, re-penetrable intumescent sealants, caulking or putty materials for use with flexible cable or cable bundles.Equivalent products listed in ULC Fire Resistance Directory – Volume III or UL Products Certified for Canada (cUL) Directory.

.9 Wall opening protective materials for use with cUL/ULC listed metallic and specified nonmetallic outlet boxes. Equivalent products listed in UL Products Certified for Canada (cUL) Directory.

.10 Firestop collar or wrap devices attached to assembly around combustible plastic pipe (closed and open piping systems) tested to 50 Pa. differential. Equivalent products listed in ULC Fire Resistance Directory – Volume III or UL Products Certified for Canada (cUL) Directory.

.11 Materials used for large size/complex penetrations made to accommodate cable trays, multiple steel and copper pipes, electrical busways in raceways. Equivalent products listed in ULC Fire Resistance Directory – Volume III or UL Products Certified for Canada (cUL) Directory.

.12 Non curing, re-penetrable materials used for large size/complex penetrations made to accommodate cable trays, multiple steel and copper pipes, electrical busways in raceways. Equivalent products listed in ULC Fire Resistance Directory – Volume III or UL Products Certified for Canada (cUL) Directory.

.13 Sealants or caulking materials used for openings between structurally separate sections of wall and floors. Equivalent products listed in ULC Fire Resistance Directory – Volume III or UL Products Certified for Canada (cUL) Directory.

.14 For blank openings made in fire-rated wall or floor assemblies, where future penetration of pipes, conduits, or cables is expected. Equivalent products listed in ULC Fire Resistance Directory – Volume III or UL Products Certified for Canada (cUL) Directory.

.15 Re-penetrable, round cable management devices for use with cable bundles penetrating gypsum or masonry walls. Equivalent products listed in ULC Fire Resistance Directory – Volume III or UL Products Certified for Canada (cUL) Directory.

.16 For single or cable bundles up to one inch diameter penetrating gypsum, masonry, concrete walls or wood floor assemblies. The following product is acceptable:

.17 Fire Barrier Insulation Block for expansion joints in fire-rated wall assemblies. For penetrations through Fire Wall or horizontal Fire Separation provide firestop system with “FT” Rating as determined by ULC or cUL which is equal to fire resistance rating of construction being penetrated.

.19 For joints provide firestop system with Assembly Rating as determined by CAN/ULC S115 or UL 2079 which is equal to fire resistance rating of construction being penetrated.

.20 For service penetrations and joints through Fire Separation wall provide firestop system with "F" Rating as determined by ULC or cUL as indicated below:

Fire Resistance Rating of Separation	Required ULC or cUL “F” Rating of Firestopping Assembly
30 minutes	20 minutes
45 minutes	45 minutes
1 hour	45 minutes
1.5 hours	1 hour
2 hours	1.5 hours
3 hours	2 hours
4 hours	3 hours

Note - For combustible pipe penetrations through Fire Separation provide firestop system with “F” Rating as determined by ULC or cUL which is equal to fire resistance rating of construction being penetrated.

Part 3 Execution

3.1 PREPARATION

.1 Verification of Conditions: Examine areas and conditions under which work is to be performed and identify conditions detrimental to proper or timely completion.

.1 Verify penetrations are properly sized and in suitable condition for application of materials.

.2 Surfaces to which firestop materials will be applied to be free of dirt, grease, oil, rust, laitance, release agents, water repellents, and any other substances that may effect proper adhesion.

.3 Provide masking and temporary covering to prevent soiling of adjacent surfaces by firestopping materials.
.4 Comply with manufacturer's recommendations for temperature and humidity conditions before, during and after installation of firestopping.
.5 Do not proceed until unsatisfactory conditions have been corrected.

3.2 CO-ORDINATION

.1 Co-ordinate location and proper selection of cast-in-place Firestop Devices with trade responsible for work. Ensure device is installed before placement of concrete.

.2 Responsible trade is to provide adequate spacing of field run pipes to allow for installation of cast-in-place firestop devices without interference.

3.3 INSTALLATION

.1 Regulatory Requirements: Install firestop materials in accordance with ULC Fire Resistance Directory or UL Products Certified for Canada (cUL) Directory or Omega Point Laboratories Directory, and FCIA MOP.

.2 Manufacturer's Instructions: Comply with manufacturer's instructions for installation of through-penetration and construction joint materials.
.1 Seal all holes or voids made by penetrations to ensure air and water resistant seal.
.2 Consult with mechanical engineer, project manager, and damper manufacturer prior to installation of ULC or cUL firestop systems that might hamper performance of fire dampers as it pertains to duct work.
.3 Protect materials from damage on surfaces subjected to traffic.

.3 Firestopping and Smoke Seals of New Fire Separations.
.1 Install firestopping to maintain the integrity of all fire separations in fire rated floors and walls whenever affected by construction including:
.1 Penetrations through and top of fire-resistance rated masonry, and gypsum board walls.
.2 Penetrations through fire-resistance rated floor assemblies.
.3 Intersections of fire-resistance rated masonry and gypsum board walls.
.4 Control joints in fire-resistance rated floor assemblies, and masonry and gypsum board walls.
.5 Openings and sleeves installed for future use through fire separations.
.6 Around mechanical and electrical assemblies penetrating fire separations.
.7 Rigid ducts greater than 129 cm^2: firestopping to consist of bead of firestopping material between retaining angle and fire separation and between retaining angle and duct, on each side of fire separation.

3.4 FIELD QUALITY CONTROL

.1 Do not conceal firestopping installations until Consultant, the City's inspection agency or Authorities Having Jurisdiction have examined each installation.

.2 Perform under this Section, patching and repairing of firestopping caused by cutting or penetrating of existing firestop systems already installed by other trades.

.3 Inspection of through-penetration firestopping shall be performed in accordance with ASTM E 2174, "Standard Practice for On-Site Inspection of Installed Fire Stops" or other recognized standard.

.4 Identify firestopping with pressure sensitive, self-adhesive preprinted vinyl warning labels. Attach labels permanently to surfaces of penetrated construction on both sides of all firestopping installations where the labels will be visible to anyone seeking to add to or remove penetrating items or firestopping at a future date. Photograph all installations for record purposes. Include the following information on all warning labels:

.1 The words: "WARNING FIRESTOPPING DO NOT DISTURB. NOTIFY BUILDING MANAGEMENT OF ANY DAMAGE"
.2 Contractor's name, address and phone number.
.3 Firestopping system designation of applicable testing and inspecting agency (ULC or cUL).
.4 Date of installation.
.5 Firestopping product used and manufacturer's name.
.6 Installer's name.

.5 Cut and remove systems for visual review by Consultant and manufacturer's representative. Once review is completed and accepted, replace firestop system with new. For such exploratory reviews per approved design system listings, allow:

.1 Minimum of 2% of each service penetration design listing for each area of 900 m^2;
.2 Cut test perimeter joints every 15 meters;
.3 Cut test bottom- and top-of-wall joints, wall-to-wall joints and building expansion joints every 15 meters minimum.
.4 All Exploratory Reviews (cut tests) must meet the Firestop Systems minimum thickness, depth and/or widths of the annular requirements. These reviews will be performed 28 days after the installation to allow for curing of the product as a minimum. The Consultant will not accept the installed system to be below the system's minimum requirements (depth and width). Shrinkage of the product installation must be factored into all installations on this Project.

3.5 ADJUSTING AND CLEANING

.1 Clean off excess fill materials adjacent to openings as work progresses by methods and with cleaning materials recommended by firestopping manufacturer and that do not damage materials in which openings occur. Leave finished work in neat, clean condition with no evidence of spillovers or damage to adjacent surfaces.

.2 Provide final protection and maintain conditions during and after installation that ensure firestopping systems are without damage or deterioration at time of Substantial Performance of the Work. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated firestopping systems immediately and install new materials to produce firestopping systems complying with specified requirements.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 07 62 00 – Metal Flashing and Trim.

.2 Section 08 11 00 – Metal Doors and Frames.

.3 Section 08 41 13 – Aluminum-Framed Entrances and Storefronts.

.4 Section 08 44 13 – Glazed Aluminum Curtain Walls

.5 Section 09 29 00 – Gypsum Board.

.6 Section 09 90 00 – Painting and Coating.

1.2 REFERENCES

.1 American Society for Testing and Materials (ASTM).
- .1 ASTM C509-06(2015), Standard Specification for Elastomeric Cellular Preformed Gasket and Sealing Material.
- .2 ASTM C510-16, Standard Test Method for Staining and Colour Change of Single- or Multi-component Joint Sealants.
- .3 ASTM C717-17a, Standard Terminology of Building Seals and Sealants.
- .4 ASTM C919-12(2017), Standard Practice for Use of Sealants in Acoustical Applications.
- .5 ASTM C920-18, Standard Specification for Elastomeric Joint Sealant.
- .6 ASTM C1193-16, Standard Guide for Use of Joint Sealants.
- .7 ASTM C1253-14, Standard Test Method for Determining Outgassing Potential of Sealant Backing.
- .8 ASTM C1330-02(2013), Standard Specification for Cylindrical Sealant Backing for Use with Cold Liquid Applied Sealants.
- .9 ASTM C1518-16, Standard Specification for Precured Elastomeric Silicone Joint Sealants.
- .10 ASTM C1520-02(2015)e1, Standard Guide for Paintability of Latex Sealants.
- .11 ASTM D3574-17, Standard Test Methods for Flexible Cellular Materials-Slab, Bonded, and Molded Urethane Foams.

.2 South Coast Air Quality Management District (SCAQMD).
- .1 Rule 1168 - Adhesive and Sealant Applications, 2005.

1.3 QUALITY ASSURANCE

.1 Regulatory Requirements.
- .1 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of hazardous materials; and regarding labeling and provision of material safety data sheets acceptable to Labour Canada.

1.4 DELIVERY, STORAGE, AND HANDLING

.1 Deliver all material to site in manufacturer’s original unopened packaging with labels clearly identifying product name and manufacturer.

.2 Store materials in a dry, enclosed area protected from exposure to moisture, construction activity, and direct sunlight in strict accordance with manufacturer's recommendations.

.3 Handle all products with appropriate precautions and care as stated manufacturer's instructions.

.4 Cleaning and Waste Management in accordance with Sections 01 74 00.

1.5 SITE CONDITIONS

.1 Conform to manufacturer's recommended temperatures, relative humidity, and substrate moisture content for application and curing of sealants including special conditions governing use.

.2 Clean porous materials such as concrete by brushing, grinding, blast cleaning, mechanical abrading or combinations of these methods to provide a clean, sound substrate for optimum sealant adhesion. Remove loose particles that are present from grinding, abrading, or blast cleaning by blowing out joint with oil-free compressed air prior to application of a primer and/or sealant.

1.6 WARRANTY

.1 Manufacturer’s Product Warranty: provide an extended warranty for Work of this Section for a period of 20 years from date of Substantial Performance. Manufacturer hereby warrants joint sealants to be free of manufacturing defects and will maintain proper weatherseal, and these or other observed defects and deficiencies will be repaired or replaced to the satisfaction of the Consultant and the City, and at no expense to the City.

.2 Installation Contractor’s Warranty: provide an extended warranty for Work of this Section for a period of three (3) years from date of Substantial Performance of the Work. Contractor hereby warrants that installation of joint sealants will not crack, crumble, melt, shrink, run, lose adhesion, leak or stain adjacent surfaces, and these or other observed defects and deficiencies will be repaired or replaced to the satisfaction of the Consultant and the City, and at no expense to the City.

Part 2 Products

2.1 MATERIALS

.1 Joint Sealants and Sealant Primers: as recommended by sealant manufacturer for use with their product on applicable substrates.
- .1 Silicone Sealant: to ASTM C1518 at all locations unless otherwise indicated.
- .2 Interior Latex Acrylic Sealant: to ASTM C1520 for interior joints in surfaces to be painted.
- .3 Acoustical Sealant to ASTM C919.
- .4 Expanding Joint Sealant to ASTM D3574.

.2 Preformed Compressible Joint Filler Material.
- .1 Closed-cell foam backing rod to ASTM C1330.
- .2 Polyethylene, Urethane, Neoprene or Vinyl Foam.
  - .1 Extruded open cell foam backer rod.
  - .2 Size: oversize 30% to 50%.
- .3 Neoprene or Butyl Rubber.
  - .1 Round solid rod, Shore A hardness 70.
- .4 High Density Foam.
  - .1 Extruded closed cell polyvinyl chloride (PVC), extruded polyethylene, closed cell, Shore A hardness 20, tensile strength 140 to 200 kPa, extruded polyolefin foam, 32 kg/m^3 density, or neoprene foam backer, size as recommended by manufacturer.
- .5 Bond Breaker Tape.
  - .1 Self-adhesive, pressure sensitive tape mad from TFE-flourocarbon (Teflon) or polyethylene which sealant will not adhere to.

.3 Joint Cleaner.
.1 Non-corrosive and non-staining type, compatible with joint forming materials and sealant recommended by sealant manufacturer.
.2 Primer: as recommended by manufacturer.

2.2 SEALANT MATERIALS

.1 Do not use caulking that emits strong odors, contains toxic chemicals, or is not certified as mould resistant in air handling units.

.2 When low toxicity caulks are not possible, confine usage to areas which off-gas to the exterior, are contained behind air barriers, or are applied several months before occupancy to maximize off-gas time.

Part 3 Execution

3.1 PREPARATION OF JOINT SURFACES

.1 Prior to commencement of work, verify that site joints and surfaces have been provided as specified under work of other sections, and that joint conditions will not adversely affect execution, performance or quality of completed work, and that they can be put into acceptable condition by means of preparation specified in this section.

.2 Examine joint sizes and conditions to establish correct depth to width relationship for installation of joint filler materials and sealants.

.3 Ascertain that sealers and coatings applied to sealant substrates are compatible with sealant used and that full bond between sealant and substrate is attained. Request samples of sealed or coated substrate from their fabricators for testing of compatibility and bond, if necessary, or test on site to Consultant's acceptance.

.4 Clean bonding joint surfaces of harmful matter substances including dust, oil grease, loose mortar and other matter which may impair work. Remove rust, mill scale and coatings from ferrous metals by wire brush, grinding or sandblasting.

.5 Do not apply sealants to joint surfaces treated with sealer, curing compound, water repellent, or other coatings unless tests have been performed to ensure compatibility of materials. Remove coatings as required.

.6 Ensure that releasing agents, coatings or other treatments have either not been applied to joint surfaces or that they are entirely removed.

.7 Ensure joint surfaces are dry and frost free.

.8 Verify that specified environmental conditions are ensured before commencing work.

.9 Where necessary to prevent staining, mask adjacent surfaces prior to priming and caulking.

.10 Defective work resulting from application to unsatisfactory joint conditions will be considered the responsibility of those performing the work of this section.

3.2 PRIMING

.1 Where necessary to prevent staining, mask adjacent surfaces prior to priming and caulking.

.2 Prime sides of joints in accordance with sealant manufacturer's instructions immediately prior to caulking.

3.3 JOINT FILLER MATERIAL

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

.2 Pack joints continuously with closed cell backer rod joint backing material allowing a recess to receive sealant. Installation of backer rod with a sharp tool such as putty knife is not permitted. Ensure surface skin of the backer rod is not punctured or cut during installation. A puncture in the backer rod may result in outgassing into the uncured sealant resulting in voids or other defects in the cured sealant.

.3 Backer rod to be installed under adequate compression to hold it in-place in the joint opening and to resist the pressure applied when tooling a non-sag sealant into place. Backer rod diameter to be 25% greater than the joint width. Install backer rod without stretching. Under no circumstances should backer rod that is too small for the joint be doubled up or braided together to fit the opening.

.4 Where joint configuration and/or size does not permit the use of a backer rod, install bond breaker tape. The tape shall be installed continuously with no skips or voids in the tape application.

.5 Install joint filler to achieve correct joint depth and shape (ratio 1:2) with approximately 30% compression.

3.4 APPLICATION

.1 Sealant.
- .1 Apply sealants to manufacturer's printed instructions.
- .2 Mask edges of joint where irregular surface or sensitive joint border exists to provide neat joint.
- .3 Apply sealant in continuous beads.
- .4 Apply sealant using gun with proper size nozzle.
- .5 Use sufficient pressure to fill voids and joints solid. Superficial pointing with skin bead is not acceptable.
- .6 Form surface of sealant with full bead, smooth, free from ridges, wrinkles, sags, air pockets, embedded impurities.
- .7 Tool exposed surfaces before skinning begins to give slightly concave shape.
- .8 Remove excess compound promptly as work progresses and upon completion.
- .9 Install continuous bead or joint sealant along all gypsum board control joints.

.2 Curing.
- .1 Cure sealants in accordance with sealant manufacturer's instructions.
- .2 Do not cover up sealants until proper curing has taken place.

3.5 CLEANING

.1 Clean adjacent surfaces immediately and leave work neat and clean.

.2 Remove excess and droppings, using recommended cleaners as work progresses.

.3 Remove masking tape after initial set of sealant.

3.6 PROTECTION

.1 Protect installed work of other trades from staining or contamination.
- .1 Disposing of materials with evidence of moisture damage.

END OF SECTION

ADO-C	Automatic Doop Operator - Concealed	(08 71 13)
ADO-S	Automatic Doop Operator - Surface Mounted	(08 71 13)
AL	Aluminum	(08 44 13)
AS	Aluminum Sliding Door	
EP	Electric Power	(Division 26)
GSF	Glazing Surface Film	(08 87 00)
HM	Hollow Metal	(08 11 00)
HMI	Hollow Metal Welded Insulated	(08 11 00)
KP	Kickplate - Stainless Steel	(08 71 00)
P	Paint	(09 90 00)
PF	Prefinished	
PR	Pair	
ST	Stain finish (Factory Prefinished)	(09 90 00)
WSV	Wood Solid Core Veneer Faced Door	(08 14 00)
SPG	Switchable Privacy Glass	(08 80 00)

TYPICAL NOTES:

1. Install door frames 50 mm from adjacent perpendicular wall unless otherwise noted.
2. Coordinate electrical requirements to door frames where required. (Refer to Electrical)
3. All interior HM frames shall wrap around steel stud and gypsum board wall type indicated (ie. nominal throat dimension equals wall width) unless otherwise noted. Refer to architectural drawings for special conditions.
4. Kickplates to be applied to push side only unless otherwise noted.
5. Refer to architectural drawing elevations for aluminum frame styles and sizes.

REMARKS:

N1 Doors and sidelights to receive GSF (1, 2) pattern. Allow for two rows of circles as per CWADS in addition to privacy pattern as indicated on drawings. MPR glazing and automated sliding doors/sidelights at entrances to receive vision circles only.

N2 Automatic Sliding Doors. Refer to project manual specifications.

N3 Undercut door for washroom stall 50 mm.

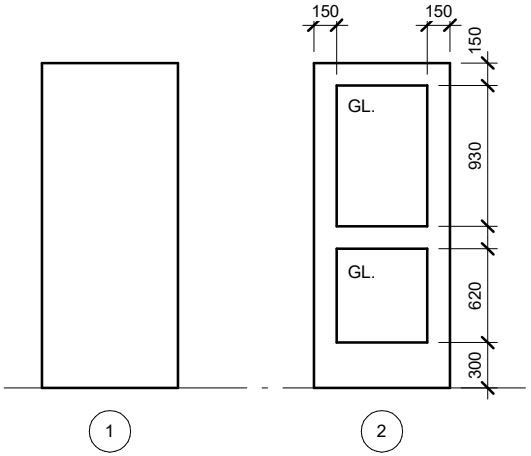
Room No.	Door No.	Width	Height	Thickness	Door Type	Door Finish	Door Style	Frame Type	Frame Finish	Frame Style	Fire Rating	Hardware Group	Remarks
0:01	0:01	900	900	50	HM	P	1	HM	P	3	45	01	
0:03	0:03	900	900	50	HM	P	1	HM	P	3	45	01	
1:01	1:01	2440	2600	50	AS	PF	-	AL	PF	-	-	15	N1, N2, EP
1:01	1:01.1	2440	2600	50	AS	PF	-	AL	PF	-	-	15	N1, N2, EP
1:05	1:05	1000	2150	50	WSV	ST	2	HM	P	2	-	03	ADO-S, EP, KEYPAD, KP
1:06	1:06	1000	2150	50	HM	P	1	HM	P	1	-	05	KP
1:07	1:07	1000	2150	50	HM	P	1	HM	P	1	45	05	KP
1:08	1:08	1000	2440	50	AL	PF	-	AL	PF			11	ADO-C, CA, EP
1:09	1:09	1000	2150	50	WSV	ST	1	HM	P	1	-	02	ADO-S, EP, KP
1:10	1:10	1000	2150	50	HM	P	1	HM	P	1	45	05	KP
1:12A	1:12A	1000	2150	45	WSV	ST	1	HM	P	4	-	13	N3
1:12B	1:12B	760	2150	45	WSV	ST	1	HM	P	4	-	14	N3
1:12C	1:12C	760	2150	45	WSV	ST	1	HM	P	4	-	14	N3
1:12D	1:12D	760	2150	45	WSV	ST	1	HM	P	4	-	14	N3
1:12E	1:12E	760	2150	45	WSV	ST	1	HM	P	4	-	14	N3
1:12F	1:12F	760	2150	45	WSV	ST	1	HM	P	4	-	14	N3
1:12G	1:12G	1000	2150	45	WSV	ST	1	HM	P	4	-	13	N3
1:13	1:13	1000	2150	50	WSV	ST	1	HM	P	1	-	02	ADO-S, EP, KP
1:14	1:14	2440	2600	50	AS	PF	-	AL	PF	-	-	15	N1, N2, EP
1:14	1:14.1	2440	2600	50	AS	PF	-	AL	PF	-	-	16	N1, N2, EP
1:15	1:15	1000	2440	50	AL	PF	-	AL	PF	-	-	06	N1, ADO-S, EP
1:16	1:16	1000	2440	50	AL	PF	-	AL	PF	-	-	06	N1, ADO-S, EP
1:18	1:18.1	1000	2440	50	AL	PF	-	AL	PF	-		08	ADO-C, EP
1:20	1:20	2000	2440	50	AL	PF	-	AL	PF	-	-	04	ADO-C, EP, SPG
1:20	1:20.1	2000	2418	50	AL	PF	-	AL	PF	-		09	ADO-S, EP, SPG
1:21	1:21	1800	2150	50	WSV	ST	1	HM	P	1	-	10	EP, KEYPAD, PR
1:22	1:22	1000	2440	50	AL	PF	-	AL	PF	-	-	07	N1, ADO-S, EP, CA

DOOR STYLES

SCALE 1 : 50

NOTES:

1. ALL GLAZING (GL.) TO BE 6 mm THICK CLEAR TEMPERED GLASS UNLESS OTHERWISE NOTED.
2. ALL GLAZING IN DOORS REQUIRING A FIRE-RATING TO BE WIRED UNLESS OTHERWISE NOTED. REFER TO DOOR SCHEDULE.



Door Styles

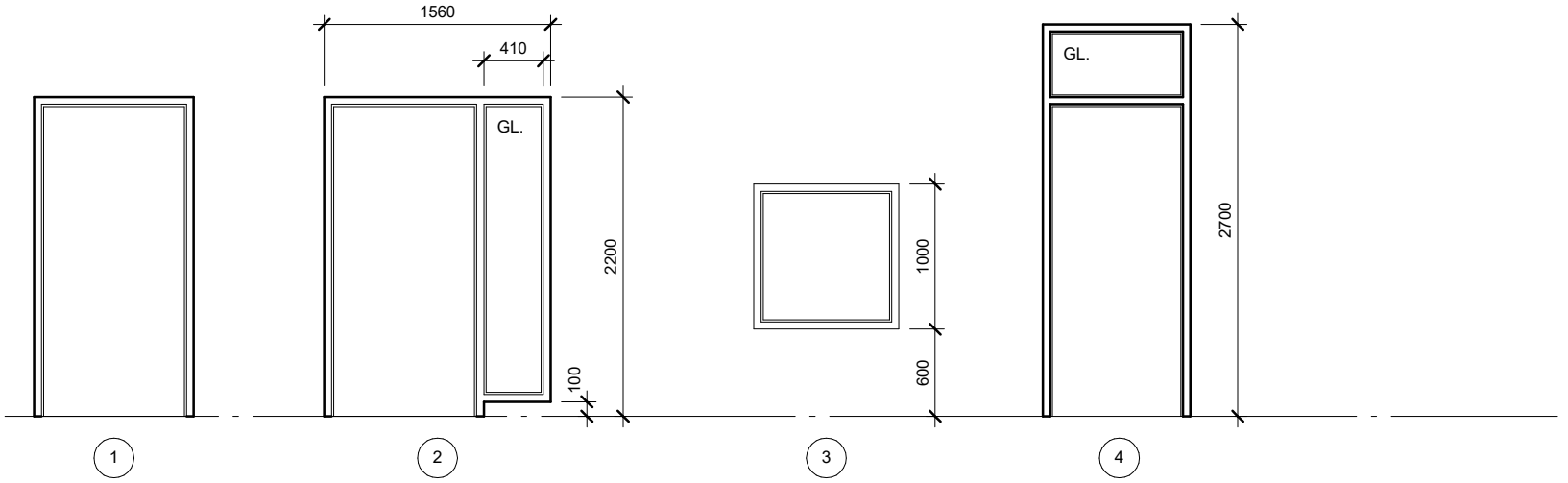
SCALE 1 : 50

FRAME STYLES

SCALE 1 : 50

NOTES:

1. ALL FRAMES TO BE HOLLOW METAL (HM) UNLESS OTHERWISE NOTED.
2. ALL GLAZING (GL.) IN SIDELIGHTS TO BE 6 mm THICK CLEAR TEMPERED GLASS UNLESS OTHERWISE NOTED.
3. ALL GLAZING IN ASSEMBLIES REQUIRING A FIRE-RATING TO BE WIRED UNLESS OTHERWISE NOTED.



Frame Styles

SCALE 1 : 50

Part 1 General

1.1 RELATED SECTIONS

.1 Section 06 10 00 – Rough Carpentry.

.2 Section 07 92 00 – Joint Sealants.

.3 Section 08 06 10 – Door Schedule.

.4 Section 08 71 00 – Door Hardware.

.5 Section 08 80 50 – Glazing.

.6 Section 09 29 00 – Gypsum Board.

.7 Section 09 90 00 – Painting and Coating.

1.2 REFERENCES

.1 American Society for Testing and Materials (ASTM).
- .1 ASTM A653/A653M-17, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by 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).
- .1 CSA G40.20-13/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).

.4 Canadian Steel Door Manufacturers' Association, (CSDMA).
- .1 Recommended Specifications for Commercial Steel Door and Frame Products, 2006.
- .2 Recommended Dimensional Standards for Commercial Steel Doors and Frames, 2009.
- .3 Canadian Fire Labeling Guide for Commercial Steel Doors and Frame Products, 2009.
- .4 Guide Specifications for Installation and Storage of Hollow Metal Doors and Frames, 2012.

.5 National Fire Protection Association (NFPA).
- .1 2016 NFPA 80, Standard for Fire Doors and Other Opening Protectives.
- .2 2017 NFPA 252, Standard Methods of Fire Tests of Door Assemblies.

.6 Underwriters' Laboratories of Canada (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 Meeting the Performance Required by CAN/ULC-S104.
- .3 CAN/ULC S701.1-17, Standard for Thermal Insulation, Polystyrene Boards and Pipe Covering.
- .4 CAN/ULC S702.1-14, Standard for Mineral Fibre Thermal Insulation for Buildings, Part 1: Material Specification
- .5 CAN/ULC S702.2-15, Standard For Mineral Fibre Thermal Insulation for Buildings, Part 2: Installation
- .6 CAN/ULC S704.1-17, Standard for Thermal Insulation, Polyurethane and Polyisocyanurate Boards, Faced.

1.3 SYSTEM DESCRIPTION

.1 Design Requirements.
- .1 Design exterior frame assembly to accommodate to expansion and contraction when subjected to minimum and maximum surface temperature of -35°C to 35°C.
- .2 Maximum deflection for exterior steel entrance screens under wind load of 1.2 kPa not to exceed 1/175th of span.

1.4 SUBMITTALS

.1 Shop Drawings.
- .1 Submit shop drawings in accordance with Section 01 33 00.
- .2 Indicate each type of door, material, steel core thicknesses, mortises, reinforcements, location of exposed fasteners, openings, arrangement of hardware, fire ratings and finishes.
- .3 Indicate each type frame material, core thickness, reinforcements, glazing stops, location of anchors and exposed fastenings and finishes.
- .4 Include schedule identifying each unit, with door marks and numbers relating to numbering on drawings and in door schedule.

1.5 QUALITY ASSURANCE

.1 Regulatory Requirements.
- .1 Steel fire rated doors and frames to be labeled and listed by organization accredited by Standards Council of Canada in conformance with CAN/ULC S104, CAN/ULC S105, NFPA 80 and NFPA 252 for ratings specified or indicated.
- .2 Provide fire labeled frame products for those openings requiring fire protection ratings, as scheduled. Test products in strict conformance with CAN/ULC S104 or NFPA 252 and list by nationally recognized agency having factory inspection service and construct as detailed in Follow-Up Service Procedures/Factory Inspection Manuals issued by listing agency to individual manufacturers.

1.6 DELIVERY, STORAGE, AND HANDLING

.1 Deliver all material to site in manufacturer’s original unopened packaging with labels clearly identifying product name and manufacturer.

.2 Store materials in a dry, well ventilated area protected from exposure to moisture, construction activity, and direct sunlight in strict accordance with manufacturer's recommendations.

.3 Protect by suitable means until installation. Brace and stack to prevent racking, bending, twisting and other damage.

.4 Handle all products with appropriate precautions and care as stated manufacturer's instructions.

.5 Cleaning and Waste Management in accordance with Sections 01 74 00.

Part 2 Products

2.1 MATERIALS

.1 Hot Dipped Galvanized Steel Sheet: to ASTM A653/A653M, ZF75, minimum base steel thickness in accordance with CSDMA Table 1 - Recommended Specifications for Commercial Steel Door and Frame Products.

.2 Reinforcement channel: to CSA G40.20-04/G40.21, Type 44W, coating designation to ASTM A653M, ZF75.

.3 Door Core Materials.
- .1 Honeycomb Core: structural small cell, 24.5 mm maximum kraft paper 'honeycomb', weight: 36.3 kg per ream minimum, density: 16.5 kg/m^3 minimum sanded to required thickness.
- .2 Insulated Core.
  - .1 Expanded polystyrene to CAN/ULC-S701.1, density 16 to 32 kg/m^3.
  - .2 Polyurethane to CAN/ULC S704.1 rigid, modified poly/isocyanurate, closed cell board, density 32 kg/m^3.
- .3 Temperature Rise Rated (TRR): core composition to limit temperature rise on unexposed side of door to 250°C at rating(s) indicated in Door Schedule. Core to be tested as part of complete door assembly, in accordance with CAN/ULC S104 or NFPA 252, covering Standard Method of Tests of Door Assemblies and listed by nationally recognized testing agency having factory inspection service.

.4 Adhesives.
- .1 Honeycomb cores and steel components: heat resistant, spray grade, resin reinforced neoprene/rubber (polychloroprene) based, low viscosity, contact cement.
- .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.

.5 Glazing stops: fabricate as formed channel, 0.9 mm (20-gauge) base steel thickness, minimum 16 mm height typical, accurately fitted, butted at corners and fastened with counter-sunk oval head sheet metal screws (secured from room side and not corridor or public side).

.6 Frame floor anchors and channel spreaders: 1.6 mm (16-gauge) base steel thickness.

.7 Guard boxes: 0.8 mm (22 gauge) base steel thickness.

.8 Hinge reinforcing: 3.4 mm (10-gauge) base steel thickness.

.9 Lock and strike reinforcing: 1.6 mm (16-gauge) base steel thickness.

.10 Fasteners: expansion bolts to ASTM F1554, galvanized.

.11 Astragals: 2.1 mm (14-gauge) base steel thickness.

.12 Metallic paste filler: to manufacturer's standard.

.13 Primer: touch-up primer to ASTM A780/A780M.

.14 Paint: field paint steel doors and frames in accordance with Section 09 90 00.

.15 Glazing: in accordance with Section 08 80 00.

.16 Joint Sealants: in accordance with Section 07 92 00.

.17 Door bumpers: single stud black rubber/neoprene type.

2.2 FABRICATION

.1 General.
- .1 Fabricate steel doors and frames as detailed to Canadian Steel Door and Frame Manufacturers' Association, (CSDFMA) specifications.
- .2 Fabricate doors and frames to profiles and maximum face sizes as indicated, approved shop drawings and ULC or WHI requirements as applicable.
- .3 Make provision for glazing on doors and frames as indicated, and provide necessary glazing stops.

.4 Make provision for continuous hinges to maintain even margins as specified in Paragraph 3.1.3.
.5 Build-in required hardware reinforcing and guard boxes.
.6 Attach ULC or WHI labels to required fire rated doors and frames as indicated.
.7 Lock Seam Edge: door made with an outer pan which is punched for hinges and latching hardware, then bent on each stile to form the door edge. The bending has a lock seam edge for interlocking the inside pan which has also been punched for the latching hardware.
.8 Welded Seam Seamless Edge: lockseam door which has the lockseam tackwelded every 150 mm long the full height of the door. These welds are then ground smooth and the seam is filled and finished to provide a seamless edge.

.2 Hollow Metal (HM / HMI) Door Fabrication.
.1 Doors: swing type, flush, with provision for glazed openings as indicated.
.2 Form each face sheet for exterior doors from 1.2 mm (18-gauge) galvanized sheet steel with insulated polystyrene or polyurethane core laminated under pressure to face sheets, welded seam seamless edge.
.3 Form each face sheet for interior doors from 1.2 mm (18-gauge) galvanized sheet steel with honeycomb core laminated under pressure to face sheets, welded seam seamless edge.
.4 Bevel hinge and lock door edges 3 mm in 50 mm. Square edges on hinge and/or lock stiles are not acceptable
.5 Provide flush steel top caps to exterior doors with waterproof filler. Provide inverted, recessed, spot welded channel closure to top and bottom of interior doors. Fill all gaps of spot welded channels.
.6 Reinforce doors where required, for surface mounted hardware.
.7 Blank, reinforce, drill doors and tap for mortised, templated hardware and electronic hardware.
.8 Reinforce perimeter of glazing openings exceeding 800 mm with minimum 0.8 mm (22-gauge) channels spot welded to door face skins all four sides.
.9 Factory prepare holes 12.7 mm diameter and larger except mounting and through-bolt holes, on site, at time of hardware installation.
.10 Provide factory-applied touch-up primer at areas where zinc coating has been removed during fabrication.
.11 Fabricate doors requiring top and bottom concealed exit devices to hardware templates in relation to door bottom clearance.
.12 Provide fire labelled doors for those openings requiring fire protection ratings, as scheduled. Test such products in strict conformance with CAN/ULC S104 or NFPA 252 and list by nationally recognized agency having factory inspection service and construct as detailed in Follow-Up Service Procedures/Factory Inspection Manuals issued by listing agency to individual manufacturers.
.13 Manufacturer's nameplates on doors are not permitted.
.14 Construct matching transoms/panels in same manner as doors.
.15 Provide astragal to paired doors to ULC or WHI requirements where required.

.3 Hollow Metal (HM / HMI) Welded Frame Fabrication.
.1 Fabricate exterior and interior double returned welded-frames from 1.6 mm (16-gauge) galvanized steel, fully welded construction in accordance with CSA W59.
.2 Fabricate custom frames as detailed from minimum 1.6 mm (16-gauge) galvanized steel, fully welded construction. Exact gauge of frame to be determined by application in accordance with CSA W59.
.3 Accurately mitre or mechanically joint frame product and securely weld entire joint on inside of profile.

.4 Cope accurately and securely weld butt joints of mullions. Grind welded joints and corners to flat plane, fill with metallic paste and sand to uniform smooth finish.
.5 Grind welded joints and corners to flat plane, fill with metallic paste and sand to uniform smooth finish.
.6 Securely attach floor anchors to inside of each jamb profile.
.7 Weld in two (2) temporary jamb spreaders per frame to maintain proper alignment during shipment.
.8 Reinforce head of frames wider than 1200 mm.
.9 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.
.10 Protect strike and hinge reinforcements using steel guard boxes welded to frames.
.11 Prepare frame for door silencers, three (3) for single door, two (2) at head for double door.
.12 Manufacturer's nameplates on frames and screens are not permitted.
.13 Conceal fastenings except where exposed fastenings are indicated.
.14 Provide factory-applied touch up primer at areas where zinc coating has been removed during fabrication.
.15 Insulate exterior frame components with expanded polystyrene or polyurethane insulation.
.16 Provide steel jamb anchors securely welded inside each jamb to frames in masonry walls in accordance with requirements of ULC or WHI.
.17 For power-assist door operators typically secured to door frame, provide additional reinforcing to support backside of mounting plate.

Part 3 Execution

3.1 INSTALLATION

.1 General.
- .1 Install labeled steel fire rated doors and frames to NFPA 80 and NFPA 252 except where specified otherwise.
- .2 Install doors and frames to CSDFMA Installation Guide

.2 Frame Installation.
- .1 Set frames plumb, square, level and at correct elevation.
- .2 Frame Anchorage.
  - .1 Provide appropriate anchorages and connections to adjacent 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 1525 mm and one (1) additional anchor for each additional 760 mm of height or fraction thereof.
- .3 Brace frames rigidly in position while building-in. Install temporary horizontal wood spreader at third points of door opening to maintain frame width. Provide vertical support at centre of head for openings over 1200 mm wide. Remove temporary spreaders after frames are built-in.
- .4 Make allowances for deflection of structure to ensure structural loads are not transmitted to frames.
- .5 Continuously caulk perimeter of all frames (both sides between frame and surrounding construction) and all seams at glazing stops (both sides of glazing).
- .6 Maintain continuity of vapour barrier as applicable.

.7 Install glazing for frames in accordance with Section 08 80 00.
.8 Install neoprene door bumpers in frames (following field painting of frames).

.3 Door Installation.
.1 Install doors and hardware in accordance with hardware templates and manufacturer's instructions and Section 08 71 00.
.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 and thresholds: 13 mm.
.3 Adjust operable parts for correct function.

.4 Field Repairs.
.1 Touch up finishes damaged during installation with primer.
.2 Fill surfaces with imperfections with metallic paste filler and sand to uniform smooth finish.

.5 Glazing.
.1 Install glazing for doors and frames in accordance with Section 08 80 00.

3.2 SCHEDULES

.1 Refer to Section 08 06 10.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 06 40 00 – Architectural Woodwork.

.2 Section 08 06 10 – Door Schedule.

.3 Section 08 11 00 – Metal Doors and Frames.

.4 Section 08 71 00 – Door Hardware.

.5 Section 08 80 00 – Glazing.

.6 Section 09 90 00 – Painting and Coating.

1.2 WORK OF OTHER SECTIONS

.1 On-site surface preparation and application of transparent or semi-transparent stain and clear coat finish to all surfaces of wood veneer faced wood doors by Section 09 90 00 in accordance with NAAWS.

1.3 DEFINITIONS

.1 Basic Considerations.
- .1 Exposed Surfaces Include:
  - .1 Both visible faces of doors, including applied mouldings, lights, and louvers.
  - .2 Both vertical edges of doors.

1.4 REFERENCES

.1 American National Standards Institute (ANSI)/National Particleboard Association (NPA).
- .1 ANSI/NAP A208.1-2016, Particleboard.

.2 American Society for Testing and Materials (ASTM).
- .1 ASTM D5456-18, Standard Specification for Evaluation of Structural Composite Lumber Products.

.3 Architectural Woodwork Manufacturers Association of Canada (AWMAC) / Woodwork Institute (WI).
- .1 North American Architectural Woodwork Standards (NAAWS), Edition 3.1, 2017.

1.5 SUBMITTALS

.1 Shop Drawings.
- .1 Submit shop drawings in accordance with Section 01 33 00.
- .2 Show elevations indicating materials, core construction, and surface grain directions.
- .3 Indicate details of construction including profiles, assembly methods, jointing details, fastening methods and other related details.

1.6 QUALITY ASSURANCE

.1 Regulatory Requirements.
- .1 Perform work to Premium Grade standards in accordance with Section 09 – Doors of North American Architectural Woodwork Standards (NAAWS).

1.7 DELIVERY, STORAGE, AND HANDLING

.1 Deliver all material to site in manufacturer's original unopened packaging with labels clearly identifying product name and manufacturer.

.2 Store materials in a dry, well ventilated area protected from exposure to moisture, construction activity, and direct sunlight in strict accordance with manufacturer's recommendations.

.3 Handle all products with appropriate precautions and care as stated manufacturer's instructions.

.4 Cleaning and Waste Management in accordance with Section 01 74 00.

1.8 WARRANTY

.1 Manufacturer's Product Warranty: provide an extended warranty for Work of this Section from date of Substantial Performance of the Work to term of warranty specified. Manufacturer hereby warrants that wood doors will not warp, twist, show core lines, split, delaminate, sag, and these or other observed defects subject to proper care and maintenance, and these or other observed defects and deficiencies will be repaired or replaced to the satisfaction of the Consultant and the City, and at no expense to the City.

.1 Wood Solid Core Veneer Faced Doors (WSV).

.1 Lifetime against manufacturing and material defects.

Part 2 Products

2.1 MANUFACTURED UNITS

.1 Wood Solid Core Veneer Faced Doors (WSV).

.1 Construction: 5 ply, particleboard core, wood veneer faced.

.2 Components.

.1 Solid Core: particleboard core LD-1, density of 449-513 kg/m3 in accordance with ANSI/NAP A208.1, containing no added urea-formaldehyde resins.

.2 Stiles: 16 mm solid wood edge (species to match face veneer) laminated to 30 mm structural composite lumber (SCL).

.3 Top and Bottom Rails: 16 mm solid wood edge (species to match face veneer) to 150 mm structural composite lumber (SCL).

.4 Face: 2 ply pre-manufactured door skins consisting of cross-banded hardwood veneer, grade "AA", white oak, rift cut, vertical grain in accordance with NAAWS; stain and clear coat finish by Section 09 90 00.

.3 Core to Edge Assembly: particleboard core bonded to stiles and rails, and sanded prior to application of wood veneer face to eliminate telegraphing.

.4 Adhesive: Type 1, containing no added urea-formaldehyde, cold pressing as recommended by door manufacturer.

.5 Edge Details: continuous Type "D" edge in accordance with NAAWS, stain and finish by Section 09 90 00.

.6 Glazing: complete with solid wood glazing stops (species to match face veneer), Stain and finish by Section 09 90 00. Glazing in accordance with Section 08 80 00.

2.2 FABRICATION

.1 Fabricate wood doors to "Premium Grade" standards in accordance with Section 9 - Doors of NAAWS.

.2 Prepare wood doors for hardware, coat hooks, glazing, and other special details as scheduled. All cutouts to be factory machined by wood door manufacturer. Cutouts by anyone other than manufacturer is unacceptable.

.3 Bevel vertical edges of single acting doors 3 mm in 50 mm on lock side and 1.5 mm in 50 mm on hinge side.

.4 Radius vertical edges of double acting doors to 60 mm radius.

Part 3 Execution

3.1 PREPARATION

.1 Ensure work areas are under constant climate control for temperature and humidity for minimum 48 hours before door installation, and will remain in effect until completion of project.

.2 Allow doors to become acclimatized to finished building heat and humidity before hanging.

3.2 INSTALLATION

.1 Install doors to "Premium Grade" standards in accordance with Section 9 - Doors of NAAWS.

.2 Install doors and hardware in accordance with manufacturer's printed instructions.

- .1 Do not impair utility or structural strength of door in fitting, application of hardware, or cutting and altering door for other special details.
- .2 Drill pilot holes for all fasteners.
- .3 Install and adjust hardware for correct function.

.3 Install glazing in accordance with Section 08 80 00 and Section 9 - Doors of NAAWS.

3.3 ADJUSTING

.1 Re-adjust doors and hardware just prior to completion of building to function freely and properly.

3.4 SCHEDULES

.1 Refer to Section 08 06 10.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 06 10 00 – Rough Carpentry.

.2 Section 09 65 00 – Resilient Flooring.

1.2 REFERENCES

.1 American Society for Testing and Materials (ASTM).
- .1 ASTM A36/A36M-14, Standard Specification for Carbon Structural Steel.
- .2 ASTM A506-12, Standard Specification for Alloy and Structural Alloy Steel, Sheet and Strip, Hot-Rolled and Cold-Rolled.
- .3 ASTM A653/A653M-15, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- .4 ASTM B209M-14, Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate [Metric].
- .5 ASTM B221M-13, Standard Specification for Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes [Metric].

.2 Canadian Standards Association (CSA).
- .1 CAN/CSA S157-05/S157.1-05 (R2015), Strength Design in Aluminum/Commentary on CSA S157-05, Strength Design in Aluminum.
- .2 CSA W59.2-M1991 (R2013), Welded Aluminum Construction.

.3 Occupational Safety and Health Administration (OSHA).
- .1 OSHA 1926.502, Fall Protection Systems Criteria and Practices.

1.3 SYSTEM DESCRIPTION

.1 Performance Requirements.
- .1 Covers reinforced to support a minimum live load of 732 kg/m^2 with a maximum deflection of 1/150th of the span.
- .2 Operation of the cover to be smooth and easy with controlled operation throughout the entire arc of opening and closing, and not be affected by temperature.
- .3 Entire door including all hardware components to be highly corrosion resistant.

1.4 SUBMITTALS

.1 Shop Drawings.
- .1 Submit shop drawings in accordance with Section 01 33 00.
- .2 Indicate size and description of components, materials, attachment devices, and description of frame and finish, and construction details.

.2 Closeout Submittals.
- .1 Provide operation and maintenance data for incorporation into Operations and Maintenance Manual specified in Section 01 78 00.

1.5 DELIVERY, STORAGE, AND HANDLING

.1 Deliver all material to site in manufacturer’s original unopened packaging with labels clearly identifying product name and manufacturer.

.2 Store materials in a dry, enclosed area protected from exposure to moisture, and construction activity in strict accordance with manufacturer's recommendations.

.3 Handle all products with appropriate precautions and care as stated manufacturer's instructions.

.4 Cleaning and Waste Management in accordance with Section 01 74 00.

1.6 SEQUENCING

.1 Co-ordinate work of this Section with 06 10 00 and Structural.

1.7 WARRANTY

.1 Manufacturer's Product Warranty: provide an extended warranty for Work of this Section for a period of five (5) years from date of Substantial Performance of the Work. Manufacturer hereby warrants floor doors to be free of manufacturing and material defects, and these or other observed defects and deficiencies will be repaired or replaced to the satisfaction of the Consultant and the City, and at no expense to the City.

Part 2 Products

2.1 MANUFACTURERS

.1 Basis of Design Products.

.1 Small Floor Door.

.1 Bilco Model K Single Leaf Aluminum Floor Access Door complete with Bilco LadderUP Safety Post, model LU-3.

.2 Maxam ASF complete with Maxam SLP-4 Safety Post.

.2 Large Floor Door.

.1 Bilco Model J-AL Single Leaf aluminum Floor Access Door, without drain coupling, complete with BilcoModel FPG Fall Protection Grating System.

.2 Requests for substitutions will be considered subject to specified requirements and in accordance with Bidding Procedures B8.

.3 Supply similar products from single manufacturer.

2.2 MATERIALS

.1 Sheet Aluminum: to ASTM B209M.

.2 Extruded Aluminum: to ASTM B221M, 6063-T5 alloy and temper.

.3 Steel Sheet: regular quality alloy steel to ASTM A506.

.4 Galvanized Steel Sheet: commercial quality to ASTM A653/A653M with Z275 designation zinc coating.

.5 Gaskets: extruded resilient neoprene, with full recovery after 50% compression.

.6 Isolation coating: alkali resistant bituminous paint or epoxy solution.

2.3 COMPONENTS

.1 Small Floor Door.

.1 Size: 915 mm x 915 mm.

.2 Cover: 6 mm aluminum diamond patterned plate to withstand a live load of 732 kg/m^2 (150 psf) with a maximum deflection of 1/150th of the span.

.3 Frame: 6 mm extruded aluminum channel frame.

.4 Hinges: specifically designed for horizontal installation, through-bolted to cover.

.5 Lifting Mechanisms: compression spring operators enclosed in telescopic tubes to provide, smooth, easy, and controlled cover operation throughout the entire arc of opening and to act as a check in retarding downward motion of the cover when closing.

.6 Turn/Lift handle: removable exterior turn/lift handle with a spring loaded ball detent to open the cover, latch release to be protected by a flush, gasketed, removable screw plug.

.7 Finishes: factory mill finish aluminum with bituminous coating applied to the exterior of the frame.

.8 Hardware.

.1 Hinges: heavy forged Type 316 stainless steel hinges, each having a minimum 6 mm diameter Type 316 stainless steel hinge pins.

.2 Hold-Open Arm: automatic hold open arm which automatically locks the cover in the open position.

.3 Snap Lock: Type 316 stainless steel snap lock with fixed handle mounted on the underside of the cover.

.4 Lock Option: keyed deadbolt cylinder lock.

.9 Safety Post.

.1 High strength steel with telescoping tubular section that locks automatically when fully extended.

.2 Fully assembled with fasteners for securing to access ladder rungs (by others) in accordance with manufacturer's instructions.

.3 Upward and downward movement controlled by stainless steel spring balance mechanism.

.2 Large Floor Door.

.1 Size: 915 mm x 3660 mm (confirm exact size with Consultant and details).

.2 Cover: 6 mm aluminum diamond patterned plate to withstand a live load of 1464 kg/m^2 (300 psf) with a maximum deflection of 1/150th of the span.

.3 Frame: 6 mm extruded aluminum channel frame.

.4 Hinges: specifically designed for horizontal installation, through-bolted to cover.

.5 Drain Coupling: none.

.6 Lifting Mechanisms: compression spring operators enclosed in telescopic tubes to provide, smooth, easy, and controlled cover operation throughout the entire arc of opening and to act as a check in retarding downward motion of the cover when closing. Upper tube shall be the outer tube to prevent accumulation of moisture, grit, and debris inside the lower tube assembly. Lower tube shall interlock with a flanged support shoe fastened to a formed 6 mm gusset support plate.

.7 Turn/Lift handle: removable exterior turn/lift handle with a spring loaded ball detent to open the cover, latch release to be protected by a flush, gasketed, removable screw plug.

.8 Finishes: factory mill finish aluminum with bituminous coating applied to the exterior of the frame.

.9 Hardware.

.1 Hinges: heavy forged Type 316 stainless steel hinges, each having a minimum 6 mm diameter Type 316 stainless steel hinge pins.

.2 Hold-Open Arm: automatic hold open arm which automatically locks the cover in the open position.

.3 Compression Spring Operators: Type 316 stainless steel, cover fitted with required number and size of operators.

.4 Snap Lock: Type 316 stainless steel snap lock with fixed handle mounted on the underside of the cover.

.5 Lock Option: keyed deadbolt cylinder lock.

.10 Fall Protection Grating.

.1 Grating: aluminum to OSHA 29 CFR 1926.502(c) requirements for fall protection, powder coat paint finish: high visibility safety yellow.

.2 Hold open feature: Type 316 stainless hold open device to automatically lock cover in fully open 90° position.

.3 Hardware: All hardware shall be Type 316 stainless steel.

Part 3 Execution

3.1 INSTALLATION

.1 Install floor access doors plumb, square, level and in proper alignment in accordance details, reviewed shop drawings and manufacturer's written installation instructions.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 06 10 00 – Rough Carpentry.

.2 Section 07 26 00 – Air/Vapour Barrier Membrane - Self Adhesive.

.3 Section 07 42 13 – Metal Wall Panels.

.4 Section 07 62 00 – Sheet Metal Flashing and Trim.

.5 Section 07 92 00 – Joint Sealants.

.6 Section 08 06 10 – Door Schedule.

.7 Section 08 44 13 – Glazed Aluminum Curtain Walls.

.8 Section 08 71 00 – Door Hardware.

.9 Section 08 71 13 – Automatic Door Operators.

.10 Section 08 80 00 – Glazing.

1.2 REFERENCES

.1 American Architectural Manufacturers Association (AAMA).
- .1 AAMA 2604-17a, Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels.
- .2 AAMA CW-10-15, Care and Handling of Architectural Aluminum from Shop to Site.
- .3 AAMA 611-98, Voluntary Specification for Anodized Architectural Aluminum.

.2 Aluminum Association (AA).
- .1 Aluminum Standards and Data, 2017 Edition.
- .2 Aluminum Alloy Castings - Properties, Processes, and Applications, 2004 Edition.
- .3 Introduction to Aluminum Alloys and Tempers, 2000 Edition.
- .4 Designation System for Aluminum Finishes, 2003 (R2009).

.3 American Society for Testing and Materials (ASTM).
- .1 ASTM B221M-12, Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes [Metric].

.4 Canadian Standards Association (CSA).
- .1 AAMA/WDMA/CSA 101/I.S.2/A440-17, North American Fenestration Standard / Specification for Windows, Doors, and Skylights.
- .2 CAN/CSA S157-17/S157.1-17, Strength Design in Aluminum/Commentary on CSA S157-05, Strength Design in Aluminum.

.5 National Building Code of Canada, 2010 (NBCC).

1.3 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 components, anchorage and fasteners, glass and infill, and internal drainage details and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings.
- .1 Each drawing submission to be engineered and prepared by manufacturer, and stamped and signed by qualified professional Engineer licensed in jurisdiction of Place of Work.

.2 Indicate system dimensions, framed opening requirements and tolerances, adjacent construction, anticipated deflection under load, affected related work, expansion and contraction joint locations and details, anchorage details, location of isolation coatings, and field welding as required.

.3 Indicate materials and large scale details for head, jamb and sills, profiles of components, interior and exterior trim, elevations of unit, description of related components and exposed finishes, fasteners and caulking. Indicate location of manufacturer's nameplates.

.4 Samples.

.1 Submit for review and acceptance of each unit.

.2 Samples will be returned for inclusion into work.

.3 Submit two (2) samples illustrating prefinished aluminum surface for each 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 Closeout Submittals

.1 Provide operation and maintenance data for incorporation into Operation and Maintenance Manual specified in Section 01 78 00.

1.4 QUALITY ASSURANCE

.1 Qualifications.

.1 Fabricator: approved by aluminum-framed entrance and storefront manufacturer with fabrication of manufacturer’s aluminum-framed entrances and storefronts on projects of equal or greater size and degree of complexity.

.2 Installer: approved by aluminum-framed entrance and storefront manufacturer and with minimum five (5) years’ experience with installation of manufacturer’s aluminum-framed entrances and storefronts on projects of equal or greater size and degree of complexity.

.3 Information confirming above criteria may be requested by Consultant.

.4 Aluminum-framed entrance and storefront manufacturer to take full responsibility for fabrication and installation.

1.5 DELIVERY, STORAGE, AND HANDLING

.1 Deliver all material to site in manufacturer’s original unopened packaging with labels clearly identifying product name and manufacturer.

.2 Store materials in a dry, enclosed area protected from exposure to moisture, construction activity, and direct sunlight in strict accordance with manufacturer's recommendations.

.3 Handle work of this Section in accordance with AAMA CW-10.

.4 Cleaning and Waste Management in accordance with Section 01 74 00.

1.6 SITE CONDITIONS

.1 Do not install sealants when ambient and surface temperature is less than 5ºC.

.2 Maintain this minimum temperature during and after installation of sealants until cured.

1.7 WARRANTY

.1 Manufacturer's Product Warranty: provide an extended warranty for Work of this Section for a period of two (2) years from date of Substantial Performance of the Work. Manufacturer hereby warrants aluminum-framed entrances and storefronts to be free of manufacturing and material defects, and these or other observed defects and deficiencies will be repaired or replaced to the satisfaction of the Consultant and the City, and at no expense to the City.

.2 Installation Contractor's Warranty: provide an extended warranty for Work of this Section for a period of two (2) years from date of Substantial Performance of the Work. Contractor hereby warrants that work of this Section will remain rigid, and these or other observed defects and deficiencies will be repaired or replaced to the satisfaction of the Consultant and the City, and at no expense to the City.

Part 2 Products

2.1 MATERIALS

.1 Extruded Aluminum: Aluminum Association AA 6063-T6 alloy and temper in accordance with ASTM B221M and CAN/CSA S157/S157.1, member wall thickness sufficient to meet the specified structural requirements, tolerances in accordance with Aluminum Association Aluminum Standards and Data.

.2 Sealants: in accordance with Section 07 92 00.

.3 Glazing: in accordance with Section 08 80 00.

2.2 COMPONENTS

.1 Interior Aluminum Frames. (Single Glazed)
- .1 Construct frames of aluminum extrusions with minimum wall thickness of 1.8 mm and of the following (nominal) size(s):
  - .1 45 mm x 115 mm (side, top, centre), centre glazing.
  - .2 100 mm x 115 mm (base), centre glazing.

.2 Interior Aluminum Doors (Medium Style).
- .1 Construct doors of porthole extrusions with minimum wall thickness of 2.3 mm and of the following (nominal) sizes:
  - .1 Stiles Width: 100 mm wide ±10 mm.
  - .2 Top Rail Height: 100 mm wide ±10 mm.
  - .3 Centre Rail Height: 210 mm wide ±10 mm.
  - .4 Bottom Rail Height: 170 mm ±10 mm.
  - .5 Stile & Rail Depth: 45 mm ±10 mm.
- .2 Reinforce mechanically-joined corners of doors to produce sturdy door unit.
- .3 Glazing stops: interlocking snap-in type for dry glazing, tamperproof type.

.3 Weathering and Glazing Gaskets: in accordance with Section 08 80 00.

.4 Thermal separators for door cladding to be rigid polyvinylchloride (PVC) extrusions.

.5 Sill Sweep: Door bottom rail weathering to be an extruded elastomeric blade sweep strip applied with concealed fasteners.

.6 Weatherstripping: EPDM and pile weatherstripping.

.7 Isolation Coating: alkali resistant bituminous paint as recommended by manufacturer.

2.3 ACCESSORIES

.1 Fasteners: 300 series stainless steel or 400 series stainless steel cadmium plated of size, type, quantity and length to meet load requirements of aluminum entrances and storefronts in accordance with building code and all applicable local regulations, and to maintain weather-resistant installation. Size and quantity to perform their intended function.

2.4 FABRICATION

.1 Doors and framing to be by same manufacturer.

.2 Fabricate aluminum-framed entrances and storefronts from extrusions of size and shape shown on reviewed shop drawings in accordance with AAMA/WDMA/CSA 101/I.S.2/A440. Member wall thickness sufficient to meet the specified structural requirements.

.3 Accurately machine, assemble, and seal all joints to provide neat, flush, hairline, and weathertight joints.

.4 Visible manufacturer's identification labels not permitted.

.5 Brace frames to maintain squareness and rigidity during shipment and installation.

.6 Fabricate system components with minimum clearances and shim spacing around perimeter of assembly, yet enabling installation and dynamic movement of perimeter seal.

.7 Make allowance for anticipated deflection of structure to ensure that structural loads are not transmitted to aluminum entrance framing.

.8 Fabricate vertical and horizontal members from tubular extrusions designed for shear block corner construction.

.9 Reinforce with aluminum or galvanized steel plates for finishing hardware to templates supplied.

.10 Break form aluminum closures to details indicated and of same finish as aluminum entrances and storefronts.

.11 Fabrication Tolerances.

.1 Co-ordinate with fabrication of glass and insulation glass units (IGU) specified in Section 08 80 00 to ensure proper fit and installation into frames provided by work of this Section.

2.5 FINISHES

.1 Shop Finishing:

.1 Exposed Aluminum Surfaces: AA-M12C22 A31 (0.4 mils) Architectural Class II black Anodic Coating in accordance with Aluminum Association Designation System for Aluminum Finishes.

.2 Appearance: visibly free of flowlines, streaks, sags, blisters and other surface imperfections.

.3 Repair of factory applied finish: use exterior grade air-drying touch-up material from coating manufacturer.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify conditions of substrates previously installed under other Sections are acceptable for aluminum doors and frames installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Consultant.

.2 Inform Consultant 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 Consultant.

3.2 INSTALLATION

.1 Aluminum Entrances and Storefronts.

.1 Install aluminum entrances and storefronts in accordance with manufacturer's instructions and reviewed shop drawings.

.2 Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.

.3 Make allowance for deflection of structure to ensure that structural loads are not transmitted to aluminum-framed entrances and storefronts.

.4 Provide alignment attachments and shims as required to permanently fasten system to building structure. Clean weld surfaces as required and apply protective primer to field welds and adjacent surfaces.

.5 Set all components level, square, plumb, at proper elevations and in alignment with other work.

.6 Field apply isolation coating to aluminum in contact with concrete, mortar, plaster, and other dissimilar metals.

.7 Seal joints between aluminum entrances and storefront framing and other building components with caulking in accordance with Section 07 92 00.

.8 Install door hardware in accordance with templates. Adjust operable parts for correct function.

.2 Glazing.

.1 Site glaze aluminum entrances and storefronts framing in accordance with Section 08 80 00, using glazing method recommended by framing manufacturer for use with their system.

3.3 CLEANING

.1 Wash down surfaces with solution of mild detergent in warm water, applied with soft, clean wiping cloths. Take care to remove dirt from corners. Wipe surfaces clean.

.2 Remove excess sealant by moderate use of mineral spirits or other solvent acceptable to sealant manufacturer.

3.4 PROTECTION

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

.2 Repair damage to adjacent materials caused by installation.

3.5 SCHEDULES

.1 Refer to Section 08 06 10.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 06 10 00 – Rough Carpentry.

.2 Section 07 92 00 – Joint Sealants.

.3 Section 08 06 10 – Door Schedule.

.4 Section 08 80 00 – Glazing.

.5 Section 09 29 00 – Gypsum Board.

1.2 REFERENCES

.1 American Society for Testing and Materials (ASTM).
- .1 ASTM B209M-10, Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate [Metric].
- .2 ASTM B221M-13, Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes [Metric].

.2 American National Standards Institute (ANSI).
- .1 ANSI Z97.1-2009, Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test.
- .2 ANSI/BHMA A156.10-2005, Power Operated Pedestrian Doors.
- .3 ANSI/BHMA A156.19-2007, Power Assist and Low-Energy Power-Operated Doors.

.3 Aluminum Association Inc. (AA).
- .1 Aluminum Standards and Data, 2006 Edition.
- .2 Aluminum Alloy Castings - Properties, Processes, and Applications, 2004 Edition.
- .3 Introduction to Aluminum Alloys and Tempers, 2000 Edition.
- .4 Designation System for Aluminum Finishes, 2003.

1.3 SYSTEM DESCRIPTION

.1 Performance Requirements.
- .1 Single Slide (SX-SO) with Sensor Operation System (both sides of doors).
- .2 Design framing members to withstand their own weight, weight of glass, loads imposed by motion of operable elements, and design wind and suction loads, as calculated in accordance with 2010 National Building Code and applicable municipal regulations, to maximum allowable deflection of 1/175 of span.
- .3 Provide expansion joints to accommodate movement in door, door frame and sidelite framing system, and between system and building structure, caused by structural movements, and dynamic loading and release of loads, without permanent distortion, damage to infills, racking of joints, breakage of seals, or water penetration.
- .4 Provide for thermal movement of door and sidelite framing system caused by ambient temperature changes without causing buckling, failure of seals, undue stress on fasteners or other detrimental effects, and to prevent transmission of stress to operators.
- .5 Provide for dimensional distortion of components during operation.
- .6 Provide manual operation for opening and closing of doors during electrical power failure and when power is manually switched off.
- .7 Provide fully adjustable operators for opening and closing speeds, hold open time, and cancellation of activation as specified.
- .8 All products used to have all parameters field programmable without necessity of using proprietary hand held or plug-in programming device.

1.4 SUBMITTALS

.1 Shop Drawings.
- .1 Submit shop drawings in accordance with Section 01 33 00.
- .2 Indicate on shop drawings, layout, dimensions, elevations, detail sections of members and sill conditions, materials, finishes, recesses, hardware including mounting heights, anchors and reinforcements, provisions for expansion and contraction, methods of joining sheet metal and joint locations, glass types and glass thicknesses, glazing details, types of sealants, details of other pertinent components of work, and adjacent construction to which work of this section is attached. Identify installation tolerances required, assembly conditions, routing of service lines, locations of operating components, controls and boxes. Indicate door signs.

.2 Product Data.
- .1 Provide manufacturer's technical product data for door units, framing systems and operators for each type of entrance required. Include fabrication methods, finishing, hardware and operator sizes, roughing-in and wiring diagrams, parts lists, accessories and other components. Include data substantiating that system will perform as specified.

.3 Quality Assurance.
- .1 Provide manufacturer's certificate confirming that automatic entrance door systems meet or exceed specified requirements, performance characteristics, and emergency exit requirements. Include test results from recognized testing laboratory or agency indicating compliance.

.4 Closeout Submittals.
- .1 Provide operation and maintenance data for incorporation into Operation and Maintenance Manual specified in Section 01 78 00.
- .2 Include manufacturer's parts lists, servicing frequencies, instructions for adjustment and operation applicable to each type of component or hardware, and name, address and telephone number of nearest authorized service representative.
- .3 Provide maintenance data for cleaning and maintenance of aluminum finishes.

1.5 QUALITY ASSURANCE

.1 Manufacturer’s qualifications: specialized in manufacture of automatic entrance door operating equipment and framing assemblies, having minimum five (5) years’ successful experience in fabrication of automatic doors of type required for this project and be capable of providing field service representation during installation, approving acceptable installer and approving application method.

.2 Installer’s qualifications: authorized representative of automatic entrance door manufacture for both installation and maintenance of type of units specified.

1.6 DELIVERY, STORAGE, AND HANDLING

.1 Deliver all material to site in manufacturer’s original unopened packaging with labels clearly identifying product name and manufacturer.

.2 Store materials in a dry, enclosed area protected from exposure to moisture, construction activity, and direct sunlight in strict accordance with manufacturer's recommendations.

.3 Handle work of this Section in accordance with AAMA CW-10.

.4 Cleaning and Waste Management in accordance with Section 01 74 00.

1.7 FIELD MEASUREMENTS

.1 Field measure openings and clearances before fabrication to ensure proper fitting of work. Show measurements on final shop drawings as indicated. Co-ordinate fabrication with construction progress to avoid delay. If necessary, proceed with fabrication of non-critical items until measurements can be taken.

1.8 WARRANTY

.1 Provide an extended warranty for Work of this Section for a period of two (2) years from date of Substantial Performance of the Work. Contractor hereby warrants automatic entrance door systems against defects and malfunctions under normal usage, and these or other observed defects and deficiencies will be repaired or replaced to the satisfaction of the Consultant and the City, and at no expense to the City.

.2 Warranty coverage to include repair or replacement of components or entire units which fail in materials or workmanship. Failures include but are not necessarily limited to, structural failures including excessive deflection, excessive leakage or air infiltration, faulty operation of operators, speed control and hardware, deterioration of metals, metal finishes, and other materials beyond normal weathering.

Part 2 Products

2.1 MANUFACTURERS

.1 Basis of Design Products.

.1 Automatic Sliding Doors.

.1 Horton Automatics Automatic ProSlide Series 2003 Belt Drive Type 110 Single Slide with Apex Sensor Operation System (both sides of doors), recessed threshold full length, overall 2440 mm wide unit, with 1220 mm sliding door width, overall 2600 mm high including header, clear glass unit as specified.

.2 Requests for substitutions will be considered subject to specified requirements and in accordance with Bidding Procedures B8.

.3 Supply products from single manufacturer.

2.2 MATERIALS

.1 Aluminum Door and Frame Extrusions: in accordance ASTM B221M and Aluminum Association alloy AA6063-T5 alloy and temper.

.1 Structural Header Sections: minimum 5 mm thickness.
.2 Structural Frame Sections: minimum 3 mm thickness.
.3 Structural Panel Sections: commercial grade.

.2 Manufactured Door Units: include operator, header and track, jambs, sliding door panel(s), and breakaway sidelite. Units can be mounted within rough opening with sliding panel(s) sliding along sidelite.

.3 Header: aluminum with removable face plate and capable of self-support up to length of 4877 mm on standard door size and glazing. Header size to be 152 mm deep by 152 mm high.

.4 Track: recessed aluminum, 16 mm wide and replaceable. Door-hanger rollers will be non-metallic, sealed ball bearing wheels 44 mm diameter. Accomplish anti-derailing by means of separate adjustable roller.

.5 Sliding Panel and Sidelite: aluminum, 44 mm deep with narrow stile horizontal and vertical rails. Weatherstripping to be along perimeter of sliding panel and swing-out sidelite. All weatherstripping to be vinyl. Concealed guides to stabilize bottom of sliding panel. Standard glazing prep to be for glass thickness as specified.

.6 Emergency Egress: slide-swing panels can swing out 90° from any position of slide movement and require no more than 222 N (50 lbf.) of force applied at lock stile to open. Swing-slide panels and swing-out sidelites have torsion spring designed to re-close panel if pushed open in direction of egress; also, include intermediate horizontal rail.

.1 Sliding Panel and Sidelite Options.

.1 Recessed sidelite and track and non-threshold application as indicated.

.2 Horizontal muntin(s) of size and type indicated.

.3 Prep for glazing 6 mm to 25 mm.

.7 Jambs/Frame: aluminum, jamb dimensions to be 44 mm deep by 100 mm wide unless otherwise indicated.

.8 Glazing.

.1 Exterior: IGU1 in accordance with Section 08 80 00.

.2 Interior: 6 mm tempered safety glass (clear) in accordance with Section 08 80 00.

.3 Provide vision strips GSF to glazing surfaces of sliding doors and sidelights in accordance with Section 08 87 00; Confirm height and pattern with Consultant.

.9 Operator: belt driven electric mechanism mounted and concealed within header. Operating force accomplished through 1/8 HP DC permanent magnet motor with worm gear transmission and 1800 RPM working with drive belt, attached door hangers, and idler pulley. Drive belt to be neoprene reinforced nylon, 19 mm wide. Idler pulley to be reinforced, non-metallic material.

.1 Supply microprocessor master control with manufacture's software and programmable speed values for: Open Speed, Close Speed, Open Check, Close Check, and Open Cushion; however, Close Speed not to exceed 305 mm per second.

.2 Control to also have programmable time values for: Full-Open Time Delay and Partial-Open Time Delay. Partial-Opening to be adjustable in increments of 25 mm. Modes of operation: auto-seal mode with self-close approximately every 11 seconds, self-cycle test mode (operates door during tune-in process), day mode autolock prevention, day 1-way and 2-way, night 1-way and 2-way. Diagnostics accomplished via digital display.

.3 Control to have dedicated interface connection.

.4 Revolution encoder to instruct control on sliding panel's speed and position. Adjustable reversing circuit will reopen door unit if closing path is obstructed. Maximum force required to prevent sliding panel from closing is 28 lbf.

.5 Finger Safety: When unit slides open, strike rail of sliding panel will stop 89 mm short of adjacent sidelite; resulting opening is net slide.

.10 Enhanced Sensor System (24 VAC, class ll circuit).

.1 Provide dual sensing patterns consisting of microwave motion detection and infrared presence detection on both sides of all automatic doors.

.2 Microwave sensor: header-mounted each side of door unit for detection of traffic each direction. Sensor also includes serial interface with door operator and active infrared presence sensor that provides additional threshold protection. Installer to adjust so that minimum width of detection pattern equals clear door opening, minimum projection out from threshold equals 1092 mm, and detection is within 127 mm of closed door.

.3 Two hold-open beam: LED pulsed infrared photoelectric beam to be mounted in vertical rails of sidelite or in jambs at height of 610 mm and 1220 mm above floor. Beam to remain active from fully open to within 152 mm of closed.

.11 Security and Safety Operations
- .1 South Vestibule.
  - .1 Interior Vestibule Door:
    - .1 Power On/Off Switch: keyed switch on interior side of door to engage night mode (disengage motion sensors and engage lock).
      - .1 Keyed switch (with key provided in nearby lock box) on exterior side of door to disengage lock and engage motion sensors for emergency services access.
    - .2 Monitored Power Fail (battery back-up): Autolock Fail Secure: If power fails lock automatically engages:
      - .1 Panic bar on interior side of door to allow emergency egress.
      - .2 Keyed switch (with key provided in nearby lock box) on exterior side of door to engage battery operated sliding door function for emergency services access.
    - .3 Security Monitoring: door contacts to monitor if door is closed or broken away:
      - .1 Closed Door Monitoring Switch and SX Cut-off Switch.
  - .2 Exterior Vestibule Door:
    - .1 Power On/Off Switch: No locking capabilities, motion sensor always in operation.
- .2 North Vestibule.
  - .1 Interior Vestibule Door:
    - .1 Power On/Off Switch: No locking capabilities, motion sensor always in operation.
  - .2 Exterior Vestibule Door:
    - .1 Power On/Off Switch: keyed switch on interior side of door to engage night mode (disengage motion sensors and engage lock).
      - .1 Keyed switch (with key provided in nearby lock box) on exterior side of door to disengage lock and engage motion sensors for emergency services access.
    - .2 Monitored Power Fail (battery back-up): Autolock Fail Secure: If power fails lock automatically engages:
      - .1 Panic bar on interior side of door to allow emergency egress.
      - .2 Keyed switch (with key provided in nearby lock box) on exterior side of door to engage battery operated sliding door function for emergency services access.
    - .3 Security Monitoring: door contacts to monitor if door is closed or broken away:
      - .1 Closed Door Monitoring Switch and SX Cut-off Switch.

.12 On/Off Key Switch.
- .1 Wall Mounted Key Switch: key switch for each door, mounted on adjacent wall to turn on and off door operation. Confirm and co-ordinate exact location with Consultant.

2.3 FABRICATION

.1 Prefabricate sliding aluminum door panels as packaged units complete with doors, frames, and related components, hardware, and accessories before shipment to project site.

.2 Panel Construction: mortise and tenon type joints, neatly and mechanically secured. Sash consists of snap-in glass stops, snap-in glazing beads and vinyl gaskets.

.3 Frame Construction: butt joints, neatly and mechanically secured by means of screws and formed aluminum corner brackets.

.4 Operator Construction: electromechanical, modular type construction.

.5 Manufacturer's nameplates on doors or frames are not permitted. Place manufacturer's name plates in semi-concealed locations.

2.4 FINISHES

.1 Shop Finishing.

.1 Exterior and Interior Exposed Aluminum Surfaces: AA-M12C22 A31 (0.4 mils) Architectural Class II black Anodic Coating in accordance with Aluminum Association Designation System for Aluminum Finishes.

.2 Visible appearance of flowlines, streaks, sags, blisters and other surface imperfections is not acceptable.

Part 3 Execution

3.1 EXAMINATION

.1 Verify surfaces, openings and recesses are ready to receive work, and opening dimensions are as indicated on shop drawings. Notify Contractor in writing of conditions detrimental to proper and timely completion of work. Do not start work until all unacceptable conditions are corrected in manner acceptable to installer and manufacturer.

.2 Verify power supply is available and roughed-in to power operated devices.

3.2 INSTALLATION

.1 Install doors, frames in accordance with reviewed shop drawings and manufacturer's instructions.

.2 Co-ordinate installation of components with related and adjacent work.

.3 Set work plumb, square, level, free from warp, twist and superimposed loads. Securely anchor work in required position. Brace frames rigidly for building-in.

.4 Apply isolation coating to separate aluminum and primed or galvanized steel surfaces at points of contact with cementitious materials.

.5 Set tracks, header assemblies, operating brackets, rails and guides level and true to location, with adequate anchorage for permanent support.

.6 Maintain clearances between head members and structure to ensure that structural loads are not transmitted to frames.

.7 Attach and seal air/vapour barrier membrane to framing as detailed in accordance with Section 07 26 00.

.8 Install sealant and back-up materials in accordance with Section 07 92 00 to provide weather tight seal at exterior framing.

.9 Pack fibrous insulation in shim spaces at perimeter of assembly and void spaces between members to maintain continuity of thermal barrier.

.10 Install hardware using templates provided.

.11 Install header and framing members in bed of sealant or with joint filler or gaskets. Co-ordinate installation with wall flashings and other components of construction.

.12 Prepare frames to accommodate glass and glazing methods specified. Supply and install glass in accordance with Section 08 80 00.

3.3 ADJUSTMENT

.1 After repeated operation of completed installation, readjust doors for optimum smooth operating condition and safety. Lubricate hardware, operating equipment and other moving parts.

.2 All subsequent adjustments to automatic door controls to be field adjustable without need for any external programmers.

3.4 DEMONSTRATION

.1 Provide demonstration and training in accordance with Sections 01 79 00.

.2 Manufacturer’s authorized representative to demonstrate operation of equipment and systems to the City 's personnel.

3.5 CLEANING AND PROTECTION

.1 Refer to Section 01 74 00.

.2 Clean glass and aluminum surfaces promptly after installation, and lubricate operating equipment for optimum condition and safety.

.3 Repair or replace damaged installed products.

3.6 SCHEDULES

.1 Refer to Section 08 06 10.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 06 10 00 – Rough Carpentry.

.2 Section 07 26 00 – Air/Vapour Barrier Membrane - Self Adhesive.

.3 Section 07 62 00 – Sheet Metal Flashing and Trim.

.4 Section 07 92 00 – Joint Sealants.

.5 Section 08 06 10 – Door Schedule.

.6 Section 08 41 13 – Aluminum-Framed Entrances and Storefronts.

.7 Section 08 71 00 – Door Hardware.

.8 Section 08 71 13 – Automatic Door Operators.

.9 Section 08 80 00 – Glazing.

1.2 ALLOWANCES

.1 Curtain wall & Air/Vapour Barrier Membrane Inspection and Testing paid for by Cash Allowance. Refer to Section 01 21 00.

1.3 REFERENCES

.1 American Architectural Manufacturers Association (AAMA).
- .1 AAMA CW-10-15, Curtain Wall Manual #10 Care and Handling of Architectural Aluminum From Shop to Site.
- .2 AAMA CW-DG-1-96(2005), Aluminum Curtain Wall Design Guide Manual.
- .3 AAMA 611-14, Voluntary Specification for Anodized Architectural Aluminum.
- .4 AAMA 2604-13, Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels.

.2 Aluminum Association (AA).
- .1 Aluminum Standards and Data, 2013 Edition.
- .2 Aluminum Alloy Castings - Properties, Processes, and Applications, 2004 Edition.
- .3 Introduction to Aluminum Alloys and Tempers, 2000 Edition.
- .4 Designation System for Aluminum Finishes, 2003.

.3 American Society for Testing and Materials (ASTM).
- .1 ASTM B209M-14, Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate [Metric].
- .2 ASTM B221M-13, Standard Specification for Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes [Metric].
- .3 ASTM C864-05(2015), Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers.
- .4 ASTM E283-04(2012), Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
- .5 ASTM E330/E330M-14, Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.
- .6 ASTM E331-00(2009), Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference.

.7 ASTM E547-00(2009), Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Cyclic Static Air Pressure Difference.
.8 ASTM E783-02(2010), Standard Test Method for Field Measurement of Air Leakage Through Installed Exterior Windows and Doors.
.9 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.
.10 ASTM F588-14, Standard Test Methods for Measuring the Forced Entry Resistance of Window Assemblies, Excluding Glazing Impact.

.4 Canadian General Standards Board (CGSB).
.1 CAN/CGSB 12.20-M89, Structural Design of Glass for Buildings.

.5 Canadian Standards Association (CSA).
.1 AAMA/WDMA/CSA 101/I.S.2/A440-17, North American Fenestration Standard / Specification for Windows, Doors, and Skylights.
.2 CAN/CSA-A440-00/A440.1-00(R2005), CAN/CSA-A440-00, Windows / Special Publication A440.1-00, User Selection Guide to CSA Standard CAN/CSA-A440-00, Windows.
.3 CAN/CSA A440.2-14/A440.3-14, Fenestration Energy Performance / User Guide to CSA A440.2-09, Fenestration Energy.
.4 CAN/CSA A440.4-07(R2012), Window, Door and Skylight Installation.
.5 CAN/CSA S157-05/S157.1-05(R2015), Strength Design in Aluminum/Commentary on CSA S157-05, Strength Design in Aluminum.

.6 National Building Code of Canada, 2010 (NBCC).

1.4 SYSTEM DESCRIPTION

.1 Design Requirements.
.1 Provide thermally broken tubular extruded aluminum sections with supplementary support framing, shop fabricated, vented and drained rain screen glazing cavity, vision glass, related flashings, anchorage and attachment devices.
.2 Assembled system to permit re-glazing of individual glass and infill panel units without requiring removal of structural mullion sections.
.3 Design the entire skin based on the "Rain Screen" principle and provide:
.1 Such gaskets, baffles, overlaps and seals as required to provide a "Rain Screen" barrier to effectively drain water entering joints, condensation occurring in glazing channels, or migrating moisture occurring within system, to the exterior by a weep drainage network.
.2 The necessary "air seals" to minimize air passage from the system cavities into the building and vice versa, to assure adequate pressure equalization of the system cavities with the outside.
.3 The "air and vapour seals" required to minimize air borne vapour exfiltration from the building into the system cavities.
.4 Incorporate continuous silicone “heal bead” to seal inside face of glazing to aluminum frame.
.5 Openings between these cavities and the outside of sufficient cross-section to provide pressure equalization. Baffle openings or otherwise guard to minimize direct water entry.
.4 Design and size components to withstand dead and live loads caused by pressure and suction of wind acting normal to plane of pressure plate glazing system and structural sealant glazing system as calculated in accordance with National Building Code of Canada, Climatic Information for Building Design for the Place of the Work, but not less than specified thickness and dimension.

.5 Design coupling mullions to provide a functional split to permit modular construction and allow for thermal expansion.

.6 Integrate exterior aluminum framing sections with a glass-reinforced nylon thermal break to form a rigid composite assembly without the use of fasteners or other thermal bridging elements.

.7 Provide system to accommodate, without damage to components or deterioration of seals:

.1 Expansion and contraction within system caused by a cycling temperature changes without causing detrimental affect to system components including buckling, failure of joint seals, or undue stress on fasteners.

.2 Movement between system and perimeter framing components.

.3 Dynamic loading and release of loads.

.4 Deflection of structural support framing.

.8 Design and size components to meet or exceed the requirements for loads on walls acting as guards in accordance with National Building Code of Canada

.9 Maintain continuous air/vapour barrier throughout assembly, primarily in line with inside pane of glass and heel bead of glazing compound.

.2 Performance Requirements.

.1 Glazed Aluminum Curtain Wall.

.1 Structural performance in accordance with CSA S157/S157.1 and a maximum deflection of L/175 of the span.

.2 Air infiltration not to exceed 0.0003 $m^3/s/m^2$ (0.062 cfm/ft^2) when tested in accordance with ASTM E283 with a static air pressure differential of 300 Pa (6.24 p.s.f.).

.3 No water infiltration when tested in accordance with ASTM E331 with a static air pressure differential of 480 Pa (10 p.s.f.).

.4 Composite frame assembly not to exceed 7224 N/100 mm (1650 lbf/4 in.) resistance to shear between aluminum and thermal break materials. Dry shrinkage of thermal break not to exceed 0.10% of the framing member length.

.5 Size glass units and glass dimensions to limits established in CAN/CGSB12.20.

.6 Drain water entering joints, condensation occurring in glazing channels, or migrating moisture occurring within system, to the exterior by a weep drainage network.

.7 Ensure no vibration harmonics, wind whistles, noises caused by thermal movement, thermal movement transmitted to other building elements, loosening, weakening, or fracturing of attachments or components of system occur.

.2 Exterior Aluminum Doors.

.1 Air Infiltration (doors-single): not to exceed 2.78 $m^3/h/m$ per linear foot of perimeter crack, measured at reference differential pressure across assembly of 75 Pa as measured in accordance with ASTM E283.

.2 Air Infiltration (doors-double): not to exceed 5.56 $m^3/h/m$ per linear foot of perimeter crack, measured at reference differential pressure across assembly of 75 Pa as measured in accordance with ASTM E283.

.3 Exterior Window Classification: To NAFS 11 (North American Fenestration Standards)

.1 PG AW 85 (Awning)

.2 Condensation resistance: Temperature Index, I58.

.3 Forced Entry: F40.

1.5 SUBMITTALS

.1 Make all submittals in accordance with requirements of Section 01 33 00.

.2 Product Data.
.1 Submit manufacturer's instructions, printed product literature and data sheets for curtain wall components, anchorage and fasteners, glass and infill, and internal drainage details and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings.
.1 Shop drawings to bear the signature and stamp of a qualified professional Engineer registered in the jurisdiction of the Place of the Work.
.2 Aluminum curtain wall framing system, complete with internal steel reinforcing as required, to be engineered to meet the requirements of the National Building Code of Canada, Climatic Information for Building Design for at the Place of the Work.
.3 Indicate system dimensions, framed opening requirements and tolerances, adjacent construction, anticipated deflection under load, affected related work, weep drainage network, expansion and contraction joint locations and details, anchorage details, location of isolation coatings, and field welding as required.
.4 Indicate materials and large scale details for head, jamb and sills, profiles of components, interior and exterior trim, elevations of unit, description of related components and exposed finishes, fasteners and caulking. Indicate location of manufacturer's nameplates.
.5 Indicate fabrication tolerance of aluminum curtain wall framing with respect to incorporation of insulating glass units (IGU) specified in Section 08 80 00.

.4 Samples.
.1 Submit for review and acceptance of each unit.
.2 Samples will be returned for inclusion into work.
.3 Submit two (2) samples 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 Test Reports.
.1 Submit substantiating engineering data, test results of previous tests by independent laboratory which purport to meet performance criteria, and supportive data.

.7 Closeout Submittals
.1 Provide maintenance data for incorporation into Operation and Maintenance Manual specified in Section 01 78 00.

1.6 QUALITY ASSURANCE

.1 Qualifications.
.1 Fabricator: approved distributor of the aluminum curtain wall/skylight manufacturer. Information confirming this criteria may be requested by the Consultant.
.2 Installer: approved distributor of the aluminum curtain wall/skylight manufacturer with minimum five (5) years' experience with installation of glazed aluminum curtain wall/skylight on projects of equal or greater size and degree of complexity.

.2 Mock-ups.
.1 Mock-up glazed aluminum curtain wall/skylight installation in accordance with Section 01 45 00.
.2 Locate full size mock-up on site as part of final installation. Mock-up will be reviewed for fabrication, installation including co-ordination with work of other Sections, and testing by independent testing agency.

.3 Once tested and approved, the mock-up will set a standard of acceptance for remaining installations.

.3 Pre-installation Meetings.

.1 Schedule pre-installation meeting prior to commencement of the aluminum curtain wall installation work with all building envelope Contractors in attendance. Discuss the quality of workmanship expected, and ensure that all Contractors are fully aware of the mock-up required and testing procedures that will be undertaken on their work to ensure that the quality of workmanship is met. The independent testing agency will be in attendance to identify testing procedures that will be used on the project and to answer any questions.

1.7 DELIVERY, STORAGE, AND HANDLING

.1 Deliver all material to site in manufacturer's original unopened packaging with labels clearly identifying product name and manufacturer.

.2 Store materials in a dry, enclosed area protected from exposure to moisture, construction activity, and direct sunlight in strict accordance with manufacturer's recommendations.

.3 Handle work of this Section in accordance with AAMA CW-10.

.4 Cleaning and Waste Management in accordance with Sections 01 74 00.

1.8 SITE CONDITIONS

.1 Do not install sealants when ambient and surface temperature is less than 5ºC.

.2 Maintain this minimum temperature during and after installation of sealants until cured.

1.9 WARRANTY

.1 Manufacturer's Product Warranty: provide an extended warranty for Work of this Section for a period of two (2) years from date of Substantial Performance of the Work. Manufacturer hereby warrants glazed aluminum curtain wall/skylight free of manufacturing and material defects, and these or other observed defects and deficiencies will be repaired or replaced to the satisfaction of the Consultant and the City, and at no expense to the City.

.2 Installation Contractor's Warranty: provide an extended warranty for Work of this Section for a period of two (2) years from date of Substantial Performance of the Work. Contractor hereby warrants that work of this Section will remain rigid and weathertight, and these or other observed defects and deficiencies will be repaired or replaced to the satisfaction of the Consultant and the City, and at no expense to the City.

Part 2 Products

2.1 MATERIALS

.1 Extruded Aluminum: Aluminum Association AA 6063-T6 alloy and temper in accordance with ASTM B221M and CAN/CSA S157/S157.1, member wall thickness sufficient to meet the specified structural requirements but not less than 1.8 mm wall thickness at any location for the main frame, tolerances in accordance with Aluminum Association Aluminum Standards and Data.

.2 Exposed Formed Sheet Aluminum: to ASTM B209M, formed aluminum components shall be 3 mm thick sheet of alloy and temper suitable for their purpose and finish to sizes and profiles indicated, colour to match extruded aluminum.

.3 Air/vapour Barrier Membrane - Self Adhesive: in accordance with Section 07 26 00.

.4 Joint Sealants: in accordance with Section 07 92 00.

.5 Glazing: in accordance with Section 08 80 00.

2.2 COMPONENTS

.1 Exterior Aluminum Curtain Wall.

.1 Construct curtain wall from vertical and horizontal members, thermally broken with interior tubular extruded aluminum section insulated from exterior pressure plate, matching exterior cap and pressure plate of sufficient size and strength to provide adequate bite on insulated glass panels, drainage holes, deflector plates and internal flashings to accommodate internal weep drainage system, internal mullion baffles to eliminate "stack effect" air movement within internal spaces, and with the following (nominal) size(s):

.1 Frame Width: 65 mm ±5 mm.

.2 Overall Frame Depth (including cap): 150 mm ±5 mm, or as indicated.

.3 Cap Depth: 19 mm.

.2 Ensure caps for mullion assemblies are constructed without gap.

.3 Ensure vertical and horizontal members are tubular extrusions designed for shear block corner construction.

.4 Insulating glazing units (IGU): in accordance with Section 08 80 00.

.2 Aluminum Doors (Medium Style).

.1 Construct swing doors of aluminum extrusions for insulated glass unit with minimum wall thickness of 2.3 mm and of the following (nominal) sizes:

.1 Stiles Width: 100 mm wide ±10 mm.

.2 Top Rail Height: 100 mm wide ±10 mm.

.3 Centre Rail Height: 210 mm wide ±10 mm.

.4 Bottom Rail Height: 170 mm ±10 mm.

.5 Stile & Rail Depth: 45 mm ±10 mm.

.2 Insulating glazing units (IGU): in accordance with Section 08 80 00.

.3 Operable Windows.

.1 Construct top-hung, project out, awning windows of aluminum extrusions for insulated glass unit compatible with curtain wall system, with minimum wall thickness of 1.6 mm.

.2 Insulating glazing units (IGU): in accordance with Section 08 80 00.

.4 Gaskets: in accordance with ASTM C864 and be extruded of a silicone compatible EPDM rubber that provides for silicone adhesion.

.5 Thermal Barrier: thermal separator extruded of a silicone compatible elastomer that provides for silicone adhesion.

.6 Thermal separators for door cladding to be rigid polyvinylchloride (PVC) extrusions.

.7 Door bottom rail weathering to be an extruded elastomeric blade sweep strip applied with concealed fasteners.

.8 Isolation Coating: alkali resistant bituminous paint as recommended by manufacturer.

2.3 ACCESSORIES

.1 Fasteners: 300 series stainless steel or 400 series stainless steel cadmium plated of a size, type, quantity and length to meet the load requirements of the aluminum curtain wall/skylight in accordance with building code and all applicable local regulations, and to maintain a weather-resistant installation. size and quantity to perform their intended function.

.2 Exposed Formed Sheet Aluminum: break formed aluminum components as indicated (including flashings, trims, air/vapour barrier tie-in strip, spandrel panels, closures at window jambs) to be 3 mm thick sheet of alloy and temper suitable for their purpose and finish to sizes and profiles indicated, colour to match extruded aluminum.

.3 Extruded Aluminum Sills: extruded aluminum section to sizes and profiles indicated, finish to match aluminum window mullion sections, secured with purpose made sill chairs and concealed fastening method in accordance with manufacturer's instructions.

.4 Window Hardware

.1 Hinging hardware for operable window: heavy duty stainless steel 4 bar concealed hinge with positive stop and adjustable friction shoe.

.2 Operator: pivot shoe roto (top-projected open-out vent) operator to have silver painted zinc die cast case, removable crank handle and knob with hardened steel worm gear and gear arms.

.3 Provide two (2) cam locking handles: silver painted zinc die cast handle and body with concealed fastening and multi-point locking capability. Join stainless steel locking rollers with extruded aluminum connecting bar traveling freely in extruded aluminum track to engage zinc die cast lock keepers. Rollers and keepers to be adjustable to accommodate manufacturing tolerances and to optimize compression on gasket seals.

.4 Insect screen: glassfibre mesh in accordance with CAN/CSA-A440, screen rating - heavy duty, factory installed in pre-bowed extruded aluminium frames, finish to match window frame and rigidly joined at corners, and secured in place using friction fit extruded elastomer splines, removable to permit re-screening. Screens must not be removable form outside. Interior mounting.

2.4 FABRICATION

.1 General.

.1 Fabricate aluminum curtain wall framing from extrusions of size and shape shown on reviewed shop drawings in accordance with CAN/CSA-A440. Member wall thickness sufficient to meet the specified structural requirements.

.2 Provide internal steel reinforcing as required to meet requirements of National Building Code of Canada, Climatic Information for Building Design in the Place of the Work.

.3 Integrate aluminum window framing sections specified with a glass-reinforced nylon thermal break to form a rigid composite assembly without the use of fasteners or other thermal bridging elements.

.4 Accurately machine, assemble, and seal all joints to provide neat, flush, hairline, and weathertight joints. Provide shielded drainage and pressure equalization vents where required. Seal all horizontal members to vertical members to provide individual compartments within the system in accordance with the rain screen principal.

.5 All glazing pockets to be vented, pressure equalized and drained to the exterior.

.6 Factory predrill slotted weep holes at 610 mm o.c. along bottom edge of all horizontal exterior caps at sill locations.

.7 Visible manufacturer's identification labels not permitted.

.8 Brace frames to maintain squareness and rigidity during shipment and installation.

.9 Fabricate system components with minimum clearances and shim spacing around perimeter of assembly, yet enabling installation and dynamic movement of perimeter seal.

.10 Make allowance for anticipated deflection of structure to ensure that structural loads are not transmitted to curtain wall framing.

.11 Break form aluminum closures to details indicated and of same finish as aluminum curtain wall.

.12 Sealant used in fabrication of aluminum curtain wall framing to be compatible with structural silicone seal used at vertical glazing joints.

.13 Fabricate vertical and horizontal members from tubular extrusions designed for shear block corner construction.

.14 Just before assembling the horizontal members, apply a generous bead of silicone sealant between the front face of the shear blocks and the vertical members, and extend 19 mm along top and bottom of shear block.

.15 Prepare system components to receive exterior doors as specified, and hardware specified in Section 08 71 00.

.2 Fabrication Tolerances.

.1 Co-ordinate fabrication tolerance of insulating glass units (IGU) to be installed in aluminum curtain wall framing with glazing manufacturer in accordance with Section 08 80 00.

2.5 FINISHES

.1 Shop Finishing.

.1 Exterior and Interior Exposed Aluminum Surfaces: AA-M12C22 A31 (0.4 mils) Architectural Class II black Anodic Coating in accordance with Aluminum Association Designation System for Aluminum Finishes.

.2 Visible appearance of flowlines, streaks, sags, blisters and other surface imperfections is not acceptable.

Part 3 Execution

3.1 EXAMINATION

.1 Verify substrate conditions which have been previously installed under other Sections, are acceptable for product installation in accordance with manufacturer's instructions.

3.2 INSTALLATION

.1 Aluminum Curtain Wall

.1 Install aluminum curtain wall in accordance with manufacturer's written instructions and reviewed shop drawings.

.2 Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.

.3 Make allowance for deflection of structure to ensure that structural loads are not transmitted to aluminum curtain wall framing.

.4 Provide alignment attachments and shims as required to permanently fasten system to building structure. Clean weld surfaces as required and apply protective primer to field welds and adjacent surfaces.

.5 Set all components level, square, plumb, at proper elevations and in alignment with other work.

.6 Provide thermal isolation where components penetrate or disrupt building insulation.

.7 Field apply isolation coating to aluminum in contact with concrete, mortar, plaster, and other dissimilar metals.

.8 Co-ordinate attachment and seal of perimeter air/vapour barrier membrane to curtain wall framing to ensure continuity of building envelope.

.9 Provide thermal isolation where components penetrate or disrupt building insulation.

.10 Install low volume expansion closed-cell polyurethane foam insulation in shim spaces along perimeter of curtain wall framing to maintain continuity of building envelope.

.11 Field apply isolation coating to aluminum in contact with concrete, mortar, plaster, and other dissimilar metals.

.12 Provide sealant at joints between curtain wall framing and other building components in accordance with Section 07 92 00. DO NOT INSTALL CAULKING WHERE IT MAY IMPEDE DRAINAGE OF CAVITY.

.13 Prepare aluminum curtain wall framing to accommodate glazing and site glaze in accordance with Section 08 80 00.

.14 Install door hardware in accordance with templates. Adjust operable parts for correct function.

.2 Extruded Aluminum Sills.

.1 Install aluminum sills as indicated with uniform wash to exterior, level in length, straight in alignment with plumb upstands and faces.

.2 Secure sills in place on purpose made sill chairs at ends and evenly spaced 610 mm o.c. in between in accordance with manufacturer's instructions.

.3 Maintain 3 mm space between butt ends of continuous sills. For sills over 1200 mm in length, maintain 3 mm space at each end. Fasten expansion joint cover plates and drip deflectors with self tapping stainless steel screws.

.4 Install sealant between aluminum sill upstand and curtain wall framing.

.5 Install continuous bead of caulking along edge of aluminum sills and adjacent building materials. DO NOT INSTALL CAULKING WHERE IT MAY IMPEDE DRAINAGE OF CAVITY AND/OR WALL COMPONENTS.

.3 Extruded Aluminum Head and Jamb Flashings.

.1 Install aluminum head and jamb flashings as indicated, level in length, straight in alignment with window mullions and adjacent materials.

.2 Secure in place to back-sections in accordance with manufacturer's instructions.

.3 Install continuous bead of caulking along edge of head and jamb flashing and adjacent building materials.

.4 Extruded Aluminum Trim Closures.

.1 Install aluminum trim closures as indicated, level in length, straight in alignment with curtain wall mullions and adjacent materials.

.2 Secure in place in accordance with manufacturer's instructions.

.3 Install continuous bead of caulking along edge of jamb flashing and adjacent building materials.

.5 Glazing: site glaze aluminum curtain wall framing in accordance with Section 08 80 00 using glazing method recommended by framing manufacturer for use with their system.

3.3 FIELD QUALITY CONTROL

.1 Independent testing of aluminum curtain wall will be carried out by independent testing agency approved by the City and Consultant. Smoke and pressure tests will be performed on mock-ups of curtain wall installations including seal of the curtain wall framing to the air/vapour barrier membrane and glazing installation. Once tested and approved, mock-up of curtain wall unit will set a standard of acceptance for all other installations. Following this, inspection and testing will be performed at random selected areas during installation. Aluminum curtain wall fabricator and/or installer will be responsible for all re-testing costs associated with return visits by the independent testing agency as a result of work that has failed testing procedures.

.2 Manufacturer's Field Services.

.1 Obtain written report from manufacturer of curtain wall and glass, verifying compliance of Work, in handling, installing, applying, protecting and cleaning of products, and submit written reports in acceptable format to verify compliance of Work with Contract within three (3) days of review.

.2 Submit 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 Ensure manufacturer's representative of curtain wall and glass is present before and during critical periods of installation and testing.

.4 Schedule site visits to review Work at stages listed:

.1 After delivery and storage of products, and when preparatory Work on which Work of this Section depends is complete, but before installation begins.

.2 Two (2) times during progress of Work at 25% and 60% complete.

.3 Upon completion of Work, after cleaning is carried out.

3.4 CLEANING

.1 Remove protective material from prefinished aluminum surfaces. Wash down surfaces with a solution of mild detergent in warm water, applied with soft, clean wiping cloths. Take care to remove dirt from corners. Wipe surfaces clean.

.2 Remove excess sealant by moderate use of mineral spirits or other solvent acceptable to sealant manufacturer.

3.5 PROTECTION

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

.2 Repair damage to adjacent materials caused by glazed aluminum curtain wall installation.

3.6 SCHEDULES

.1 Refer to Section 08 06 10.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 08 06 00 – Door Schedule.

.2 Section 08 11 00 – Metal Doors and Frames.

.3 Section 08 14 00 – Wood Doors.

.4 Section 08 41 13 – Aluminum-Framed Entrances and Storefronts.

.5 Section 08 44 13 – Glazed Aluminum Curtain Walls.

.6 Section 08 71 13 – Automatic Door Operators.

1.2 REFERENCES

.1 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 A156.3-2014, Exit Devices.
- .4 ANSI/BHMA A156.4-2013, Door Controls - Closers.
- .5 ANSI/BHMA A156.5-2014, Cylinders and Input Devices for Locks.
- .6 ANSI/BHMA A156.6-2015, Architectural Door Trim.
- .7 ANSI/BHMA A156.7-2016, Template Hinge Dimensions.
- .8 ANSI/BHMA A156.8-2015, Door Control - Overhead Stops and Holders.
- .9 ANSI/BHMA A156.13-2017, Mortise Locks and Latches.
- .10 ANSI/BHMA A156.15-2015, Closer Holder, Electromagnetic and Electromechanical.
- .11 ANSI/BHMA A156.16-2013, Auxiliary Hardware.
- .12 ANSI/BHMA A156.17-2014, Self-Closing Hinges and Pivots.
- .13 ANSI/BHMA A156.18-2016, Materials and Finishes.
- .14 ANSI/BHMA A156.21-2014, Thresholds.
- .15 ANSI/BHMA A156.22-2017, Door Gasketing and Edge Seal System.
- .16 ANSI/BHMA A156.26-2017, Continuous Hinges.
- .17 ANSI/BHMA A156.28-2013, Recommended Practices for Mechanical Keying Systems.
- .18 Canadian Steel Door and Frame Manufacturers' Association (CSDFMA).
  CSDFMA Canadian Metric Guide for Steel Doors and Frames (Modular Construction) standard hardware location dimensions.

.2 National Building Code of Canada, 2010 (NBCC).

1.3 SUBMITTALS

.1 Shop Drawings.
- .1 Submit hardware schedule in accordance with Section 01 33 00.
- .2 Indicate hardware proposed, including make, model, material, function, finish, and all other pertinent information for each door.

.2 Samples.
- .1 Submit samples of each type of hardware specified, when requested by Consultant in accordance with Section 01 33 00.
- .2 Identify each sample indicating applicable specification paragraph number, brand name and number, finish, and hardware package number.

.3 Closeout Submittals.
- .1 Provide operation and maintenance data for incorporation into Operation and Maintenance Manual specified in Section 01 78 00.

.2 Supply 2 sets of wrenches for hardware adjustment.

1.4 DELIVERY, STORAGE, AND HANDLING

.1 Package each item separately or in like groups, label each item or package as to item identification and intended location.

.2 Deliver all hardware to site in the manufacturer's original packaging. Packaging to contain manufacturer's name, product name and identification number and other related information.

.3 Provide and maintain dry, off-ground weatherproof storage. Protect hardware in accordance with manufacturer's recommendations. Remove only in quantities required for same day use.

.4 Cleaning and Waste Management in accordance with Section 01 74 00.

Part 2 Products

2.1 MANUFACTURERS

.1 Hardware manufacturers and Basis of Design Products as specified in Schedule at end of this Section.

.2 Requests for substitutions will be considered subject to specified requirements and in accordance with Bidding Procedures B8.

.3 Supply similar products from single manufacturer.

.4 Auto operators as specified in Section 08 71 13 to be supplied by this section.

2.2 FASTENINGS

.1 Supply and use only manufacturer's fastening devices required for satisfactory installation and operation of hardware.

.2 Exposed fastening devices to match finish of hardware.

.3 Use fasteners compatible with material through which they pass.

2.3 KEYING

.1 Door locks to be keyed to facility approved Best cores for all exterior locks and Schlage cores for all interior locks. Prepare detailed keying schedule in conjunction with the City.

.2 Provide three (3) keys for every lock in this Contract.

.3 Provide seven (7) master keys for each MK group.

.4 All keys, permanent cylinder cores, and key records are to be sent directly to the City via registered delivery.

.5 Supply all lock cylinders with Factory Construction Keying. Supply ten (10) construction keys.

Part 3 Execution

3.1 INSTALLATION

.1 Installation of door hardware is responsibility of door hardware supplier.

.2 Supply Sections 08 11 00 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 Canadian Metric Guide for Steel Doors and Frames (Modular Construction) prepared by Canadian Steel Door and Frame Manufacturers' Association.

.5 Use of “Lock-tite” or other sealants during hardware installation will not be accepted.

.6 Hang doors on 3 hinges for doors up to 900 mm wide and 2200 mm high. For doors wider than 900 mm or higher than 2200 mm use four (4) hinges.

.7 Locked outswing doors to have NRP hinges.

.8 Provide adapter plates to door closers where door or frame conditions require.

.9 Install kickplates and edge guards as specified. Install kickplates on one side of door unless otherwise specified. Install kickplates and edge guards with oval head countersunk screws.

.10 Drill protection plates for other hardware as required.

.11 Remove construction cores when directed by Consultant. Permanent cores to be installed by others.

3.2 FIELD QUALITY CONTROL

.1 Hardware may be inspected by hardware consultant for compliance with specification.
- .1 If removal of hardware causes delay to job, incorrect material will be used until correct material is provided.
- .2 Incorrect material will be removed and replaced with specified material at no cost to the City.

.2 If “Lock-tite” or other sealants are found, installer may be requested to replace hardware at no cost to the City.

3.3 ADJUSTING

.1 Adjust door hardware, operators, closures and controls for optimum, smooth operating condition, safety and for weather tight closure.

.2 Lubricate hardware, operating equipment and other moving parts.

.3 Adjust door hardware to provide tight fit at contact points with frames.

3.4 HARDWARE SCHEDULE

.1 Refer to Section 08 06 10.

.2 Hardware Sets following this Section.

END OF SECTION

Heading 01

1 SGL DOOR(S) 0:01 CRAWLSPACE
1 SGL DOOR(S) 0:03 CRAWLSPACE
900 X 900 X 45 X HMD X PSF X 45MIN

Each Assembly to have:

3	EA	SPRING HINGE	3SP1 114X102MM	652	IVE
1	EA	PASSAGE SET	ND10S SPA	619	SCH
1	EA	OH STOP	450S	630	GLY
1	SET	SMOKE SEAL	W-22 TO SUIT OPENING	BLK	KNC

Both levers always unlocked. Inside lever is always free for immediate egress.

Heading 02

1 SGL DOOR(S) 1:09 CORRIDOR / STAFF WASHROOM
1 SGL DOOR(S) 1:13 CORRIDOR / UTR
1000 X 2150 X 45 X WD X PSF

Each Assembly to have:

3	EA	HINGE	5BB1 127X114MM	646	IVE
1	EA	DEAD LOCK W/OCC IND	L496P 619 L583-363	619	SCH
1	EA	MONITOR STRIKE	LMS-1		SEC
1	EA	PUSH PLATE	8200 150X405MM	630	IVE
1	EA	LONG DOOR PULL	9266F 305MM “O”	630	IVE
1	EA	AUTO OPERATOR	AS SPECIFIED 08 71 13	BLK	
2	EA	ACTUATOR	AS SPECIFIED 08 71 13	630	
1	EA	KICK PLATE	8400 255MM X 40MM LDW B-CS	630	IVE
1	EA	WALL STOP	WS401/402CVX	626	IVE
3	EA	SILENCER	SR64	GRY	IVE

Heading 03

1 SGL DOOR(S) 1:05 CORRIDOR / STAFF ROOM
1000 X 2150 X 45 X WD X PSF

Each Assembly to have:

3	EA	HINGE	5BB1 127X114MM	646	IVE
1	EA	STOREROOM LOCK	ND80PD SPA	619	SCH
1	EA	ELECTRIC STRIKE	6211 FSE CON	630	VON
2	EA	ACTUATOR	AS SPECIFIED 08 71 13	630	
1	EA	AUTO OPERATOR	AS SPECIFIED 08 71 13	BLK	
1	EA	KICK PLATE	8400 255MM X 40MM LDW B-CS	630	IVE
1	EA	WALL STOP	WS401/402CVX	626	IVE
3	EA	SILENCER	SR64	GRY	IVE
1	EA	WIRE HARNESS	CON-192P		SCH
1	EA	ELECTRONIC KEYPAD	KP212	628	SCE

Outside lever locked at all times, key retracts latch bolt. Inside lever is always free for immediate egress.
Electric strike is released when power is applied (Fail Secure). With Connector.
Automatically Opens & Closes Door.
Auto Operator Exterior Actuator Active with valid keypad entry, inside actuator always active.

Heading 04

1 SGL DOOR(S) 1:20 EXTERIOR / MPR
2/1000 X 2440 X 45 X ALD X ALF

Each Assembly to have:

2	EA	CONT. HINGE	027XY EPT	315AN	IVE
2	EA	POWER TRANSFER	EPT2	695	VON
1	EA	ELEC PANIC HARDWARE	QEL-3549A-EO-CON 24 VDC	315	VON
1	EA	ELEC PANIC HARDWARE	QEL-3549A-NL-OP-388-CON 24 VDC	315	VON
1	EA	MORTISE CYLINDER	20-001 114 (KEY SWITCH)	619	SCH
1	EA	RIM CYLINDER	1E72	622	BES
2	EA	LONG DR PULL OFFSET	9264F 305MM “O”	BLK	IVE
2	EA	OH STOP	100S	BLK	GLY
1	EA	SURFACE CLOSER	4021	693	LCN
1	EA	MOUNTING PLATE	4020-18	693	LCN
2	EA	ACTUATOR	AS SPECIFIED 08 71 13	630	
1	EA	AUTO OPERATOR	AS SPECIFIED 08 71 13	BLK	
1	EA	KEY SWITCH	AS SPECIFIED 08 71 13	630	
2	EA	DOOR CONTACT	7764	628	SCE
1	EA	POWER SUPPLY	PS902	LGR	SCE

Free Egress at all times, Cylinder dogging holds push bar and retracts latch bolt.
Key cylinder retracts latch bolt.
Exterior actuator disabled when latch bolt is engaged in electric strike.
Auto Operator opens door when actuator pressed.

Heading 05

1 SGL DOOR(S) 1:06 CORRIDOR / JANITOR
1 SGL DOOR(S) 1:07 CORRIDOR / MECHANICAL
1 SGL DOOR(S) 1:10 CORRIDOR / JANITOR
1000 X 2150 X 45 X HMD X PSF X 45MIN

Each Assembly to have:

3	EA	HINGE	5BB1 127X114MM	646	IVE
1	EA	STOREROOM LOCK	ND80PD SPA	619	SCH
1	EA	SURFACE CLOSER	1450 REG	689	LCN
1	EA	KICK PLATE	8400 255MM X 40MM LDW B-CS	630	IVE
1	EA	WALL STOP	WS401/402CVX	626	IVE
1	SET	SMOKE SEAL	W-22 TO SUIT OPENING	BLK	KNC

Heading 06

1 SGL DOOR(S) 1:15 LIBRARY / TUTORIAL
1 SGL DOOR(S) 1:16 LIBRARY / TUTORIAL
1000 X 2440 X 45 X ALD X ALF

Each Assembly to have:

4	EA	HINGE	5BB1 127 X 114	BLK	IVE
1	EA	LONG DOOR PULL	PR 9266F 305MM “N”	BLK	IVE
2	EA	ACTUATOR	AS SPECIFIED 08 71 13	630	
1	EA	AUTO OPERATOR	AS SPECIFIED 08 71 13	BLK	
1	EA	WALL STOP	WS401/402CVX	619	IVE
1			SEALS BY DOOR SUPPLIER		

Heading 07

1 SGL DOOR(S) 1:22 LIBRARY / OFFICE
1000 X 2440 X 45 X ALD X ALF

Each Assembly to have:

4	EA	HINGE	5BB1 127 X 114	BLK	IVE
1	EA	LATCHLOCK	4510	BLK	ADA
1	EA	LEVER HANDLE	4560	335	ADA
1	EA	MORTISE CYLINDER	20-013 X B502-292	622	SCH
1	EA	ELECTRIC STRIKE	6211AL FSE	630	VON
1	EA	LONG DR PULL OFFSET	9264F 305MM “N”	BLK	IVE
1	EA	AUTO OPERATOR	AS SPECIFIED 08 71 13	BLK	
2	EA	ACTUATOR	AS SPECIFIED 08 71 13	630	
1	EA	WALL STOP	WS401/402CVX	619	IVE
1	EA	CARD READER	BY DIVISION 28	630	
1	EA	DOOR CONTACT	BY DIVISION 28	630	
1	EA	KEY SWITCH	AS SPECIFIED 08 71 13	630	
1			SEALS BY DOOR SUPPLIER		

Heading 08

1 SGL DOOR(S) 1:18.1 EXTERIOR / LIBRARY
1000 X 2440 X 45 X ALD X ALF

Each Assembly to have:

1	EA	CONT. HINGE	027XY EPT	315AN	IVE
1	EA	POWER TRANSFER	EPT2	695	VON
1	EA	ELEC PANIC HARDWARE	CDSI-LX-35A-EO	315	VON
1	EA	MORTISE CYLINDER	20-001 114 XQ11-949	622	SCH
1	EA	LONG DR PULL OFFSET	9264F 305MM “O”	BLK	IVE
1	EA	OH STOP	100S	BLK	GLY
1	EA	AUTO OPERATOR	AS SPECIFIED 08 71 13	BLK	
2	EA	ACTUATOR	AS SPECIFIED 08 71 13	630	
1	EA	DOOR SWEEP	W-24S TO SUIT DOOR WIDTH	628	KNC
1	EA	THRESHOLD	CT-65	627	KNC
1	EA	DOOR CONTACT	7764	628	SCE

Free Egress at all times. Pressing Push Bar retracts latch bolts Dogging by key cylinder with visible security indicator locks down the push bar or crossbar so the latch bolt remains retracted. Automatically Opens & Closes Door. Actuators disabled when latch bolt is engaged in strike.

Heading 09

1 PR DOOR(S) 1:20.1 LIBRARY / MULTI-PURPOSE
2/1000 X 2440 X 45 X ALD X ALF

Each Assembly to have:

8	EA	HINGE	5BB1 127 X 114	BLK	IVE
2	EA	MANUAL FLUSH BOLT	FB457	622	IVE
1	EA	DUST PROOF STRIKE	DP1	626	IVE
1	EA	MS LOCK HD	MS1850S	BLK	ADA
2	EA	MORTISE CYLINDER	20-013 X B502-292	622	SCH
2	EA	LONG DR PULL OFFSET	PR 9264F 305MM "N"	BLK	IVE
2	EA	OH STOP & HOLDER	100H	BLK	GLY
1	EA	SURFACE CLOSER	4021	693	LCN
1	EA	MOUNTING PLATE	4020-18	693	LCN
2	EA	ACTUATOR	AS SPECIFIED 08 71 13	630	
1	EA	AUTO OPERATOR	AS SPECIFIED 08 71 13	BLK	
1	EA	KEY SWITCH	AS SPECIFIED 08 71 13	630	

Automatically Opens & Closes Door.

Heading 10

1 PR DOOR(S) 1:21 MULTI-PURPOSE / STORAGE
2/900 X 2150 X 45 X WD X PSF
180 DEG

Each Assembly to have:

6	EA	HINGE	5BB1 114X102MM NRP	646	IVE
2	EA	MANUAL FLUSH BOLT	FB458	619	IVE
1	EA	DUST PROOF STRIKE	DP1	626	IVE
1	EA	ELEC CLASSROOM LOCK	CO-100-CY-70-KP-SPA-P	619	SCE
2	EA	KICK PLATE	8400 255MM X 25MM LDW B-CS	630	IVE
2	EA	WALL STOP	WS401/402CVX	619	IVE
2	EA	SILENCER	SR64	GRY	IVE

Heading 11

1 SGL DOOR(S) 1:08 EXTERIOR / STAFF
1000 X 2440 X 45 X ALD X ALF

Each Assembly to have:

1	EA	CONT. HINGE	027XY	315AN	IVE
1	EA	PANIC HARDWARE	35A-NL-OP-388	315	VON
1	EA	RIM CYLINDER	1E72	622	BES
1	EA	ELECTRIC STRIKE	6300 FSE	630	VON
1	EA	LONG DR PULL OFFSET	9264F 305MM “O”	BLK	IVE
1	EA	OH STOP	100S	BLK	GLY
2	EA	ACTUATOR	AS SPECIFIED 08 71 13	630	
1	EA	AUTO OPERATOR	AS SPECIFIED 08 71 13	BLK	
1	EA	DOOR SWEEP	W-24S TO SUIT DOOR WIDTH	628	KNC
1	EA	THRESHOLD	CT-65	627	KNC
1	EA	CARD READER	BY DIVISION 28		
1	EA	DOOR CONTACT	BY DIVISION 28	630	
1			SEALS BY DOOR SUPPLIER		

Heading 12

HEADING NUMBER NOT USED.

Heading 13

1 SGL DOOR(S) 1:12A WASHROOM / STALL
1 SGL DOOR(S) 1:12G WASHROOM / STALL
1000 X 2150 X 45 X WD X PSF

Each Assembly to have:

1	EA	HINGE	5BB1 114X102MM	646	IVE
2	EA	SPRING HINGE	3SP1 114X102MM	646	IVE
1	EA	DEAD LOCK W/OCC IND	L496P 619 L583-363	619	SCH
1	EA	PUSH PLATE	8200 150X405MM	630	IVE
1	EA	LONG DOOR PULL	9266F 305MM “STD”	630	IVE
1	EA	DOOR PULL	M87A (Inside)	630	SMH
1	EA	OH STOP	450S	630	GLY
1	EA	SILENCER	SR66	GRY	IVE

Heading 14

1 SGL DOOR(S) 1:12B WASHROOM / STALL
1 SGL DOOR(S) 1:12C WASHROOM / STALL
1 SGL DOOR(S) 1:12D WASHROOM / STALL
1 SGL DOOR(S) 1:12E WASHROOM / STALL
1 SGL DOOR(S) 1:12F WASHROOM / STALL
760 X 2150 X 45 X WD X PSF

Each Assembly to have:

1	EA	HINGE	5BB1 114X102MM	646	IVE
2	EA	SPRING HINGE	3SP1 114X102MM	646	IVE
1	EA	DEAD LOCK W/OCC IND	L496P 619 L583-363	619	SCH
1	EA	PUSH PLATE	8200 150X405MM	630	IVE
1	EA	LONG DOOR PULL	9266F 305MM “STD”	630	IVE
1	EA	OH STOP	450S	630	GLY
1	EA	SILENCER	SR66	GRY	IVE

Heading 15

1 SL DOOR(S) 1:01 EXTERIOR / VESTIBULE
1 SL DOOR(S) 1:14 EXTERIOR / VESTIBULE
1 SL DOOR(S) 1:01.1 VESTIBULE / LIBRARY
2/1000 X 2368 X 45 X ALD X ALF

Each Assembly to have:

2	EA	MORTISE CYLINDER	1E74 c/w Construction Cylinder	622	BST
		BALANCE OF HARDWARE BY DOOR SUPPLIER			

Heading 16

1 SL DOOR(S) 1:14.1 VESTIBULE / LIBRARY

Each Assembly to have:

		HARDWARE BY DOOR SUPPLIER			

Part 1 General

1.1 RELATED SECTIONS

.1 Section 08 06 00 – Door Schedule.

.2 Section 08 11 00 – Metal Doors and Frames.

.3 Section 08 41 13 – Aluminum-Framed Entrances and Storefronts.

.4 Section 08 44 13 – Glazed Aluminum Curtain Walls.

.5 Section 08 71 00 – Door Hardware.

1.2 REFERENCES

.1 American Society for Testing and Materials (ASTM).
- .1 ASTM B221M-13, Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes [Metric].

.2 Builders Hardware Manufacturers Association (BHMA).
- .1 ANSI/BHMA A156.10-2017, Power Operated Pedestrian Doors.
- .2 ANSI/BHMA A156.19-2013, Power Assist and Low Energy Power Operated Doors.

.3 International Code Council/American National Standards Institute (ICC/ANSI).
- .1 ICC/ANSI A117.1-2017, Accessible and Usable Buildings and Facilities.

.4 National Building Code of Canada, 2010 (NBCC).

1.3 SUBMITTALS

.1 Product Data.
- .1 Submit manufacturer's catalogue data, detail sheets and specifications in accordance with Section 01 33 00.

.2 Shop Drawings.
- .1 Submit in accordance with Section 01 33 00.
- .2 Show complete elevations, details and method of anchorage, installation of hardware; size, shape, joints and connections, and details of joining with other construction.
- .3 Provide manufacturer's catalogue data, detail sheets and specifications.
- .4 Templates, diagrams and shop drawings to be supplied to fabricators and installers of related work for coordination of operators with doors, frames, hardware and other work.

.3 Closeout Submittals.
- .1 Provide operating and maintenance instructions, parts lists and wiring diagrams for incorporation into Operations and Maintenance Manual specified in Section 01 78 00.

1.4 QUALITY ASSURANCE

.1 Manufacturer's qualifications: factory-authorized and trained distributor having minimum of five (5) years' experience specializing in work of this Section, and who maintains parts inventory and trained personnel capable of providing service.

.2 Requirements of Regulatory Agencies.
- .1 Meet requirements of disabled in accordance with ICC/ANSI A117.1.

.3 All automatic equipment to comply with ANSI/BHMA A156.19.

1.5 DELIVERY, STORAGE, AND HANDLING

.1 Deliver all material to site in manufacturer's original unopened packaging with labels clearly identifying product name and manufacturer.

.2 Store materials in a dry, enclosed area protected from exposure to moisture, construction activity, and direct sunlight in strict accordance with manufacturer's recommendations.

.3 Handle all products with appropriate precautions and care as stated manufacturer's instructions.

.4 Cleaning and Waste Management in accordance with Section 01 74 00.

Part 2 Products

2.1 MANUFACTURERS

.1 Basis of Design Products.

.1 Concealed Automatic Swing Door Operator System (ADO-C).
.1 Horton HD-Swing Series 4800 Overhead Concealed Operator c/w Bottom Access Header.

.2 Surface Mounted Automatic Swing Door Operator System (ADO-S).
.1 Horton Series 4100.

.4 Column Type Door Actuators.
.1 BEA LPR36 Actuator.
.2 Wikk Industries I36-3 Clear INGRESS'R.

.2 Requests for substitutions will be considered subject to specified requirements and in accordance with Bidding Procedures B8.

.3 Supply similar products from single manufacturer.

2.2 MATERIALS

.1 Extruded Aluminum: to ASTM B221M, 6063-T5 alloy and temper, anodized, header sections minimum 3 mm thick.

2.3 CONCEALED AUTOMATIC SWING DOOR OPERATOR SYSTEM (ADO-C)

.1 Overhead Concealed Operator with Connecting Arm and Pivots: operator header is mounted directly over the door and serves as the door frame header.
.1 Independent Pivot Connecting Arm: operator output shaft to connect to an arm that transmits power to the door via a slide block connected to the arm. The arm works in a track that is mounted in the top web of the door. The door pivot is independent of the operator allowing for the removal of the operator without removing the door.

.2 Bottom Access Header Case (across full with of door): extruded aluminum case 114 mm x 152 mm. Conceal header above ceiling system.

.3 Operator: isolation mounted and concealed in extruded aluminum case for smooth and quiet operation, maximum current draw not to exceed 3.15 amps.
.1 Opening Action: accomplished by a 1/8 HP D.C. permanent magnet motor working through reduction gears to the output shaft. Gear train bearings to be sealed ball bearing types.

.2 Field Adjustable Spring Closing Action: accomplished by a maximum-duty spring (four independent coil springs separated by teflon discs and enclosed in an external spring box) with a lifetime warranty. Spring to be adjustable, without removing the operator from the header, to accommodate a wide range of field conditions.

.3 Independent Adjustable Closing and Latching Speed Control: operator to employ a rheostat module to allow for independent field adjustment of closing and latching speeds using the motor as a dynamic brake.

.4 Field Adjustable Open Stop: operator to provide a field adjustable open stop to accommodate opening angles from 80° to 135° without the need for additional components.

.5 Consistent Cycle: operator to deliver an even, consistent open force across the entire transition from door fully closed to door open check. Additionally, the range of the force to be field adjustable to accommodate a wide range of on-site conditions.

.6 Manual Use: operator to function as a manual door closer in the direction of swing with or without electrical power. Operator to deliver an even, consistent open force across the entire transition from door fully closed to door fully open.

.7 Controller Protection: controller to incorporate the following features to ensure trouble free operation:

.1 Automatic reset upon power up.

.2 Main fuse protection.

.3 Electronic surge protection.

.4 Internal power supply protection.

.5 Resettable sensor supply fuse protection.

.8 Push Button Interface: controller to have push button switches to allow for selection or change of the following parameters: carpet or timer logic, single or dual door, activation options, normal back check or large back check, push-to-open assist on/off.

.9 Soft Start/Stop: “soft-start”/ “soft-stop” motor driving circuit to be provided for smooth normal opening and recycling.

.10 Control Switch: automatic door operators to be equipped with a three position function switch to control the operation of the door. Control switch to provide three modes of operation - automatic, off, and hold-open.

.11 Master Control: incorporate the following features:

.1 Adjustable time delay of 1 to 28 seconds.

.2 Infinite adjustment to opening and open check speeds including adjusting the opening force without affecting the opening speed.

.3 Immediate reversal of door motion without undue strain on the drive train accomplished by supplying stepped voltage to the motor. The door to reverse when closing if an object stops the door.

.4 Motor Protection Circuit: locked door motor protection circuit to be supplied that will shut off current to the motor when the door is inadvertently locked or otherwise prevented from opening.

.4 On/Off Key Switch.

.1 Wall Mounted Key Switch: key switch mounted on adjacent wall to turn on and off door operators. Confirm and co-ordinate exact location with Consultant.

2.4 SURFACE MOUNTED AUTOMATIC SWING DOOR SYSTEM (ADO-S)

.1 Mode of operation: spring close. Operator opens door by energizing motor and stops door by stalling motor against mechanical stop. Door closes slowly by means of spring energy with closing force of 26.6N (6 lb-force) minimum controlled by gear system and motor being used as dynamic brake without power. Complete automatic door cycle 18 to 20 seconds. Door operation not to require any fluids or gases under pressure to be used in opening and closing of door.

.2 Fail-safe: to operate as manual door in event of power failure with 62N maximum applied to door stile.

.3 Components.

.1 Operator housing: nominal 140 mm wide x 127 mm high aluminum extrusion with finished end caps and prepared for surface mounting to new pressed steel door frames. Housing to extend full width of door header. All structural sections to have minimum thickness of 3.7 mm and be fabricated from 6063-T5 aluminum alloy.

.2 Power Operator: completely assembled and sealed unit including helical gear-driven transmission, overriding clutch (to provide easy manual operation, spring-close), mechanical spring and bearings all located in cast aluminum housing and filled with special lubricant for extreme temperature conditions. Attach DC shunt-wound permanent magnet motor with sealed ball bearings to transmission system. Operate motor from 115-volt supply requiring less than 5 amps at full power stall. Resilient mount complete unit with provisions for easy replacement, without removing door from pivots or frame.

.3 Electronic Control: self-contained unit including necessary transformer, relays, rectifiers, and other electronic components for proper operation and switching of power operator. Plug-in type relays for individual replacement. All connecting harnesses to have interlocking plugs. Controls include time delay for normal cycle and adjustable hold-open (2 to 60 seconds) time delay module. Include "Time Out" feature which will turn off opening force when door is stopped for one second. If this occurs, door begins to close, and operator immediately resets and will accept another opening signal.

.4 Connecting Hardware.

.1 Pull-type operation: urethane covered roller riding in track fabricated of 6061-T6 aluminum alloy attached to top door rail.

.2 Push-type operation: two-piece drive arm with self-aligning rod ends and connecting door bracket.

.5 Presence Detector.

.1 Presence Detector: active infrared sensor, mounted to top rail of door on approach side, detects person in its path and sends signal to hold open or reactivate door until person has moved out of its pattern. Detection response time <50 ms; infinite presence detection time; detection range 685 mm to 2490 mm.

.2 Relay: prevents presence detector from activating door when door is manually operated permitting door to close without hold-open delay.

.4 On/Off Key Switch.

.1 Wall Mounted Key Switch: key switch mounted on adjacent wall to turn on and off door operators. Confirm and co-ordinate exact location with Consultant.

2.5 DOOR ACTUATORS

.1 Column Type Door Actuators (Typical unless noted otherwise): 152 mm wide x 38 mm deep x 915 mm, surface mounted, tapered profile, hard wired, clear anodized aluminum with blue wheelchair logo and text “PUSH TO OPEN”.

.2 Jamb Mounted Door Actuator (where note on drawings): 44 mm x 127 mm satin stainless steel recessed push button where indicated with handicap engraved emblem and "press to open" wording.

2.6 FINISHES

.1 Concealed Automatic Swing Door Operator System (ADO-C).
  .1 To match aluminum entrance framing and doors.

.2 Surface Mounted Automatic Swing Door Operator System (ADO-S).
  .1 Shop applied custom paint finish; Colour(s) to be selected by Consultant.

2.7 MARKINGS

.1 Decals: provide decals visible from either side, instructing user as to operation and function of door.

Part 3 Execution

3.1 EXAMINATION

.1 Verify that door openings and doors are properly installed and ready for installation of door operators.

.2 Verify that electrical service is available, properly located and of proper type.

3.2 INSTALLATION

.1 Automatic door equipment: installed by factory-trained installers in compliance with manufacturer's recommendations, reviewed shop drawings, ANSI/BHMA A156.19 and Manitoba Amendments for universal design to the National Building Code.

.2 Install work plumb, square, level and true to line.

.3 Aluminum surfaces in contact with masonry, concrete, and steel: protected from contact by use of neoprene gaskets where indicated or coat of bituminous paint to prevent galvanic or corrosive action.

3.3 FIELD QUALITY CONTROL

.1 Site Tests: verify that electrical connections are made correctly and with dedicated grounding.

3.4 ADJUSTING

.1 Adjust door operators for proper operation, without binding or scraping and without excessive noise.

.2 After repeated operation of completed installation, readjust door operators and controls for optimum operating condition and safety.

3.5 CLEANING

.1 After installation, clean operator components as recommended by manufacturer.

3.6 SCHEDULE

.1 Refer to Section 08 06 10.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 06 40 00 – Architectural Woodwork.

.2 Section 08 11 00 – Metal Doors and Frames.

.3 Section 08 14 00 – Wood Doors.

.4 Section 08 41 13 – Aluminum-Framed Entrances and Storefronts.

.5 Section 08 42 29 – Automatic Entrances.

.6 Section 08 44 13 – Glazed Aluminum Curtain Walls.

.7 Section 08 87 00 – Glazing Surface Films.

.8 Section 10 28 00 – Toilet, Bath and Laundry Accessories.

.9 Division 26 – Electrical.

1.2 REFERENCES

.1 American National Standards Institute (ANSI).
- .1 ANSI Z97.1-15, Standard for Safety Glazing Materials Used in Buildings.

.2 American Society for Testing and Materials (ASTM).
- .1 ASTM C1036-16, Standard Specification for Flat Glass.
- .2 ASTM C1048-12e1, Standard Specification for Heat-Treated Flat Glass - Kind HS, Kind FT Coated and Uncoated Glass.
- .3 ASTM C1503-08(2013), Standard Specification for Silvered Flat Glass Mirror.
- .4 ASTM D823-17, Standard Practices for Producing Films of Uniform Thickness of Paint, Varnish, and Related Products on Test Panels.
- .5 ASTM D1212-91(2013) Standard Test Methods for Measurement of Wet Film Thickness of Organic Coatings.
- .6 ASTM D2240-15e1, Standard Test Method for Rubber Property - Durometer Hardness.
- .7 ASTM E283-04(2012), Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls and Doors Under Specified Pressure Differences Across the Specimen.
- .8 ASTM E330/E330M-14, Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.
- .9 ASTM E331-00(2016), Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls and Doors by Uniform Static Air Pressure Difference.
- .10 ASTM E547-00(2016), Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Cyclic Static Air Pressure Difference.
- .11 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 Canadian General Standards Board (CGSB).
- .1 CAN/CGSB-12.1-M90, Tempered or Laminated Safety Glass.
- .2 CAN/CGSB-12.3-M91, Flat, Clear Float Glass.
- .3 CAN/CGSB-12.4-M91, Heat Absorbing Glass.
- .4 CAN/CGSB 12.8-97 AMEND, Insulating Glass Units.

.4 Canadian Standards Association (CSA).
- .1 AAMA/WDMA/CSA 101/I.S.2/A440-17, North American Fenestration Standard / Specification for windows, doors, and skylights.
- .2 CAN/CSA A440.2-14/A440.3-14, Fenestration Energy Performance/User Guide to CSA A440.2-14, Fenestration Energy Performance.
- .3 CSA A440.4-07(R2016), Window, Door and Skylight Installation.

.5 Consumer Product Safety Commission (CPSC).
- .1 CPSC 16 CFR 1201: Safety Standard for Architectural Glazing Materials

.6 Insulating Glass Manufacturers Alliance (IGMA).
- .1 TR-1200-83(07), Guidelines for Commercial Insulating Glass Dimensional Tolerances.
- .2 TM-4000-02(07), Insulating Glass Manufacturing Quality Procedures.

.7 National Building Code of Canada, 2010 (NBCC).

1.3 SYSTEM DESCRIPTION

.1 Design Requirements.
- .1 Design and size insulating glazing units to withstand wind loads, dead loads and positive and negative live loads in accordance with ASTM E330/E330M, and the National Building Code of Canada, Climatic Information for Building Design for at the Place of the Work, but not less than specified thickness and dimension.

1.4 SUBMITTALS

.1 Product Data.
- .1 Submit manufacturer's printed product literature, specifications and data sheet in accordance with Section 01 33 00.
- .2 Indicate dimensional tolerances of insulating glass units (IGU) in accordance with IGMA TR-1200 to be installed in hollow metal doors and frames, aluminum storefronts and aluminum window framing specified in Section 08 51 13.

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

.3 Certificates.
- .1 Submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

.4 Closeout Submittals.
- .1 Provide maintenance data including cleaning instructions for incorporation into Operation and Maintenance Manual specified in Section 01 78 00.

1.5 DELIVERY, STORAGE, AND HANDLING

.1 Deliver all material to site in manufacturer’s original unopened packaging with labels clearly identifying product name and manufacturer.

.2 Store materials in a dry, enclosed area protected from exposure to moisture, construction activity, and direct sunlight in strict accordance with manufacturer's recommendations.

.3 Handle all products with appropriate precautions and care as stated manufacturer's instructions.

.4 Cleaning and Waste Management in accordance with Section 01 74 00.

1.6 SITE CONDITIONS

.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.

1.7 WARRANTY

.1 Provide an extended warranty for Work of this Section for a period of 10 years from date of Substantial Performance of the Work. Contractor hereby warrants insulating glass units against failure of seal, cracking of coatings, and deposits on inner faces of glass detrimental to vision, and these or other observed defects and deficiencies to be repaired or replaced to the satisfaction of the Consultant and the City, and at no expense to the the City.

Part 2 Products

2.1 MATERIALS

.1 Float Glass (GL): to ASTM C1048 and ANSI Z97.1, 6 mm thick.

.2 Safety Glass (SG): to CAN/CGSB-12.1, Type 2 (tempered), Class B (float glass), clear, clean-cut (with minimum serration, hackle, etc.), ground and polished edges where exposed, 6 mm thick, unless noted otherwise.

.3 Switchable Privacy Glass (SPG): two (2) layers of 6 mm clear tempered glass laminated to a 1 mm thick switchable PDLC interlayer for a total thickness of 13 mm, capable of adjustable transparency from clear to opaque, and as follows:

.1 Response Time: 0.1 Seconds

.2 Power:

.1	Power:	36V-70V AC
.2	Frequency:	50/60Hz
	Current:	0.1 amperes per 10 s
.3	Power:	5 watts per 10 s

.3 Optical:

		On	Off
.1	Light Transmittance:	95%	67%
.2	Light Reflectance:	14%	18%
.3	Haze:	4%	97%
.4	UV Block:	54%	99%
.5	IR Block:	12%	73%

.4 Insulating Glass Units (IGU): to CAN/CGSB-12.8, IGMA TR-1200 and IGMA TM-4000, consisting of two or three lites of glass as indicated, separated by high performance window spacers and air spaces which are hermetically sealed by an organic compound and kept continually dehydrated by a specially formulated desiccant material inside the spacer.

.1 IGU-1: 25 mm thick dual-pane insulating glass unit – exterior pane of 6 mm clear heat strengthened glass with low emissivity coating (surface #2), inner pane of 6 mm clear heat strengthened glass, 1-13 mm argon gas filled air spaces, complete with air spacer. Note - edge deletion is required for low e coating.

.2 IGU-2: 44 mm thick triple-pane insulating glass unit – exterior pane of 6 mm clear heat strengthened glass with low emissivity coating (surface #2), mid pane of clear heat strengthened glass, inner pane of 6 mm clear heat strengthened glass with low emissivity coating (surface #5), 2-13 mm argon gas filled air spaces, complete with air spacers. Note - edge deletion is required for low e coating.

.3 IGU-3: 51 mm thick triple-pane insulating glass unit – exterior pane of 6 mm clear heat strengthened glass with low emissivity coating (surface #2), mid pane of 6 mm clear heat strengthened glass, inner pane Switchable Privacy Glass (SPG) as specified above, 2-13 mm argon gas filled air spaces, complete with air spacers. Note - edge deletion is required for low e coating.

.5 Mirrors (unframed or custom stainless steel channel border): to ASTM C1503, 6 mm thick tempered select float glass, electrolytically copper-plated by galvanic process, grind and polish edges exposed in final assembly, size as indicated.

2.2 ACCESSORIES

.1 Glazing Tape.

.1 Co-extruded EPDM gasket with integral glazing tape.

.2 Closed cell polyvinyl chloride foam, coiled on release paper over adhesive on two sides, maximum water absorption by volume 2%, designed for compression of 25%, to effect an air and vapour seal; size to suit application as recommended by manufacturer.

.2 Glazing Gasket: elastomeric of durometer compatible with glazing tape.

.3 Setting Blocks: neoprene, 80 - 90 Shore “A” durometer hardness to ASTM D2240, minimum 100 mm x width of glazing rabbet space minus 1.5 mm x height to suit glazing method, glass light weight and area.

.4 Spacer Shims: neoprene, 50 - 60 Shore “A” durometer hardness to ASTM D2240, 75 mm long x one half height of glazing stop x thickness to suit application. Self-adhesive on one face.

.5 Mirror Attachment Accessories: concealed stainless steel clips.

.6 Primer-sealers and Cleaners: to glass manufacturer's standard.

.7 Cleaners: to glass manufacturer's standard.

2.3 FABRICATION

.1 Fabricate insulating glass units (IGU) in accordance with IGMA TM-4000.

.2 Co-ordinate with Section 08 51 13, the dimensional tolerances of insulating glass units (IGU) to be installed in aluminum window framing in accordance with IGMA TR-1200.

Part 3 Execution

3.1 EXAMINATION

.1 Verify that openings for glazing are correctly sized and within tolerance.

.2 Verify that surfaces of glazing channels or recesses are clean, free of obstructions, and ready to receive glazing.

3.2 PREPARATION

.1 Remove protective coatings and 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.

3.3 INSTALLATION

.1 Exterior Wet/Dry Method (preformed tape and sealant).
- .1 Glaze VISIONstrip in place as required for flush or offset glazing in accordance with manufacturer's instructions.
- .2 Place a toe bead of sealant compatible to VISIONstrip, 150 mm in each direction from each corner filling the void beneath the VISIONstrip to the sill of the frame.
- .3 EPDM or neoprene setting blocks shall be positioned at quarter points from both ends of the sill.
- .4 Place the vision glazing unit in the opening, resting on the appropriately placed setting blocks. Centre the glazing unit and then push firmly to the VISIONstrip.
- .5 Install the removable stop and VISIONstrip in the face clearance provided to maintain the appropriate compression and render the glazing system weather-tight.
- .6 Use edge blocking when required in accordance with the glass manufacturer's written instructions.

.2 Exterior Dry Method (preformed glazing).
- .1 Perform work in accordance with IGMA and for glazing installation methods.
- .2 Cut glazing tape to length; install on glazing light. Seal corners by butting tape and sealing junctions with sealant.
- .3 Place setting blocks at 1/4 points, with edge block maximum 150 mm from corners.
- .4 Rest glazing on setting blocks and push against fixed stop with sufficient pressure to attain full contact.
- .5 Install removable stops without displacing glazing tape. Exert pressure for full continuous contact.
- .6 Trim protruding tape edge.

.3 Mirror.
- .1 Set mirrors with stainless steel clips. Place plumb and level, and anchor rigidly to wall construction.

3.4 CLEANING

.1 Refer to Section 01 74 00.

.2 Remove glazing materials and labels from finish surfaces.

.3 Remove labels after work is complete.

.4 Clean glass using approved non-abrasive cleaner in accordance with manufacturer's instructions.

3.5 SCHEDULES

.1 Refer to Section 08 06 10.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 08 80 00 – Glazing.

1.2 REFERENCES

.1 American National Standards Institute (ANSI).
- .1 ANSI Z97.1-2015, Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test.

.2 American Society for Testing and Materials (ASTM).
- .1 ASTM D882-18, Standard Test Method for Tensile Properties of Thin Plastic Sheeting.
- .2 ASTM D1004-13, Standard Test Method for Tear Resistance (Graves Tear) of Plastic Film and Sheeting
- .3 ASTM D1044-13, Standard Test Method for Resistance of Transparent Plastics to Surface Abrasion.
- .4 ASTM D2582-16, Standard Test Method for Puncture-Propagation Tear Resistance of Plastic Film and Thin Sheeting.
- .5 ASTM E84-19a, Standard Test Method for Surface Burning Characteristics of Building Materials.

.3 International Window Film Association (IWFA).

1.3 SUBMITTALS

.1 Samples.
- .1 Submit one (1) 500 x 500 mm sample of surface film specified installed on 6 mm thick clear float glass in accordance with Section 01 33 00.

.2 Maintenance Data.
- .1 Provide maintenance data for incorporation into Operation and Maintenance Manual specified in Section 01 78 00.

1.4 QUALITY ASSURANCE

.1 Qualifications.
- .1 Glazing surface film manufacturer and installer to be members of International Window Film Association (IWFA).

1.5 DELIVERY, STORAGE, AND HANDLING

.1 Deliver all material to site in manufacturer’s original unopened packaging with labels clearly identifying product name and manufacturer.

.2 Store materials in a dry, enclosed area protected from exposure to moisture, construction activity, and direct sunlight in strict accordance with manufacturer's recommendations.

.3 Store rolls of film flat on cross supports. Do not stand rolls of film on end.

.4 Handle all products with appropriate precautions and care as stated manufacturer's instructions. Remove only in quantities required for same day use.

.5 Cleaning and Waste Management in accordance with Section 01 74 00.

1.6 SITE CONDITIONS

.1 Maintain constant 21°C air temperature at installation area for 72 hours before, during and 48 hours after installation.

1.7 WARRANTY

.1 Manufacturer's Product Warranty: provide an extended warranty for Work of this Section for a period of five (5) years from date of Substantial Performance of the Work. Manufacturer hereby warrants that surface film will maintain all properties without cracking, crazing or peeling of film, and maintain adhesion properties without blistering, bubbling or delaminating from glass, and these or other observed defects and deficiencies will be repaired or replaced to the satisfaction of the Consultant and the City, and at no expense to the City.

.2 Warranty to include full cost of film, removal, and re-application labour.

Part 2 Products

2.1 MATERIALS

.1 Glazing Surface Film (GSF): 3 mil polycarbonate thin film coated with high performance acrylic solvent based adhesive, coupled with 1.5 mil polyester release liner. Resistant to most common cleaning agents including mild acid and ammonia.
- .1 Elongation: to ASTM D882.
- .2 Break Strength: to ASTM D882.
- .3 Young's Modulus: to ASTM D882.
- .4 Tear Resistance: to ASTM D1004.
- .5 Impact Resistance: to ANSI Z97.1.
- .6 Abrasion Resistance: ASTM D1044.
- .7 Flammability: surface burn characteristics to ASTM E84.
- .8 Adhesive: high mass pressure sensitive, acrylic non-synthetic base, peel strength: 2.5 - 3.5 kg/25 mm width to ANSI Z97.1.
- .9 Tensile Strength: minimum 172.25 MPa to ASTM D882.
- .10 Puncture Resistance: 0.8 kg to ASTM D2582.
- .11 Colours:
  - .1 GSF1: colour, finish and layout pattern to be confirmed with Consultant.
  - .2 GSF2: colour, finish and layout pattern to be confirmed with Consultant.

.2 Glazing Surface Film (GSF3): Applied graphic film complete with clear matte laminate. Graphic to be determined by Consultant, allow for full colour printing (apply to back surface of end panel display; Refer to Section 06 40 00).

Part 3 Execution

3.1 EXAMINATION

.1 Examine glass under natural daylight and identify cracks, blisters, bubbles, discoloration, edge defects or other anomalies that may cause, film to delaminate, or vision transparency or distortion problems. Report findings to Consultant.

3.2 PREPARATION

.1 Clean glass before beginning installation using neutral cleaning solution.

.2 Ensure no deleterious material adheres to glass by balding surface of glass using industrial razors.

.3 Ensure dust, grease, and chemical residue are removed from surface of glass before installation of film.

.4 Before beginning work, place absorbent material on sill or at sash frame to absorb moisture accumulation generated by film application.

3.3 INSTALLATION

.1 Apply and attach film to glass in accordance with manufacturer's written instructions.

.2 Cut film edges straight and square in accordance with manufacturer's written instructions.

.3 Splicing.
- .1 Splice film only when glass is greater in width than film.
- .2 Splice film only after receipt of written approval from Consultant.
- .3 Use butt factory edges only.

.4 Use only water and film slip solution on glass to facilitate positioning of film.

.5 Ensure finished surface of film is vision free of blisters, bubbles, tears, scratches, edge defects, delaminating or vision distortion when viewed under natural daylight from 2 m minimum.

.6 Ensure removal of excess water from between film and glass.

.7 Remove left over material from work area and return work area to original condition.

.8 Do not apply film to insulated glass units.

3.4 FIELD QUALITY CONTROL

.1 View completed installation from distance of 2 m against bright uniform sky or background.

.2 Film to appear uniform in appearance with no visible streaks, creases, air bubbles, banding, thin spots, pin holes or other visible distortion.

.3 Installation deemed acceptable when Visual Quality Standard for applied glazing surface film, as adopted by IWFA are passed.

.4 Return to work place after 30 days but no longer than 40 days for final cleaning and inspection of installed film. Remove and replace without glass replacement, film that shows blisters, bubbles, tears, scratches, edge defects or vision distortion in film when viewed under natural daylight from 2 m minimum.

3.5 CLEANING

.1 Allow installation to cure one (1) month prior to cleaning.

.2 Wash film and both sides of glass using cleaning solution recommended by film manufacturer. Dry with soft clean cloths or soft paper towels.

.3 Follow manufacturers written instructions for care and maintenance of film.

.4 Use only cleaning solution recommended by manufacturer for regularly scheduled cleaning of film.

END OF SECTION

C	Concrete	03 30 00
C	Cement Board	09 29 00
GL	Glazing	08 80 00
GB	Gypsum Board	09 29 00
LVT	Luxury Vinyl Tile	09 65 00
P	Paint	09 90 00
PF	Prefinished	
PL	Plywood	
PT	Porcelain Floor and Wall Tile	09 31 00
R	Rubber Cove Base (100 mm height)	09 65 00
RV	Rigid Vinyl Wall Protection	
ST	Wood Stain finish	09 90 00
TC	Tile Carpeting	09 68 13
WSP	Weathered Steel Panel	07 42 13
WVP	Wood Veneer Panel C/W stain finish	06 40 00/09 90 00
WWS	Wood Wall System	09 54 26
W	Solid Wood Planks	06 40 00

TYPICAL NOTES:

1. All measurements indicated are millimeters and are indicated as height above finished floor.
2. Floor finishes to transition at centerline of door unless otherwise noted.
3. Refer to interior elevations for clarification of material distribution where multiple finishes are listed.
4. Refer to Reflected Ceiling Plans for ceiling types and finishes.
5. All GB ceilings and bulkheads to be painted P1 unless otherwise noted.
6. General Contractor to submit finished samples as specified for all hardwood, hardwood veneer paneling etc. for Design Consultant's approval.
7. Where two wall materials are indicated, first is lower,second is upper (i.e. RV/GB).
8. All exposed steel structure, conduit, sprinkler lines and HVAC to be painted (colour to be selected by Design Consultant) in gloss level G2 unless otherwise noted.
9. All exposed HSS columns to receive paint finish, G2 gloss level unless otherwise noted.
10. Exposed structural wood deck to receive factory finish as specified.
11. Refer to A9.1 Furniture, Equipment and Floor Finishes Plan for further clarification of floor patterning, material grain directions and transitions. Room Finish Schedule to be read in conjunction with A9.1.
12. Refer to 09 68 13 for concept tile carpet pattern and layout.

REMARKS:

N1 Refer to elevations for extent of WWS and moss panel installation.

N2 Combination of WVP (WVP1 and WVP2 - 2 stain colour) and Moss panels with GB above. Refer to elevations for extent.

N3 Apply RV on lower wall with paint finish above. Refer to elevations.

N4 Multi-colour carpet tile pattern (overall TC quantities approximately TC1 - 42%, TC2 - 56%, TC3 - 2%). Refer to Project Manual 09 68 13 for Concept Flooring Pattern Layout for design intent.

N5 PT1 to surround recessed flooring grid. Coordinate tile layout and transitions with floor recess details and shop drawings. Extend PT1 into Smartlocker wall recess.

N6 Paint one side of low partition surround Self Checkout Area. R base to be applied to painted wall sides only. Refer to Elevations.

N7 Refer to A9.1 for clarification regarding location of PT to R base transitions.

N8 WSP to be applied 3 sides of fireplace wall to u/s of bulkhead. Refer to elevations.

ROOM NO.	ROOM NAME	FLOOR		BASE		NORTH WALL		EAST WALL		SOUTH WALL		WEST WALL		PAINT GLOSS LEVEL	REMARKS
		MATL	FIN	MATL	FIN	MATL	FIN	MATL	FIN	MATL	FIN	MATL	FIN		
0:01	CRAWLSPACE	C	-	C,CB	-	C	-	CB	-	C	-	C	-		
0:02	CRAWLSPACE	C	-	C,CB	-	C	-	CB	-	C	-	CB	-		
0:03	CRAWLSPACE	C	-	C,CB	-	C	-	C	-	C	-	CB	-		
1:01	ENTRY VEST. A	C	PT1	GB	PT1	GL	-	GB	P	GL	-	GB	P		N5
1:02	LIBRARY SERVICES AREA	C	PT1	GB	PT1	GB	P	GB	P	GB	P	GB	P,WWS, PT2/P		N1, N6
1:02A	SELF CHECKOUT AREA	C	TC1	GB	R	GB	P	GB	P	GB	P	-	-		N4, N6
1:03	SERVICE DESK	C	LVT	GB	PT1	GB	P	-	-	GB	P	GB	WWS/ MOSS		N1, N2
1:04	LIBRARY SERVICES WORKROOM	C	LVT	GB	R, PT1	GB	P	GB	P	GB/GL	P	GB	P		N7
1:05	STAFF WORK AREA	C	LVT	GB	R	GB	P	GB	P	GB	P	GB	P		
1:06	ELECTRICAL ROOM	C	P	GB	R	GB	P	GB	P	GB	P	GB	P		
1:07	MECHANICAL ROOM	C	P	GB	R	GB	P	GB	P	GB	P	GB	P		
1:08	STAFF ROOM	C	LVT	GB	R	GB	P	GB	P	GB	P	GB	P		
1:09	STAFF UTR	C	PT1	GB	PT1	GB	PT3	GB	PT2	GB	PT2	GB	PT2		
1:10	JANITOR ROOM	C	P	GB	R	GB	RV/P	GB	RV/P	GB	RV/P	GB	RV/P		N3
1:11	CORRIDOR	C	PT1	GB	PT1	GB	PT2/EP	GB	PT2/P	GB	P	GB	PT2/EP		
1:12	UNIVERSAL WASHROOM	C	PT1	GB	PT1	GB	PT2/EP	GB	PT2/EP	GB	PT3/EP	GB	PT2/EP		
1:12A	UWS	C	PT1	GB	PT1	GB	EP	GB	EP	GB	EP	GB	EP		
1:12B	STALL	C	PT1	GB	PT1	GB	EP	GB	EP	GB	EP	GB	EP		
1:12C	STALL	C	PT1	GB	PT1	GB	EP	GB	EP	GB	EP	GB	EP		
1:12D	STALL	C	PT1	GB	PT1	GB	EP	GB	EP	GB	EP	GB	EP		
1:12E	STALL	C	PT1	GB	PT1	GB	EP	GB	EP	GB	EP	GB	EP		
1:12F	STALL	C	PT1	GB	PT1	GB	EP	GB	EP	GB	EP	GB	EP		
1:12G	UWS	C	PT1	GB	PT1	GB	EP	GB	EP	GB	EP	GB	EP		
1:13	UTR	C	PT1	GB	PT1	GB	PT2	GB	PT2	GB	PT2	GB	PT3		
1:14	ENTRY VEST. B	C	PT1	GB	PT1	GL	-	GB	P	GL	-	GB	P		N5
1:15	TUTORIAL ROOM A	C	TC1	GB	R	GB	P	GB	P	GL/GB	-/P	GB	P		N4
1:16	TUTORIAL ROOM B	C	TC1	GB	R	GB	P	GB	P	GL/GB	-/P	GB	P		N4
1:17	CHILDREN'S AREA	C	TC1, TC2, TC3	GB	R	GL/GB	-/P	GL/GB	-/P	-	-	GB	P		N4
1:18	OPEN LIBRARY	C	TC1, TC2, TC3	GB	R	-	-	GL/GB	-/P	GL/GB	-/P	GL/GB	-/P		N4
1:19	LIVING ROOM	C	TC1, TC2	GB,GL	R	GB	WVP,MOSS /P	GL/GB	-/P	GB/GL	WSP/P	-	-		N2, N4, N8
1:20	MPR	C	TC1, TC2	GB	R	GB	P	GL/GB	-/P	GB	P	GL/GB	-/P		
1:21	MPR STORAGE	C	LVT	GB	R	GB	P	GB	P	GB	P	GB	P		
1:22	BRANCH HEAD OFFICE	C	TC1	GB	R	GL/GB	-/P	GL,GB	-,P	GB	P	GB	P		

Part 1 General

1.1 RELATED SECTIONS

.1 Section 06 10 00 – Rough Carpentry.

.2 Section 07 92 00 – Joint Sealants.

.3 Section 09 29 00 – Gypsum Board.

1.2 REFERENCES

.1 American Society for Testing and Materials (ASTM).
- .1 ASTM A568/A568M-17a, Standard Specification for Steel, Sheet, Carbon, and High-Strength, Low Alloy, Hot Rolled and Cold Rolled, General Requirements for.
- .2 ASTM A653/A653M-17, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by Hot-Dip Process.
- .3 ASTM A792/A792M-10(2015), Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.
- .4 ASTM A924/A924M-17a, Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.
- .5 ASTM C645-14e1, Standard Specification for Nonstructural Steel Framing Members.
- .6 ASTM C754-17, Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products.
- .7 ASTM C840-17a, Standard Specification for Application and Finishing of Gypsum Board.

.2 Canadian Sheet Steel Building Institute (CSSBI).
- .1 CSSBI S18-2007, Guide Specification for Non-loadbearing Steel Framing.
- .2 CSSBI Technical Bulletin Volume 7, No. 1 - 2007, Maximum Height Tables for Interior Non-Loadbearing Partitions.

.3 Canadian Standards Association (CSA).
- .1 CAN/CSA S136-16, North American Specification for the Design of Cold-Formed Steel Structural Members.

1.3 QUALITY ASSURANCE

.1 Stud Height Limitations: to meet deflection limits of L/120, L/240, L/360 in accordance with CAN/CSA S136 and ASTM C754 “Maximum Stud Height Tables”, and CSSBI Technical Bulletin Volume 7, No. 1 “Maximum Height Tables for Interior Non-Loadbearing Partitions”, for stud width and spacing used.

1.4 DELIVERY, STORAGE, AND HANDLING

.1 Deliver all material to site in manufacturer’s original unopened packaging with labels clearly identifying product name and manufacturer.

.2 Store materials in a dry, enclosed area protected from exposure to moisture, and in strict accordance with manufacturer's recommendations.

.3 Handle all products with appropriate precautions and care as stated manufacturer's instructions.

.4 Cleaning and Waste Management in accordance with Section 01 74 00.

Part 2 Products

2.1 MATERIALS

.1 Steel Stud Framing for Screw Attachment of Gypsum Board: to be roll formed from 0.49 mm (25-gauge), 0.91mm (standard duty 20-gauge) and 1.22 mm (18-gauge) thick cold formed steel with hot dipped galvanized coating.

.2 Stud Widths: to be 41 mm, 64 mm, 92 mm, 152 mm, 203 mm as indicated on plans and to include factory pre-punched cutouts for services and channel bridging.

.3 Slotted Top Track: to be of same material as studs and sized to suit. Leg length of top track to be 63 mm long, and slotted to suit vertical deflection of structure.

.4 Bottom Track: to be of same material as studs and sized to suit stud. Leg length of bottom track to be 30 mm.

.5 Stud Bridging Channels: to be provided on all steel stud framing consisting of 13 mm x 38 mm roll formed from 1.2 mm (18-gauge) thick cold formed steel with hot dipped galvanized coating.
- .1 Up to 3050 mm high partition - 1 row mid height.
- .2 Over 3050 mm high partition - maximum 1525 mm on-centre

.6 Fasteners: to secure metal framing together to be No. 8 x 16 mm Wafer Head Speed Tec Framing Screw.

.7 Resilient Channels (to reduce air-borne sound transmission): roll formed from 0.49 mm (25-gauge) thick cold formed galvanized steel.

.8 Furring Channels (Hat Shaped): roll formed from 0.49 mm (25-gauge) thick cold formed galvanized steel with knurled face to accept screw attachment of gypsum board.

.9 Acoustical Sealant: in accordance with Section 07 92 00.

Part 3 Execution

3.1 INSTALLATION

.1 Ensure height and spacing of steel studs and furring members meet the requirements of CAN/CSA S136, ASTM C754, and CSSBI Technical Bulletin Volume 7, No. 1 to provide proper support for gypsum board and any other wall mounted items.

.2 Provide co-operation to other trades to accommodate window and door frames, mechanical and electrical items and any other special supports or anchorage for work specified in other Sections required to be incorporated into or co-ordinated with framing system.

.3 Install partitions to underside of roof/floor structure above unless otherwise indicated.

.4 Align tracks at top and bottom of partitions and secure 610 mm on-centre maximum and maximum 50 mm from each end using shield screws, power driven fasteners, or other suitable fasteners.

.5 Place studs vertically as indicated 400 mm on-centre maximum and maximum 50 mm from abutting walls and each side of corners and openings.

.6 Install partitions to accommodate vertical deflection of structure to avoid transmission of structural loads onto framing by use of 63 mm leg slotted top tracks. Steel stud framing to be 13 mm short of underside of roof/floor structure and free to move.

.7 Attach studs to track using Speed Tec sheet metal framing screws.

.8 Install doubled (boxed) studs at each side of openings in stud walls where openings are more than one stud space. Fasten studs together to act as single structural unit. Install track at head and sills to accommodate intermediate studs. Install intermediate studs above and below openings at same spacing as wall studs.

.9 Install steel stud framing between studs for attachment of electrical receptacles and other mechanical and/or electrical systems.

.10 Construct chase walls where indicated, consisting of two parallel steel stud partitions as indicated. Tie walls together at centre and quarter points with cross ties. Securely fasten to studs.

.11 Install resilient furring channels transverse to framing members where indicated. Start rows of channel 50 mm up from floor and within 152 mm from ceiling. Space rows at maximum 400 mm on-centre maximum. Locate splices over framing and secure channel ends to framing.

.12 Install acoustical sealant under tracks around perimeter of sound control partitions indicated.

.13 Finished work to be rigid, secure, square, level, plumb and erected to maintain dimensions and contours.

END OF SECTION

Part 1 General

1.1 RELATED WORK

.1 Section 07 21 00 – Thermal Insulation.

.2 Section 07 62 00 – Sheet Metal Flashing and Trim.

.3 Section 07 92 00 – Joint Sealants.

1.2 REFERENCES

.1 American Association of Textile Chemists and Colorists (AATCC).
- .1 AATCC 127-2017, Water Resistance: Hydrostatic Pressure Test.

.2 American Society for Testing and Materials (ASTM).
- .1 ASTM C144-18, Standard Specification for Aggregate for Masonry Mortar.
- .2 ASTM C150/C150M-18, Standard Specification for Portland Cement.
- .3 ASTM C206-14, Standard Specification for Finishing Hydrated Lime.
- .4 ASTM C897-15, Standard Specification for Aggregate for Job-Mixed Portland Cement-Based Plasters.
- .5 ASTM C926-18b, Standard Specification for Application of Portland Cement-Based Plaster.
- .6 ASTM C933-18, Standard Specification for Welded Wire Lath.
- .7 ASTM C1063-18b, Standard Specification for Installation of Lathing and Furring to Receive Interior and Exterior Portland Cement-Based Plaster.
- .8 ASTM E84-18b, Standard Test Method for Surface Burning Characteristics of Building Materials.
- .9 ASTM E96/E96M-16, Standard Test Methods for Water Vapor Transmission of Materials.
- .10 ASTM E2178-13, Standard Test Method for Air Permeance of Building Materials.

1.3 DELIVERY, STORAGE AND HANDLING

.1 Deliver all materials to site in the manufacturer's original packaging. Packaging to contain manufacturer's name, product name and identification number and other related information.

.2 Prevent damage to materials during handling and storage. Keep materials under cover and free from dampness.

.3 Cleaning and Waste Management in accordance with Sections 01 74 00.

1.4 SITE CONDITIONS

.1 Do not apply cement parging when substrate or ambient air temperature is less than 10°C or more than 27°C for 24 hours before, during, and after parging application.

.2 Do not use frozen materials or apply parging materials to frozen surfaces or surfaces containing frost.

.3 Apply parging to clean, adequately prepared surfaces free from dust, dirt or other deleterious substances.

.4 Provide adequate protection from contaminates and the weather for substrates prior to and during parging applications. Maintain in place until parging is adequately cured.

.5 Protect parging surfaces from uneven and excessive evaporation during hot, dry or windy weather.

.6 Take necessary care to identify and protect adjacent surfaces from damage from parging application and promptly remove all droppings.

.7 Report any unsatisfactory conditions in writing to the Consultant. Commencement of work shall imply acceptance of surfaces or conditions.

1.5 WARRANTY

.1 Manufacturer's Product Warranty: provide an extended warranty for Work of this Section for a period of 10 years from date of Substantial Performance of the Work. Manufacturer hereby warrants building paper to be free of manufacturing and material defects, and these or other observed defects and deficiencies will be repaired or replaced to the satisfaction of the Consultant and the City, and at no expense to the City.

Part 2 Products

2.1 MATERIALS

.1 Building Paper: spunbonded polyolefin, non-perforated, non-woven, non-absorbing, breathable membrane with ribbed surface texture, basis weight: 2.1 oz./yd², air penetration resistance in accordance with ASTM E2178, water vapour transmission in accordance with ASTM E96/E96M, water penetration resistance in accordance with AATCC 127, surface burning characteristics: Class A in accordance with ASTM E84.

.2 Building Paper Tape: manufacturer's purpose made tape constructed of an oriented polypropylene film coated with a specially formulated permanent acrylic adhesive.

.3 Exterior Cement Parging.

- .1 Basecoat: factory blend of Portland cement, fibers and proprietary ingredients. Improved workability, excellent coverage, compressive and flexural strength and resistance to shrinkage cracking. When mixed with sand and water it produces a fiber-reinforced stucco basecoat that provides a high quality substrate for a finish coat.
- .2 Finish Coat: mixture of Portland cement to ASTM C150/C150M, hydrated lime to ASTM C206, inert aggregates, and additives specially blended to provide improved workability, better coverage, colour consistency, and increased water resistance. Colour to be selected by Consultant.

.4 Welded Wire Lath (stucco wire): standard type galvanized wire lath to ASTM C933 and of following types as required:

- .1 20-gauge lath with openings not to exceed 25 mm.
- .2 16-gauge lath with openings not to exceed 50 mm.

.5 Cornerite: standard manufacture, expanded 0.50 mm (minimum) galvanized sheet steel with 75 mm legs.

.6 Striplath: standard manufacture, expanded 0.50 mm (minimum) diamond mesh sheet steel, 100 mm wide galvanized.

.7 Water: potable, clean and free from injurious amounts of oil, acid, alkali, organic matter or other deleterious substances.

.8 Sand: to ASTM C897, natural or manufactured, clean, sharp and free of loam, clay, silt, soluble salts and organic matter, freshwater washed. Sampling and testing to conform to ASTM C144.

2.2 ACCESSORIES

.1 Provide all parging accessories and/or trim, such as expansion and control joints, stops (casing beads), internal corner reinforcement, etc. as detailed on drawings and/or as required to complete the work in accordance with best trade practices.

.2 Provide accessories with an embedment flange to key into parging with depth (grounds) of accessories dependent on the required thickness of base coat, without the finish coat.

.3 Sheet Metal Flashing and Trim: in accordance with Section 07 62 00.

.4 Joint Sealants: in accordance with Section 07 92 00.

2.3 FASTENERS

.1 Fasteners: of suitable corrosion resistant material (electro and/or hot dipped galvanized steel, stainless steel) compatible with material, sheathing, framing or other substrate being fastened.

.2 Select fasteners to suit material and substrate condition and shall bear tight against attachment item and penetrate into steel framing members through sheathing.

2.4 MIXES

.1 Mix products in strict accordance with manufacturer's printed instructions.

Part 3 Execution

3.1 EXAMINATION

.1 Prior to commencement of work of this Section, review all conditions and thoroughly inspect all substrates and surfaces scheduled to have wire lath and parging applied and report in writing to the Consultant any conditions or surfaces that will adversely affect proper installation of the parging system.

.2 Ensure wire lath, accessories and trim are tight and fastened securely in place and fixtures, conduits, pipes, cables and outlets are properly plugged, capped or covered before commencing cement parging application.

.3 Do not commence with this work until work which is to receive it and site conditions are satisfactory.

3.2 INSTALLATION

.1 Building Paper.
- .1 Install in accordance with manufacturer's instructions over rigid insulation provided in accordance with Section 07 21 00. Secure to insulation thermostud channel fastening system specified using building paper manufacture's recommended fasteners.
- .2 Install building paper with grooved surface pattern in vertical position.
- .3 Install building paper shingle lapped such that each successive course (starting from the bottom and going upward) overlaps the previous (lower) course for proper water drainage. Ensure proper shingling is maintained at all in all situations where any flashing, termination, or penetration exists above the building paper.
- .4 Seal laps, holes, tears, and punctures in building paper with building paper tape as specified prior to installation of parging base coat.

.2 Lath (stucco wire).
- .1 Install lath in accordance with ASTM C1063.

.2 Install welded wire lath (stucco wire) with long dimension horizontal, lapping joints at least one (1) mesh but not less than 25 mm, lapping upper courses over lower courses, and lapping ends.

.3 At external corners, wrap wire lath around corner and reinforce with external corner reinforcement.

.4 At internal corners, fold wire through corner and reinforce with interior corner reinforcement.

.3 Accessories.

.1 Install accessories and trim straight, plumb, level, rigid and in the proper plane. Use full length pieces to minimize joints. Fit lengths together without gaps, accurately align and rigidly secure each side of joints. Mitre and fit corners accurately, without rough edges.

.2 Provide corner beads at external angles. Secure into position at maximum 200 mm on-centre.

.3 Provide casing beads wherever parging terminates and abuts other surfaces.

.4 Provide control joints at same locations as masonry control joints or minimum 10 m on-centre. Attach in manner to provide secure, true grounds for plaster.

3.3 PARGING APPLICATION

.1 General.

.1 Apply parging coats to entire surface in one continuous operation using trowel to finish entire section of wall at one time, interrupted only at natural breaks in construction such as changes of planes, openings, or at control joints.

.2 Minimum parging application standards shall be in accordance with ASTM C926 with application methods in accordance with best trade practices for type and application of materials used.

.3 Tolerances: true and even, level to within 3 mm in 1.5 m finished surface free of tool marks and other blemishes.

.2 Scratch Coat.

.1 Apply parging mortar over lath and exterior face of board insulation at concrete grade beam, beginning at elevation 100 000 and extending down to minimum 200 mm below finish grade with sufficient material and force to form good key.

.2 Scratch coat to completely embed lath to a minimum thickness of 10 mm and thick enough to allow for a uniform and shallow scoring approx. 3 mm of surface.

.3 Allow scratch coat to stiffen before applying finish coat.

.3 Finish Coat.

.1 Apply not sooner than seven (7) days after installation of scratch coat.

.2 Spread on an even coat of finish coat material using a trowel coat to achieve minimum 19 mm total parging thickness, then trowel to desired finish textured as indicated free of tool marks and other blemishes. Always work away from a wet edge.

.3 Texture: smooth trowel finish.

.4 Allow finish coat a minimum of 24 hours to set with sufficient moisture retained or applied to permit proper hydration and to prevent shrinkage.

3.4 FIELD QUALITY CONTROL

.1 Parging surfaces will be considered to lack uniformity and soundness if any of the following defects are apparent:

.1 Cracks resulting from incorrect application methods.

.2 Evidence of poor coverage (i.e., not applied to thickness specified), particularly at joints and corners.

.3 Damage due to touching before parging is sufficiently dry or any other contributory cause.

.4 Damage due to application on moist surfaces or caused by inadequate protection from the weather.

.5 Damage and/or contamination of parging due to wind-blown contaminants (dust, salt spray, etc.).

.2 Parging surfaces rejected by the Consultant to be corrected as follows: Small affected areas may be touched up. Large affected areas or areas without adequate coverage or with cracking shall be removed and redone.

3.5 PROTECTION

.1 Ensure that all newly applied parging surfaces are protected from rain, snow, condensation, contamination, dust, salt spray and freezing temperatures until parging is completely dry and cured. Curing periods shall exceed the manufacturer's recommended minimum time requirements.

.2 Ensure that barriers or screens and signs are provided by others to warn of or limit or direct traffic away or around work area and to protect newly applied parging surfaces from hazardous contact.

3.6 CLEANING

.1 Upon completion of this work, thoroughly clean and remove surplus plaster materials.

.2 Inspect adjacent surfaces and remove all traces of splashed parging.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 06 10 00 – Rough Carpentry.

.2 Section 07 21 00 – Thermal Insulation.

.3 Section 07 26 00 – Air/Vapour Barrier Membrane - Self Adhesive.

.4 Section 07 84 00 – Firestopping and Smoke Seals.

.5 Section 07 92 00 – Joint Sealants.

.6 Section 08 11 00 – Metal Doors and Frames.

.7 Section 08 44 13 – Glazed Aluminum Curtain Walls.

.8 Section 09 06 00.13 – Room Finish Schedule.

.9 Section 09 22 16 – Non-Structural Metal Framing.

.10 Section 09 31 00 – Tiling.

.11 Section 09 65 00 – Resilient Flooring.

.12 Section 09 90 00 – Painting and Coating.

1.2 REFERENCES

.1 American Society for Testing and Materials (ASTM).

- .1 ASTM A123/A123M-17, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
- .2 ASTM C475/C475M-17, Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board.
- .3 ASTM C840-18b, Standard Specification for Application and Finishing of Gypsum Board.
- .4 ASTM C954-18 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.
- .5 ASTM C1002-18, Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.
- .6 ASTM C1047-14a, Standard Specifications for Accessories for Gypsum Wallboard and Gypsum Veneer Base.
- .7 ASTM C1177/C1177M-17, Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing.
- .8 ASTM C1178/C1178M-18, Standard Specification for Coated Glass Mat Water-Resistant Gypsum Backing Panel.
- .9 ASTM C1186-08(2016), Standard Specification for Flat Fiber-Cement Sheets.
- .10 ASTM C1278/C1278M-17, Standard Specification for Fiber-Reinforced Gypsum Panel.
- .11 ASTM C1280-13a, Standard Specification for Application of Exterior Gypsum Panel Products for Use as Sheathing.
- .12 ASTM C1325-18, Standard Specification for Non-Asbestos Fiber-Mat Reinforced Cementitious Backer Units.
- .13 ASTM C1396/C1396M-17, Standard Specification for Gypsum Board.
- .14 ASTM C1629/C1629M-18, Standard Classification for Abuse-Resistant Nondecorated Interior Gypsum Panel Products and Fiber-Reinforced Cement Panels.

.15 ASTM D1784-11, Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds.
.16 ASTM D3273-16, Standard Test Method for Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber.
.17 ASTM D3678-14, Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Interior-Profile Extrusions.
.18 ASTM E84-18a, Standard Test Method for Surface Burning Characteristics of Building Materials.
.19 ASTM E136-16a, Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750°C.

.2 Gypsum Association (GA).
.1 GA 214-15, Recommended Levels of Gypsum Board Finish.
.2 GA 216-16, Application and Finishing of Gypsum Panel Products.
.3 GA 253-18, Application of Gypsum Sheathing.

.3 Underwriters Laboratories of Canada (ULC).
.1 CAN/ULC S101-14, Standard Methods of Fire Endurance Tests of Building Construction and Materials.
.2 CAN/ULC S102-18, Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.

1.3 DELIVERY, STORAGE, AND HANDLING

.1 Deliver all material to site in manufacturer's original unopened packaging and containers with labels clearly identifying product name and manufacturer.

.2 Store materials in a dry, enclosed area protected from exposure to moisture, construction activity, and direct sunlight in strict accordance with manufacturer's recommendations.

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

.4 Cleaning and Waste Management in accordance with Section 01 74 00.

1.4 SITE CONDITIONS

.1 Maintain temperature minimum 10°C, maximum 21°C for 48 hours prior to and during application of gypsum boards and joint treatment, and for at least 48 hours after completion of joint treatment.

.2 Apply board and joint treatment to dry, frost-free surfaces.

.3 Ventilate building spaces as required to remove excess moisture that would prevent drying of joint treatment material immediately after its application.

Part 2 Products

2.1 MATERIALS

.1 Non-rated Gypsum Board: to ASTM C1396/C1396M, 16 mm thick unless otherwise indicated, 1220 mm wide x maximum practical length, ends square factory cut, edges tapered.

.2 Fire-rated Gypsum Board: to ASTM C1396/C1396M and ASTM E136, Type X, 16 mm thick unless otherwise indicated, 1220 mm wide x maximum practical length, ends square factory cut, edges tapered.

.3 Non-rated and Fire-rated Water/Mould-resistant Gypsum Board: to ASTM C1396/C1396M and ASTM D3273, 16 mm thick unless otherwise indicated, 1220 mm wide x maximum practical length, ends square factory cut, edges tapered, water resistant through core, paintable surface.

.4 Exterior Fibreglass-Faced Gypsum Board Sheathing: to ASTM C1177/C1177M and ASTM D3273, 13 mm thick moisture and mould-resistant gypsum core with inorganic glass matt facing both sides and long edges, ends square factory cut.

.5 Tile Backer Board: to ASTM C1178/C1178M, ASTM C1278/C1278M and ASTM D3273, 16 mm fiber-reinforced gypsum panel that provides strength and water resistance as well as superior tile bond for ceramic tile, 1220 mm wide x maximum practical length, ends square factory cut, edges tapered, water resistant through core, paintable surface.

.6 Cement Board Sheathing: to ASTM C1325 and ASTM D3273, 16 mm thick Portland cement board with fully embedded alkali resistant glass-fibre mesh facing, 1220 mm wide x maximum practical length, ends square factory cut.

2.2 ACCESSORIES

.1 Gypsum Board Fasteners: self-drilling screws to ASTM C954.

.2 Fasteners for Exterior Fibreglass-Faced Gypsum Board Sheathing: to ASTM C1280.

.3 Fasteners for Cement Board Sheathing: 32 mm No. 8 x 9.5 mm HD self-drilling corrosion resistant (stainless steel or galvanized to ASTM A123/A123M) wafer head screws in accordance with ASTM C1186, unless otherwise recommended by cement board manufacturer.

.4 Joint Tape: to ASTM C475, 51 mm wide, high strength, coated, alkali-resistant, glass fiber reinforcing tape.

.5 Standard Joint Compound: to ASTM C475/C475M, asbestos-free.

.6 Mould Resistant Joint Compound: to ASTM C475/C475M, asbestos-free, mould-resistant.

.7 Metal Corner Beads: roll formed from 0.40 mm (18-gauge) thick cold formed galvanized steel, beading angle, flange length as required.

.8 Metal Casing Beads: roll formed from 0.40 mm (28-gauge) thick cold formed galvanized steel, type “L” or “J” as required, beading angle or casing with one side knurled for joint filling.

.9 Paper Faced Metal Corner and Casing Beads: roll formed flanges from 0.40 mm (28-gauge) thick cold formed galvanized steel laminated to exposed paper tape.

.10 Furring Channels (Hat Shaped): roll formed from 0.49 mm (25-gauge) thick cold formed galvanized steel with knurled face to accept screw attachment of gypsum board.

.11 Resilient Channels (to reduce air-borne sound transmission): roll formed from 0.49 mm (25-gauge) thick cold formed galvanized steel.

.12 Ceiling Suspension Members.

- .1 Main Runners (Carrying Channels): 38 mm channels, roll formed from 1.5 mm (16-gauge) thick cold formed galvanized steel.
- .2 Cross Furring: hat-shaped furring channels, roll formed from 0.49 mm (25-gauge) thick cold formed galvanized steel with knurled face to accept screw attachment of gypsum board.
- .3 Tie Wire: saddle-tie cross furring channels to main runners with double strand of 1.2 mm (18-gauge) galvanized tie wire.
- .4 Hanger Wire: saddle-tie wire hangers around main runners with 4.1 mm (8-gauge) galvanized hanger wire.

.13 PVC Gypsum Board Control Joint: co-extruded flexible PVC to ASTM C1047, ASTM D3678 Class 2, and ASTM D1784, "V" joined flexible centre designed to provide a full 6 mm of protection against the stresses of expansion and contraction, Class A rating for flame spread and smoke developed when tested under ASTM E84.

.14 Access Doors (to mechanical and electrical systems): in accordance with Mechanical and Electrical Divisions.

.15 Thermal Insulation: in accordance with Section 07 21 00.

.16 Joint Sealants: in accordance with Section 07 92 00.

Part 3 Execution

3.1 INSTALLATION

.1 Gypsum Board.
- .1 Apply gypsum board in accordance with ASTM C840, ASTM C1280, GA 216, and GA 253.
- .2 Do not apply gypsum board until bucks, anchors, blocking, electrical and mechanical work are approved.
- .3 Apply single and double layer gypsum board to metal furring or framing using screw fasteners. Spacing and length of fasteners in accordance with manufacturer's written instructions.
- .4 Apply fire rated gypsum board to metal furring or framing using screw fasteners. Spacing and length of fasteners in accordance with manufacturer's written instructions to obtain required fire rated assemblies.
- .5 Install moisture/mould-resistant gypsum board on partial wall surfaces containing plumbing fixtures and tile backerboard where indicated.

.2 Exterior Fibreglass-faced Gypsum Board.
- .1 Install exterior fibreglass-faced gypsum board sheathing to metal furring or metal framing in accordance with manufacturer's printed instructions.
  - .1 Apply using screw fasteners in accordance with ASTM C1280.
  - .2 Space fasteners 200 mm on-centre at perimeter and 200 mm on-centre along intermediate framing.
  - .3 Locate fasteners not less than 10 mm from edges and ends of sheathing panels.
  - .4 Length of fasteners in accordance with ASTM C1280.
  - .5 Fasteners must be driven so as to bear tight against and flush with surface of sheathing. Fasteners must NOT be countersunk.

.3 Cement Board Sheathing.
- .1 Install cement board sheathing to metal framing using screw fasteners in accordance with ASTM C1186.
- .2 Space fasteners 150 mm on-centre at perimeter and 150 mm on-centre along intermediate framing.
- .3 Locate fasteners not less than 10 mm from edges and ends of sheathing panels.
- .4 Length of fasteners in accordance with ASTM C1186.
- .5 Fasteners must be driven so as to bear tight against and flush with surface of sheathing. Fasteners must NOT be countersunk.

.4 Suspended and Furred Ceilings.
- .1 Erect hangers and runner channels for suspended gypsum board ceilings to ASTM C840.
- .2 Support light fixtures by providing additional ceiling suspension hangers within 150 mm of each corner and at maximum 600 mm around perimeter of fixture.
- .3 Install work level to tolerance of 1:1200.

.4 Frame for furring channels, perimeter of openings for access panels, light fixtures, diffusers and grilles.
.5 Install 22 x 64 mm furring channels parallel to, and at exact locations of steel stud partition header track.
.6 Furr for gypsum board faced vertical bulkheads as detailed.

.5 Wall Furring.
.1 Install wall furring for gypsum board wall finishes to ASTM C840.
.2 Furr openings and around built-in equipment, cabinets, access panels, on four sides. Extend furring into reveals. Check clearances with equipment suppliers.
.3 Furr duct shafts, beams, columns, pipes and exposed services where indicated.

.6 Control Joints.
.1 Construct control joints of preformed units as specified set in gypsum board facing and supported independently on both sides of joint.
.2 Locate control joints at 7315 mm on-centre horizontally and vertically on walls and ceilings unless otherwise indicated.
.3 Install control joints straight and true.

.7 Accessories.
.1 Erect accessories straight, plumb or level, rigid and at proper plane. Use full-length pieces where practical. Make joints tight, accurately aligned and rigidly secured. Mitre and fit corners accurately, free from rough edges. Secure at 150 mm o.c.
.2 Install casing beads where gypsum board butts against surfaces having no trim concealing junction and where indicated. Seal joint with sealant.
.3 Apply 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 cutouts around electrical boxes and ducts in partitions where perimeter sealed with acoustic sealant.
.4 Install access doors to electrical and mechanical fixtures specified in respective sections. Rigidly secure access door frames to furring or framing systems.

3.2 CONSTRUCTION

.1 Gypsum Board Finish Levels: to GA 214 and GA 216, except use mould-resistant joint compound on moisture/mould-resistant gypsum board, and as follows:
.1 Level 1: Embed tape at joints in ceiling plenum areas, concealed areas and where indicated unless higher level of finish is required for fire resistance rated and sound rated assemblies.
.2 Level 2: Embed tape and apply separate first coat of joint compound to tape, fasteners and trim flanges where indicated.
.3 Level 3: Embed tape and apply separate first and fill coats of joint compound to tape, fasteners and trim flanges where indicated and for surfaces receiving medium-or heavy-textured finishes before painting or heavy wallcoverings where lighting conditions are not critical.
.4 Level 4 (typical): Embed tape and apply separate first, fill, and finish coats of joint compound to tape, fasteners and trim flanges.
.5 Level 5: Embed tape and apply separate first, fill, and finish coats of joint compound to tape, fasteners and trim flanges, and apply skim coat of joint compound over entire surface where indicated and for surfaces to receive gloss or semi-gloss paint finish and surfaces subject to severe lighting.

.2 Taping and Filling.
.1 Finish corner beads and trim as required with two coats of joint compound and one coat of taping compound, feathered out onto panel faces.

.2 Fill screw head depressions with joint and taping compounds to bring flush with adjacent surface of gypsum board so as to be invisible after surface finish is completed.

.3 Sand lightly to remove burred edges and other imperfections. Avoid sanding adjacent surface of board.

.4 Completed installation to be smooth, level or plumb, free from waves and other defects and ready for surface finish.

.5 Finished work smooth, seamless, plumb, true and flush with square, neat corners.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 09 06 00.13 – Room Finish Schedule.

.2 Section 09 65 00 – Resilient Flooring.

1.2 REFERENCES

.1 American Society for Testing and Materials (ASTM).
- .1 ASTM C485-16, Standard Test Method for Measuring Warpage of Ceramic Tile.
- .2 ASTM C627-18, Standard Test Method for Evaluating Ceramic Floor Tile Installation Systems Using the Robinson-Type Floor Tester.
- .3 ASTM C1028-07e1, 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 ASTM D638-14, Standard Test Method for Tensile Properties of Plastics.
- .5 ASTM E96/E96M-16, Standard Test Methods for Water Vapor Transmission of Materials

.2 American National Standards Institute (ANSI).
- .1 ANSI A108/A118/A136.1-2017, American National Standards Specifications for Installation of Ceramic Tile.
- .2 ANSI A137.1-2017, American National Standards Specifications for Ceramic Tile.

.3 Terrazzo Tile and Marble Association of Canada (TTMAC).
- .1 2016-2017 Specification Guide 09 30 00 Tile Installation Manual.

1.3 SUBMITTALS

.1 Samples.
- .1 Submit samples in accordance with Section 01 33 00.
- .2 Submit sample each colour, texture, size, and pattern of tile and colour matching grout for approval.

.2 Closeout Submittals.
- .1 Submit operation and maintenance data for incorporation into Maintenance and Warranty Manual specified in Section 01 78 00.

1.4 DELIVERY, STORAGE, AND HANDLING

.1 Deliver all material to site in manufacturer’s original unopened packaging with labels clearly identifying product name and manufacturer.

.2 Store materials in a dry, enclosed area protected from exposure to moisture, construction activity, and direct sunlight in strict accordance with manufacturer's recommendations.

.3 Handle all products with appropriate precautions and care as stated manufacturer's instructions to avoid chipping edges or damaging units in any way.

.4 Waste Management and Disposal: in accordance with Section 01 74 00.

1.5 SITE CONDITIONS

.1 Comply with requirements of WHMIS regarding use, handling, storage, and disposal of hazardous materials.

.2 Provide continuous ventilation during and after ceramic tile installation. Run ventilation system 24 hours per day during installation and provide continuous ventilation and for 48 to 72 hours after installation. Do not let contaminated air re-circulate through existing building air distribution system.

1.6 MAINTENANCE

.1 Comply with requirements of Section 01 78 00.

.2 Provide maintenance materials as follows:

.1 Porcelain Floor Tile Units and Adhesive: supply quantity of full-size units equal to 5% of amount installed for each type of unit. Provide can of adhesive of quantity sufficient to install maintenance materials.

.3 Maintenance materials to be from same production run as installed materials.

Part 2 Products

2.1 MANUFACTURERS

.1 Basis of Design Products.

.1 Porcelain Tile (PT).

.1 PT1: Ames Tile and Stone, Nextone Series, 12” x 24”, Matt, through coloured body porcelain tile, colour: one (1) colour to be selected.

.2 PT2/PT3: Ames Tile and Stone, Nextone Series, 12” x 24”, Line Pattern, through coloured body porcelain tile, colours: up to two (2) colours to be selected.

.2 Waterproofing and Crack Prevention Membrane (shower only).

.1 Custom Building Products, RedGard Waterproofing and Crack Prevention Membrane including Custom building Products waterproofing accessories (tape and mesh) at coves, corners, cracks and floor drains.

.3 Uncoupling Membrane.

.1 Schluter Systems Canada Inc., Ditra.

.4 Edge Strip (at all exposed tile edge installations on wall application, including top of base where exposed)

.1 Schluter Systems Canada Inc., Schiene-EB, Brushed Stainless Steel finish.

.5 Corner Trim (wall tile to wall tile outside corner transition)

.1 Schluter Systems Canada Inc., Quadec-EB, Brushed Stainless Steel finish c/w matching connectors as required.

.6 Transition Strip (PT to LVT finish and PT to Concrete finish).

.1 Profilitec, Ramptec ZRR.

.7 Coved Transition (floor tile to wall tile).

.1 Schluter Systems Canada Inc., Dilex-HKS, coved transition piece c/w all connection and corner pieces as required.

.8 Surface Joint.

.1 Schluter Systems Canada Inc., Dilex-AKWS, aluminum surface joint, PVC colour to selected by Consultant from manufacturer’s full colour range.

.2 Requests for substitutions will be considered subject to specified requirements and in accordance with Bidding Procedures B8.

.3 Supply similar products from single manufacturer or production run.

2.2 MATERIALS

.1 Porcelain Tile (PT): to ANSI A137.1, ASTM C485 and ASTM C1028. 100 mm high base of same material unless indicated otherwise.

.2 Self-Levelling Underlayment: Latex-modified, portland cement-based, as recommended by tile-setting manufacturer.

.3 Waterproofing and Crack Prevention Membrane (shower only): premixed elastomeric waterproofing and crack prevention membrane to ANSI A108/A118/A136.1, ASTM C627, ASTM D638 and E96/E96M for installation under porcelain floor tile complete with purpose made waterproofing tape and mesh at coves, corners, drains and cracks.

.4 Uncoupling Membrane: 3 mm thick, orange, high-density polyethylene membrane with grid structure of 12 mm x 12 mm square dovetail configured cavities and a polypropylene anchoring fleece laminated to its underside, load bearing, bonded, waterproof membranes for thin-set ceramic tile in accordance with ANSI A108/A118/A136.1. Conforms to uncoupling membrane in accordance with TCNA Handbook for Ceramic, Glass, and Stone Tile Installation.

.5 Mortar.
- .1 Wall Tile Mortar: Modified non-sagging dry-set lightweight cement mortar complying with ANSI A108/A118/A136.1 and ISO 13007 C2TES1P1.
- .2 Floor Tile Mortar: Improved modified dry-set cement mortar, fast setting non-sagging for large and heavy tile thin-set applications, complying with ANSI A108/A118/A136.1 and ISO 13007 C2TFS1P1.

.6 Tile Grout.
- .1 Polymer-Modified Grout: Fast-setting, sanded polymer-modified grout, complying with ANSI A118.6, ANSI A118.7 and ISO 13007 CG2WAF.
  - .1 Colour(s): selected by Consultant from manufacturer's standard range.
- .2 Epoxy Grout: to ISO 13007 classification R2T/RG, ANSI A118.3, two-component, 100% solid, water-cleanable, non-sagging, epoxy grout, chemical- and stain-resistant.
  - .1 Colour(s): selected by Consultant from manufacturer's standard range.

.7 Water: potable, clean, and free of chemicals and contaminants detrimental to mortar or grout mixes.

.8 Edge Strip: stainless steel profile consisting of a trapezoid-perforated anchoring leg which is secured in the mortar bond coat beneath the tile for outside installation at all horizontal and vertical exposed edges of tile on wall applications, including top of base.

.9 Corner Trim: stainless steel profile consisting of a trapezoid-perforated anchoring leg that is secured in the mortar bond coat beneath the tile and a reveal that forms a square outer corner along the surface edge.

.10 Transition Strip: Anodized aluminum profile consisting of a trapezoid-perforated anchoring leg which is secured in the mortar bond coat beneath the tile, and a profile with 20° sloped exposed surface. Sized to suit installation.

.11 Coved Transition (floor tile to wall tile): roll formed stainless steel profile with integrated trapezoid-perforated anchoring leg, connected at a 90° angle by a cove-shaped section with radius that forms the visible surface, including all applicable corner pieces.

.12 Surface Joint: Anodized aluminum profile consisting of a trapezoid-perforated anchoring legs which are secured in the mortar bond coat beneath the tiles complete with soft PVC movement zone.

.13 Joint Sealants: in accordance with Section 07 92 00.

Part 3 Execution

3.1 PREPARATION

.1 Ensure surfaces are plum, level, true with square corners, smooth and dry, free of paint, grease, sealers, irregularities or loose material, and meet all requirements listed in TTMAC Tile Specification Guide and ANSI A108/A118/A136.1.

.2 Ensure floor tile conforms to ANSI A137.1 and has a warpage edge of no more than 1.3 mm. Contractor to inspect tiles on site prior to installation, for warpage and other deformations to ensure compliance with lippage tolerance as specified for all tile installation patterns as indicated.

.3 Work penetrating substrate to be completed before installing ceramic tile.

.4 Seal and prime wall surface to receive ceramic tile in accordance with manufacturer's instructions.

.5 Notify Consultant in writing of unacceptable substrate conditions. Beginning of installation implies acceptance of existing conditions.

3.2 INSTALLATION

.1 Install all tile work in accordance with TTMAC Tile Specification Guide, ANSI A108/A118/A136.1, and manufacturer's printed instructions.

.2 Lay out all tilework according to drawings and patterns so that perimeter and all cut tiles are no less than one half in size and locate cuts so as to be least conspicuous.

.3 Align all joints to give straight grout lines parallel to walls. Make internal angles square, external angles bullnosed.

.4 Place edge strips at exposed tile edges unless otherwise indicated.

.5 All joint widths to be maximum 3 mm unless noted otherwise.

.6 Fit tile around corners, fitments, fixtures, and other built-in objects to maintain uniform joint appearance. Make cut edges smooth, even and free from chipping. Edges resulting from splitting not acceptable.

.7 For tile with raised or textured backs, bonding material must be pressed into back of tile to ensure min. of 95% coverage. Set tile in place while bond coat is wet and tacky, prior to skinning over. Slide tile back and forth to ensure proper bond and level surface. Avoid lippage by leveling tiles to conform to 1 mm tolerance over 3 mm joint. Backbutter as required, to ensure 95% bond coverage (backbutter by applying adhesive to back of tile using flat edge of trowel). Clean backs of tiles to ensure proper bonding. Clean excess mortar from surface, prior to mortar setting. Sound tiles after setting and replace any hollow sounding tiles before grouting.

.8 When appropriate, mix tiles from several boxes prior to installation to assure that colour variations from tile to tile are evenly distributed throughout field.

.9 Follow grout manufacturer's recommendations as to grouting procedures and precautions.

.10 Test grout on sample of tile prior to installation to determine need for special sealers, grout releases, or cleaning procedures.

.11 Clean all surfaces after completion of grouting and remove any grout haze.

3.3 PROTECTION

.1 Protect wall tiles and bases from impact, vibration, heavy hammering on adjacent and opposite walls for at least 14 calendar days after installation.

3.4 SCHEDULES

.1 Refer to Section 09 06 00.13.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 06 10 00 – Rough Carpentry.

.2 Section 09 29 00 – Gypsum Board.

.3 Section 09 54 26 – Linear Wood Ceilings.

1.2 REFERENCE

.1 American Society for Testing and Materials (ASTM).
- .1 ASTM A641/A641M-09a(2014), Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire.
- .2 ASTM A653/A653M-17, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- .3 ASTM C423-17, Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.
- .4 ASTM C635/C635M-17, Standard Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings.
- .5 ASTM C636/C636M-13, Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels.
- .6 ASTM D1037-12, Standard Test Methods for Evaluating Properties of Wood-Base Fiber and Particle Panel Materials.
- .7 ASTM D2486-17, Standard Test Methods for Scrub Resistance of Wall Paints.
- .8 ASTM D3273-16, Standard Test Method for Resistance to Growth of Mould on the Surface of Interior Coatings in an Environmental Chamber.
- .9 ASTM D4828-94(2016), Standard Test Methods for Practical Washability of Organic Coatings.
- .10 ASTM E84-17, Standard Test Method for Surface Burning Characteristics of Building Materials.
- .11 ASTM E1264-14, Standard Classification for Acoustical Ceiling Products.
- .12 ASTM E1414/E1414M-16, Standard Test Method for Airborne Sound Attenuation Between Rooms Sharing a Common Ceiling Plenum.
- .13 ASTM E1477-98a(2017), Standard Test Method for Luminous Reflectance Factor of Acoustical Materials by Use of Integrating-Sphere Reflectometers.

.2 Underwriters Laboratories of Canada (ULC).
- .1 CAN/ULC-S102-10, Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.

1.3 SYSTEM DESCRIPTION

.1 Design Requirements.
- .1 Maximum deflection: 1/360th of span to ASTM C635 deflection test.

1.4 SUBMITTALS

.1 Shop Drawings.
- .1 Submit shop drawings in accordance with Section 01 33 00.
- .2 Indicate lay-out, insert and hanger spacing and fastening details, splicing method for main and cross runners, and acoustic unit support at ceiling fixture.

.2 Samples.
- .1 Submit samples in accordance with Section 01 33 00.
- .2 Submit 150 mm x 150 mm sample of each type of acoustical units.

.3 Submit 200 mm length of each type of wall moulding and suspension system including main runner and cross tee.

.4 Submit 200 mm length of each type of perimeter trim.

.3 Closeout Submittals.

.1 Provide maintenance data for incorporation into Operation and Maintenance Manual specified in Section 01 78 00.

1.5 QUALITY ASSURANCE

.1 Single-source responsibility: provide acoustical panel units and grid components by single manufacturer.

.2 Surface Burning Characteristics: identify acoustical ceiling components with appropriate markings of applicable testing and inspecting organization.

.1 Surface Burning Characteristics: tested per ASTM E84 and complying with CAN/ULC-S102 and ASTM E1264 for Class A products, Flame Spread 25 or less, Smoke Developed 50 or less (UL labeled).

1.6 DELIVERY, STORAGE, AND HANDLING

.1 Deliver all material to site in manufacturer’s original unopened packaging with labels clearly identifying product name and manufacturer.

.2 Store materials in a dry, enclosed area protected from exposure to moisture, construction activity, and direct sunlight in strict accordance with manufacturer's recommendations.

.3 Handle all products with appropriate precautions and care as stated manufacturer's instructions to avoid chipping edges or damaging units in any way.

.4 Cleaning and Waste Management in accordance with Sections 01 74 00.

1.7 SITE CONDITIONS

.1 Permit wet work to dry before commencement of installation.

.2 Maintain uniform minimum temperature of 15°C and humidity of 20 - 40% before, during and after installation.

.3 Store materials in work area 48 hours prior to installation.

1.8 SEQUENCING

.1 Co-ordinate ceiling work to accommodate components of other sections including, but not limited to gypsum board, mechanical systems, electrical systems, diffusers, speakers, and light fixtures.

1.9 WARRANTY

.1 Manufacturer’s Product Warranty: provide an extended warranty for Work of this Section for a period of 30 years from date of Substantial Performance of the Work. Manufacturer hereby warrants acoustical ceilings to be free of manufacturing and material defects, and these or other observed defects and deficiencies will be repaired or replaced to the satisfaction of the Consultant and the City, and at no expense to the City. Failures include, but are not limited to:

.1 Acoustical Panels: visible sag, mould/mildew & bacteria.

.2 Grid System: rusting and manufacturer’s defects.

1.10 MAINTENANCE

.1 Comply with requirements of Section 01 78 00.

.2 Provide maintenance materials as follows:
- .1 Acoustical Ceiling Units: supply quantity of full-size units equal to 5% of amount installed for each type of unit.
- .2 Exposed Suspension System Components: supply quantity of each exposed suspension component equal to 2% of amount installed.

.3 Maintenance materials to be from same production run as installed materials.

Part 2 Products

2.1 MANUFACTURERS

.1 Basis of Design Products.

- .1 Wood Grille Ceiling System Suspension (LWCS). Refer to Section 09 54 26.
  - .1 Heavy Duty T-Grid Suspension System.
    - .1 Armstrong Prelude XL 15/16", Black.
    - .2 CGC Donn DX/DXL26 (Custom Colour Black).
    - .3 Attachment system shall allow for ceiling access to service mechanical, electrical and plumbing equipment.
- .2 Acoustical Ceiling System (ACS).
  - .1 Suspension System.
    - .1 Armstrong Prelude XL 15/16", White.
    - .2 CGC Donn DX/DXL 15/16”, White.
  - .2 Acoustic Unit.
    - .1 Armstrong Ultima 1914.
    - .2 CGC Mars High-CAC #88785.

.2 Requests for substitutions will be considered subject to specified requirements and in accordance with Bidding Procedures B8.

.3 Supply similar products from single manufacturer.

.4 Supply all products from same dye lot or production run.

2.2 MATERIALS

.1 Linear Wood Ceiling System Suspension (LWCS). Refer to Section 09 54 26.
- .1 All main beams and cross tees (supporting suspended wood ceiling system): commercial quality hot-dipped galvanized steel to ASTM A653/A653M, double-web steel construction with 15/16" exposed flange design, exposed surfaces chemically cleansed, capping pre-finished galvanized steel in baked polyester paint, rotary stitching.
  - .1 Structural Classification: ASTM C635/C635M Heavy Duty.
  - .2 Colour: black.

.2 Acoustical Ceiling System (ACS).
- .1 Non-Rated Suspension System (Typical).
  - .1 All main beams and cross tees: commercial quality hot-dipped galvanized steel to ASTM A653/A653M, double-web steel construction with 15/16" exposed flange design, exposed surfaces chemically cleansed, capping pre-finished galvanized steel in baked polyester paint, rotary stitching.
    - .1 Structural Classification: ASTM C635/C635M Intermediate duty.
    - .2 Colour: white.
- .2 Acoustic Unit.
  - .1 Classification: Type IV, Form 2, Pattern E to ASTM E1264.
  - .2 Surface Texture: fine texture.

.3 Composition: wet-formed mineral fibre.
.4 Noise Reduction Coefficient (NRC): 0.75 to ASTM C423.
.5 Ceiling Attenuation Class (CAC): 35to ASTM E1414.
.6 Light reflectance (LR): 90% to ASTM E1477.
.7 Edge Type: bevelled tegular
.8 Colour: white.
.9 Size: 610 mm x 2440 mm x 19 mm thick.
.10 Shape: flat.
.11 Fire Resistance:
  .1 Flame Spread Index: 25 or less.
  .2 Smoke Developed Index: 50 or less.
.12 Surface Finish: factory-applied latex paint.
.13 Antimicrobial Treatment: guaranteed resistance against growth of mould/mildew and bacteria to ASTM D3273.
.14 Dimensional Stability: superior resistance to sagging in high humidity conditions up to but not including standing water and outdoor applications.
.15 Formaldehyde: low formaldehyde.

2.3 ACCESSORIES

.1 Edge and Shadow Mouldings and Trim: manufacturer's standard metal mouldings of types and profiles for edges and penetrations, including light fixtures, that fit type of edge detail and suspension system indicated. Provide mouldings with exposed flange of same width as exposed runner.

.2 Attachment Devices: size for 5 times design load indicated in ASTM C635, Table 1, Direct Hung unless otherwise indicated.

.3 Wire for Hangers and Ties: ASTM A641/A641M, Class 1 zinc coating, soft temper, pre-stretched, with yield stress load of at least 3 times design load, but not less than 12-gauge (0.106") diameter.

2.4 FABRICATION

.1 Fabricate acoustical units for suspended ceiling system to ASTM E1264.

Part 3 Execution

3.1 EXAMINATION

.1 Do not install acoustic tiles in ceiling suspension system until work above ceiling has been inspected by Consultant.

.2 Do not proceed with installation until all wet work such as painting has been completed and thoroughly dried out.

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. Co-ordinate panel layout with mechanical, electrical, and sprinkler fixtures.

3.3 INSTALLATION

.1 Install suspension system and panels in accordance with manufacturer's written instructions, and in compliance with ASTM C636/C636M and with authorities having jurisdiction.

.2 Suspend main beam from overhead construction with hanger wires spaced 1220 mm on centre along length of main runner and within 150 mm of ends. Install hanger wires plumb and straight spaced.

.3 Install wall mouldings at intersection of suspended ceiling, vertical surfaces, and lay-in diffusers. Miter corners where wall mouldings intersect or install corner caps.

.4 Install acoustical panels in co-ordination 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 mouldings.

.5 Install trim and mouldings in accordance with manufacturer's written instructions.

3.4 ADJUSTING AND CLEANING

.1 Replace damaged and broken panels.

.2 Clean exposed surfaces of acoustical ceiling, including trim, edge mouldings, and suspension members. Comply with manufacturer's instructions for cleaning and touch-up of minor finish damage. Remove and replace work that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 06 10 00 – Rough Carpentry

.2 Section 06 40 00 – Architectural Woodwork.

.3 Section 09 51 00 – Acoustical Ceilings.

1.2 REFERENCES

.1 American Society for Testing and Materials (ASTM).
- .1 ASTM C635/C635M-13a, Standard Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings.
- .2 ASTM C1071-16, Standard Specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material).

.2 Architectural Woodwork Manufacturers Association of Canada (AWMAC) / Woodwork Institute (WI).
- .1 North American Architectural Woodwork Standards (NAAWS), Edition 3.1, 2017.

.3 Underwriters Laboratories of Canada (ULC).
- .1 CAN/ULC S102-10, Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.

1.3 SUBMITTALS

.1 Shop Drawings.
- .1 Indicate construction details including typical and special installation conditions, materials being supplied and all connections, attachments, anchorage and location of exposed fastenings, as applicable.
- .2 Indicate dimensions, description of materials and finishes, material thicknesses, general construction, specific modifications, component connections, anchorage methods, hardware, and installation procedures, plus the following specific requirements:
  - .1 Include section drawings of typical and special millwork, work surfaces and accessories.
  - .2 Indicate locations of plumbing and electrical service field connection by others.
- .3 Submit manufacturer's descriptive literature of specialty items not manufactured by Contractor.

.2 Samples.
- .1 Provide duplicate 625 cm² finished samples of each finish to be applied at factory.
- .2 Submit samples of each type of hardware specified when requested by Consultant. Identify each sample by label indicating applicable specification paragraph number, brand name and number, finish and hardware package number.
- .3 When approved, samples serve as standard for workmanship and appearance for similar items throughout project.

1.4 QUALITY ASSURANCE

.1 Single Source Responsibility.
- .1 Single-Source Responsibility for Panel Systems: panel system shall be obtained from a single fabricator of that particular type of system, with in-house shop drawing capabilities, in-house assembly and finishing capabilities, and with resources to provide products of consistent quality in appearance and physical properties without delaying the project.

.2 Single-Source Responsibility for Suspension System: obtain each type of suspension system from a single source with resources to provide products of consistent quality in appearance and physical properties without delaying project.

.2 Qualifications.
.1 Installer Qualifications: skilled tradesman to be employed by specialty company recognized and trained as approved installer by manufacturer, normally engaged in this type of work with minimum three (3) years' experience on projects of similar size, requirements and complexity.

.3 Regulatory Requirements.
.1 Fire Test Response Characteristics: provide wood ceiling components that meet CAN/ULC-S102 Flame Spread Rating 25 or less, Smoke Developed Classification 50 or less.
.2 Materials provided shall be identical to materials tested.
.3 Test shall be based on current edition.
.4 Product shall be tested as a composite assembly.

.4 Mock-ups.
.1 Prepare mock-up of suspended wood ceiling system installation in accordance with Section 01 45 00.
.2 Locate mock-up on site in pre-determined location as part of final installation.
.3 Co-ordinate with suspended lighting and sprinkler heads.
.4 Mock-up will be reviewed for quality of workmanship and overall appearance.
.5 Once approved, mock-up will set standard of acceptance for remaining installations.

.5 Pre-installation Meeting.
.1 Convene pre-installation meeting prior installation of suspended wood ceiling panels. Required attendance of parties directly affecting work of this Section to include Contractor, and Consultant. Review system requirements, mock-ups, installation procedures, and co-ordination with other work.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Maintain relative humidity during fabrication, storage and installation of architectural woodwork between 35% and 55% at 21°C in order to keep unfinished interior wood at satisfactory moisture level.

.2 Complete all wet-work, including installation of windows and doors before unpackaging and installation. Handle carefully to avoid damaging.

.3 Transport, handle or store assembled architectural woodwork and/or their component parts in manner to preclude damage of any kind.
.1 Do not subject items to abnormal heat, extreme dryness, humid conditions, sudden changes in temperature, or direct sunlight.
.2 Store items on level surface in area with proper humidity control and ventilation to prevent wetting and/or other damage.

1.6 MAINTENANCE

.1 Comply with requirements of Section 01 78 00.

.2 Provide maintenance materials as follows:
.1 Suspended Linear Wood Ceiling System (LWCS): 2% of the ceiling area for each type installed.
.2 Suspension System Components: furnish quantity of each component equal to 2% of amount installed.

.3 Maintenance materials to be from same production run as installed materials.

1.7 SEQUENCING

.1 Co-ordinate ceiling work to accommodate components of other Sections including, but not limited to mechanical systems, electrical systems, diffusers, speakers, and light fixtures.

1.8 WARRANTY

.1 Provide an extended warranty for Work of this Section for a period of one (1) year from date of Substantial Performance of the Work. Contractor hereby warrants that linear wood ceiling system will not warp, twist, show core lines, split, sag, and these or other observed defects and deficiencies will be repaired or replaced to the satisfaction of the Consultant and the City, and at no expense to the City.

Part 2 Products

2.1 MANUFACTURERS

.1 Basis of Design Products:

- .1 Linear Wood Ceiling System (LWCS).
  - .1 Architectural Components Group, Inc., Product #L03-325-C Linear Open Series 3, Panelized Wood Ceiling System.
- .2 Linear Wood Wall System (WWS).
  - .1 Same as WCS above.

.2 Requests for substitutions will be considered subject to specified requirements and in accordance with Bidding Procedures B8.

.3 Supply product from a single manufacturer.

.4 Supply all products from same dye lot or production run.

2.2 MATERIALS

.1 Linear Wood Ceiling System (LWCS): Wood plank ceiling panels on heavy-duty suspension system.

- .1 Wood: white oak, rift cut, slip matched, veneer edge banded and in accordance with North American Architectural Woodwork Standards (NAAWS).
- .2 Finish: factory finished, clear satin finish, low VOC.
- .3 Panel Size: 305 mm wide x minimum 3050 mm long.
- .4 Blades: One continuous length, no finger joints.
- .5 Plank Size: 83 mm wide x 19 mm thick.
- .6 Blade Spacing: 19 mm reveal space.
- .7 Backer: Cross wood backer, notched and screwed in place.
- .8 Scrim: Black.
- .9 Provide 25 mm thick duct liner behind panels for minimum 0.70 NRC, refer to Black-Faced Acoustic Liner below.
- .10 Fire Rating: meet CAN ULC-S102, flame spread rating of 25 or less, smoke developed classification of 50 or less; typical all components.
- .11 Fabricate to North American Architectural Woodwork Standards (NAAWS) Premium Grade.

.2 Linear Wood Wall System (WWS).

- .1 Same as LWCS above.

.3 Suspension System: heavy-duty suspension system as specified in accordance with Section 09 51 00 – Acoustical Ceilings.

- .1 Closure angle: as specified in Section 09 51 00 – Acoustical Tile Ceilings.

.4 Black-Face Acoustic Insulation: 25 mm thick flexible duct liner insulation made from strong glass fibers bonded with a thermosetting resin in accordance with ASTM C1071, surface protected with acrylic surface coating system for exceptional durability and superior acoustical and thermal performance, roll length and width to suit application.

2.3 ACCESSORIES

.1 Trim: trim and end panels to match wood panels.

.2 Hinged Access Panel: custom panel to match complete with 170° hinge and keyed lock. Refer to details.

.3 Touch-up: type and colour to match panels.

.4 Provide attachment clips as required for complete installation.

Part 3 Execution

3.1 PREPARATION

.1 Examine substrates and structural framing to which ceiling attaches or abuts for compliance with requirements specified with this and other Sections that affect ceiling installation and anchorage. Verify that surfaces are ready to receive work.

.2 Do not proceed with installation until conditions have been corrected. Beginning of installation means acceptance of site conditions.

.3 Measure each ceiling area and establish the layout of wood ceiling system and conform to the layout shown on reflected ceiling plans in accordance with linear ceilings manufacturer's approved Shop Drawings. For custom factory cut to size panels, field dimension shall be verified prior to manufacture of wood ceiling system.

.4 Provide the layout for supports that shall be installed for suspension of ceilings. Provide concrete inserts, steel deck hanger clips, or similar devices for installation, in time to co-ordinate the work. Co-ordinate work of this Section with other construction elements that penetrates wood ceiling system; including light fixtures, HVAC equipment, fire-suppression system components, partitions assemblies and all perimeter conditions. The position of such elements shall be located and cut in the field.

3.2 INSTALLATION

.1 Suspension grid: Installer shall provide and install suspension system using main runners, cross-tees, wall angle or shadow mouldings of types, structural classifications, and black finishes indicated and that comply with applicable ASTM 635 requirements. A 12-gauge black wire hanger shall be installed at 1220 mm on centre along each main runner. All wire hangers are to be attached to an industry standard connecting device meeting recommended loading requirements (i.e., inserts, screw eyes, etc.). Set wire hangers back from view.

.2 Wood ceiling system shall be handled and installed with care in order to prevent surface and structure damage. Field cutting shall be kept to a minimum and performed as recommended by manufacturer.

.3 Fasten suspended wood ceiling system to heavy duty suspension system in accordance with reviewed shop drawings and manufacturer's printed instructions. Install true and plumb to within manufacturing tolerance of 3 mm within 2440 mm of length.

.4 Cut backer strips to accommodate light fixtures. Secure backer strips prior to cutting openings for light fixtures. Light fixtures and HVAC penetrations: all mechanical and electrical installations integral to the ceiling must be suspended and supported independently of all wood ceiling system elements.

.5 Install black-face acoustic insulation above entire area of wood ceiling system. Apply edge treatment to all site-cut edges and neatly abut insulation together to avoid cracks.

.6 Attach horizontal linear wood wall panels to furring strips with painted out (black) hidden fasteners and as detailed.

.7 Clean all wood ceiling systems prior to installation according to manufacturer's recommended maintenance procedures. Upon completion of installation, panels shall be inspected and cleaned as needed.

3.3 CLEANING

.1 Comply with manufacturer's written instructions for cleaning and touch-up of minor finish damage. Remove and replace work that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

.2 Where touch-up finishing is allowed at damages areas, the finish appearance must be acceptable to the Consultant.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 07 92 00 – Joint Sealants.

.2 Section 09 06 00.13 – Room Finish Schedule.

.3 Section 09 29 00 – Gypsum Board.

1.2 REFERENCES

.1 American Society for Testing and Materials (ASTM).
- .1 ASTM F710-17, Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring.
- .2 ASTM F970-17, Standard Test Method for Measuring Recovery Properties of Floor Coverings after Static Loading.
- .3 ASTM F1700-18a Standard Specification for Solid Vinyl Floor Tile.
- .4 ASTM F1861-16, Standard Specification for Resilient Wall Base.

.2 South Coast Air Quality Management District (SCAQMD).
- .1 Rule 1168 - Adhesive and Sealant Applications, 2005.

.3 Underwriters Laboratories of Canada (ULC).
- .1 CAN/ULC S101-14, Standard Methods of Fire Endurance Tests of Building Construction and Materials.
- .2 CAN/ULC S102-10, Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.
- .3 CAN/ULC S102.2-10, Standard Method of Test for Surface Burning Characteristics of Flooring, Floor Coverings, and Miscellaneous Materials and Assemblies.

1.3 SUBMITTALS

.1 Shop Drawings.
- .1 Submit shop drawings in accordance with Section 01 33 00.
- .2 Indicate locations and lengths of seams for all floor areas and other details required by Consultant to approve installation.

.2 Samples.
- .1 Submit samples in accordance with Section 01 33 00.
- .2 Submit one (1) 300 x 300 mm sample of each type of resilient flooring.

.3 Closeout Submittals.
- .1 Provide maintenance data for incorporation into Operation and Maintenance Manual specified in Section 01 78 00.

1.4 QUALITY ASSURANCE

.1 Qualifications.
- .1 Skilled tradesman to be employed by a specialty company recognized and trained as approved installer by manufacturer, normally engaged in this type of work with extensive experience in installation of products specified.

.2 Field Testing.

.1 Perform moisture and alkalinity tests prior to resilient flooring installation. Moisture content must not exceed the capacity of the manufacturer's recommended adhesive (verify using the anhydrous calcium chloride test as per ASTM F1869) and pH level should be in the range of 7 to 8.5.

.3 Mock-ups.

.1 Prepare mock-up of each resilient flooring installation in accordance with Section 01 45 00.

.2 Locate mock-up installation c/w seaming and coved base on site as part of final installation. Mock-up will be reviewed for workmanship, seam welding, base coving, and overall appearance.

.3 Once approved, mock-ups will set standard of acceptance for remaining installations.

1.5 DELIVERY, STORAGE, AND HANDLING

.1 Deliver all material to site in manufacturer's original unopened packaging with labels clearly identifying product name and manufacturer.

.2 Store materials in a dry, enclosed area protected from exposure to moisture, construction activity, and direct sunlight in strict accordance with manufacturer's recommendations.

.3 Handle all products with appropriate precautions and care as stated manufacturer's instructions.

.4 Cleaning and Waste Management in accordance with Section 01 74 00.

1.6 SITE CONDITIONS

.1 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of hazardous materials.

.2 Maintain air temperature and structural base temperature at flooring installation area above 20°C, and relative humidity between 10% and 30% for 48 hours before, during and 48 hours after installation.

.3 Provide continuous ventilation during and after resilient flooring installation. Run ventilation system 24 hours per day during installation and provide continuous ventilation and for 48 to 72 hours after installation. Do not let contaminated air re-circulate through existing building air distribution system.

1.7 WARRANTY

.1 Manufacturer's Product Warranty: provide an extended warranty for Work of this Section from date of Substantial Performance of the Work to term of warranty specified. Manufacturer hereby warrants resilient flooring and linoleum wall protection to be free of manufacturing and material defects subject to proper care and maintenance, and these or other observed defects and deficiencies will be repaired or replaced to the satisfaction of the Consultant and the City, and at no expense to the City.

.1 Luxury Vinyl Tile (LVT).

.1 15 years against manufacturing and material defects.

1.8 MAINTENANCE

.1 Comply with requirements of Section 01 78 00.

.2 Provide maintenance materials as follows:
- .1 Luxury Vinyl Tile (LVT): 5% of floor area for each type, colour and pattern of resilient flooring installed.
- .2 Adhesives: Sufficient volume to install maintenance materials but not less than unopened 1 litre can of each type of adhesive.

.3 Maintenance materials to be from same production run as installed materials.

Part 2 Products

2.1 MANUFACTURERS

.1 Basis of Design Products.
- .1 Luxury Vinyl Tile (LVT).
  - .1 Patcraft Commercial Flooring, Surface Tone Collection.

.2 Requests for substitutions will be considered subject to specified requirements and in accordance with Bidding Procedures B8.

.3 Supply similar products from single manufacturer and from same dye lot or production run.

2.2 MATERIALS

.1 Luxury Vinyl Tile (LVT): 229 mm x 915 mm x 5.0 mm total thickness, to ASTM F1700 Class III Type B, 0.5 mm wear layer and in accordance with ASTM F970, heat welded seams. Colour to be Confirmed with Consultant.

.2 Rubber base (R): to ASTM F1861, Type TP, Group 2, top set coved, 3 mm thick x 100 mm and 50 mm high x continuous lengths. Colour(s) to be confirmed with Consultant.

2.3 ACCESSORIES

.1 Welding Rods: manufacturer's standard, multi-colours and patterns to match resilient sheet flooring unless otherwise indicated.

.2 Metal Edge Strips: stainless steel, mill finish with lip to extend under floor finish, shoulder flush with top of adjacent floor finish.

.3 Vinyl Transition Strips, profile to suit floor material transitions from resilient flooring to carpet and resilient flooring to concrete.

.4 Subfloor Filler and Leveler: as recommended by flooring manufacturer for use with their product.

.5 Joint Sealants: in accordance with Section 07 92 00.

2.4 COLOURS

.1 Consultant may select multiple colours for resilient products from manufacturer's entire selection. For each product specified, not more than two (2) colours will be selected per room or area.

.2 Consultant may select multiple colours for accessories to coordinate or contrast with resilient flooring.

Part 3 Execution

3.1 EXAMINATION

.1 Installation of resilient flooring not to be carried sooner than the specified curing time of concrete subfloor (normal density concrete curing time is approximately 28 days for development of design strength).

.2 Smooth, dense concrete finish, highly compacted with a tolerance of 3 mm in 3 m radius to be observed prior to installation of resilient flooring.

.3 Notify Consultant in writing of any adverse floor conditions prior to start of work. Do not proceed until defects are corrected.

3.2 PREPARATION

.1 Sub-floor preparation is to include all required work to prepare floor for installation of products specified in this Section and meet all conditions as specified in manufacturer's current printed subfloor preparation guidelines.

.2 Materials used in sub-floor preparation and repair to be as recommended by resilient flooring manufacturer and chemically and physically compatible with resilient flooring product.

.3 Floors to be clean, dry, smooth, level, structurally sound and free from moisture, alkali, dust, solvents, paint, wax, oil, grease, asphalt adhesive, sealing compounds and other contaminants in accordance with ASTM F710.

.4 Remove sub-floor ridges and bumps that would transmit through flooring materials and affect installation in accordance with ASTM F710.

.5 Fill low spots, cracks, joints, holes and other defects with sub-floor filler approved by resilient flooring manufacturer, prior to commencement of installation of flooring materials. Thickness of filler to ensure flat floor and that installation of resilient flooring against adjacent materials (lippage) does not exceed difference of 1 mm. Steel trowel and float to leave smooth, flat, hard surface. Prohibit traffic until filler is cured and dry.

.6 Prime concrete as required to flooring manufacturer's printed instructions and in accordance with ASTM F710.

.7 Vacuum all areas to be covered with resilient flooring immediately prior to spreading adhesive.

3.3 INSTALLATION

.1 Luxury Vinyl Tile (LVT).

.1 Install luxury vinyl tile flooring in accordance with manufacturer's current printed installation manual or guidelines.

.2 Lay tiles by finding the centre of the floor by marking vertical & horizontal lines across the floors at the center of the walls. Measure the squareness of the marked lines, and then begin to work from the center outwards, leaving a 3 mm expansion gap along the perimeter between the flooring & walls.

.3 Scribe and fit tightly to door frames. Seal at edge of door frames with small, neat, continuous bead of caulking. Cut flooring and fit neatly around fixed objects.

.4 Be sure to follow recommended working times from the adhesive manufacturer, often for porous surfaces, along with all equipment recommendations, such as trowel notch-size. Do not spread more adhesive than can be installed within the recommended working time.

.2 Rubber Base (R).

.1 Lay out base to keep number of joints at minimum. Use longest practical lengths to minimize joints.

.2 Clean walls of dust and prime with one coat of adhesive.

.3 Apply adhesive to back of base and set base in adhesive tightly against wall with hand roller.

.4 Install straight and level to variation of plus or minus 3 mm over 3 m straight edge.

.5 Scribe and fit to door frames and other obstructions.

.6 Miter internal corners and wrap external corners. Premoulded corners not permitted.

.7 Install base at toe space of casework unless indicated otherwise.

3.4 FIELD QUALITY CONTROL

.1 Instruct flooring manufacturer representative to visit site at commencement of work as well as periodically throughout duration of work to confirm that conditions are acceptable for product installation and that proper procedures are followed.

3.5 CLEANING

.1 Remove excess adhesive from floor, base and wall surfaces without damage.

.2 Clean floor and base surface to flooring manufacturer's printed instructions.

3.6 PROTECTION

.1 Prohibit traffic on floor for 48 hours after installation, or according to manufacturer's instructions. Thereafter, protect new floors from damage during final stages of construction until substantial completion of project.

3.7 SCHEDULES

.1 Refer to Section 09 06 00.13.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 09 06 00.13 – Room Finish Schedule.

1.2 REFERENCES

.1 American Society for Testing and Materials (ASTM).
- .1 ASTM D4258-05(2012), Standard Practice for Surface Cleaning Concrete for Coating.
- .2 ASTM D4259-88(2012), Standard Practice for Abrading Concrete
- .3 ASTM E84-13a, Standard Test Method for Surface Burning Characteristics of Building Materials.
- .4 ASTM E662-09, Standard Test Method for Specific Optical Density of Smoke Generated by Solid Materials.
- .5 ASTM F1869-11, Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.

.2 Underwriters Laboratories of Canada (ULC).
- .1 CAN/ULC S101-07, Standard Methods 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 S102.2-10, Standard Method of Test for Surface Burning Characteristics of Flooring, Floor Coverings, and Miscellaneous Materials and Assemblies.

.3 American Association of Textile Chemists and Colorists (AATCC).
- .1 AATCC Test Method 134-2006, Electrostatic Propensity of Carpets.

1.3 SUBMITTALS

.1 Product Data.
- .1 Submit product data in accordance with Section 01 33 00.
- .2 Submit product data sheet for carpet tile, adhesive, and subfloor filler.

.2 Closeout Submittals.
- .1 Submit operation and maintenance data for incorporation into Maintenance and Warranty Manual specified in Section 01 78 00.

1.4 QUALITY ASSURANCE

.1 Qualifications.
- .1 Skilled tradesman to be employed by specialty company recognized and trained as approved installer by manufacturer, normally engaged in this type of work with extensive experience in installation of products specified.

.2 Field Testing.
- .1 Perform moisture and alkalinity tests prior to carpet tile flooring installation. Moisture content must not exceed the capacity of the manufacturer's recommended adhesive (verify using the anhydrous calcium chloride test as per ASTM F1869) and pH level should be in the range of 7 to 8.5.

.3 Mock-ups.
- .1 Construct mock-ups in accordance with Section 01 45 00.
- .2 Prepare mock section for each tile pattern or as requested by Consultant.
- .3 Allow 48 hours for review of mock-up by Consultant before proceeding with work of this Section.

.4 When accepted, mock-up will demonstrate minimum standard for this work. Mock-up may remain as part of finished work.

1.5 DELIVERY, STORAGE, AND HANDLING

.1 Deliver all material to site in manufacturer's original unopened packaging with labels clearly identifying product name and manufacturer.

.2 Store materials in a dry, enclosed area protected from exposure to moisture, construction activity, and direct sunlight in strict accordance with manufacturer's recommendations.

.3 Handle all products with appropriate precautions and care as stated manufacturer's instructions.

.4 Cleaning and Waste Management in accordance with Section 01 74 00.

1.6 SITE CONDITIONS

.1 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of hazardous materials.

.2 Maintain air temperature and structural base temperature at flooring installation area above 20 degrees C, and relative humidity between 10% and 30% for 48 hours before, during and 48 hours after installation.

.3 Provide continuous ventilation during and after flooring installation. Run ventilation system 24 hours per day during installation and provide continuous ventilation and for 48 to 72 hours after installation. Do not let contaminated air re-circulate through existing building air distribution system.

1.7 WARRANTY

.1 Manufacturer's Product Warranty: provide an extended warranty for Work of this Section from date of Substantial Performance of the Work to term of warranty specified. Manufacturer hereby warrants carpet tile against manufacturing and materials defects, and will provide specified level of appearance and performance subject to proper care and maintenance, and these or other observed defects and deficiencies will be repaired or replaced to the satisfaction of the Consultant and the City, and at no expense to the City.

1.8 MAINTENANCE

.1 Comply with requirements of Section 01 78 00.

.2 Provide maintenance materials as follows:

.1 Carpet Tile: 10% of the floor area for each type, colour and pattern of carpet installed. Extra materials to be from same production run as installed materials.

.2 Adhesives: sufficient volume to install maintenance materials but not less than an unopened 1 litre can of each type of adhesive.

.3 Maintenance materials to be from same dye lot or production run as installed materials.

Part 2 Products

2.1 MANUFACTURERS

.1 Basis of Design Products.

.1 Tile Carpet (TC1/TC3).

.1 Shaw Contract, Off the Grid, Discover Tile.

.2 Tile Carpet (TC2).
.1 Shaw Contract, Off the Grid, Seek Tile.

.3 Rubber Base (R).
.1 Refer to Section 09 65 00.

.2 Requests for substitutions will be considered subject to specified requirements and in accordance with Bidding Procedures B8.

.3 Supply products from a single manufacturer and from same dye lot or production run.

2.2 MATERIALS

.1 Tile Carpet (TC1/TC3).
.1 Construction: Multi-Level Pattern Loop.
.2 Fibre: 100% Eco Solution Q Nylon.
.3 Dye Method: 100% Solution Dyed.
.4 Tufted Weight: 881.6 g/m^2.
.5 Gauge: 39.4 per 10 cm
.6 Finish Pile Thickness: 3.51 mm.
.7 Average Density: 0.252 g/cm^3.
.8 Electrostatic propensity: Less Than 3.5 kv.
.9 Tile Size: 305 mm x 1219 mm.
.10 Orientation: Ashlar.
.11 Colour:
.1 TC1: one (1) colour to be selected by Consultant.
.2 TC3: one (1) colour to be selected by Consultant.
.12 Percentage of Installation:
.1 TC1: approximately 42%. Confirm with final dimensions on-site.
.2 TC3: approximately 2%. Confirm with final dimensions on-site.

.2 Tile Carpet (TC2).
.1 Construction: Multi-Level Pattern Loop.
.2 Fibre: 100% Eco Solution Q Nylon.
.3 Dye Method: 100% Solution Dyed.
.4 Tufted Weight: 881.6 g/m^2.
.5 Gauge: 39.4 per 10 cm
.6 Finish Pile Thickness: 3.73 mm.
.7 Average Density: 0.236 g/cm^3.
.8 Electrostatic propensity: Less Than 3.5 kv.
.9 Tile Size: 305 mm x 1219 mm.
.10 Orientation: Ashlar.
.11 Colour: one (1) colour to be selected by Consultant.
.12 Percentage of installation: approximately 56%. Confirm with final dimensions on-site.

2.3 ACCESSORIES

.1 Subfloor Filler, leveller and sealer: as recommended by carpet tile manufacturer for use with their product.

.2 Primers and Adhesives: low VOC content, water-resistant, mildew-resistant, non-staining type recommended by carpet tile manufacturer for use with their product on applicable substrates.

Part 3 Execution

3.1 EXAMINATION

.1 Smooth, dense concrete finish, highly compacted with a tolerance of 3 mm in 3 m radius to be observed prior to installation of resilient flooring.

.2 Notify Consultant in writing of any adverse floor conditions prior to start of work. Do not proceed until defects are corrected.

3.2 PREPARATION

.1 Sub-floor preparation is to include all required work to prepare floor for installation of products specified in this Section and meet all conditions as specified in manufacturer's current printed subfloor preparation guidelines.

.2 Materials used in sub-floor preparation and repair to be as recommended by carpet tile manufacturer and chemically and physically compatible with carpet tile flooring product.

.3 Floor preparation for new carpet tile flooring installation over existing resilient flooring adhesive or carpet adhesive, or existing black emulsion (asphalt) vinyl tile adhesive as follows:

.1 Concrete surfaces must be clean and sound in accordance with ASTM D4258 and ASTM D4259. Prepare entire floor surfaces by mechanical means including steel shot blasting (Blastrac) in accordance with resilient flooring manufacturer's instructions to remove bond inhibiting materials such as curing compounds, previous coatings, adhesives, or laitance (used with existing flooring installation), or loose particles which may prevent or reduce bond. Vacuum dust, dirt, and contaminants following preparation procedures.

.4 Floors to be clean, dry, smooth, level, structurally sound and free from moisture, alkali, dust, solvents, paint, wax, oil, grease, asphalt adhesive, sealing compounds and other contaminants.

.5 Remove sub-floor ridges and bumps that would transmit through flooring materials and affect installation.

.6 Fill low spots, cracks, joints, holes and other defects with sub-floor filler approved by carpet tile manufacturer, prior to commencement of installation of flooring materials. Thickness of filler to ensure flat floor and that installation of carpet tile flooring against adjacent materials (lippage) does not exceed difference of 1 mm. Steel trowel and float to leave smooth, flat, hard surface. Prohibit traffic until filler is cured and dry.

.7 Vacuum all areas to be covered with carpet tile flooring immediately prior to spreading adhesive.

.8 Prime concrete as required to carpet tile flooring manufacturer's printed instructions.

3.3 INSTALLATION

.1 Install carpet tile in tile pattern in direction reviewed with Consultant, and in accordance with drawings and manufacturer's printed instructions. Use material from same dye lot.

.2 Apply release type adhesive and install carpet tiles with joints parallel to building lines. Border tiles minimum half tile width. Set tiles square to each other with all joints aligned and abutted.

.3 Install edge and transition strips wherever carpet tile abuts other finishes, unless otherwise indicated.

.4 Finish installation to present smooth wearing surface free of bubbles, puckers, and conspicuous seams, burring and other faults.

3.4 CLEANING

.1 Remove excess adhesive from floor and wall surfaces without damage.

.2 Vacuum carpets clean immediately after completion of installation.

3.5 PROTECTION

.1 Prohibit traffic on floor for 48 hours after installation, or according to manufacturer's instructions. Thereafter, protect new floors from damage during final stages of construction until substantial completion of project.

3.6 SCHEDULE

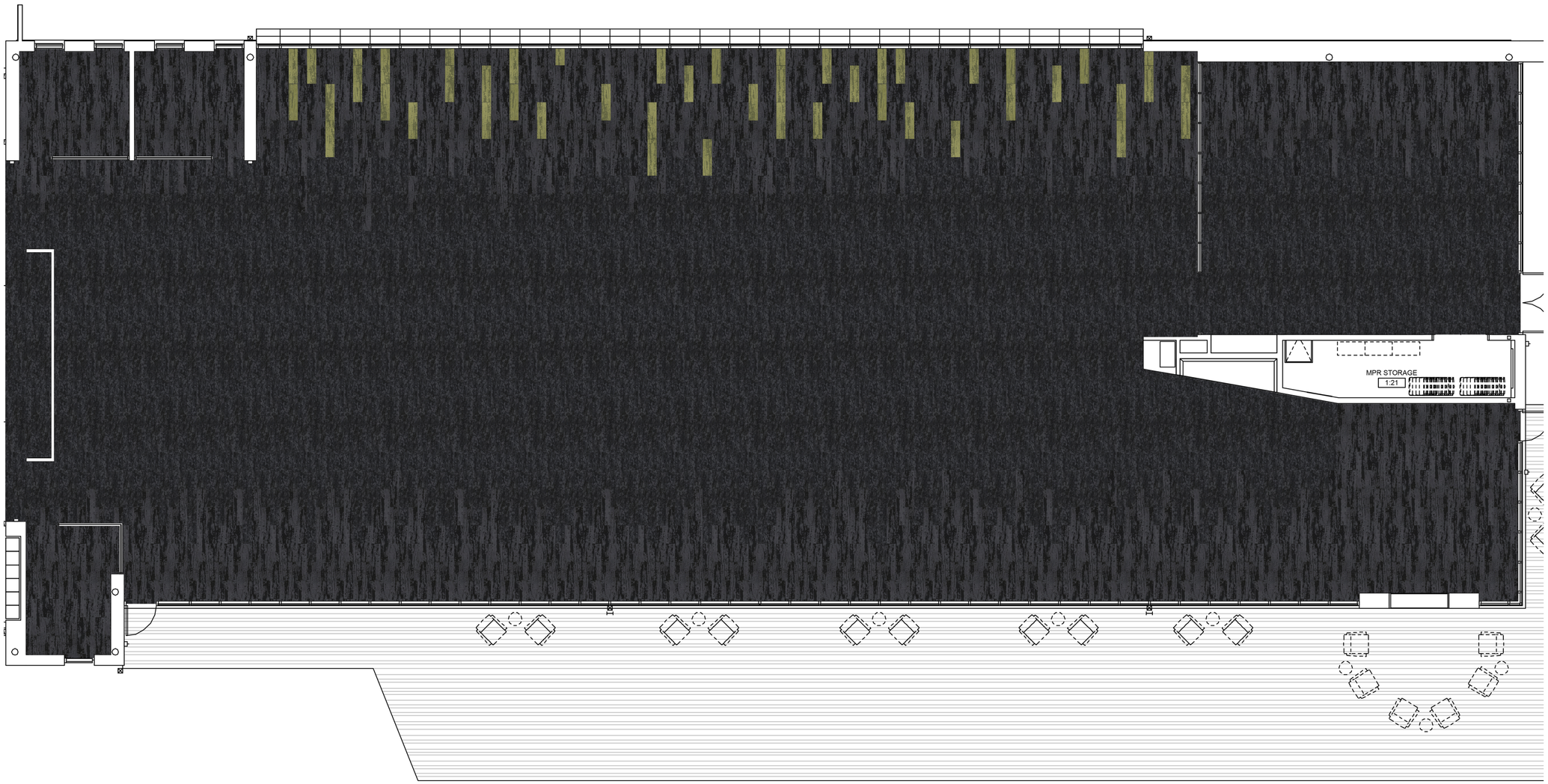
.1 Refer to Section 08 06 10, and Flooring Finish Plan; 1 page attached.

END OF SECTION

(TC1)

(TC2)

(TC3)



The layout and scale rendered in this floor plan may not be an exact representation of the actual flooring. Please review product samples for accurate color and repeat scale. The rendering provided is only for design purposes and should not be used for ordering, estimating or exact layout details. An estimate must be completed by a professional for accurate ordering and layout information

Project: The Bill and Helen Norrie Library (2v4)
Date: June 28, 2019
Account Manager: Richard Fotiuk 204.781.1899
Rendered By: CP

shaw contract®

Part 1 General

1.1 RELATED SECTIONS

.1 Section 06 10 00 – Rough Carpentry.

.2 Section 09 29 00 – Gypsum Board.

1.2 REFERENCES

.1 American Society for Testing and Materials International (ASTM)
- .1 ASTM C423-07, Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.
- .2 ASTM E84-18b, Standard Test Method for Surface Burning Characteristics of Building Materials.

.2 Underwriters Laboratories of Canada (ULC).
- .1 CAN/ULC-S102-10, Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.

1.3 SUBMITTALS

.1 Shop Drawings.
- .1 Submit shop drawings in accordance with Section 01 33 00.
- .2 Indicate lay-out, spacing and fastening details.

.2 Samples.
- .1 Submit samples in accordance with Section 01 33 00.
- .2 Submit 150 mm x 150 mm sample of each type of acoustical units.

.3 Closeout Submittals.
- .1 Provide maintenance data for incorporation into Operation and Maintenance Manual specified in Section 01 78 00.

1.4 QUALITY ASSURANCE

.1 Construct mock-up in accordance with Section 01 45 00.

.2 Construct one representative mock-up of each type acoustical wall treatment system.

.3 Construct mock-up where directed.

.4 Allow 24 hours for inspection of mock-up by Consultant before proceeding with work.

.5 When accepted, mock-up will demonstrate minimum standard for this work. Mock-up may remain as part of the finished work.

1.5 DELIVERY, STORAGE, AND HANDLING

.1 Deliver all material to site in manufacturer’s original unopened packaging with labels clearly identifying product name and manufacturer.

.2 Store materials in a dry, enclosed area protected from exposure to moisture, construction activity, and direct sunlight in strict accordance with manufacturer's recommendations.

.3 Handle all products with appropriate precautions and care as stated manufacturer's instructions to avoid chipping edges or damaging units in any way.

.4 Cleaning and Waste Management in accordance with Sections 01 74 00.

1.6 SITE CONDITIONS

.1 Commence installation after building enclosed and dust generating activities are completed.

.2 Permit wet work to dry prior to commencement of installation.

.3 Maintain uniform minimum temperature of 15°C and relative humidity of 20- 40% prior to, during and after installation.

1.7 SEQUENCING

.1 Co-ordinate ceiling work to accommodate components of other sections including, but not limited to gypsum board, mechanical systems, electrical systems, diffusers, speakers, and light fixtures.

Part 2 Products

2.1 MANUFACTURERS

.1 Basis of Design Products.

.1 Acoustic Baffle.
.1 Zintra Acoustic Baffles, Ridges.

.2 Acoustic Panel.
.1 Zintra Acoustic Panel.

.3 Tack Surface.
.1 Bulletin Board as manufactured by Forbo-Krommenie.

.2 Requests for substitutions will be considered subject to specified requirements and in accordance with Bidding Procedures B8.

.3 Supply similar products from single manufacturer.

.4 Supply all products from same dye lot or production run.

2.2 MATERIALS

.1 Acoustic Baffle.
.1 Material: 100% polyester.
.2 Fire Rating: Class A to ASTM E84 and CAN/ULC-S102.
.3 Noise reduction coefficient (NRC): 0.90 to ASTM C423.
.4 Hardware: mounting hardware provided, colour to be confirmed with Consultant.
.5 Pattern: Ridges.
.6 Baffle Depth: 254 mm deep.
.7 Baffle thickness: 12 mm thick.
.8 Baffle Spacing: 203 mm.
.9 Panel Size: 1220 mm x 2743 mm.
.10 Colour(s): up to three (3) colours to be selected by Consultant.

.2 Acoustic Panel.
.1 Material: 100% polyester.
.2 Fire Rating: Class A to ASTM E84 and CAN/ULC-S102.
.3 Noise reduction coefficient (NRC): 0.45 to 0.90 to ASTM C423.

.4 Hardware: face fastened, confirm fastener colour with Consultant.
.5 Panel thickness: 12 mm thick.
.6 Panel Size: 1220 mm x 2745 mm (custom laser cut patterns as confirmed with Consultant).
.7 Colour(s): up to two (2) colours to be selected by Consultant.

.3 Tack Surface (TS): 6 mm thick linoleum resilient homogenous tackable surface material of natural material consisting of linseed oil, granulated cork, resin binders and dry pigments, mixed and calandered to natural jute backing, fire resistance in accordance with CAN/ULC S102 and ASTM E84, self-healing, bacteria resistant, colour to be selected by Consultant from manufacturer's entire range.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

.1 Install acoustic units to clean, dry and firm substrate and install in accordance with manufacturer's written instructions.

.2 Install acoustic units plumb and aligned. Arrange units as indicated on drawings.

.3 Install tack surface in accordance with Manufacturer's written instructions.

3.3 CLEANING

.1 Protect and keep acoustic installation and all components clean. Remove blemishes immediately.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes: All labour, materials, tools and other equipment, services and supervision required to complete all painting and decorating work as indicated to full extent of drawings and specifications.

.2 Work under this contract includes, but is not necessarily limited to:

- .1 Surface preparation of substrates as required for acceptance of painting, including cleaning, small crack repair, patching, caulking, and making good surfaces and areas to limits defined under MPI preparation requirements.
- .2 Surface preparation and prime painting surfaces for wall coverings prior to installation in accordance with MPI and wall covering manufacturer's requirements.
- .3 Specific pre-treatments noted herein or specified in MPI Architectural Painting Specification Manual.
- .4 Priming and back-priming of wood materials as noted herein or specified in MPI Architectural Painting Specification Manual.
- .5 Painting of all semi-concealed areas (e.g. inside of light troughs and valances, behind grilles, and projecting edges above and below sight lines).
- .6 Painting of exposed to view mechanical (heating, ventilating and plumbing) services and equipment, e.g., ducts, sprinkler piping, etc., and electrical work, unless pre-finished.
- .7 Provision of safe and adequate ventilation as required over and above temporary ventilation supplied by others, where toxic and/or volatile / flammable materials are being used.
- .8 On-site surface preparation and application of paint to exposed wood surfaces of architectural woodwork in accordance with MPI Architectural Painting Specification Manual and North American Architectural Woodwork Standards (NAAWS).
- .9 On-site surface preparation and application of transparent finish to exposed wood surfaces of architectural woodwork in accordance with MPI Architectural Painting Specification Manual and North American Architectural Woodwork Standards (NAAWS).
- .10 On-site surface preparation and application of transparent or semi-transparent stain and clear coat or paint finish to all exposed wood surfaces of architectural woodwork in accordance with North American Architectural Woodwork Standards (NAAWS).
- .11 On-site surface preparation and application of opaque paint finish to all exposed designed saw-cuts and other narrow reveals that expose substrate or core material in architectural woodwork. Colour to be selected by Consultant.
- .12 On-site surface preparation and application of stain and laquer finish over door faces and edges (4 sides) of wood veneer faced wood doors. Confirm exact stain finish with Consultant.
- .13 Painting (exposed surface and edges) of plywood used as backboards for mounting electrical equipment.

.3 Contractor to do all work of this Section in a professional manner and clean all areas affected by painting and coating. Any area not cleaned to the satisfaction of the the City may be cleaned by the the City and charged to the Contractor. All work is to pass the inspection of the the City.

.4 The Contractor is responsible to cover or remove such items as grills, lights, smoke and heat detectors, fire pull stations, temperature sensors, etc, to ensure that no paint is applied to these items.

.5 No extras will be paid due to misinterpretation of this Section.

.6 Refer to drawings and schedules for type, location and extent of finishes required. Include all touch-ups and field painting necessary to complete work shown, scheduled or specified.

1.2 RELATED SECTIONS

.1 Section 05 50 00 – Metal Fabrications.

.2 Section 06 10 00 – Rough Carpentry.

.3 Section 06 40 00 – Architectural Woodwork.

.4 Section 08 06 00 – Door Schedule.

.5 Section 08 14 00 – Wood Doors.

.6 Section 08 11 00 – Metal Doors and Frames.

.7 Section 09 06 00.13 – Room Finish Schedule.

.8 Section 09 29 00 – Gypsum Board.

1.3 REFERENCES

.1 Green Seal Environmental Standards.
- .1 GS-11, Green Seal Standard for Paints, Coatings, Stains, and Sealers, October 26, 2015.

.2 Master Painters Institute (MPI).
- .1 MPI Architectural Painting Specification Manual, latest edition, including Identifiers, Evaluation, Systems, Preparation and Approved Product List (hereafter referred to as MPI Painting Manual).
- .2 MPI Green Performance Standard (GPS-1-12 and GPS-2-12) For Paints and Coatings.

.3 South Coast Air Quality Management District (SCAQMD).
- .1 Rule 1113 - Architectural Coatings, 2016.

1.4 QUALITY ASSURANCE

.1 Contractor to have minimum of five (5) years proven satisfactory experience and show proof before commencement of work that he will maintain qualified crew of painters throughout duration of work. When requested, provide list of last three (3) comparable jobs including, name and location, Consultant / project manager, start / completion dates and value of painting work.

.2 Engage only qualified journeypersons, as defined by local jurisdiction, in painting and decorating work. Apprentices may be employed provided they work under direct supervision of qualified journeyperson in accordance with trade regulations.

.3 All materials, preparation and workmanship to conform to requirements of MPI Painting Manual.

.4 Use only paint manufacturers and products as listed under Approved Product List section of MPI Painting Manual, except where specifically specified otherwise (see reference to “special” painting, coating, or decorating system, below).

.5 Where “special” painting, coating or decorating system applications (i.e. non-MPI listed products or systems) are to be used, provide as part of this work, certification of all surfaces and conditions for specific paint or coating system application as well as on site supervision, inspection and approval of their paint or coating system application as required at no additional cost to the City.

.6 Receive written confirmation of specific surface preparation procedures and primers used for all fabricated steel items from fabricator / supplier to ascertain appropriate and manufacturer compatible finish coat materials to be used before painting any such work.

1.5 REGULATORY REQUIREMENTS

.1 Conform to latest edition of Industrial Health and Safety Regulations issued by applicable authorities having jurisdiction in regard to site safety (ladders, scaffolding, ventilation, etc.).

.2 Conform to requirements of local authorities having jurisdiction in regard to storage, mixing, application and disposal of all paint and related waste materials. Refer to Waste Management and Disposal.

1.6 SAMPLES AND MOCK-UPS

.1 When requested by Consultant, prepare and paint designated surface, area, room or item (in each colour scheme) to requirements specified herein, with specified paint or coating showing selected colours, gloss / sheen, textures and workmanship to MPI Painting Manual standards for review and approval. Surface, area, room and/or items, when approved, become acceptable standard of finish quality and workmanship for similar on-site work.

1.7 SUBMITTALS

.1 Make all submittals in accordance with requirements of Section 01 33 00.

.2 Samples.
- .1 Provide duplicate minimum 300 mm square samples of surfaces or acceptable facsimiles requested painted with specified paint or coating in colours, gloss / sheen and textures required to MPI Painting Manual standards for review and approval.
- .2 Samples must have paint codes clearly printed on each sample for approval by Consultant.
- .3 Samples, when approved, become acceptable standard of quality for appropriate on-site surface with one of each sample retained on-site.

.3 Quality Assurance / Control Submittals.
- .1 Submit consent of surety with Bid Submission as proof of ability to supply 100% two (2) year Maintenance Bond, if MPI Accredited Quality Assurance Association's guarantee option is not used.
- .2 If requested, submit list of all painting materials to Consultant for review prior to ordering materials.
- .3 If requested, submit work schedule for various stages of work when painting occupied areas for Consultant's review and the City's approval.
- .4 Submit two (2) sets of Material Safety Data Sheets (MSDS) prior to commencement of work for review and for posting at job site as required.

.4 Closeout Submittals.
- .1 Provide itemized list complete with manufacturer, paint type and colour coding for all colours used for the City's later use in maintenance.
- .2 Provide properly packaged maintenance materials as noted herein and obtain signed receipt.

1.8 PRODUCT DELIVERY, STORAGE AND HANDLING

.1 Deliver all painting materials in sealed, original labeled containers bearing manufacturer's name, brand name, type of paint or coating and colour designation, standard compliance, materials content as well as mixing and/or reducing and application requirements.

.2 Store all paint materials in original labeled containers in secure (lockable), dry, heated and well ventilated single designated area meeting minimum requirements of both paint manufacturer and authorities having jurisdiction and at minimum ambient temperature of 7°C. Only material used on this project to be stored on site.

.3 Where toxic and/or volatile / explosive / flammable materials are being used, provide adequate fireproof storage lockers and take all necessary precautions and post adequate warnings (e.g. no smoking) as required.

.4 Take all necessary precautionary and safety measures to prevent fire hazards and spontaneous combustion and to protect environment from hazard spills. Store materials that constitute fire hazard (paints, solvents, drop clothes, etc.) in suitable closed and rated containers and removed from site on daily basis.

.5 Comply with requirements of authorities having jurisdiction, in regard to use, handling, storage and disposal of hazardous materials.

.6 Cleaning and Waste Management in accordance with Sections 01 74 00.

1.9 SITE CONDITIONS

.1 Unless specifically pre-approved by Consultant, and applied product manufacturer, perform no painting or decorating work when ambient air and substrate temperatures are below 10°C for work.

.2 Perform no interior painting or decorating work unless adequate continuous ventilation and sufficient heating facilities are in place to maintain ambient air and substrate temperatures above minimum requirements for 24 hours before, during, and after paint application. Provide supplemental ventilating and heating equipment to meet minimum requirements.

.3 Perform no painting or decorating work when relative humidity is above 85% or when dew point is less than 3°C variance between air / surface temperature.

.4 Perform no painting or decorating work when maximum moisture content of substrate exceeds:
- .1 12 % for concrete and masonry (concrete brick/block).
- .2 15% for wood.
- .3 12 % for gypsum board.

.5 Conduct all moisture tests using properly calibrated electronic Moisture Meter, except test concrete floors for moisture using simple cover patch test.

.6 Test concrete and masonry surfaces for alkalinity as required.

.7 Concrete and masonry surfaces must be installed at least 28 days prior to painting and decorating work and must be visually dry on both sides.

.8 Apply paint only to dry, clean, properly cured and adequately prepared surfaces in areas where dust is no longer generated by construction activities such that airborne particles will not affect quality of finished surfaces.

.9 Perform no painting or decorating work unless minimum lighting level of 323 Lux (30 foot candles) is provided on surfaces to be painted or decorated.

1.10 SCHEDULING

.1 Schedule painting operations to prevent disruption of and by other trades.

.2 Schedule painting operations in occupied facilities to prevent disruption of occupants in and about building. Execute after facility working hours in accordance with the City's operating requirements. Schedule work such that painted surfaces will have dried before occupants are affected. Obtain written authorization from Consultant for changes in work schedule.

1.11 MAINTENANCE MATERIALS

.1 At project completion provide four (4) liters of each type and colour of paint from same production run (batch mix) used in unopened cans, properly labeled and identified for the City's later use in maintenance. Store where directed.

1.12 GUARANTEE

.1 Provide either local MPI Accredited Quality Assurance Association's two (2) year guarantee, or 100% two (2) year Maintenance Bond - both in accordance with MPI Painting Manual requirements. Maintenance Bond to warrant that all painting work has been performed in accordance with MPI Painting Manual requirements.

.2 Perform all painting and decorating work in accordance with MPI Painting Manual requirements.

.3 If choosing Maintenance Bond option, provide maintenance bond consent from reputable surety company licensed to do business in Canada. Cash or certified cheque is not acceptable in lieu of surety consent.

Part 2 Products

2.1 MANUFACTURERS

.1 Basis of Design Products:

.1 Gypsum Board (wall and ceiling surfaces): INT 9.2B, High Performance Architectural Latex. G2, G3 and G5 Top Coats.

.1 Primer: MPI#50.G2 Top Coats (Minimum 2 coats): MPI# 138.G3 Top Coats (Minimum 2 coats): MPI# 139.G5 Top Coats (Minimum 2 coats): MPI# 141.

.2 Gypsum Board (Epoxy Paint): Non-MPI. G3 and G5 Top Coat.

.1 Primer: Non-MPI, PPG Architectural, Dulux 11000 (minimum thickness 1.5-2.0 mils).

.2 G3 Top Coats (Minimum 2 coats): Non-MPI, PPG Architectural, Pitt Glaze WB1-16-310C Eggshell (MPI Gloss Level 3) (minimum thickness 1.5-2.0 mils per coat)

.3 G5 Top Coats (Minimum 2 coats): Non-MPI, PPG Architectural, Pitt Glaze WB1-16-510 Semi-Gloss (minimum thickness 1.5-2.0 mils per coat)

.3 Interior Galvanized Metal: INT 5.3M, High Performance Architectural Latex. High Contact/High Traffic Areas (doors, frames, railings, pipes, etc.) G2 and G5 Top Coat.

.1 Primer: MPI# 134.G2 (Low Sheen) Top Coats (Minimum 2 coats): MPI# 138.G5 (Gloss Level 4) Top Coats (Minimum 2 coats): MPI# 141.Exterior Galvanized Metal: EXT 5.3M, High Performance Architectural Latex (Over W.B. Primer). G5 Top Coat.

.1 Primer: MPI# 134.Top Coats (Minimum 2 coats): MPI# 311.Interior Structural Steel and Metal Fabrications: INT 5.1B W.B. Light Industrial Coating (over w.b. rust-inhibitive primer). G5 Top Coat.

.1 Primer: MPI # 107.Top Coats (Minimum 2 coats): MPI # 153.

.6 Exterior Structural Steel and Metal Fabrications: EXT 5.1M, W.B. Light Industrial Coating (Over W.B. Epoxy Primer). G5 Top Coat.
- .1 Primer: Non-MPI, PPG Aquapon WB Waterborne Epoxy Primer.
- .2 Top Coats (Minimum 2 coats): MPI# 163, PPG Architectural, Pitt-Tech Plus DTM 100% Acrylic Semi-Gloss.

.7 Dressed Lumber: INT6.3A, High Performance Architectural Latex. G5 Top Coat.
- .1 Primer/Sealer: MPI #39.
- .2 Top Coats (Minimum 2 coats): MPI #141.

.8 Dressed Lumber (ST) (as indicated): INT 6.3WW W.B. Varnish, Clear (Over W.B. Stain), as follows:
- .1 Dulux System.
  - .1 Stain: Gemini Coatings, Gem Glo Wiping Stains (if applicable); Colour(s) to match sample(s) from Consultant.
  - .2 Sealer: Dulux VOC compliant, waterborne Satin Acrylic Varnish.
  - .3 Sand lightly (180 grit).
  - .4 Clear Top Coat: Dulux VOC compliant, waterborne Satin Acrylic Varnish.
  - .5 Repeat Steps 3 and 4 as necessary to provide smooth blemish free finish.

.9 Fire-retardant Coatings (plywood backboards for mounting electrical equipment). INT 6.2F, Fire Retardant, Pigmented.
- .1 Intumescent Fire Retardant Paint (base coat applied in 2 coats with no top coat) – MPI #64 (ULC approved).

.2 Requests for substitutions will be considered with MPI Standards, subject to specified requirements and in accordance with Bidding Procedures B8.

.3 Supply all materials from single manufacturer for each system used.

2.2 MATERIALS

.1 Only materials (primers, paints, coatings, varnishes, stains, lacquers, fillers, etc.) listed in latest edition of MPI Approved Product List (APL) are acceptable for use on this project. Supply all such material from single manufacturer for each system used.

.2 Other materials such as linseed oil, shellac, thinners, solvents, etc.: highest quality product of MPI listed manufacturer and compatible with paint materials being used as required.

.3 All paint materials to have good flowing and brushing properties and dry or cure free of blemishes, sags, air entrapment, etc. Refer to Field Quality Control / Standard of Acceptance requirements, below.

.4 Paints and coatings to meet flame spread and smoke developed ratings designated by local Code requirements and/or authorities having jurisdiction.

.5 Where indoor air quality (odour) is issue, use only MPI listed materials having minimum E3 rating.

.6 VOC Content of Field-Applied Interior and Paints and Coatings.
- .1 VOC Content: comply with GS-11 - Green Seal™ Environmental Standard for Paints and Coatings.
- .2 VOC Content (not covered by GS-11): comply with Rule 1113 of South Coast Air Quality Management District.

2.3 EQUIPMENT

.1 Painting and Decorating Equipment: to best trade standards for type of product and application.

.2 Spray Painting Equipment: of ample capacity, suited to type and consistency of paint or coating being applied and kept clean and in good working order at all times.

2.4 MIXING AND TINTING

.1 Unless otherwise specified herein or pre-approved, supply all paint ready-mixed and pre-tinted. Re-mix all paint in containers prior to and during application to ensure break-up of lumps, complete dispersion of settled pigment, and colour and gloss uniformity.

.2 Mix paste, powder or catalyzed paint mixes in strict accordance with manufacturer's written instructions.

.3 Addition of thinner, where used, not to exceed paint manufacturer's recommendations. Do not use kerosene or any such organic solvents to thin water-based paints.

.4 If required, thin paint for spraying according in strict accordance with paint manufacturer's instructions. If directions are not on container, obtain instructions in writing from manufacturer and provide copy of instructions to Consultant.

2.5 FINISH AND COLOURS

.1 Unless otherwise specified herein, perform all painting work in accordance with MPI Premium Grade finish requirements.

.2 Colours as selected by Consultant from manufacturer’s full range of colours after award of Contract.

.3 Generally, and unless otherwise specified, base quantity of colours and finishes on following criteria:

.1 No more than five (5) interior paint (P/EP) colours will be selected for entire project.

.4 Doors: different colour than door frames and trim with walls different colour than either. Unless otherwise noted or scheduled all doors, frames, and trim receive G5 (semi-gloss) finish.

.5 Access doors, exposed piping and electrical panels: to match adjacent surfaces (i.e. same colour, texture and sheen), unless otherwise noted or where pre-finished.

.6 Inside of light valances: white in G3 finish.

.7 Inside of all duct work behind louvers, grills and diffusers: flat black (non-reflecting) for minimum of 460 mm or beyond sight line, whichever is greater.

2.6 GLOSS / SHEEN RATINGS

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

Gloss Level	**Description**	**Units @ 60 degrees**	**Units @ 85 degrees**
G1	Matte or Flat finish	0 to 5	10 max.
G2	Velvet finish	0 to 10	10 to 35
G3	Eggshell finish	10 to 25	10 to 35
G4	Satin finish	20 to 35	35 min.
G5	Semi-Gloss finish	35 to 70	
G6	Gloss finish	70 to 85	

G7	High-Gloss finish	> 85	

.2 Gloss level ratings of all painted surfaces: as specified herein and as noted in Section 09 06 00.13.

Part 3 Execution

3.1 CONDITION OF SURFACES

.1 Prior to commencement of work of this section, thoroughly examine (and test as required) all conditions and surfaces scheduled to be painted and report in writing to Contractor and Consultant any conditions or surfaces that will adversely affect work of this Section.

.2 Assess degree of surface deterioration (DSD) using assessment criteria indicated in MPI Maintenance Repainting Manual. In general, DSD ratings and descriptions are as follows:

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

.3 Other than repair of DSD-1 to DSD-3 defects included under this scope of work, structural and DSD-4 substrate defects discovered prior to and after surface preparation or after first coat of paint to be made good and sanded by others ready for painting, unless otherwise agreed to by the City and painter to be included in this Section.

.4 Commence no repainting work until all such DSD-4 adverse conditions and defects have been corrected and surfaces and conditions are acceptable to Painting Subcontractor and Consultant. Subcontractor not responsible for conditions of substrate or for correcting defects and deficiencies in substrate, which may adversely affect painting work except for minimal work normally performed by Painting Subcontractor and as, indicated herein. Painting Subcontractor is responsible to see that surfaces are properly prepared before any paint or coating is applied and paint surface as specified providing that the City accepts responsibility for uncorrected DSD-4 substrate conditions.

3.2 PREPARATION OF SURFACES

.1 Prepare all surfaces in accordance with MPI requirements. Refer to MPI Painting Manual in regard to specific requirements for following:
- .1 Environmental conditions.
- .2 Shop primed ferrous metal surfaces.
- .3 Structural steel and miscellaneous metals.
- .4 Galvanized and zinc coated metal.
- .5 Gypsum board.
- .6 Exposed wood surfaces of architectural woodwork.

.2 Clean all surfaces to be painted as follows:

.1 Remove all dust, dirt, and other surface debris by vacuuming or wiping with dry clean clothes.

.2 Wash surfaces with solution of 8 oz. tri-sodium phosphate per gallon of clean warm water using a stiff bristle brush to remove dirt, oil and other surface contaminants.

.3 If mildew is present, scrub surfaces with a solution of 20% chlorine bleach and 1% liquid detergent in clean warm water.

.4 Rinse surfaces with clean water until foreign matter is flushed from surface.

.5 Allow surfaces to drain completely and allow to dry thoroughly.

.6 Sand, clean, dry, etch, neutralize and/or test all surfaces under adequate illumination, ventilation and temperature requirements.

.3 Remove and securely store all miscellaneous hardware and surface fittings / fastenings (e.g. electrical plates, mechanical louvers, door hardware (e.g. hinges, knobs, locks, trim, frame stops), removable rating / hazard / instruction labels, washroom accessories, light fixture trim, etc. from wall and ceiling surfaces, doors and frames, prior to painting. Carefully clean and replace all such items upon completion of painting work in each area. Do not use solvent or reactive cleaning agents on items that will mar or remove finishes (e.g. lacquer finishes). Remove doors before painting to paint bottom and top edges and then re-hang.

.4 Protect all adjacent surfaces and areas, including rating and instruction labels on doors, frames, equipment, piping, etc., from painting operations and damage by drop cloths, shields, masking, templates, or other suitable protective means and make good any damage caused by failure to provide such protection.

.5 Substrate defects: make good and sand by others ready for painting particularly after first coat of paint. Start of finish painting of defective surfaces (e.g. gypsum board) indicates acceptance of substrate after which Contractor to bear cost of making good defects including re-painting of entire defective surface (no touch-up painting).

.6 Confirm preparation and primer used with fabricator of steel items. Refer to Quality Assurance.

.7 Move and cover all furniture and portable equipment as required to carry out painting operations. Replace as painting operations progress.

3.3 APPLICATION

.1 Do not paint unless substrates are acceptable and/or until all environmental conditions (heating, ventilation, lighting and completion of other subtrade work) are acceptable for applications of products.

.2 Apply paint or stain in accordance with MPI Painting Manual Premium Grade finish requirements.

.3 Apply paint in workmanlike manner using skilled and trade qualified applicators as noted under Quality Assurance.

.4 Apply paint and coatings within appropriate time frame after cleaning when environmental conditions encourage flash-rusting, rusting, contamination or manufacturer’s paint specifications require earlier applications.

.5 Painting coats specified are intended to cover surfaces satisfactorily when applied at proper consistency and in accordance with manufacturer’s recommendations.

.6 Apply minimum of four (4) coats of paint where deep or bright colours are used to achieve satisfactory results.

.7 Sand and dust between each coat to provide anchor for next coat and to remove defects visible from distance up to 1000 mm.

.8 Do not apply finishes on surfaces that are not sufficiently dry. Unless manufacturer's directions state otherwise, ensure each coat is sufficiently dry and hard before following coat is applied.

.9 Continue paint finish behind all wall-mounted items (e.g. markerboards and tackboards).

.10 Seal gypsum board wall surfaces with latex sealer or equivalent as recommended by wall protection manufacturer to promote adhesion prior to installation of wall covering where noted.

3.4 MECHANICAL / ELECTRICAL EQUIPMENT AND RELATED SURFACES

.1 Unless otherwise specified or noted, paint all "unfinished" conduits, piping, hangers, ductwork and other mechanical and electrical equipment with colour and texture to match adjacent surfaces, in following areas:
- .1 Where exposed-to-view in all areas.
- .2 In all interior high humidity interior areas.
- .3 In all boiler room, mechanical and electrical rooms.
- .4 Do not paint over nameplates

.2 In unfinished areas leave exposed conduits, piping, hangers, ductwork and other mechanical and electrical equipment in original finish and touch up scratches and marks.

.3 Paint inside of all ductwork where visible behind louvers, grilles and diffusers for minimum of 460 mm or beyond sight line, whichever is greater, with primer and one coat of matt black (non-reflecting) paint.

.4 Paint disconnect switches for fire alarm system and exit light systems in red enamel.

.5 Paint red or band all fire protection piping and sprinkler lines in accordance with mechanical specification requirements. Keep sprinkler heads free of paint.

.6 Paint yellow or band all natural gas piping in accordance with mechanical specification requirements.

.7 Backprime and paint face and edges of plywood service panels for telephone and electrical equipment before installation. Leave equipment in original finish except for touch-up as required, and paint conduits, mounting accessories and other unfinished items.

.8 Paint electrical equipment backboards indicated on drawings and/or as specified. Unless otherwise recommended by manufacturer apply following to achieve ULC Class 'A' rating (Flame Spread 15, Fuel Contributed 15, and Smoke Developed 15, when tested in accordance with ASTM E84 and NFPA 255). Use primers and sealers suitable for substrate and approved by fire-resistant paint manufacturer as compatible with fire-retardant paint.
- .1 Fire-retardant paint: two (2) base coats.

3.5 FIELD QUALITY CONTROL / STANDARD OF ACCEPTANCE

.1 Inspect all surfaces, preparation and paint applications.

.2 Painted surfaces: considered to lack uniformity and soundness if any of following defects are apparent to Consultant:
- .1 brush / roller marks, streaks, laps, runs, sags, drips, heavy stippling, hiding or shadowing by inefficient application methods, skipped or missed areas, and foreign materials in paint coatings.
- .2 evidence of poor coverage at rivet heads, plate edges, lap joints, crevices, pockets, corners and re-entrant angles.

.3 damage due to touching before paint is sufficiently dry or any other contributory cause.
.4 damage due to application on moist surfaces or caused by inadequate protection from weather.
.5 damage and/or contamination of paint due to blown contaminants (dust, spray paint, etc.).

.3 Painted surfaces: considered unacceptable if any of following are evident under final lighting source (including daylight) for interior surfaces:
.1 visible defects are evident on vertical surfaces when viewed at normal viewing angles from distance of not less than 1000 mm.
.2 visible defects are evident on horizontal surfaces when viewed at normal viewing angles from distance of not less than 1000 mm.
.3 visible defects are evident on ceiling, soffit and other overhead surfaces when viewed at normal viewing angles.
.4 when final coat on any surface exhibits lack of uniformity of colour, sheen, texture, and hiding across full surface area.

.4 Make good painted surfaces rejected by Consultant at expense of Contractor. Small affected areas may be touched up; Repaint large affected areas or areas without sufficient dry film thickness of paint. Remove runs, and sags of damaged paint by scraper or by sanding prior to application of paint.

3.6 PROTECTION

.1 Protect all interior surfaces and areas, including glass, aluminum surfaces, etc. and equipment and any labels and signage from painting operations and damage by drop cloths, shields, masking, templates, or other suitable protective means and make good any damage caused by failure to provide such protection.

.2 As painting operations progress, place “Wet Paint” warning signs in occupied areas to approval of the City.

.3 Erect barriers or screens to limit or direct traffic away or around work area as required.

3.7 CLEAN-UP

.1 Remove all paint where spilled, splashed, splattered or sprayed as work progresses using means and materials that are not detrimental to affected surfaces.

.2 Keep work area free from unnecessary accumulation of tools, equipment, surplus materials and debris.

.3 Remove combustible rubbish materials and empty paint cans each day and safely dispose of same in accordance with requirements of authorities having jurisdiction.

.4 Clean equipment and dispose of wash water / solvents as well as all other cleaning and protective materials (e.g. rags, drop cloths, masking papers, etc.), paints, thinners, paint removers / strippers in accordance with safety requirements of authorities having jurisdiction.

3.8 SCHEDULES

.1 Refer to Section 08 06 10.

.2 Refer to Section 09 06 00.13.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 06 10 00 – Rough Carpentry.

.2 Section 09 29 00 – Gypsum Board.

1.2 REFERENCES

.1 Aluminum Association (AA).
- .1 Aluminum Alloy Castings - Properties, Processes, and Applications, 2004 Edition.
- .2 Designation System for Aluminum Finishes, 2003.

.2 American Society for Testing and Materials (ASTM).
- .1 ASTM A653/A653M-15, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by Hot-Dip Process.
- .2 ASTM B221M-13, Standard Specification for Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes [Metric].

.3 Underwriters Laboratories of Canada (ULC).
- .1 CAN/ULC S706-09-ER1, Standard for Wood Fibre Insulation Boards for Buildings.

1.3 SUBMITTALS

.1 Shop Drawings.
- .1 Submit shop drawings in accordance with Section 01 33 00.
- .2 Indicate location, type, size, panel arrangement, backing, hardware, anchor or mounting details, frame or trim and accessories.

.2 Closeout Submittals.
- .1 Provide maintenance data for incorporation into Operation and Maintenance Manual specified in Section 01 78 00.

1.4 DELIVERY, STORAGE, AND HANDLING

.1 Deliver all material to site in manufacturer’s original unopened packaging with labels clearly identifying product name and manufacturer.

.2 Store materials in a dry, enclosed area protected from exposure to moisture, construction activity, and direct sunlight in strict accordance with manufacturer's recommendations.

.3 Handle all products with appropriate precautions and care as stated manufacturer's instructions.

.4 Cleaning and Waste Management in accordance with Section 01 74 00.

1.5 WARRANTY

.1 Manufacturer’s Product Warranty: provide an extended warranty for Work of this Section consisting of a Lifetime Warranty from date of Substantial Performance. Manufacturer hereby warrants porcelain enamel markerboard surface against manufacturing and material defects subject to proper care and maintenance, and these or other observed defects and deficiencies will be repaired or replaced to the satisfaction of the Consultant and the City, and at no expense to the City.

Part 2 Products

2.1 MANUFACTURED UNITS

.1 Markerboards (MB).
- .1 Facing Sheet: two (2) coats fired vitreous porcelain enamel on minimum 28-gauge (0.37 mm) steel, magnetic surface, white colour.
- .2 Core: 13 mm high quality, moisture resistant fibreboard, free of tar material to CAN/ULC S706, Type II.
- .3 Backing Material: 0.10 mm tempered aluminum foil for fixed wall mounted panels.
- .4 Perimeter Trim: extruded clear anodized aluminum channel to ASTM B221, minimum 1.5 mm wall thickness.
- .5 Chalktray: full length, extruded anodized aluminum, alloy 6063-T5, ends to be rounded.
- .6 Map Rail/Tack Strip: min. 25 mm wide extruded anodized aluminum with 6 mm cork insert as indicated with * on drawings.
- .7 Joint Reinforcement: concealed mechanical jointing system to provide straight, rigid, continuously supported, tight butt, flush joints at surface.
- .8 Sizes: as indicated on drawings.

.2 Ceramic Magnets.
- .1 20 mm diameter, assorted colours.

2.2 ACCESSORIES

.1 Provide the following per markerboard.
- .1 Felt Markers: one (1) set of four (4) felt markers (black, blue, green, and red).
- .2 Eraser Brush: one (1) eraser brush.
- .3 Porcelain Writing Surface Cleaner: two (2) bottles

.2 Anchor Clips, Brackets and Fasteners: concealed type recommended by markerboard manufacturer for fixed mounting.

2.3 FABRICATION

.1 Fabricate finished panels flat, rigid and fit with joint reinforcement.

.2 Fit joints between abutting panels with covering trim.

.3 Aluminum Trim.
- .1 Install trim on panels in factory. Make mitres and joints to hair-line fit, free of rough edges with concealed brackets to reinforce and hold joints tight and flush. No exposed fasteners permitted.
- .2 Overlap trim 32 mm onto panels. Provide closed ends for open-end extrusions.
- .3 Factory fit assemblies too large for shipment to site in one piece, disassemble for delivery and site assembly.

2.4 FINISHES

.1 Aluminum Trim Finish.
- .1 AA-M12C22 A31 (0.4 mils) Architectural Class II Clear Anodic Coating in accordance with Aluminum Association Designation System for Aluminum Finishes.

Part 3 Execution

3.1 INSTALLATION

.1 Confirm fit of markerboards and ensure there are no conflicts with work of other trades. Report any discrepancies to Consultant.

.2 Install markerboards in accordance with manufacturer's instructions, parallel to floor with uniform vertical surface, plumb and level, to provide rigid, secure writing surface.

.3 Mechanical Attachment.

.1 To hollow masonry use toggle bolts or equivalent.

.2 To steel stud partitions use screws secured into wood blocking members in stud walls provided in accordance with Section 06 10 00.

3.2 CLEANING

.1 Clean surfaces after installation using manufacturer's recommended cleaning procedures.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 06 10 00 – Rough Carpentry.

.2 Section 09 29 00 – Gypsum Board.

1.2 REFERENCES

.1 Aluminum Association (AA).
- .1 Aluminum Alloy Castings - Properties, Processes, and Applications, 2004 Edition.
- .2 Designation System for Aluminum Finishes, 2003.

.2 American Society for Testing and Materials (ASTM).
- .1 ASTM A653/A653M-15, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by Hot-Dip Process.
- .2 ASTM B221M-13, Standard Specification for Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes [Metric].

.3 Underwriters Laboratories of Canada (ULC).
- .1 CAN/ULC S102-10, Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.

1.3 SUBMITTALS

.1 Shop Drawings.
- .1 Submit shop drawings in accordance with Section 01 33 00.
- .2 Indicate location, size, panel arrangement, hardware, anchor or mounting details, frame or trim and accessories.

.2 Closeout Submittals.
- .1 Provide maintenance data for incorporation into Operation and Maintenance Manual specified in Section 01 78 00.

1.4 QUALITY ASSURANCE

.1 Regulatory Requirements.
- .1 Conform to applicable code for flame/smoke rating of tackboard in accordance with CAN/ULC S102.

1.5 DELIVERY, STORAGE, AND HANDLING

.1 Deliver all material to site in manufacturer’s original unopened packaging with labels clearly identifying product name and manufacturer.

.2 Store materials in a dry, enclosed area protected from exposure to moisture, construction activity, and direct sunlight in strict accordance with manufacturer's recommendations.

.3 Handle all products with appropriate precautions and care as stated manufacturer's instructions.

.4 Cleaning and Waste Management in accordance with Section 01 74 00.

Part 2 Products

2.1 MANUFACTURED UNITS

.1 Tackboard (TB).
- .1 Facing: 6 mm thick linoleum resilient homogenous tackable surface material of natural material consisting of linseed oil, granulated cork, resin binders and dry pigments, mixed and calandered to natural jute backing, fire resistance in accordance with CAN/ULC-S102, self-healing, bacteria resistant, colour to be selected by Consultant from manufacturer's entire range.
- .2 Backing: 12 mm thick high density, moisture-resistant fibreboard.
- .3 Perimeter Trim: extruded clear anodized aluminum channel to ASTM B221, minimum 1.5 mm wall thickness.
- .4 Joint reinforcement: concealed mechanical jointing system to provide straight, rigid, continuously supported, tight butt, flush joints at surface.
- .5 Sizes: as indicated on drawings.

2.2 ACCESSORIES

.1 Laminating Adhesive: as recommended by manufacturer.

.2 Anchor Clips, Brackets and Fasteners: concealed type recommended by tackboard manufacturer for fixed mounting.

2.3 FABRICATION

.1 Make finished panels flat and rigid and fit with joint reinforcement.

.2 Fit joints between abutting panels with covering trim.

.3 Aluminum Trim.
- .1 Install trim on panels in factory. Make mitres and joints to hair-line fit, free of rough edges with concealed brackets to reinforce and hold joints tight and flush. No exposed fasteners permitted.
- .2 Overlap trim 32 mm onto panels. Provide closed ends for open-end extrusions.
- .3 Factory fit assemblies too large for shipment to site in one piece, disassemble for delivery and site assembly.

2.4 FINISHES

.1 Aluminum Trim Finish.
- .1 AA-M12C22 A31 (0.4 mils) Architectural Class II Clear Anodic Coating in accordance with Aluminum Association Designation System for Aluminum Finishes.

Part 3 Execution

3.1 INSTALLATION

.1 Confirm fit of tackboards and ensure there are no conflicts with work of other trades. Report any discrepancies to Consultant.

.2 Install tackboards in accordance with manufacturer's instructions, parallel to floor with uniform vertical surface, plumb and level, to provide rigid, secure writing surface.

.3 Mechanical Attachment.

.1 To hollow masonry use toggle bolts or equivalent.

.2 To steel stud partitions use screws secured into wood blocking members in stud walls provided in accordance with Section 06 10 00.

3.2 CLEANING

.1 Clean surfaces after installation using manufacturer's recommended cleaning procedures.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 American Society for Testing and Materials (ASTM).
- .1 ASTM A240/A240M-17, Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
- .2 ASTM D256-10e1, Standard Test Methods for Determining Izod Pendulum Impact Resistance of Plastics.
- .3 ASTM D1308-02(2013), Standard Test Method for Effect of Household Chemicals on Clear and Pigmented Organic Finishes.

1.2 SUBMITTALS

.1 Shop Drawings.
- .1 Submit shop drawings in accordance with Section 01 33 00.
- .2 Indicate size, finish, and anchorage details.

.2 Closeout Submittals.
- .1 Provide maintenance data for incorporation into Operation and Maintenance Manual specified in Section 01 78 00.

1.3 DELIVERY, STORAGE, AND HANDLING

.1 Deliver all material to site in manufacturer’s original unopened packaging with labels clearly identifying product name and manufacturer.

.2 Store materials in a dry, enclosed area protected from exposure to moisture, construction activity, and direct sunlight in strict accordance with manufacturer's recommendations.

.3 Handle all products with appropriate precautions and care as stated manufacturer's instructions.

.4 Cleaning and Waste Management in accordance with Section 01 74 00.

Part 2 Products

2.1 MANUFACTURED UNITS

.1 Stainless Steel Corner Guards 90˚ (CG): surface mounted, 16-gauge, Type 304 stainless alloy with No. 4 satin finish, 50 mm x 50 mm legs, heights as indicated on drawings, adhesive only attached.

.2 Rigid Vinyl Wall Covering (RV): 1.5 mm thick high impact PETG, thickness and finish as indicated. UL listed, impact resistance to 10-15 lbs./in. in accordance with ASTM D256, chemical and stain resistance in accordance with ASTM D1308; Type 1, Method B, Flame Spread Rating 25 or less and Smoke Developed Classification 50 or less in accordance with CAN/ULC-S102, secured to substrate with water-based adhesive. Manufacturer specific shadow grain/velvet texture with colour to be selected from manufacturer’s full colour range.

Part 3 Execution

3.1 PREPARATION

.1 Unwrap and acclimatize in installation area for 24 hours before application.

.2 Ensure surfaces are firm, smooth and dry, free from loose material or irregularities, and as recommended by manufacturer.

.3 Work penetrating wall surfaces to be completed before installing vinyl wall covering.

.4 Seal and prime wall surfaces to receive vinyl wall covering in accordance with manufacturer's instructions.

3.2 INSTALLATION

.1 Install corner guards in accordance with reviewed shop drawings and manufacturer's printed instructions.

.2 Install corner guards above specified wall base.

.3 Install rigid vinyl wall covering horizontally in longest practical lengths with the least number of vertical joints, complete with butt joint (no vertical trim pieces at joints) and in accordance with manufacturer's instructions.

.4 Apply continuous bead clear caulking along top and outside edges of corner guards and rigid vinyl wall covering.

3.3 CLEANING

.1 Upon completion of work, make sure that all wall protection is cleaned and free of surface blemishes and fingerprints.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 05 50 00 – Metal Fabrications.

.2 Section 06 10 00 – Rough Carpentry.

.3 Section 09 29 00 – Gypsum Board.

.4 Section 22 42 02 – Plumbing Fixtures.

1.2 REFERENCES

.1 American Society for Testing and Materials (ASTM).
- .1 ASTM A480/A480M-17, Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip.
- .2 ASTM A653/A653M-17, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- .3 ASTM C1503-08(2013), Standard Specification for Silvered Flat Glass Mirror.

.2 Canadian Standards Association (CSA).
- .1 CAN/CSA-B651-12(R2017), Accessible Design for Built Environment.

1.3 SUBMITTALS

.1 Shop Drawings.
- .1 Submit shop drawings in accordance with Section 01 33 00.
- .2 Indicate size and description of components, surface finish, hardware and locks, attachment devices, description of blocking requirements for accessories including grab bars.

.2 Closeout Submittals.
- .1 Provide operation and maintenance data for incorporation into Operation and Maintenance Manual specified in Section 01 78 00.
- .2 Provide special tools required for accessing, assembly/disassembly or removal of accessories.

1.4 DELIVERY, STORAGE, AND HANDLING

.1 Deliver all material to site in manufacturer’s original unopened packaging with labels clearly identifying product name and manufacturer.

.2 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.

.3 Store materials in a dry, enclosed area protected from exposure to moisture, construction activity, and direct sunlight in strict accordance with manufacturer's recommendations.

.4 Handle all products with appropriate precautions and care as stated manufacturer's instructions.

.5 Cleaning and Waste Management in accordance with Section 01 74 00.

Part 2 Products

2.1 MANUFACTURERS

.1 Basis of Design Products as scheduled at end of this Section.

.2 Requests for substitutions will be considered subject to specified requirements and in accordance with Bidding Procedures B8.

.3 Provide similar products from single manufacturer.

2.2 MATERIALS

.1 Stainless Steel: to ASTM A480/A480M, Type 304, No. 4 satin finish.

.2 Sheet Steel: to ASTM A653/A653M with G90 designation zinc coating.

.3 Fasteners: concealed screws and bolts hot dip galvanized, exposed fasteners to match face of unit. Expansion shields as recommended by accessory manufacturer for component and its intended use.

.4 Adhesive: epoxy type contact cement.

.5 Locking: where provided, locks by same manufacturer to be keyed alike.

2.3 FABRICATION

.1 Weld and grind joints of fabricated elements flush and smooth. Use mechanical fasteners only where approved.

.2 Wherever possible form exposed surfaces from one sheet of stock, free of joints.

.3 Brake form sheet metal work with 1.5 mm radius bends.

.4 Form surfaces flat without distortion. Maintain flat surfaces with scratches or dents.

.5 Paint backside of components where contact is made with building finishes to prevent electrolysis.

.6 Shop assemble components and package complete with anchors and fittings.

.7 Provide steel anchor plates and components for installation on studding and building framing.

Part 3 Execution

3.1 INSTALLATION

.1 Install and secure accessories rigidly in place as follows:
- .1 Steel Stud Walls: install steel back-plate or wood blocking to stud prior to gypsum board finish. Provide plate with threaded studs or plugs.
- .2 Hollow Masonry Units or existing plaster/gypsum board: use toggle bolts drilled into cell/wall cavity.
- .3 Use tamper-resistant fasteners.

.2 Fill units with necessary supplies shortly before final acceptance of building.

3.2 SCHEDULES

CODE	MANUFACTURER/MODEL NUMBER	DESCRIPTION
W:AHD	By Division 26	Electric Air Hand Dryer: locations and mounting heights as indicated.

CODE	MANUFACTURER/MODEL NUMBER	DESCRIPTION
W:BCS	ASI Group Canada 9018-9 Bobrick (Koala) KB200-01SS	Baby Change Station: to ASTM F2285, surface mounted wall unit, horizontal orientation, injection-moulded polypropylene cabinet with antimicrobial additive in bed surface. Type 304 brushed stainless steel veneer finish. Steel hinge assembly, integral support mechanism, and pneumatic cylinder for controlled opening and closing. Complete with liner dispenser, safety instructions in both official languages or graphic illustration, labeled with universally accepted symbol. Contoured change area complete with safety strap and bag hooks.
W:FM1	ASI Group Canada 0600-B-2430 Bobrick B-2908 2430 Bradley 780-2-2430	Framed Mirror: 610 x 760 mm to ASTM C1503, tempered glass set in one piece 19 x 19 mm, 18 gauge, satin stainless steel welded angle frame.
W:FM2	ASI Group Canada 0600-B-2460 Bobrick B-2908 2460 Bradley 780-2-2460	Framed Mirror: 610 x 1525 mm to ASTM C1503, tempered glass set in one piece 19 x 19 mm, 18-gauge, satin stainless steel welded angle frame.
W:FSS	ASI Group Canada 8203 Bobrick B-5191	Folding Shower Seat: Fold-up type, stainless steel frame and mounting brackets; one-piece seat fabricated from water-resistant solid phenolic material with drain slots. Seat size approximately 455 mm wide x 365 mm deep, 140 mm projection in folded position.
W:GR1	Bobrick B-5806.99 Bradley 832	Grab Rail: 32 mm diameter satin stainless steel, peened gripping surface, concealed mounting, 610 mm long, able to withstand 113.4 kg. minimum load.
W:GR2	Bobrick B-5806.99 Bradley 832	Grab Rail: 32 mm diameter satin stainless steel, peened gripping surface, concealed mounting, 760 mm long, able to withstand 113.4 kg. minimum load.
W:GR3	Bobrick B-5806.99 Bradley 832	Grab Rail: 32 mm diameter satin stainless steel, peened gripping surface, concealed mounting, 915 mm long, able to withstand 113.4 kg. minimum load.
W:LSD	ASI Group Canada 9343 Bobrick B-4112	Liquid Soap Dispenser: 180 x 155 x 65 mm, surface mounted, stainless steel construction, satin finish. Hinged lid for top filling. Capacity: 1.2 L.
W:MBR	ASI Group Canada 8215-4 Bobrick B-223 Bradley 9954	Mop/Broom Rack: surface mounted 22-gauge stainless steel with 4 spring-loaded mop/broom holders, 125 x 6915 mm long, satin finish.

CODE	MANUFACTURER/MODEL NUMBER	DESCRIPTION
W:NTW	ASI Group Canada 20852 Bobrick B-270 Bradley 4781-15	Napkin/Tampon Waste: surface mounted, satin stainless steel, type 304, 22-gauge, all-weld construction, self-closing door, removable leak-proof plastic receptacle.
W:PTD	Bobrick B-72974	Towel: Dispenser: automatic roll paper towel dispenser, 325 x 240 x 386 mm.
W:RHD	ASI Group Canada 7345-S Bobrick B-6727 Bradley 9124 BradEX	Robe Hook: double hook, 22-gauge, stainless steel, concealed 16-gauge stainless steel mounting bracket, satin finish.
W:SCR	Bobrick B-6047, 204-2/3, 204-1	Shower Curtain Rod: 18-gauge satin stainless steel heavy-duty shower curtain rod, 32 mm diameter x length to suit application, and 78 mm diameter flanges with 20-gauge snap on escutcheons for concealed mounting. Shower Curtain: white, 10 oz. nylon-reinforced anti-bacterial 8-gauge vinyl fabric, rust proof grommets every 150 mm, 1065 mm/1780 mm x 1830 mm complete with stainless steel spring wire hooks with snap fastener for use with 25 mm and 32 mm diameter rods.
W:SRH	Frost 1150 - Coloured Safety Coat Hook	Safety Coat Hook: spring loaded collapsible coat hook designed to collapse when loaded in excess of 11 kilograms (25 lbs.), epoxy colour coated 16 ga. stainless steel hooks on stainless steel circular base Type 304, No. 4 satin finish. Coat hooks to consist of a combination of 3 colours from manufacturer's colour selection.
W:SSS	ASI Group Canada 0692 Bobrick B-295	Stainless Steel Shelf: surface mounted, 18-gauge, type 304 satin stainless steel shelf, 125 mm x 400 mm x 125 mm deep with returned edges, complete with welded mounting brackets.
W:TPD	Bobrick B-4288	Toilet Paper Dispenser: Surface mounted, 22-gauge, stainless steel, dispensing two standard-core tissue rolls up to 135 mm diameter, extra roll automatically drops in place when bottom roll is depleted, theft resistant spindles, tumbler lock, 155 x 280 x 150 mm deep.
W:UM	By Section 08 80 00	Unframed Mirror.

CODE	MANUFACTURER/MODEL NUMBER	DESCRIPTION
W:WD	GNK Continental 25-GY Swingline Square Receptacle and Continental 1600-GY Swing Top.	Waste Disposal: Square polyethylene receptacle with rolled rim and reinforced base, approximately 420 x 420 x 685 mm high, 95 litre capacity. Provide complete with swing lid. Colour: Grey
W:WRR	Landscapeforms, Select, Double Unit	Waste & Recycling Receptacle: Solid body double unit with locking perforated doors, two-colour finish (1 for body and 1 for doors). 2 separate opening trims trim shapes and colours with separate signs as follows: 102 mm x 254 mm slot opening with # 10 *"Recycle"* signage, and 203 mm x 203 mm opening with #13 *"Waste Only"* signage, separate colour for each trim to be selected.

END OF SECTION

Part 1 General

1.1 RELATED WORK

.1 Section 06 10 00 – Rough Carpentry.

.2 Section 06 40 00 – Architectural Woodwork.

.3 Section 09 22 16 – Non Structural Metal Framing.

.4 Division 23 – Heating, Ventilating and Air Conditioning (HVAC).

.5 Division 26 – Electrical.

1.2 REFERENCES

.1 Canadian Standards Association (CSA).

.1 CSA C22.1-12, Canadian Electrical Code, Part I (22st Edition), Safety Standard for Electrical Installations.

1.3 SUBMITTALS

.1 Product Data.

.1 Submit product data in accordance with Section 01 33 00.

.2 Submit manufacturer's descriptive literature indicating materials, finishes and installation instructions for each type of fireplace specified.

.3 Show dimensions, locations of service outlets, special installation conditions and other related data required for coordination and connection.

.2 Closeout Submittals.

.1 Provide operation and maintenance data for incorporation into Operation and Maintenance Manual specified in Section 01 78 00.

1.4 QUALITY ASSURANCE

.1 Qualifications.

.1 Skilled tradesmen to be employed by specialty company recognized and trained as approved installer by manufacturer, and with minimum three (3) years' experience in installation of products specified.

.2 Regulatory Requirements.

.1 Ensure electrical connection is adequate and in conformance with the CSA C22.1 and all local codes.

1.5 DELIVERY, STORAGE, AND HANDLING

.1 Deliver all material to site in manufacturer's original unopened packaging with labels clearly identifying product name and manufacturer.

.2 Store materials in a dry, enclosed area protected from exposure to moisture, construction activity, and direct sunlight in strict accordance with manufacturer's recommendations.

.3 Handle all products with appropriate precautions and care as stated manufacturer's instructions.

.4 Cleaning and Waste Management in accordance with Section 01 74 00.

1.6 WARRANTY

.1 Manufacturer's Product Warranty: limited lifetime warranty from date of Substantial Performance of the Work. Manufacturer hereby warrants manufactured fireplace to be free of manufacturing and materials defects, and these or other observed defects and deficiencies will be repaired or replaced to the satisfaction of the Consultant and the City, and at no expense to the City.

Part 2 Materials

2.1 MANUFACTURED UNITS

.1 Basis of Design Products.

.1 Gas Fireplace.

.1 Luxuria See Thru Fireplace LVX74N2X complete with Indoor/Outdoor Kit IOL74K. Direct vent, through roof. Finishes: Shore Fire Kit SFKL and Birch Log Kit BLKXL.

.2 Requests for substitutions will be considered subject to specified requirements and in accordance with Bidding Procedures B8.

.3 Supply all products from single manufacturer.

2.2 COMPONENTS

.1 Gas Fireplace.

.1 Description: 2270 mm wide x 1046 mm high x 411 mm deep see-through natural gas fireplace as follows:

.1 BTU Output: 50, 000 BTU.
.2 Viewing Area: 1985 mm x 473 mm.
.3 Optimal heat management.
.4 Remote Control and Bluetooth app.
.5 Easy access air control for fast and precise air shutter adjustments.
.6 Electronic ignition with battery back-up.
.7 Shore and Birch Media Kits.
.8 Tempered Glass Guard Door.
.9 Ceramic Interior Safety Glass.
.10 Media Tray.
.11 Multi-Color LED Lighting.
.12 Accent Lights.
.13 Porcelain Reflective Radiant Panels.
.14 Tube Style Burner.
.15 Flame / Heat Adjustment.
.16 Firestop / Vent Shield.
.17 Stainless Steel Flex Connector.
.18 Easy Access Air Control .

Part 3 Execution

3.1 INSTALLATION

.1 Install fireplace in accordance with manufacturer's printed instructions.

.2 Install plumb, level, straight, rigidly supported, and securely fastened to abutting surfaces as applicable, free from superimposed loads.

.3 Co-ordinate connection of mechanical and electrical services.

.4 Adjust equipment for smooth and proper operation.

3.2 CLEANING

.1 Clean exposed surfaces using manufacturer recommended materials and methods. Remove labels and visible markings.

3.3 PROTECTION

.1 Protect installed product and finish surfaces from damage during construction.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 06 10 00 – Rough Carpentry.

.2 Section 09 29 00 – Gypsum Board.

.3 Section 09 90 00 – Painting and Coating.

1.2 REFERENCES

.1 National Fire Prevention Association (NFPA).
- .1 2018 NFPA 10, Standard for Portable Fire Extinguishers.

.2 Underwriters Laboratories of Canada (ULC).
- .1 CAN/ULC S504-12, Standard for Dry Chemical Fire Extinguishers.
- .2 CAN/ULC S508-02-R13, Standard for Dry Chemical Fire Extinguishers.

1.3 QUALITY ASSURANCE

.1 Regulatory Requirements.
- .1 Conform to NFPA 10 requirements for portable fire extinguishers.

1.4 SUBMITTALS

.1 Shop Drawings.
- .1 Submit shop drawings in accordance with Section 01 33 00.
- .2 Indicate location, type, size, anchor or mounting details, and accessories.

.2 Closeout Submittals.
- .1 Provide maintenance data for incorporation into Operation and Maintenance Manual specified in Section 01 78 00.

1.5 DELIVERY, STORAGE, AND HANDLING

.1 Deliver all material to site in manufacturer’s original unopened packaging with labels clearly identifying product name and manufacturer.

.2 Store materials in a dry, enclosed area protected from exposure to moisture, construction activity, and direct sunlight in strict accordance with manufacturer's recommendations.

.3 Handle all products with appropriate precautions and care as stated manufacturer's instructions.

.4 Cleaning and Waste Management in accordance with Section 01 74 00.

1.6 WARRANTY

.1 Manufacturer’s Product Warranty: provide an extended warranty for Work of this Section for a period of six (6) years from date of Substantial Performance of the Work. Manufacturer hereby warrants fire extinguishers to be free of manufacturing and material defects, and these or other observed defects and deficiencies will be repaired or replaced to the satisfaction of the Consultant and the City, and at no expense to the City.

Part 2 Products

2.1 MANUFACTURED UNITS

.1 Fire Extinguishers (FE): Refer to Section 21 13 13.

.2 Cabinets (FE-SR/FE-FR): sized to accommodate fire-extinguishers, semi-recessed (FE-SR)/fully-recessed (FE-FR), 22-gauge steel tub and 16-gauge steel door with either flat trim frame or 50 mm return frame, full length semi-concealed piano hinge and flush stainless steel door latch, entire cabinet finished in baked enamel and glazed with 5 mm clear glass. Provide fire-rated cabinets in all fire-rated wall assemblies.

Part 3 Execution

3.1 INSTALLATION

.1 Install in accordance with manufacturer's instructions, plumb and level.

.2 Mounting height of extinguishers (on brackets or in cabinets) to be in accordance with NFPA guidelines.

.3 Securely fasten to structure, square and plumb, to comply with manufacturer's instructions.

3.2 CLEANING

.1 Clean surfaces after installation using manufacturer's recommended cleaning procedures.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 06 10 00 – Rough Carpentry.

.2 Section 09 29 00 – Gypsum Board.

1.2 REFERENCES

.1 Canadian General Standards Board (CGSB).
- .1 CAN/CGSB-44.40-2001 AMEND, Steel Clothing Locker.

1.3 SUBMITTALS

.1 Shop Drawings.
- .1 Submit shop drawings in accordance with Section 01 33 00.
- .2 Indicate type and class of locker, thicknesses of metal, fabricating and assembly methods, assembled banks of lockers, tops, hooks, shelves, bases, trim, numbering, filler panels, end/back panels, doors, handles, locking method, ventilation method, finishes.

.2 Closeout Submittals.
- .1 Provide maintenance data for incorporation into Operation and Maintenance Manual specified in Section 01 78 00.

1.4 DELIVERY, STORAGE, AND HANDLING

.1 Deliver all material to site in manufacturer’s original unopened packaging with labels clearly identifying product name and manufacturer.

.2 Store materials in a dry, enclosed area protected from exposure to moisture, construction activity, and direct sunlight in strict accordance with manufacturer's recommendations.

.3 Handle all products with appropriate precautions and care as stated manufacturer's instructions.

.4 Cleaning and Waste Management in accordance with Section 01 74 00.

1.5 WARRANTY

.1 Manufacturer’s Product Warranty: provide an extended warranty for Work of this Section for a period of two (2) years from date of Substantial Performance of the Work. Manufacturer hereby metal lockers against defects in materials and workmanship subject to proper care and maintenance, and these or other observed defects and deficiencies will be repaired or replaced to the satisfaction of the Consultant and the City, and at no expense to the City.

Part 2 Products

2.1 MANUFACTURED UNITS

.1 Lockers: to CAN/CGSB-44.40, Double Tier.
- .1 Size. 380 mm wide x 460mm deep x 1830 mm high.
- .2 Body: fabricated from 24-gauge prefinished steel. Sides to have offsets and backs flanged, formed and factory punched to provide necessary assembly holes. Flange tops, bottoms, and shelves on all four sides with formed under return on front of shelves. Provide 16-gauge support bracket installed across centre of locker bottom.

.3 Frame: weld together from specially formed channel sections of prime cold rolled steel. Provide two rubber door grommets on lock side of frame. Incorporate ventilation slots at top and bottom of frames. Close door on 16-gauge frame member with 16 mm wide closure strike full height of door, fit flush with outside of frame. Weld 11-gauge security strike to frame's continuous door strike. Close door on two sound-deadening rubber grommets. Hang door on 16-gauge continuous one-piece integral right hand hinge and frame.

.4 Doors fabricate with 20-gauge outer door panel and 24-gauge inner door panel. Form outer door panel from channels on both sides, and top and bottom. Inner door panel covers back of door pocket to eliminate vandalism, formed with channels on both sides, interlocked with outer panel, and mig welded together at top, bottom and both sides on back surface edges of door. Box welded door assembly 3 mm thick. Single pan outer doors with partial inner door reinforcing pans are not acceptable.

.5 Single Point Latching: through 18-gauge single piece deep-drawn double chrome-plated recessed pocket (all locker types). Weld single piece 12-gauge channel formed hasp to both legs of 16-gauge channel frame member. Riveted hasps are not acceptable. Door is opened by pulling on 18-gauge channel formed chrome-plated door pull.

2.2 ACCESSORIES

.1 Locking System: padlocks by the City.

.2 Options.

.1 Prefinished steel trim including filler panels, corner angles, adjustable head, jamb trim and sloped top.

.2 Manufacturer's standard number plates.

.3 Locker Base: Wood in accordance with section 06 10 00

2.3 FINISHES

.1 Thoroughly machine clean cold rolled steel surfaces with phosphoric acid based cleaner and finish with high performance polymer powder coating.

.2 Consultant to select colours from manufacturer's full colour range. Allow for up to two (2) colours to be selected.

Part 3 Execution

3.1 INSTALLATION

.1 Assemble and install lockers in accordance with manufacturer's written instructions.

.2 Safely and securely fasten lockers as detailed to solid blocking in walls (or grounds and nail strips) and wood bases provided in accordance with Section 06 10 00.

.3 Install wall trim and head jamb around recessed locker banks.

.4 Install filler panels (false fronts and corners) where indicated and where obstructions occur.

.5 Install locker numbers.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 03 30 00 – Cast-In-Place Concrete.

.2 Section 09 06 00.13 – Room Finish Schedule.

1.2 SYSTEM DESCRIPTION

.1 One-piece roll-up matting with recessed perimeter frame.

1.3 REFERENCES

.1 American Society for Testing and Materials (ASTM).
- .1 ASTM B221M-13, Standard Specification for Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes [Metric].

.2 British Standards Institution (BSI).
- .1 BS 2782—0:2011, Methods of Testing Plastic. Introduction.

1.4 SYSTEM DESCRIPTION

.1 Loading: Design frame sections to support uniformly distributed load of minimum 300 psf.

1.5 SUBMITTALS

.1 Make all submittals in accordance with requirements of Section 01 33 00.

.2 Shop Drawings.
- .1 Provide manufacturer’s product specifications and installation instructions.
- .2 Indicate layout and types of floor mats and frames not less than half-scale sections of typical installations, details of patterns or designs, anchors, and accessories, and field measurements of slab recess to receive frames.

.3 Samples.
- .1 Submit 300 mm x 300 mm section of floor mat and frame material.

.4 Closeout Submittals.
- .1 Provide maintenance data for incorporation into Operation and Maintenance Manual specified in Section 01 78 00.

1.6 DELIVERY, STORAGE, AND HANDLING

.1 Deliver all material to site in manufacturer’s original unopened packaging with labels clearly identifying product name and manufacturer.

.2 Store materials in a dry, enclosed area protected from exposure to moisture, construction activity, and direct sunlight in strict accordance with manufacturer's recommendations.

.3 Handle all products with appropriate precautions and care as stated manufacturer's instructions.

.4 Cleaning and Waste Management in accordance with Sections 01 74 00.

1.7 SEQUENCING

.1 Co-ordinate with concrete work of Section 03 30 00 so that frames are available for placing integrally with floor slabs.

Part 2 Products

2.1 MANUFACTURERS

.1 Acceptable Products.
  .1 Aluminum Floor Grating (FG).
    .1 Arden G-218P EnvIRONtread II reversible grate with recycled fibre-reinforced rubber treads alternating with aluminum divider bars and vinyl spacers. Frame: EnvIRONtread F-13 aluminum recessed frame.

.2 Requests for substitutions will be considered subject to specified requirements and in accordance with Bidding Procedures B8.

.3 Supply similar products from single manufacturer.

2.2 MATERIALS

.1 Aluminum extrusions: to ASTM B221, 6061-T6, 6063-T5, 6063-T6, 6105-T5.

.2 Tread Inserts: recycled nylon reinforced buffed rubber mechanically secured to tread rails. Tread colour: Grey.

.3 Fasteners: non-corrosive screws and anchors for securing frames together and to floors.

2.3 FABRICATION

.1 Fabrication Tolerances: Obtain field measurements of recessed areas prior to fabrication, including squareness and levelness of recess.

.2 Shop fabricate floor mats and frames to greatest extent possible in sizes shown on drawings.

.3 Provide single mat for each installation, but do not exceed manufacturer's maximum size recommendation for mats intended for removal and cleaning.

.4 Butt corners of framing elements with hairline joints or provide prefabricated corner units without joints.

Part 3 Execution

3.1 EXAMINATION

.1 Examine substrates and conditions under which work is to be performed, and notify Consultant in writing of conditions detrimental to proper and timely completion of work.

.2 Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

.1 Install entrance floor mats and frames in accordance with reviewed shop drawings, manufacturer's written instructions, at locations shown and with top of frames level with adjoining finished flooring.

.2 Co-ordinate top of mat surfaces with doors that swing across mats to ensure under door clearance.

.3 Provide necessary shims, spacer, and anchorages for proper location and secure attachment of frames to concrete.

.4 Grout frames into recessed concrete using chemical resistant 100% solids epoxy grout.

3.3 PROTECTION

.1 Upon completion of frame installations, provide temporary cover of plywood on mat recesses, and cover frames with plywood protective flooring.

.2 Maintain protection until construction traffic has ended and project is near time of substantial completion.

3.4 SCHEDULES

.1 Refer to Section 09 06 00.13.

END OF SECTION

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15 Poseidon Bay, Winnipeg, MB

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LM Architectural Group

500-136 Market Ave
Winnipeg Manitoba
Canada R3B 0P4
t: (204) 942.0681
f: (204) 943.8676
www.lm-architects.com

PROJECT:
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MASTER ABBREVIATIONS LIST FOR DRAWINGS:

(REFER TO DOOR SCHEDULE AND ROOM FINISH SCHEDULE FOR DOOR AND ROOM FINISH ABBREVIATIONS)

&	AND
@	AT
℄	CENTERLINE
99	EMERGENCY CALL BUTTON
ACS	ACOUSTIC CEILING SYSTEM
ADJ.	ADJUSTABLE
ADO	AUTOMATIC DOOR OPERATOR
A.F.F./AFF	ABOVE FINISH FLOOR
ALUM.	ALUMINUM
ANOD.	ANODIZED
APPROX.	APPROXIMATE
ASPH.	ASPHALT
AWP	ACOUSTIC WALL PANEL
BD.	BOARD
BGL	BUMPER GUARD, LOWER
BGU	BUMPER GUARD, UPPER
BLDG.	BUILDING
BM.	BEAM
BR.	BRONZE
B.S./BS	BOTH SIDES
BSMT.	BASEMENT
CA	SINGLE COMPRESSED AIR OUTLET
C.B.	CATCH BASIN
CC	CUBICLE CURTAIN
CG (1200)	CORNER GUARD (# = HEIGHT)
CJ	CONTROL JOINT
CL.	CLEAR
CLG.	CEILING
C/M	CEILING MOUNTED
CMU	CONCRETE MASONRY UNIT
CO2	SINGLE CARBON DIOXIDE OUTLET
C.O.	CLEAN OUT
COL.	COLUMN
CONC.	CONCRETE
CONST.	CONSTRUCTION
CONT.	CONTINUOUS
CPT	CARPET
CPU	CPU HOLDER
CR	CHAIR RAIL
CS	CULTURED STONE
C/W	COMPLETE WITH
DA	DATA OUTLET
DAMP.	DAMPPROOFING MEMBRANE
DF	DRINKING FOUNTAIN
DIA.	DIAMETER
DN.	DOWN
DRE	DUPLEX RECEPTACLE - EMERGENCY POWER
DRN	DUPLEX RECEPTACLE - NORMAL POWER
DS	DOWNSPOUT
DW	DISPLAY WALL
DWG.	DRAWING
E OR ELECT.	ELECTRICAL
EIFS	EXTERIOR INSULATION AND FINISH SYSTEM
ELEV.	ELEVATION
ELP	ELECTRICAL PANEL
EQ.	EQUAL
ES OR ESP	EXPOSED STRUCTURE - PAINTED
ESU	EXPOSED STRUCTURE - UNFINISHED
EXIST.	EXISTING
EXT.	EXTERIOR
FACP	FIRE ALARM CONTROL PANEL
F.D.	FLOOR DRAIN
FDC	FIRE DEPARTMENT CONNECTION
FE (-S) (-F)	FIRE EXTINGUISHER (SEMI-RECESSED) (FULLY RECESSED)
FF	FORCE FLOW UNIT
FHC	FIRE HOSE CABINET
FIN.	FINISH OR FINISHEED
FLR.	FLOOR
FR	FIRE-RATED
F.S.	FULL SIZE
Ga.	GAUGE
GALV.	GALVANIZED
G.B.	GYPSUM BOARD
GBEP	GYSUM BOARD - EPOXY PAINT FINISH
GD	GLOVE DISPENSER (NIC)
GL	GLAZING
GRT	GROMMET
GSF	GLAZING SURFACE FILM
H.B.	HOSE BIB
H.M.	HOLLOW METAL
HORIZ.	HORIZONTAL
HR	HANDRAIL
H.S.S.	HOLLOW STEEL SECTION
H.	HEIGHT
HWT.	HOT WATER TANK
I.D.	INSIDE DIAMETER
INSUL.	INSULATION
INT.	INTERIOR
IVT	IV TRACK
JAN.	JANITOR
KB	KEYBOARD TRAY
LAV.	LAVATORY
LGL	LOUVERED GLAZING
LP	LIGHTING PANEL
LWCS	LINEAR WOOD CEILING SYSTEM
M	METRE
MA	SINGLE MEDICAL AIR OUTLET
MAX.	MAXIMUM
MB	MARKERBOARD
MDF	MEDIUM DENSITY FIBERBOARD
MECH.	MECHANICAL
MEZZ.	MEZZANINE
M.H.	MANHOLE
MIN.	MINIMUM
MISC.	MISCELLANEOUS
mm	MILLIMETER
M.O.	MASONRY OPENING
MOD. BIT.	MODIFIED BITUMINOUS
MTD	MOUNTED
MV	MASONRY VENEER
N	SINGLE NITROGEN OUTLET
NC	NURSE CALL
NO. OR #	NUMBER
N.I.C. OR NIC	NOT IN CONTRACT
N.T.S.	NOT TO SCALE
O/C	ON COUNTER
O.C.	ON CENTRE
O.D.	OUTSIDE DIAMETER
CFP	CITY FURNISHED PRODUCT (IN CONTRACT INSTALLATION)
O.H.	OVERHEAD
O.S.	OVERFLOW SCUPPER
OSB	ORIENTED STRAND BOARD
OSC	OVERFLOW SCUPPER THROUGH CURB
OSD	OVERFLOW SCUPPER & DOWNSPOUT
OX	SINGLE OXYGEN OUTLET
P	PAINT
PARG.	CEMENT PARGING
PCT	PRIVACY CURTAIN TRACK
PH.	PHENOLIC
PL.	PLASTIC
PL OR PL. LAM.	PLASTIC LAMINATE
PLP	PLASTIC LAMINATE PANELS
PLBG.	PLUMBING
PREFAB.	PREFABRICATED
PREFIN.	PREFINISHED
P.T.	PRESSURE TREATED
PTD. OR PTD	PAINTED
PVC	POLYVINYL CHLORIDE
PW	PLYWOOD
QTY.	QUANTITY
R.D.	ROOF DRAIN
RDD	ROOF DRAIN DISCHARGE
REINF.	REINFORCED OR REINFORCING
REQ'D.	REQUIRED
REV.	REVISION
R.O.	ROUGH OPENING
RWL	RAIN WATER LEADER
SBD	SCUPPER BOX & DOWNSPOUT
SC	SHARPS CONTAINER (NIC)
SIM. OR SIM	SIMILAR
SL.	SLOPE
SP	SPANDREL PANEL
SPD	SUMP PUMP PIT DISCHARGE
SQ.	SQUARE
S.S. OR SS	STAINLESS STEEL
SSM	SOLID SURFACING MATERIAL
ST.	STAIR
STL.	STEEL
STRUCT.	STRUCTURAL
SUSP.	SUSPENDED
T & G	TONGUE AND GROOVE
TB	TACK BOARD
TS	TACK SURFACE
T.O.	TOP OF
TYP.	TYPICAL
U/C	UNDER COUNTER
UM	UNFRAMED MIRROR
U.N.O.	UNLESS NOTED OTHERWISE
U/S	UNDERSIDE
V	SINGLE VACUUM OUTLET
V.B.	VAPOUR BARRIER
VERT.	VERTICAL
VEST.	VESTIBULE
VL	VALANCE LIGHT
W/.	WITH
WD.	WOOD
W/M	WALL MOUNTED
WGCS	WOOD GRILLE CEILING SYSTEM
WR.	WASHROOM
WV	WOOD VENEER
X	EXISTING
XJ	EXPANSION JOINT
XR	EXISTING TO BE RELOCATED

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PROJECT:

Bill and Helen Norrie Library

Project Address: 15 Poseidon Bay, Winnipeg, MB.

Refer to drawing:

DRAWN BY: HW DATE: 07.08.19

AP0.02

COMM. NO.: 1847

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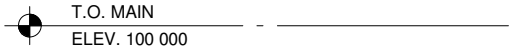
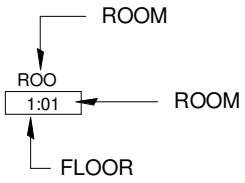
DRAWING SYMBOLS AND CONVENTIONS:

GRID AND GRID

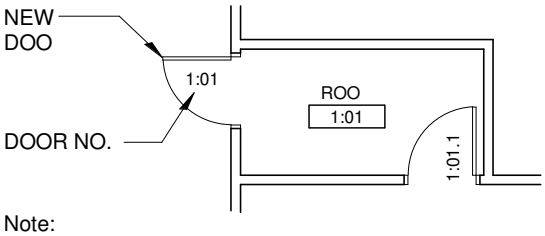
FLOOR



ROOM NAME:
ROOM



DOOR

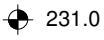


Note:
Typically the door number matches the number of the room that the door enters into regardless of the directionof swing. When a room contains more than one door the number sequence is as per the following example: 1:01, 1:01.1, 1:01.2

SITE GRADE

EXISTING

NEW



WALL

REVISION

REFERENCE

WINDOW

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PROJECT:
Bill and Helen Norrie Library

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Refer to drawing:

DRAWN BY: HW DATE: 07.08.19

AP0.03

COMM. NO.: 1847

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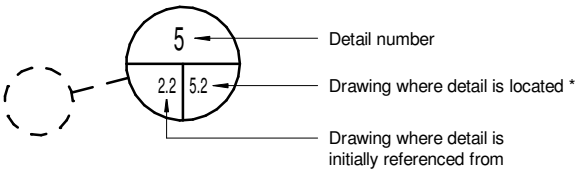
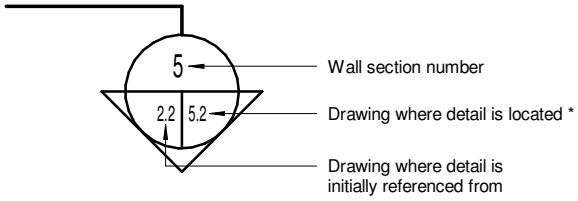
DRAWING REFERENCE SYMBOLS:

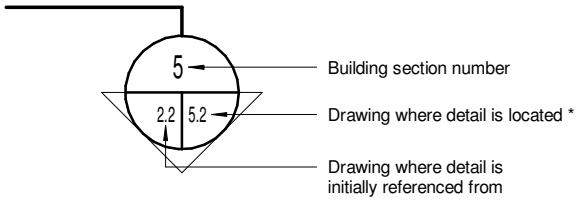
DETAIL:



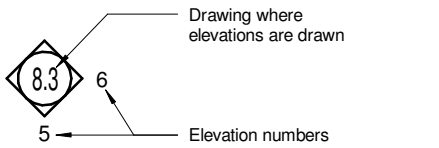
WALL SECTION:

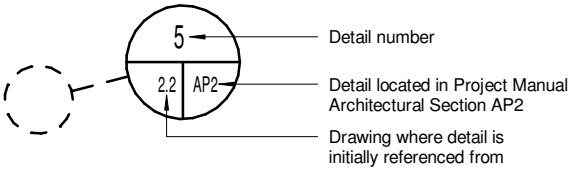


BUILDING SECTION:



ELEVATIONS:





* When REFERENCE SYMBOL includes the letters 'AP' or is referenced as AP2.5; it indicates the detail is located in the PROJECT MANUAL

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PROJECT:

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Refer to drawing:

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AP0.04

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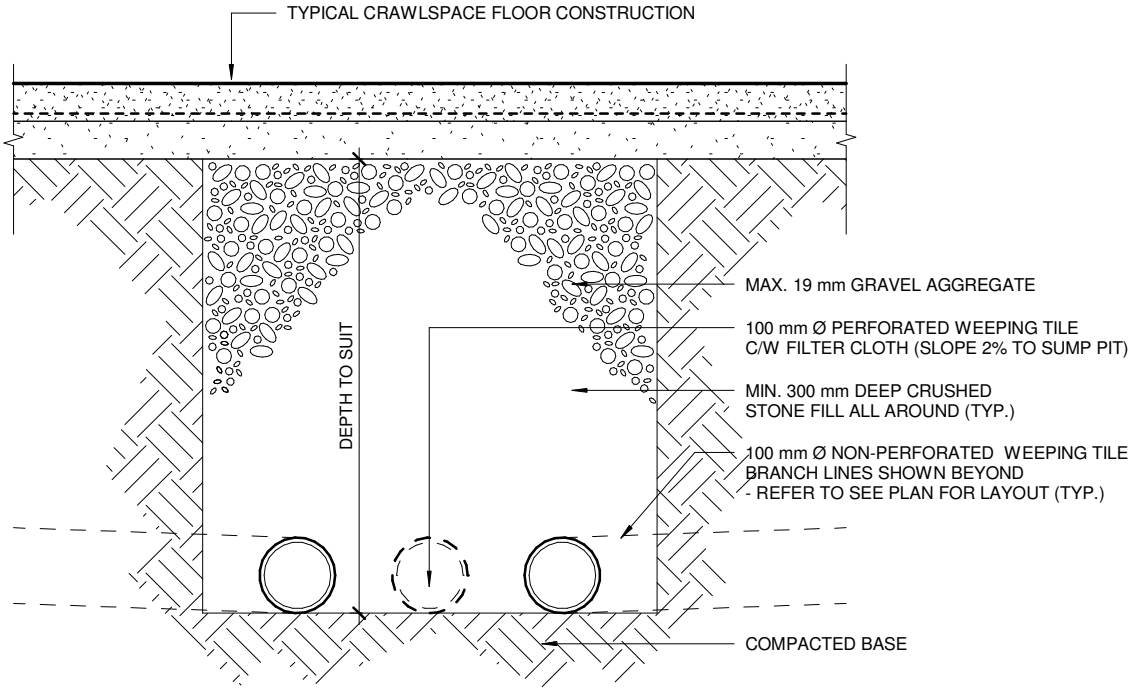
AP2

CONSTRUCTION DETAILS



CONTINUOUS WEEPING TILE TRENCH

SCALE 1 : 10

1. EXCAVATE BASE OF TRENCH TO SUIT SLOPE OF WEEPING TILE TO SUMP PIT. DO NOT OVER EXCAVATE.
2. SET WEEPING TILE ON BASE OF EXCAVATION (TYP.)

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AP2.01

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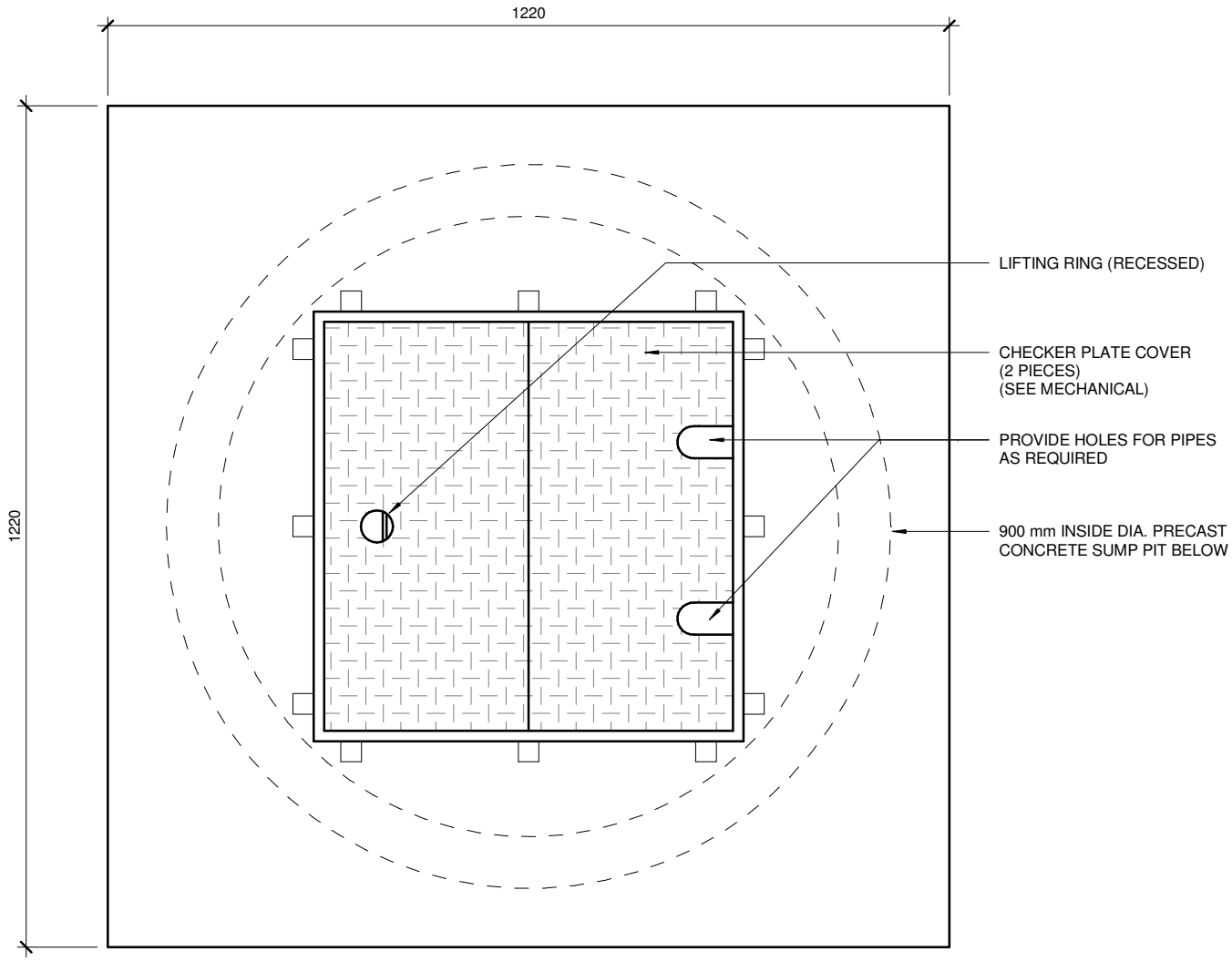

SUMP PUMP PIT COVER & FRAME

1 : 10

NOTE:

PRECAST CONCRETE SUMP PIT MIN. INSIDE DIA. 900 mm
C/W HEAVY DUTY STEEL LID C/W MECH. AND ELECT.
OPENINGS AS REQUIRED

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PROJECT:

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Refer to drawing: A2.0

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AP2.02

COMM. NO.: 1847

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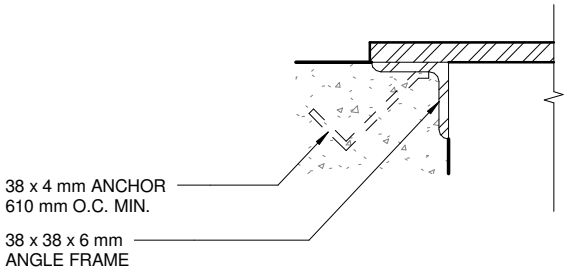
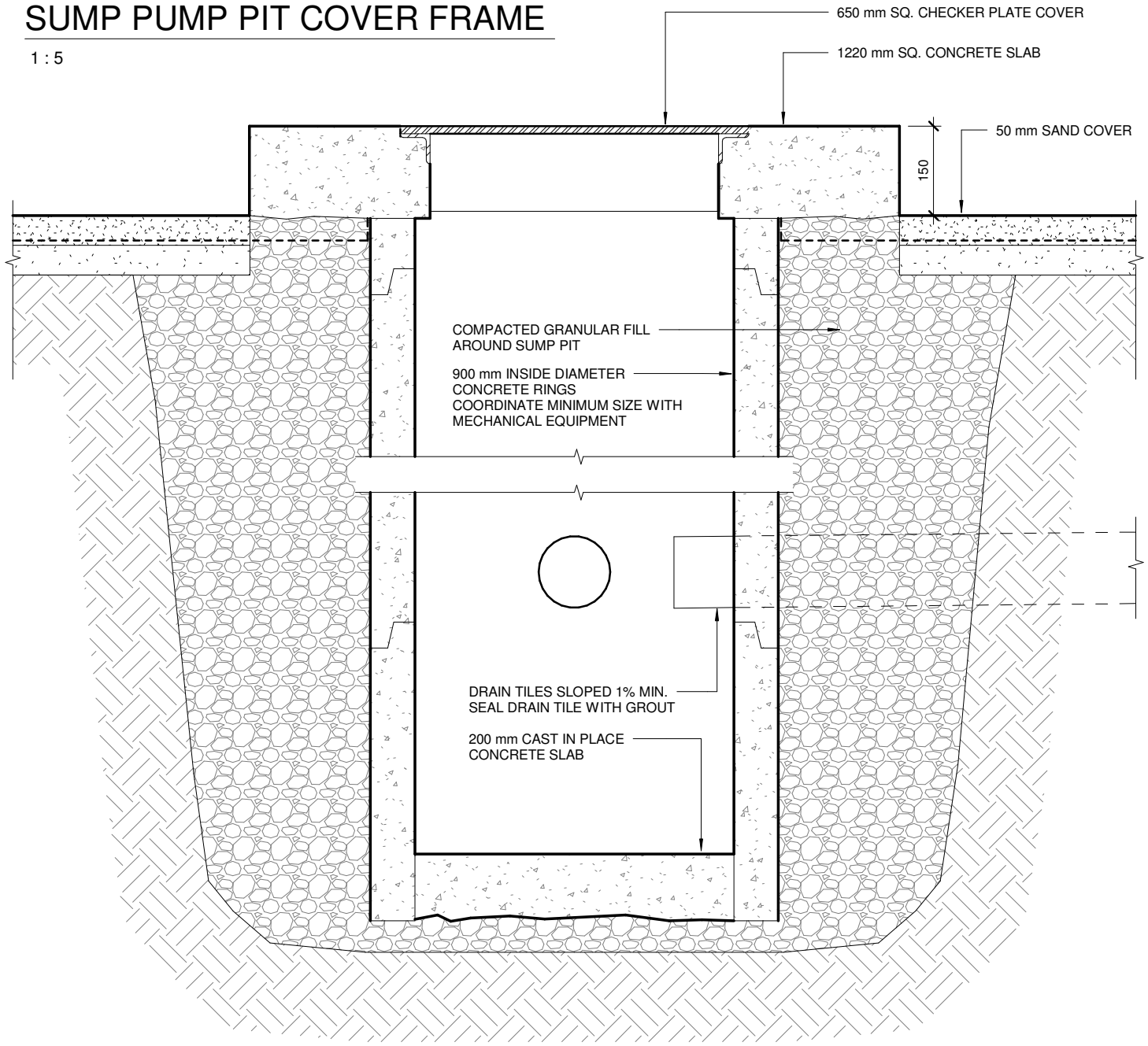


SUMP PUMP PIT COVER FRAME

1 : 5



SUMP PUMP PIT SECTION

1 : 10

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AP2.03

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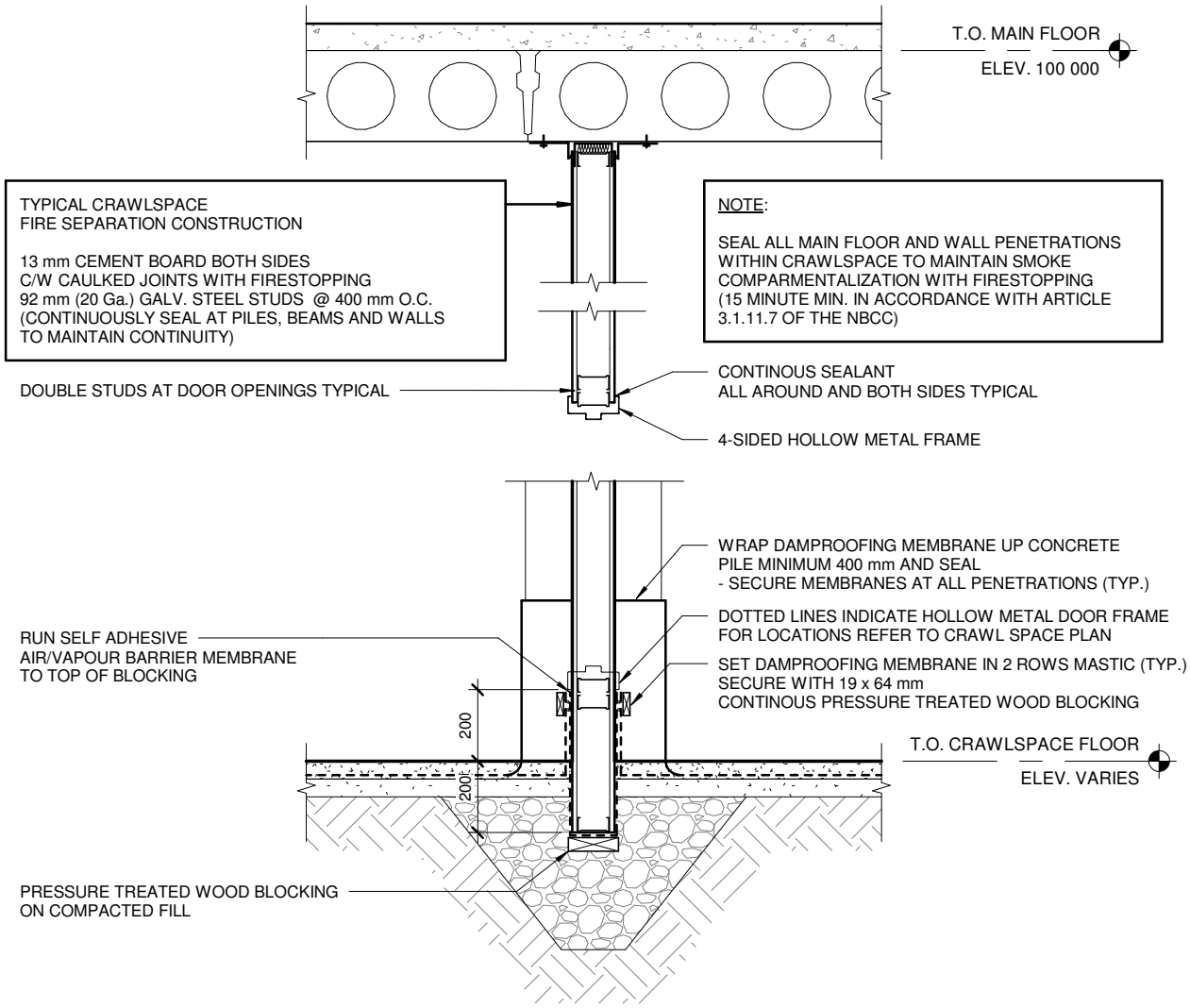

CRAWLSPACE FIRE SEPARATION SECTION

1 : 20

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Refer to drawing: A2.0

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AP2.04

COMM. NO.: 1847

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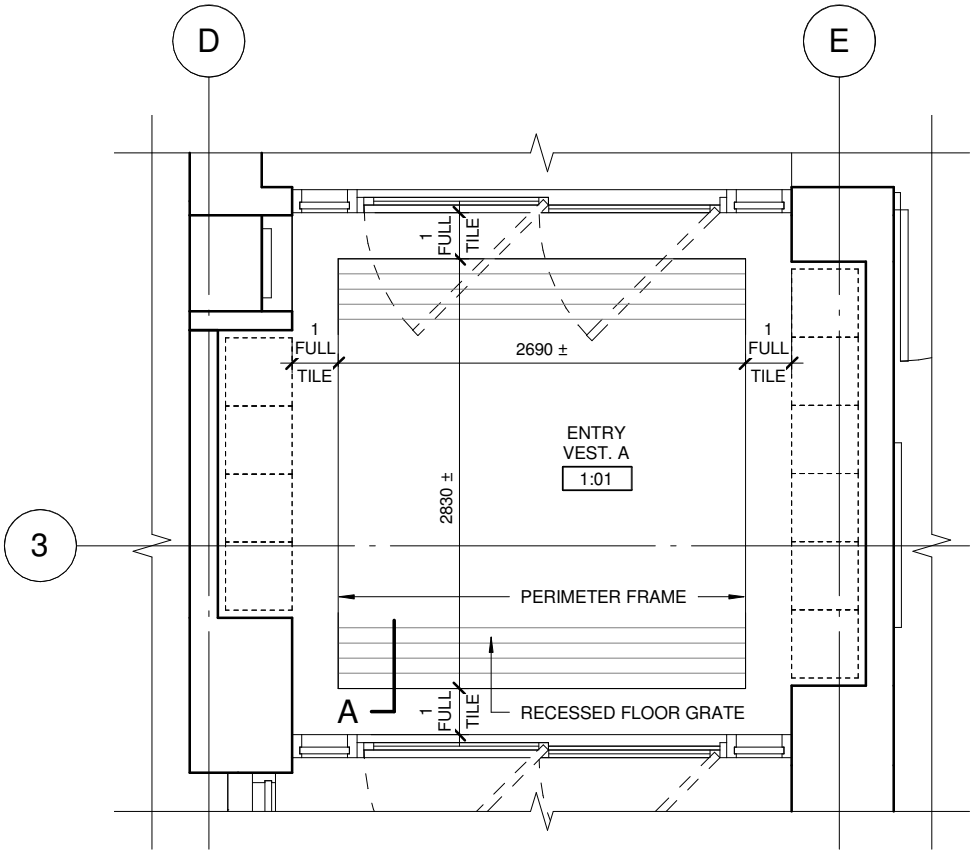
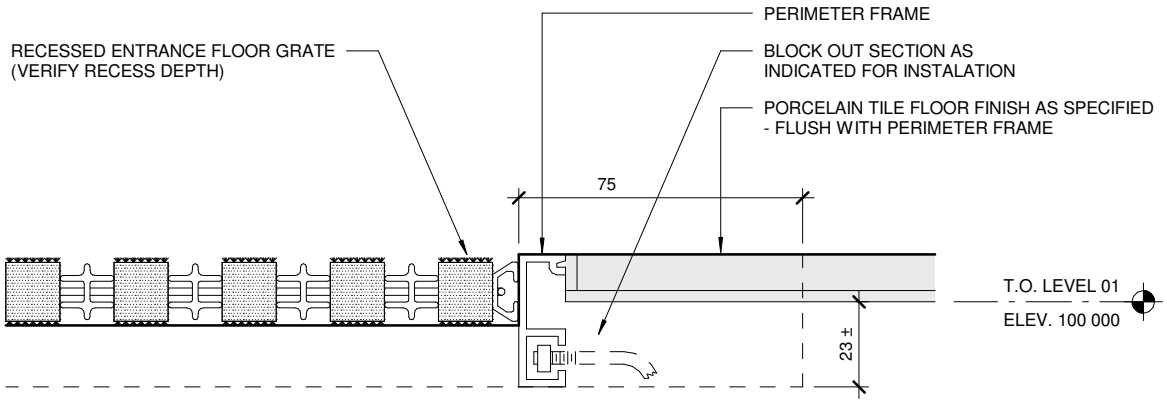


PLAN OF ENTRY VEST. A 1:01 RECESSED FLOOR GRATE

SCALE 1 : 50

NOTE: COORDINATE EXTENT OF RECESSED FLOOR GRATE WITH FLOOR TILE PATTERN AS INDICATED.



SECTION A

SCALE 1 : 2

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PROJECT:

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Refer to drawing: A2.1

DRAWN BY: HW DATE: 07.08.19

AP2.05

COMM. NO.: 1847

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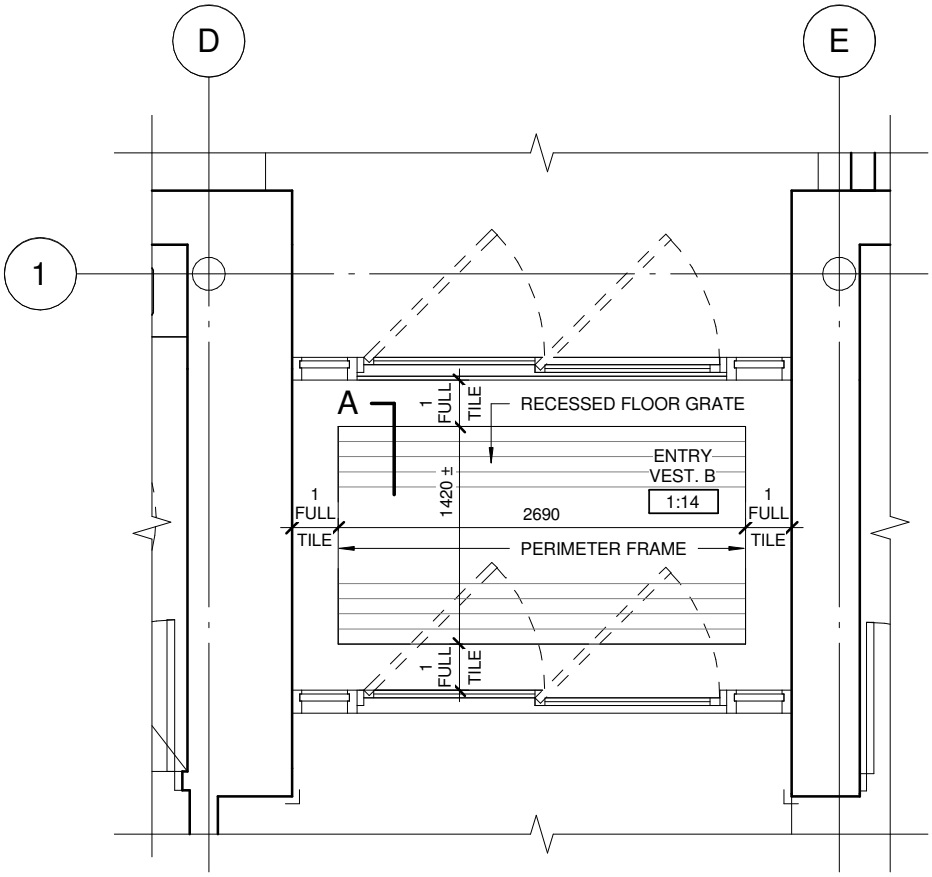
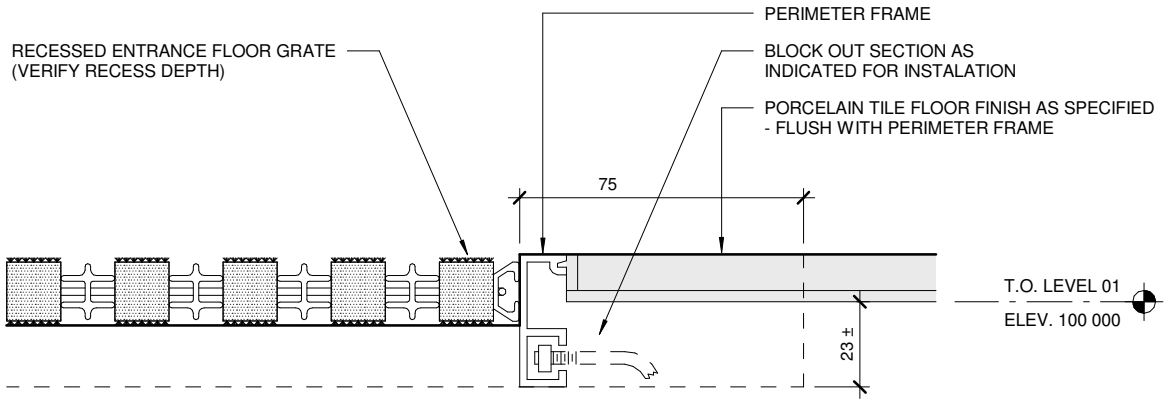


PLAN OF ENTRY VEST. B 1:14 RECESSED FLOOR GRATE

SCALE 1 : 50

NOTE:	COORDINATE EXTENT OF RECESSED FLOOR GRATE WITH FLOOR TILE PATTERN AS INDICATED.



SECTION A

SCALE 1 : 2

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PROJECT:

Bill and Helen Norrie Library

Project Address: 15 Poseidon Bay, Winnipeg, MB.

Refer to drawing: A2.1

DRAWN BY: HW DATE: 07.08.19

AP2.06

COMM. NO.: 1847

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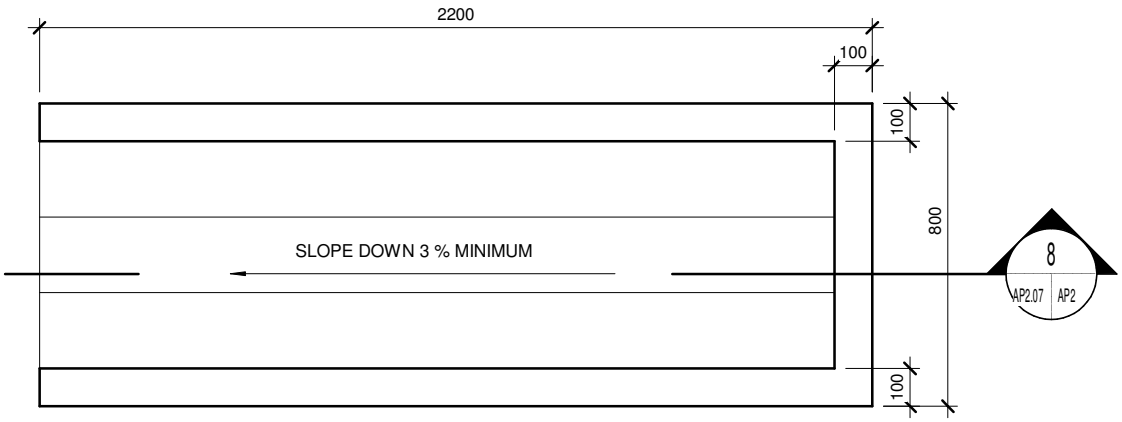

PLAN DETAIL OF CAST IN PLACE SPLASH PAD

SCALE 1 : 20

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Refer to drawing: A2.1

DRAWN BY: HW DATE: 07.08.19

AP2.07

COMM. NO.: 1847

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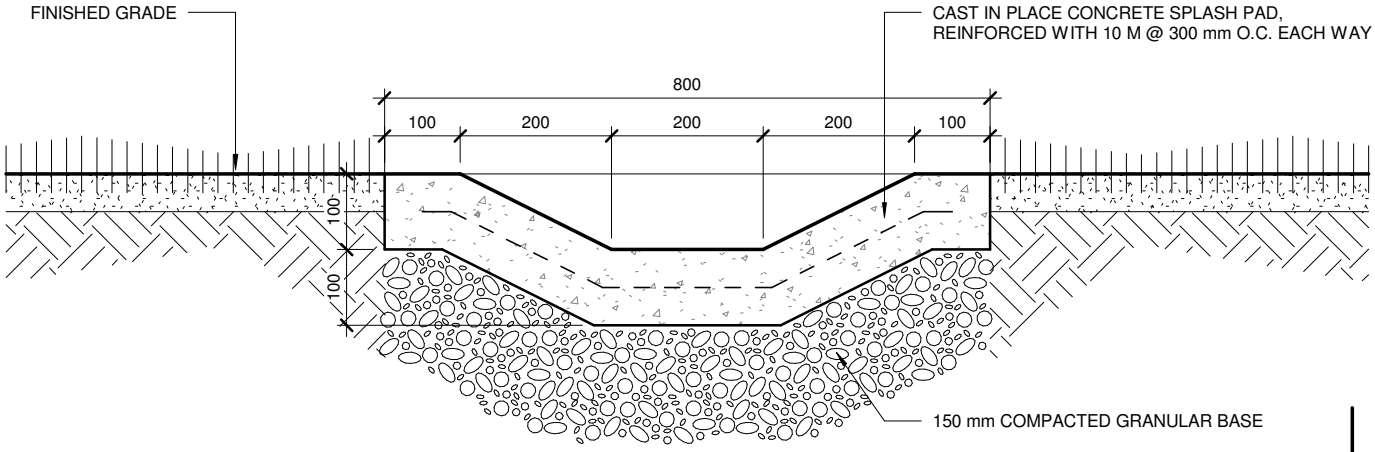
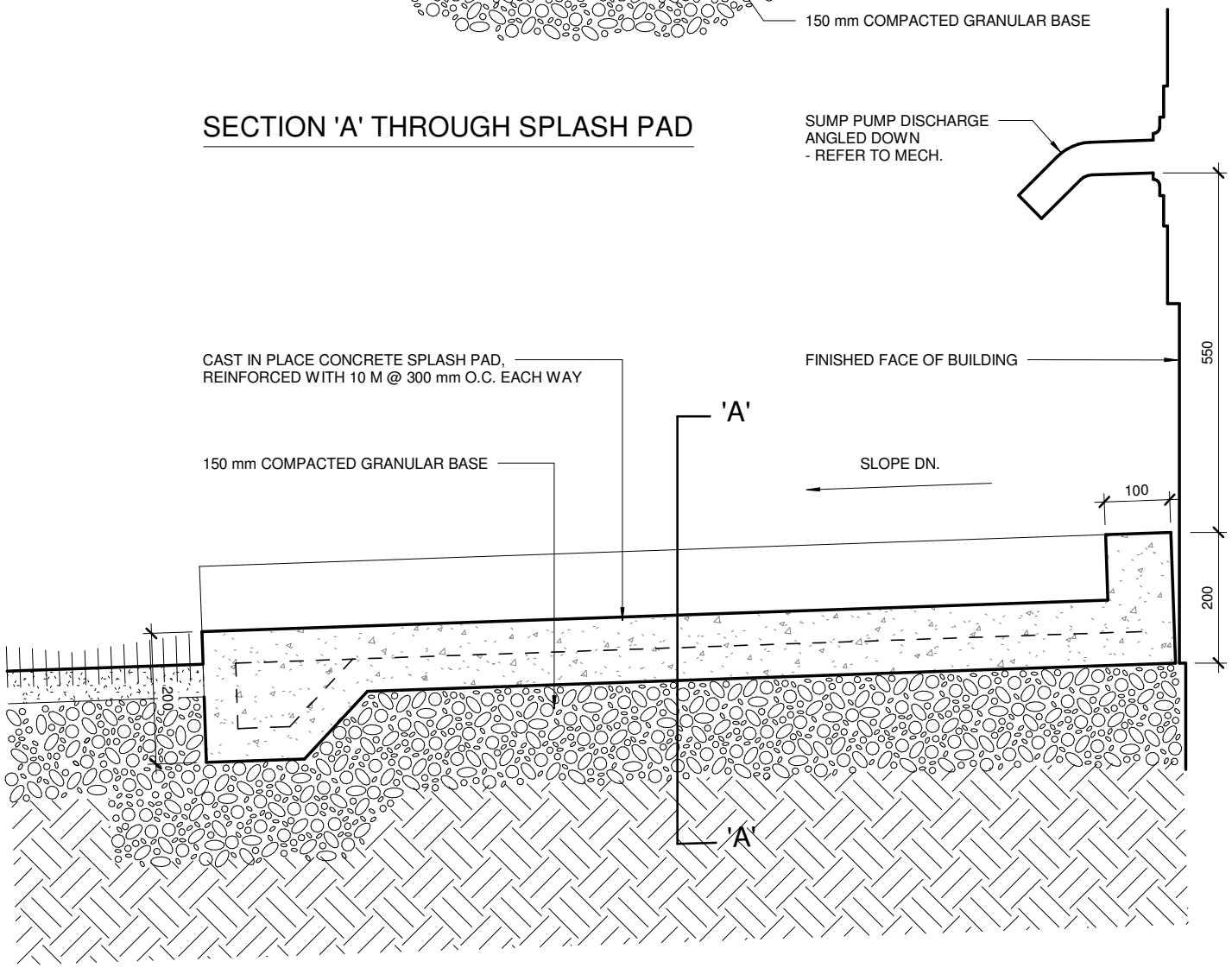


SECTION 'A' THROUGH SPLASH PAD



SECTION THRU CAST IN PLACE SPLASH PAD

SCALE 1 : 10

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PROJECT:

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Refer to drawing: A2.1

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AP2.08

COMM. NO.: 1847

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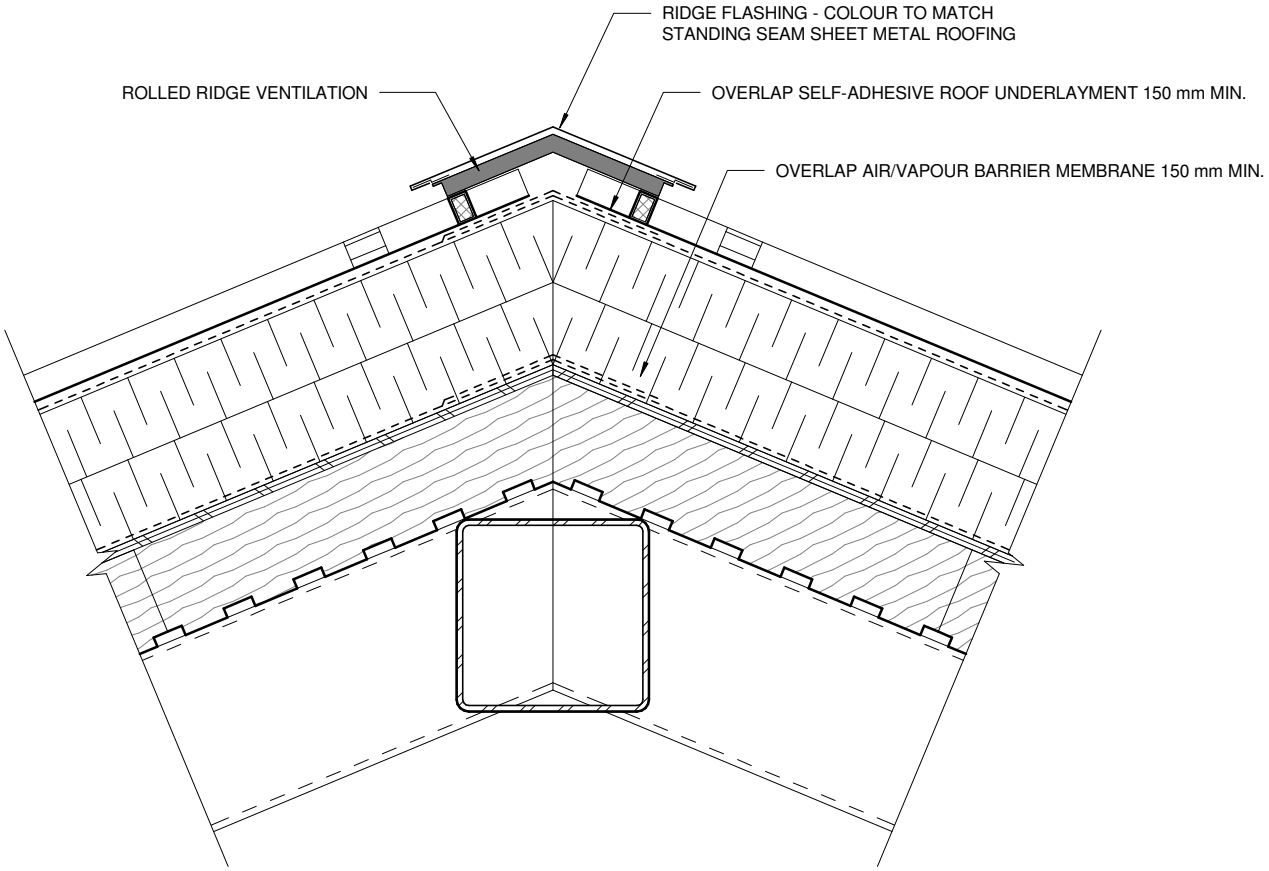

TYP. ROOF PEAK SECTION

1 : 10

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PROJECT:

Bill and Helen Norrie Library

Project Address: 15 Poseidon Bay, Winnipeg, MB.

Refer to drawing: A2.2

DRAWN BY: HW DATE: 07.08.19

AP2.09

COMM. NO.: 1847

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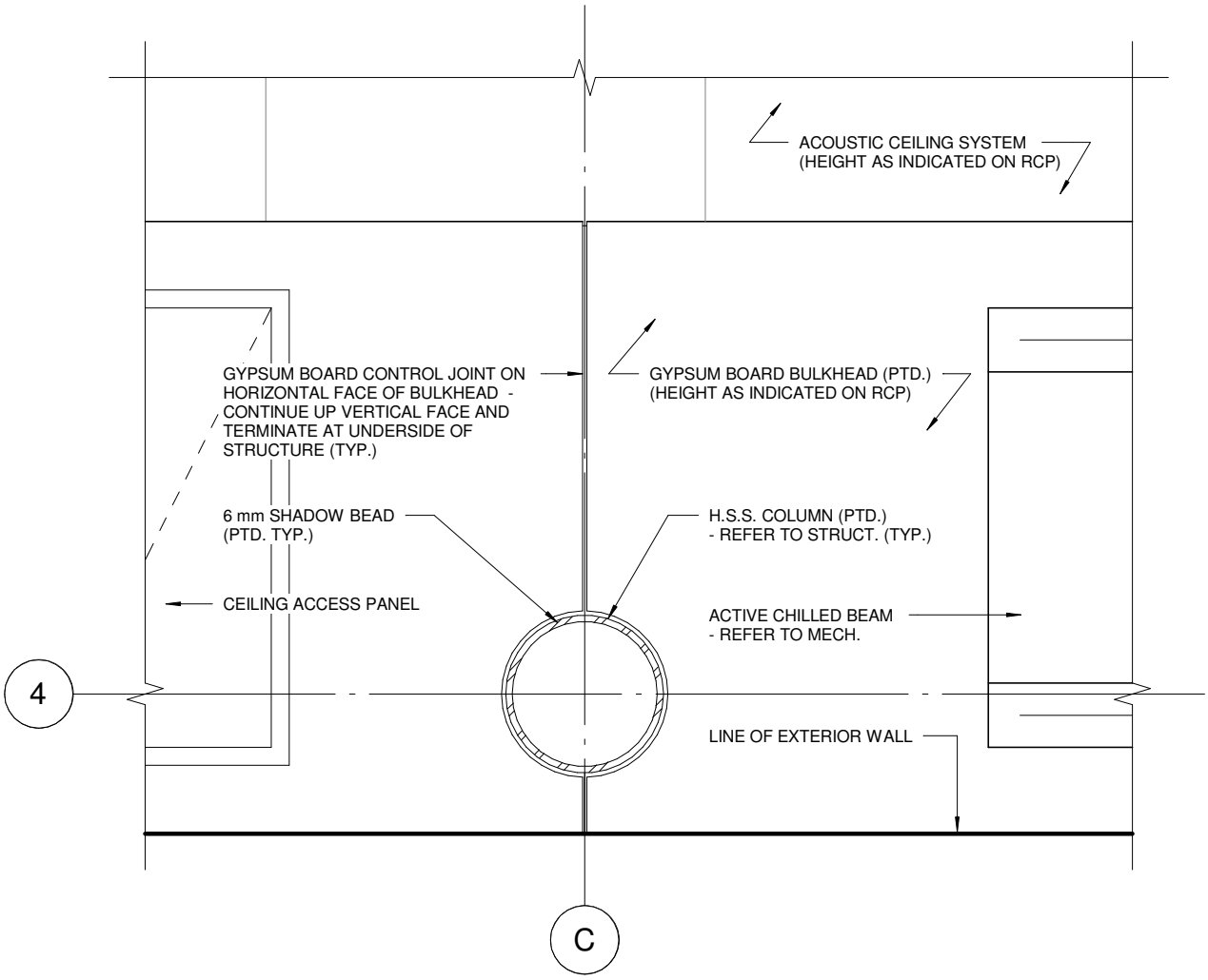
AP3

CEILING DETAILS



TYP. COLUMN DETAIL AT GYPSUM BOARD BULKHEAD

SCALE 1 : 10

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PROJECT:

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Refer to drawing: A3.1

DRAWN BY: HW DATE: 07.08.19

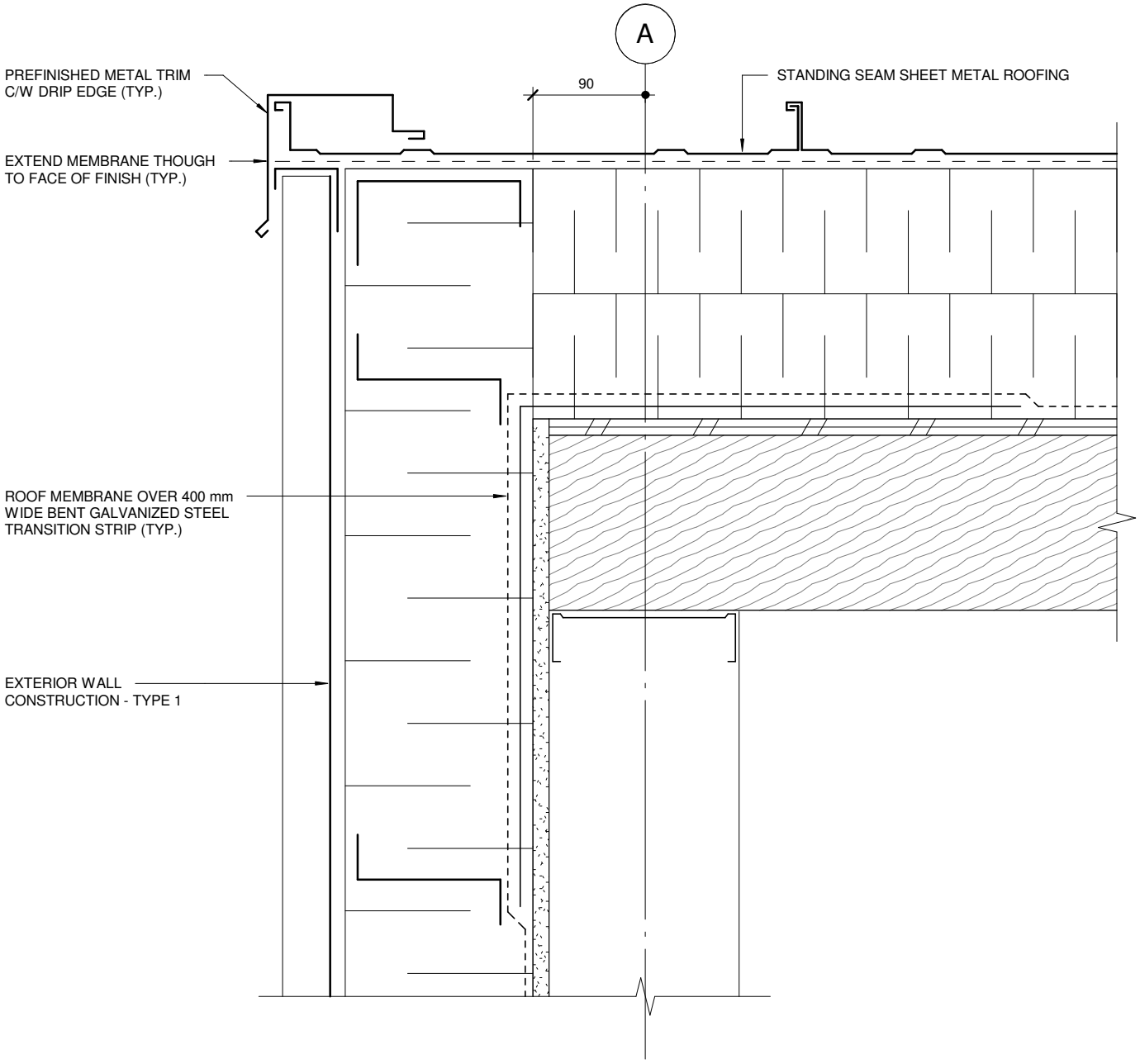
AP3.01

COMM. NO.: 1847

Plotted on: 7/24/2019 10:52:47 AM C:\Users\H.WEST\Documents\1847_BHN Library_H.West.rvt

AP5

WALL SECTION DETAILS



TYPICAL ROOF TRANSITION DETAIL

SCALE 1 : 5

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PROJECT:

Bill and Helen Norrie Library

Project Address: 15 Poseidon Bay, Winnipeg, MB.

Refer to drawing: A5.1

DRAWN BY: HW DATE: 07.08.19

AP5.01

COMM. NO.: 1847

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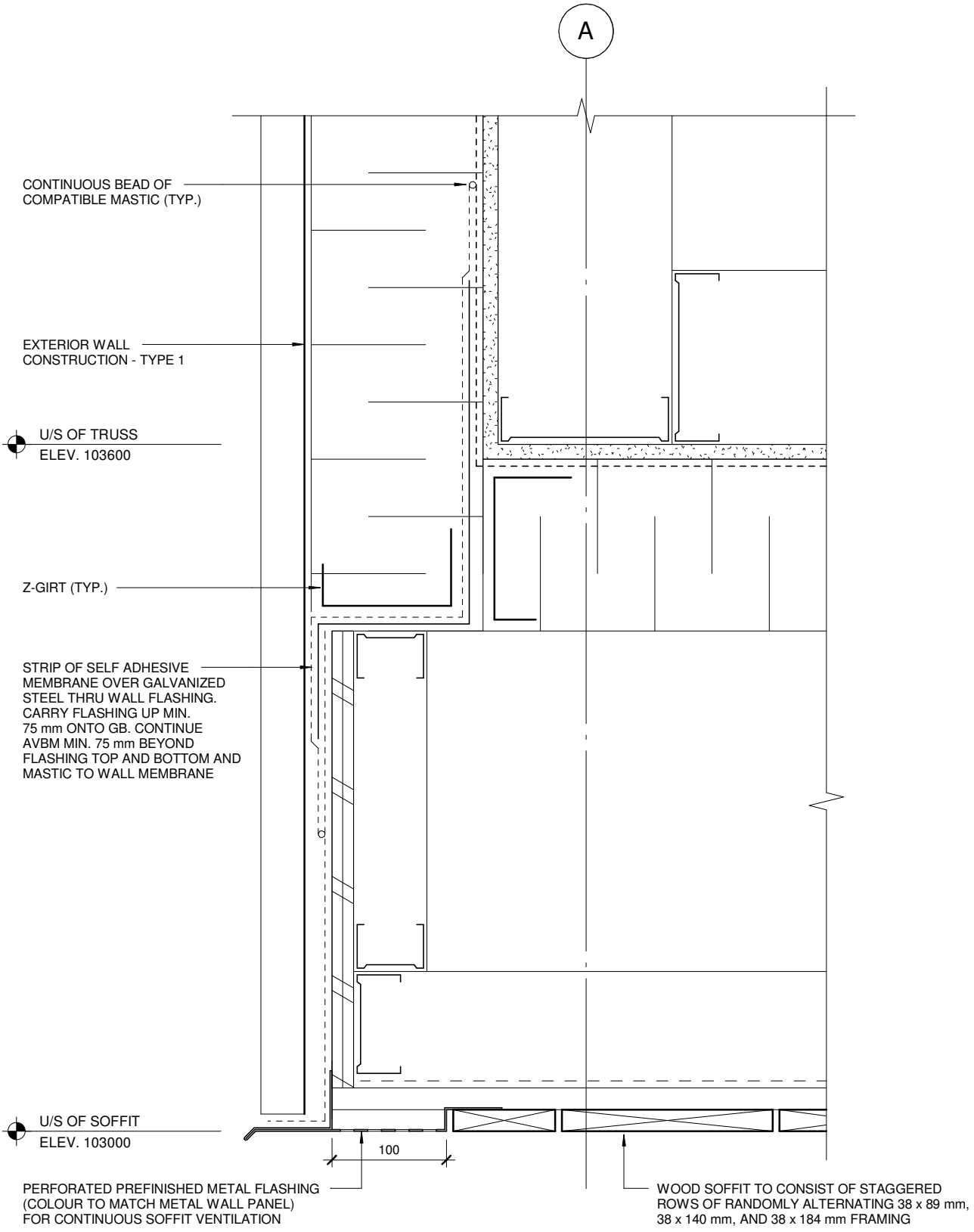

ENLARGED SOFFIT DETAIL

SCALE 1 : 5

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PROJECT:

Bill and Helen Norrie Library

Project Address: 15 Poseidon Bay, Winnipeg, MB.

Refer to drawing: A5.1

DRAWN BY: HW DATE: 07.08.19

AP5.02

COMM. NO.: 1847

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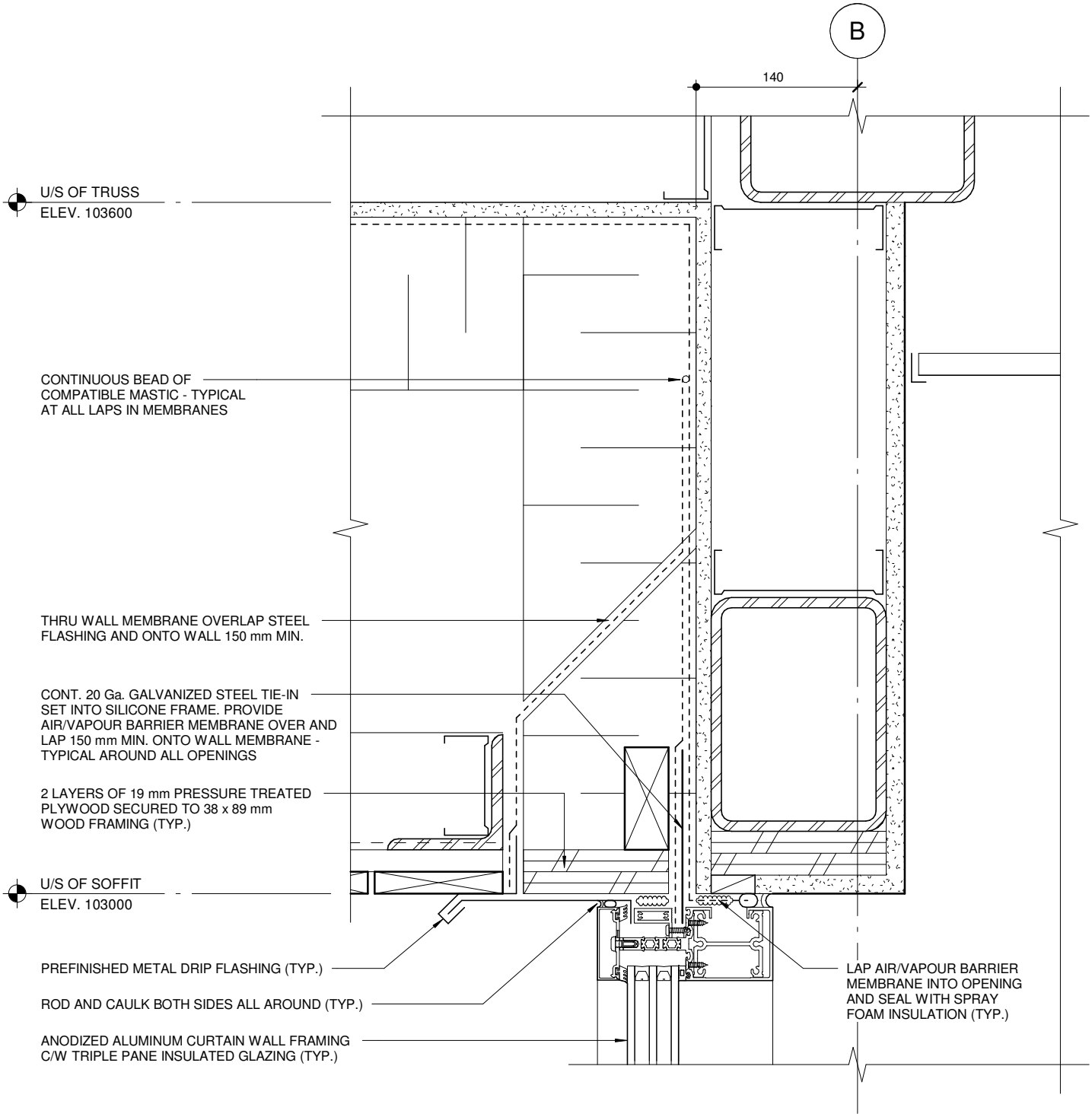

CURTIAN WALL HEAD DETAIL

SCALE 1 : 5

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PROJECT:
Bill and Helen Norrie Library

Project Address: 15 Poseidon Bay, Winnipeg, MB.

Refer to drawing: A5.1

DRAWN BY: HW DATE: 07.08.19

AP5.03

COMM. NO.: 1847

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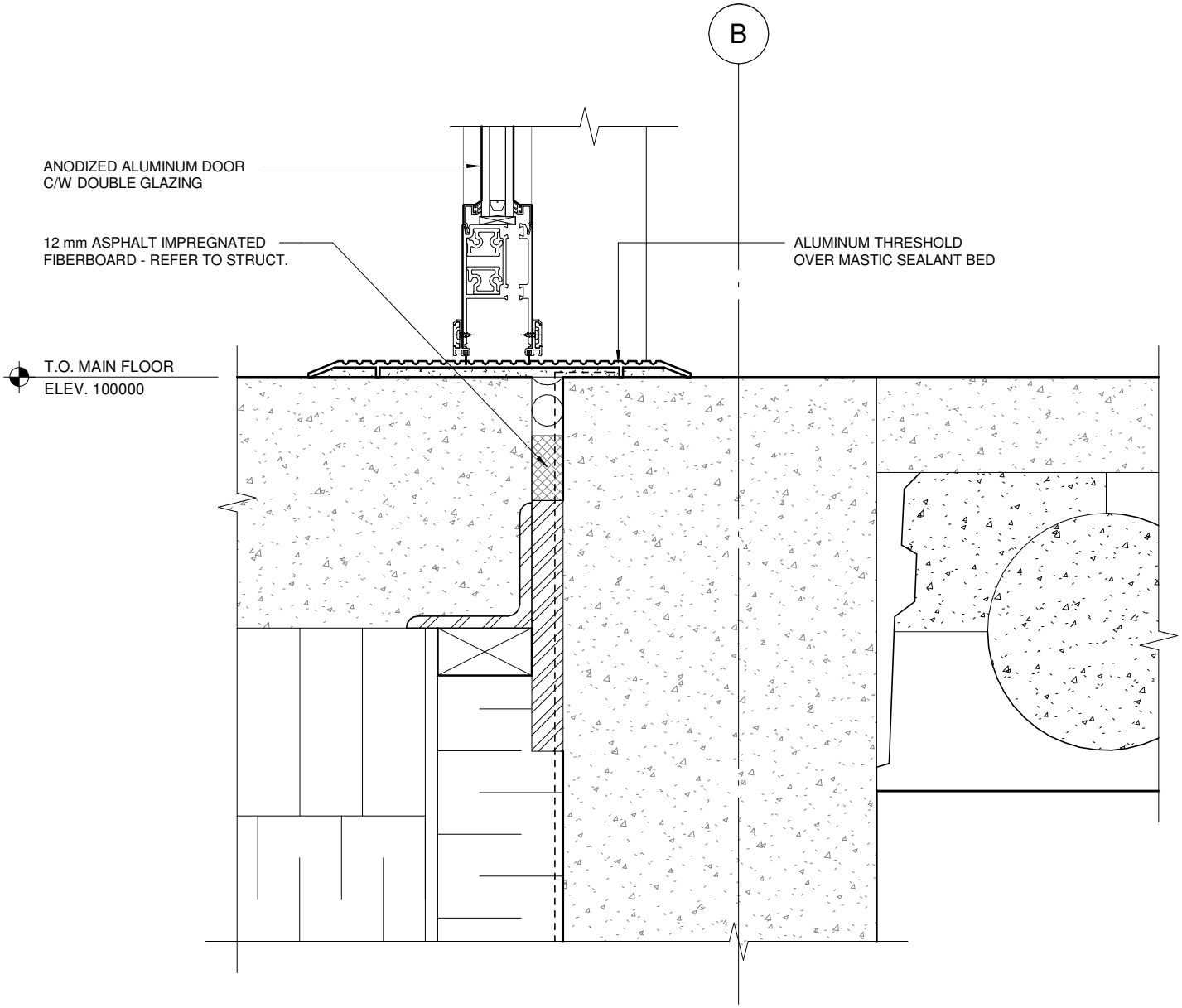

ENLARGED THRESHOLD DETAIL

SCALE 1 : 5

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PROJECT:

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Project Address: 15 Poseidon Bay, Winnipeg, MB.

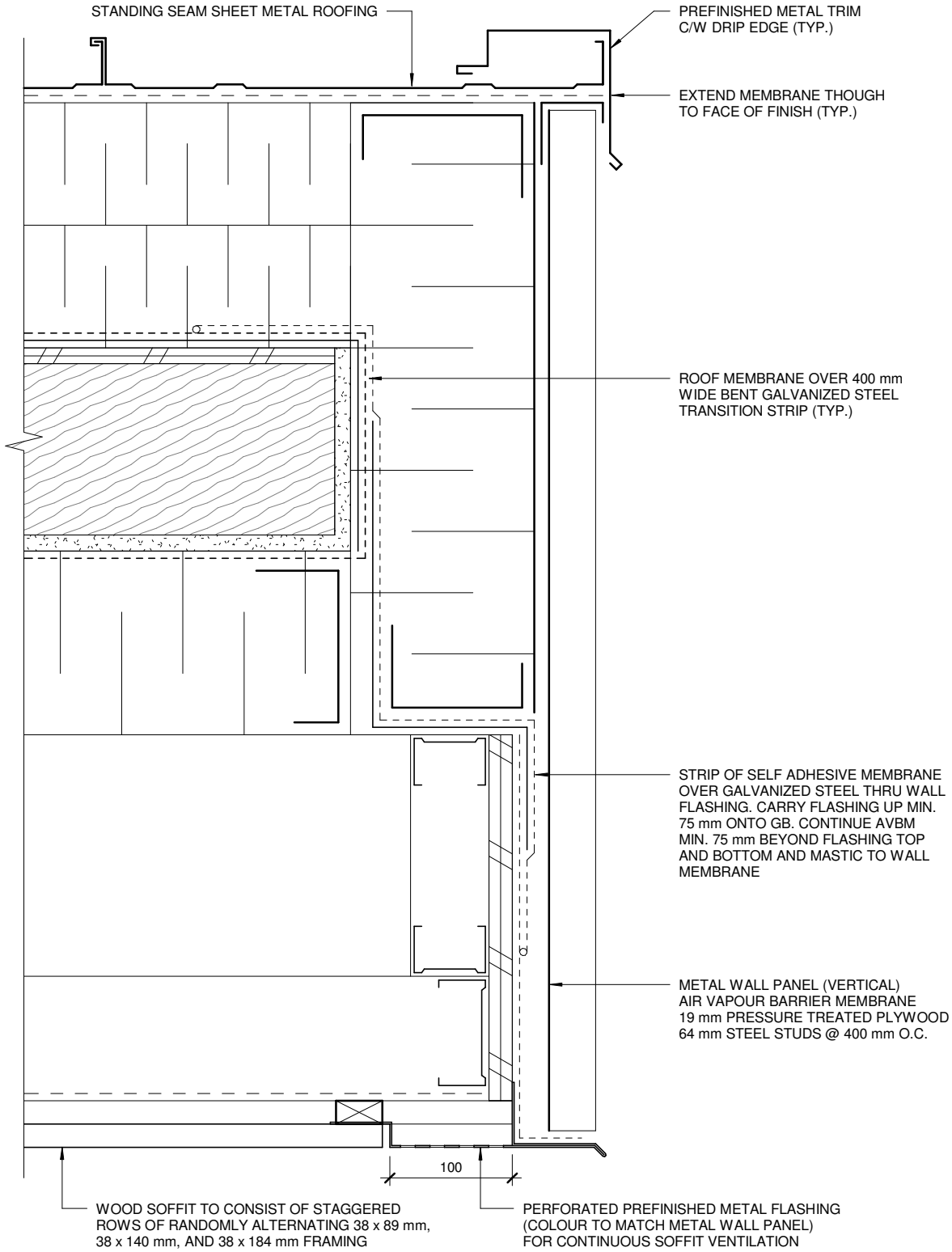
Refer to drawing: A5.1

DRAWN BY: HW DATE: 07.08.19

AP5.04

COMM. NO.: 1847

Plotted on: 7/24/2019 10:52:48 AM C:\Users\H.WEST\Documents\1847_BHN Library_H.West.rvt



ROOF TRANSITION DETAIL

SCALE 1 : 5

LM Architectural Group

500-136 Market Ave
Winnipeg Manitoba
Canada R3B 0P4
t: (204) 942.0681
f: (204) 943.8676
www.lm-architects.com

PROJECT:

Bill and Helen Norrie Library

Project Address: 15 Poseidon Bay, Winnipeg, MB.

Refer to drawing: A5.1

DRAWN BY: HW DATE: 07.08.19

AP5.05

COMM. NO.: 1847

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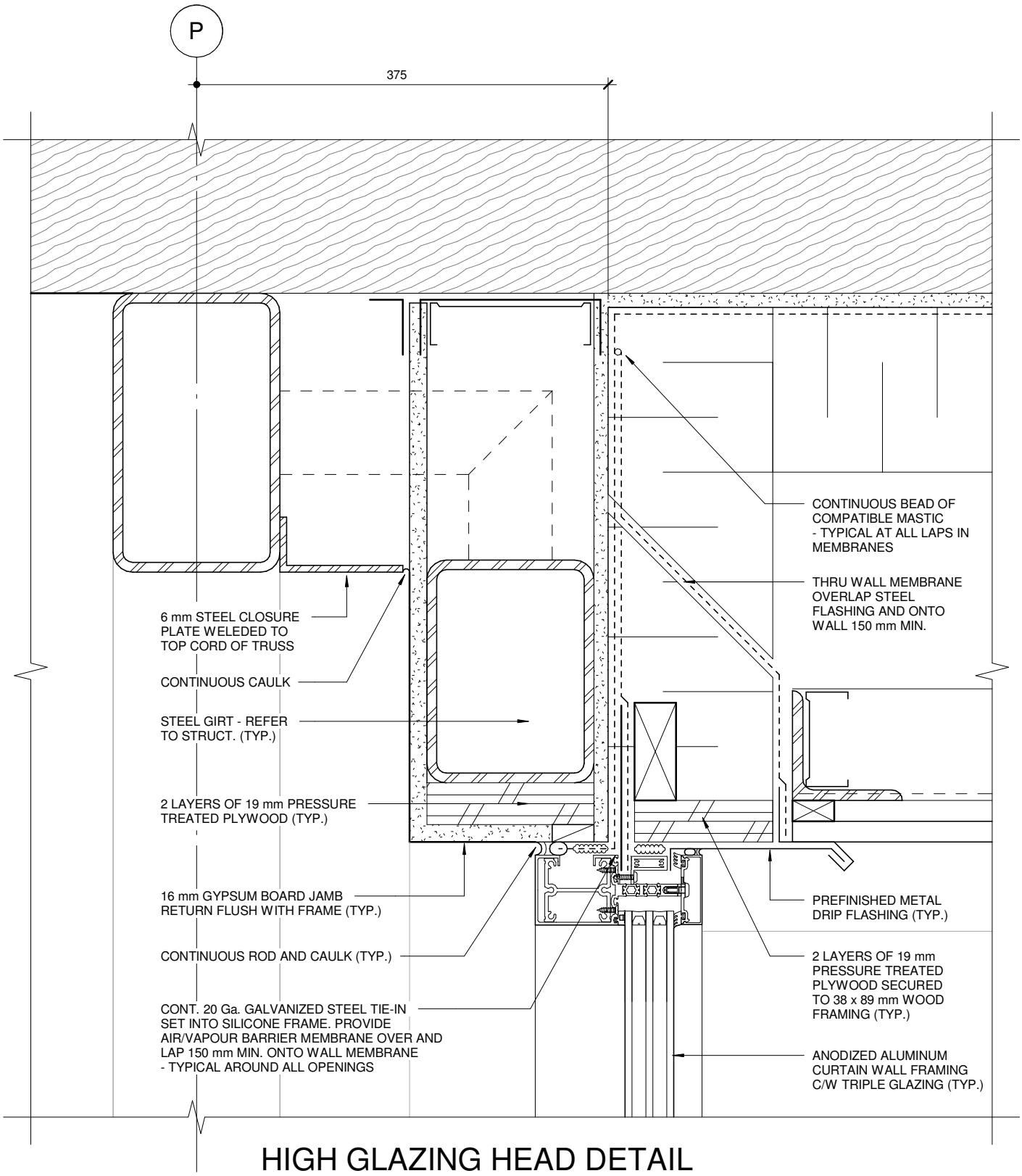

HIGH GLAZING HEAD DETAIL

SCALE 1 : 5

LM Architectural Group
500-136 Market Ave
Winnipeg Manitoba
Canada R3B 0P4
t: (204) 942.0681
f: (204) 943.8676
www.lm-architects.com

PROJECT:

Bill and Helen Norrie Library

Project Address: 15 Poseidon Bay, Winnipeg, MB.

Refer to drawing: A5.1

DRAWN BY: HW DATE: 07.08.19

AP5.06

COMM. NO.: 1847

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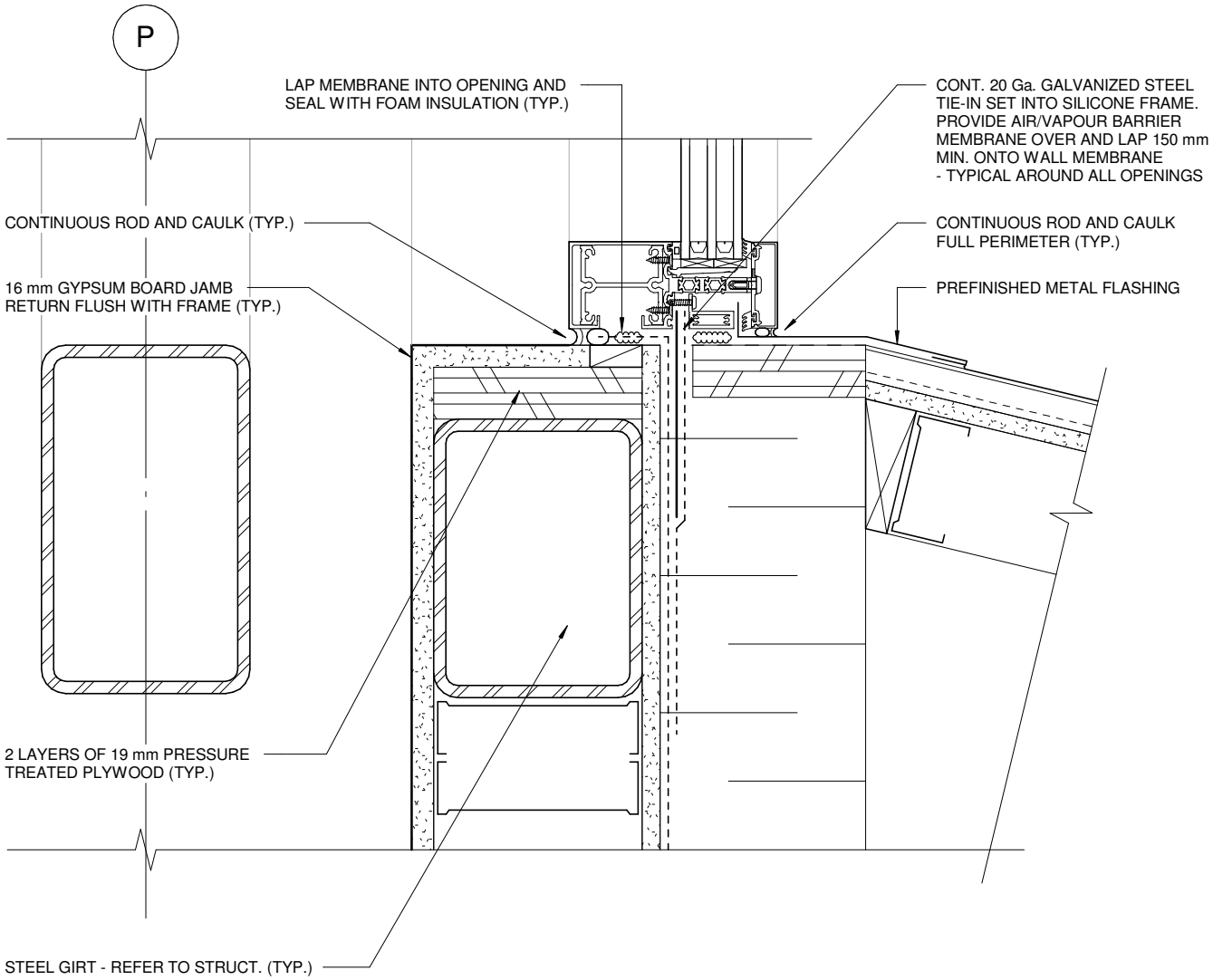

HIGH GLAZING SILL DETAIL

SCALE 1 : 5

LM Architectural Group
500-136 Market Ave
Winnipeg Manitoba
Canada R3B 0P4
t: (204) 942.0681
f: (204) 943.8676
www.lm-architects.com

PROJECT:

Bill and Helen Norrie Library

Project Address: 15 Poseidon Bay, Winnipeg, MB.

Refer to drawing: A5.1

DRAWN BY: HW DATE: 07.08.19

AP5.07

COMM. NO.: 1847

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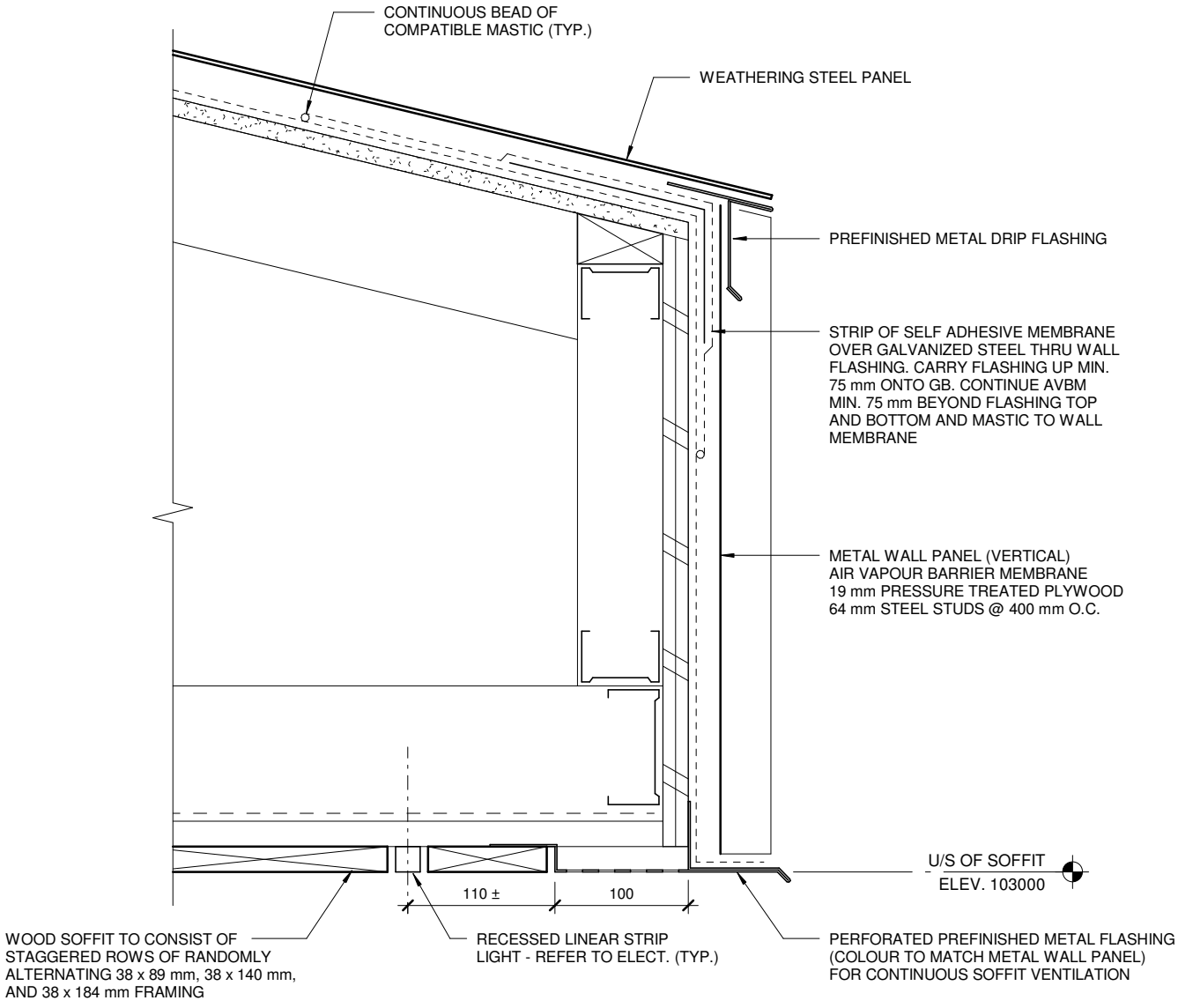

ROOF OVERHANG DETAIL

SCALE 1 : 5

LM Architectural Group
500-136 Market Ave
Winnipeg Manitoba
Canada R3B 0P4
t: (204) 942.0681
f: (204) 943.8676
www.lm-architects.com

PROJECT:

Bill and Helen Norrie Library

Project Address: 15 Poseidon Bay, Winnipeg, MB.

Refer to drawing: A5.1

DRAWN BY: HW DATE: 07.08.19

AP5.08

COMM. NO.: 1847

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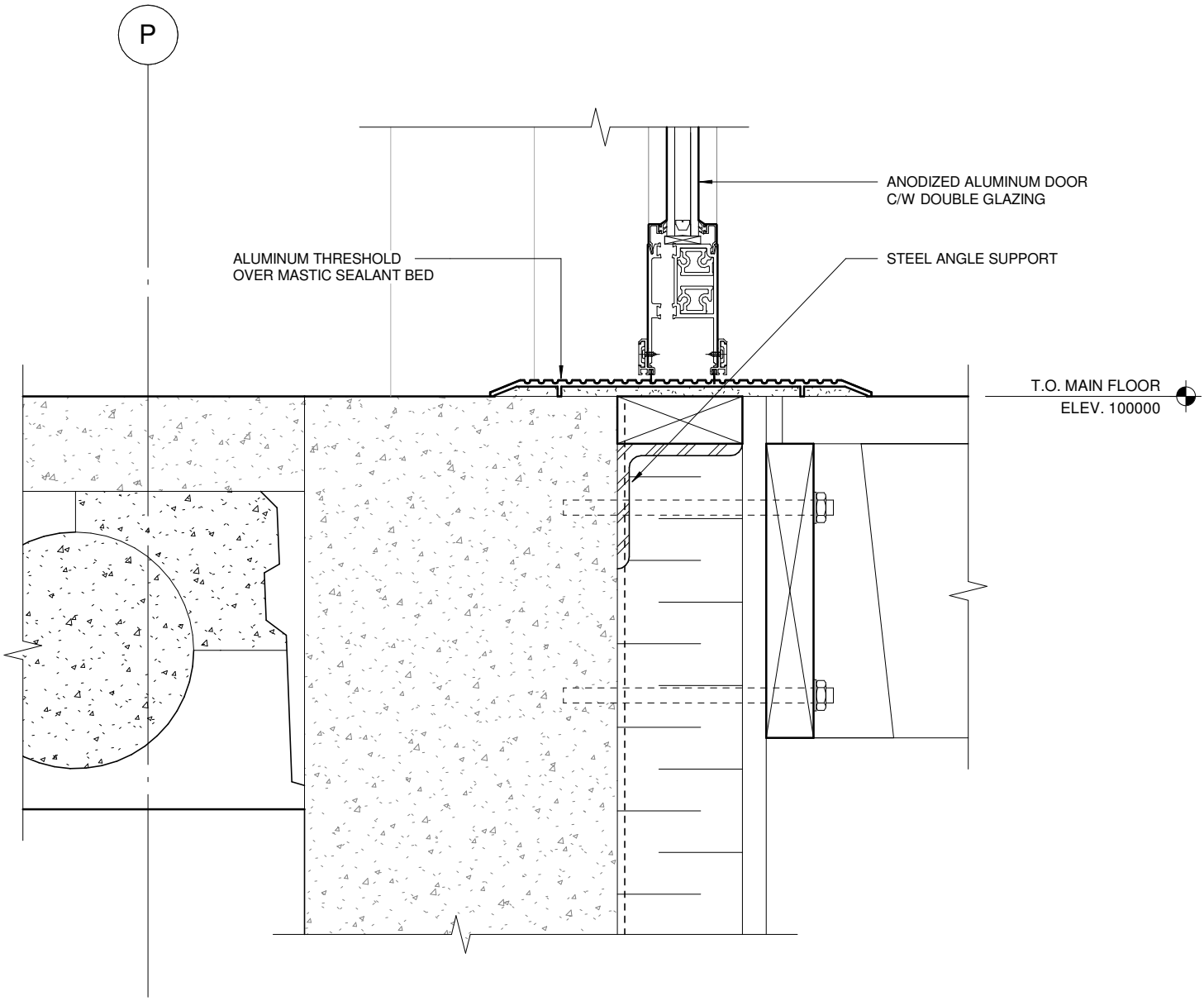


THRESHOLD DETAIL AT PORCH

SCALE 1 : 5

LM Architectural Group

500-136 Market Ave
Winnipeg Manitoba
Canada R3B 0P4
t: (204) 942.0681
f: (204) 943.8676
www.lm-architects.com

PROJECT:

Bill and Helen Norrie Library

Project Address: 15 Poseidon Bay, Winnipeg, MB.

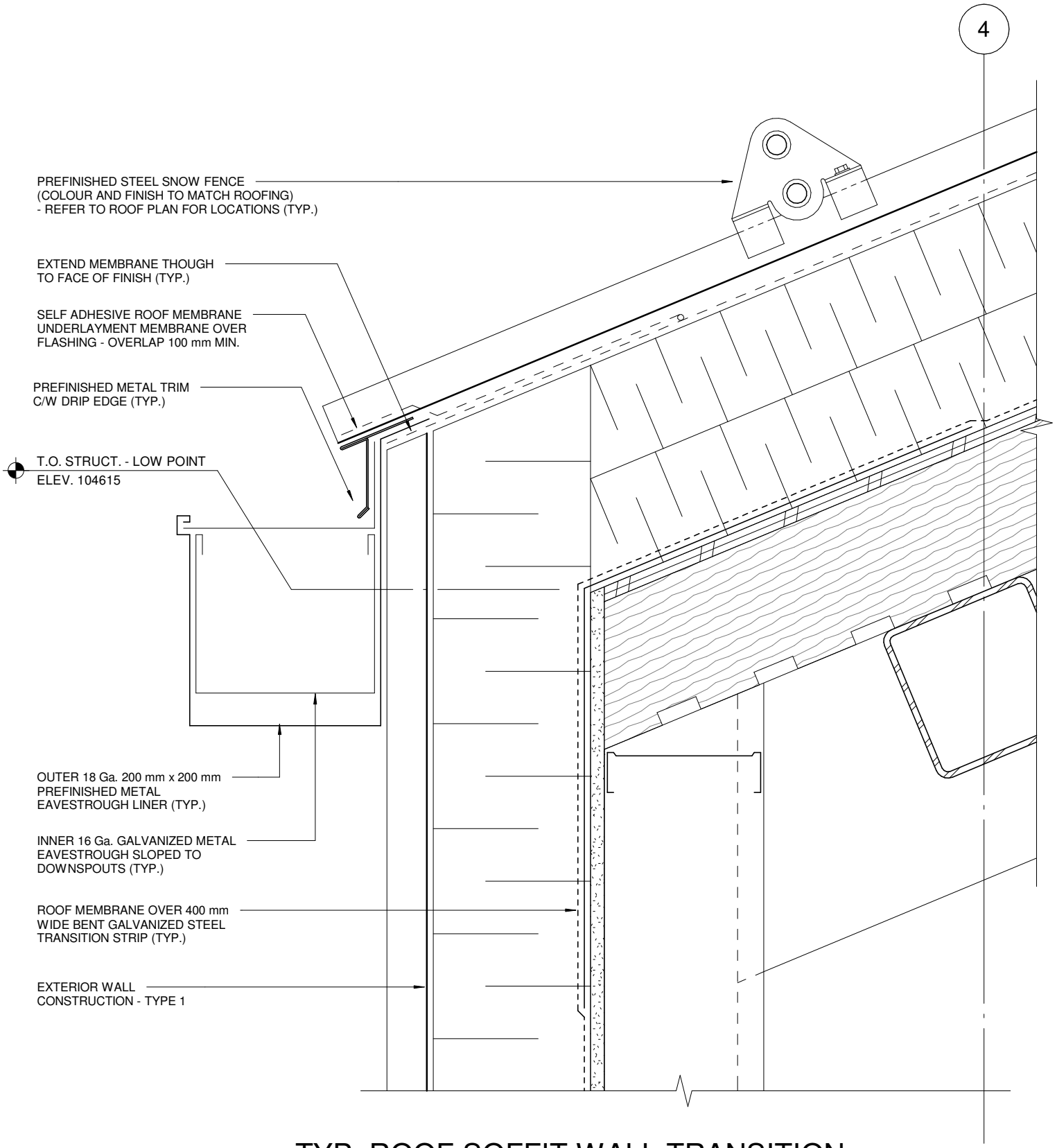
Refer to drawing: A5.1

DRAWN BY: HW DATE: 07.08.19

AP5.09

COMM. NO.: 1847

Plotted on: 7/24/2019 10:52:49 AM C:\Users\H.WEST\Documents\1847_BHN Library_H.West.rvt



TYP. ROOF SOFFIT WALL TRANSITION

SCALE 1 : 5

LM Architectural Group

500-136 Market Ave
Winnipeg Manitoba
Canada R3B 0P4
t: (204) 942.0681
f: (204) 943.8676
www.lm-architects.com

PROJECT:

Bill and Helen Norrie Library

Project Address: 15 Poseidon Bay, Winnipeg, MB.

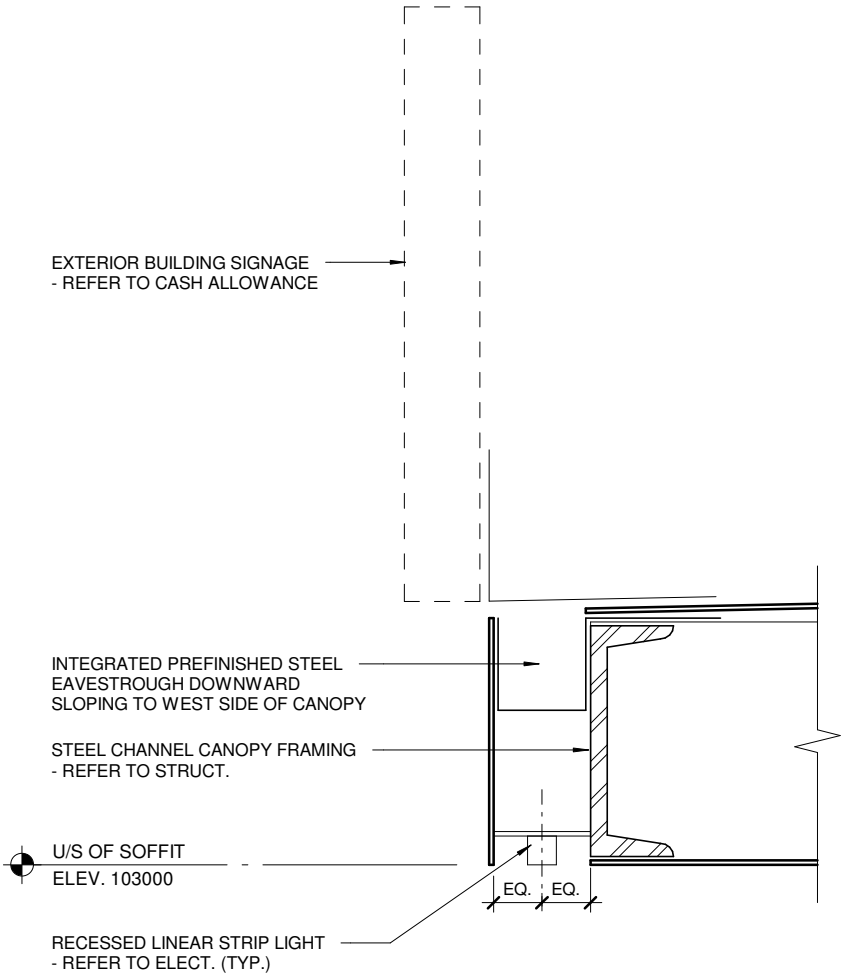
Refer to drawing: A5.1, A5.2

DRAWN BY: HW DATE: 07.08.19

AP5.10

COMM. NO.: 1847

Plotted on: 7/24/2019 10:52:49 AM C:\Users\H.WEST\Documents\1847_BHN Library_H.West.rvt



TYP. CANOPY DETAIL

SCALE 1 : 5

LM Architectural Group

500-136 Market Ave
Winnipeg Manitoba
Canada R3B 0P4
t: (204) 942.0681
f: (204) 943.8676
www.lm-architects.com

PROJECT:

Bill and Helen Norrie Library

Project Address: 15 Poseidon Bay, Winnipeg, MB.

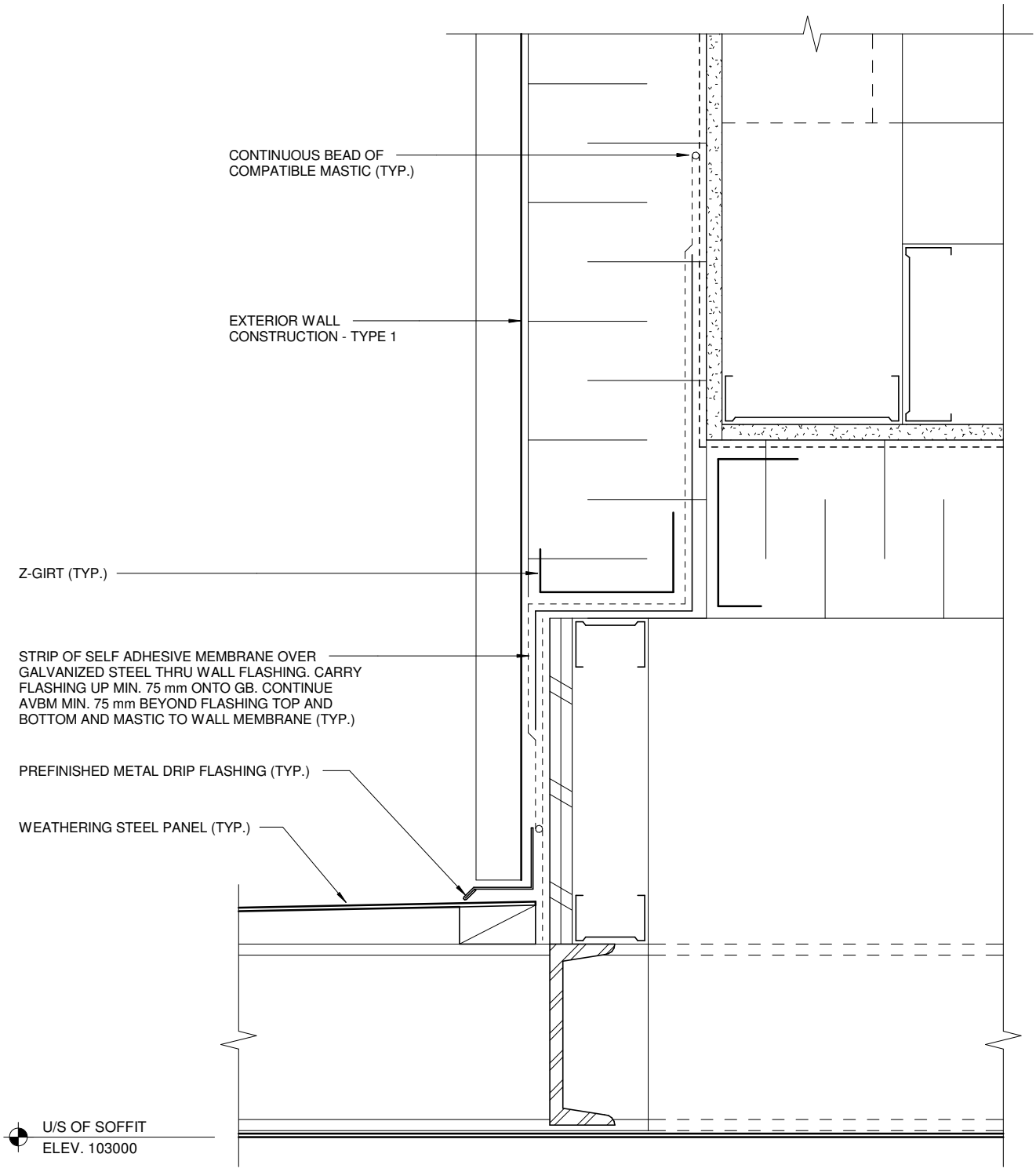
Refer to drawing: A5.1

DRAWN BY: HW DATE: 07.08.19

AP5.11

COMM. NO.: 1847

Plotted on: 7/24/2019 10:52:50 AM C:\Users\H.WEST\Documents\1847_BHN Library_H.West.rvt



TYP. CANOPY CONNECTION DETAIL

SCALE 1 : 5

LM Architectural Group

500-136 Market Ave
Winnipeg Manitoba
Canada R3B 0P4
t: (204) 942.0681
f: (204) 943.8676
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PROJECT:

Bill and Helen Norrie Library

Project Address: 15 Poseidon Bay, Winnipeg, MB.

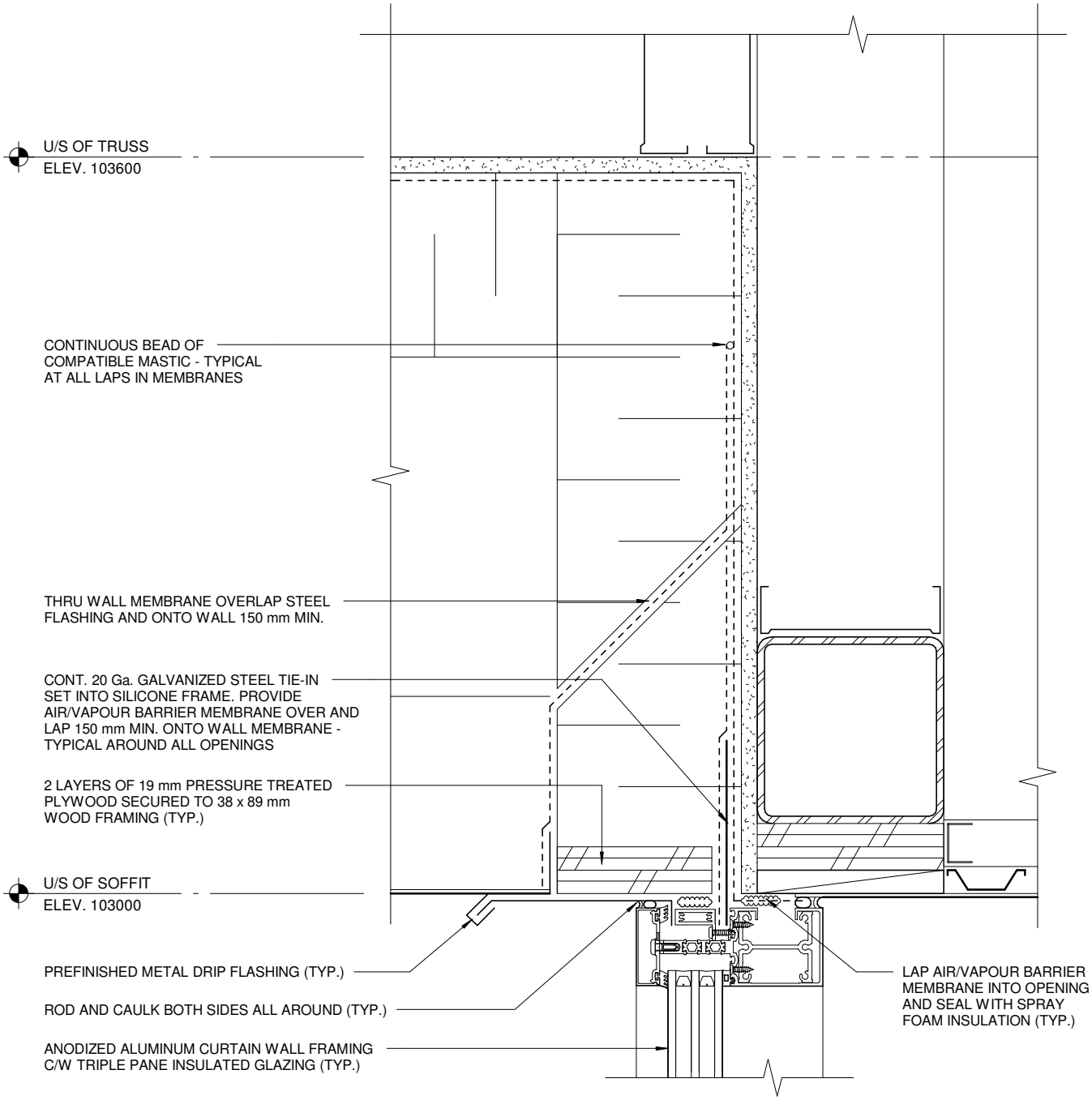
Refer to drawing: A5.1

DRAWN BY: HW DATE: 07.08.19

AP5.12

COMM. NO.: 1847

Plotted on: 7/24/2019 10:52:50 AM C:\Users\H.WEST\Documents\1847_BHN Library_H.West.rvt



VESTIBULE CURTIAN WALL HEAD

SCALE 1 : 5

LM Architectural Group
500-136 Market Ave
Winnipeg Manitoba
Canada R3B 0P4
t: (204) 942.0681
f: (204) 943.8676
www.lm-architects.com

PROJECT:
Bill and Helen Norrie Library

Project Address: 15 Poseidon Bay, Winnipeg, MB.

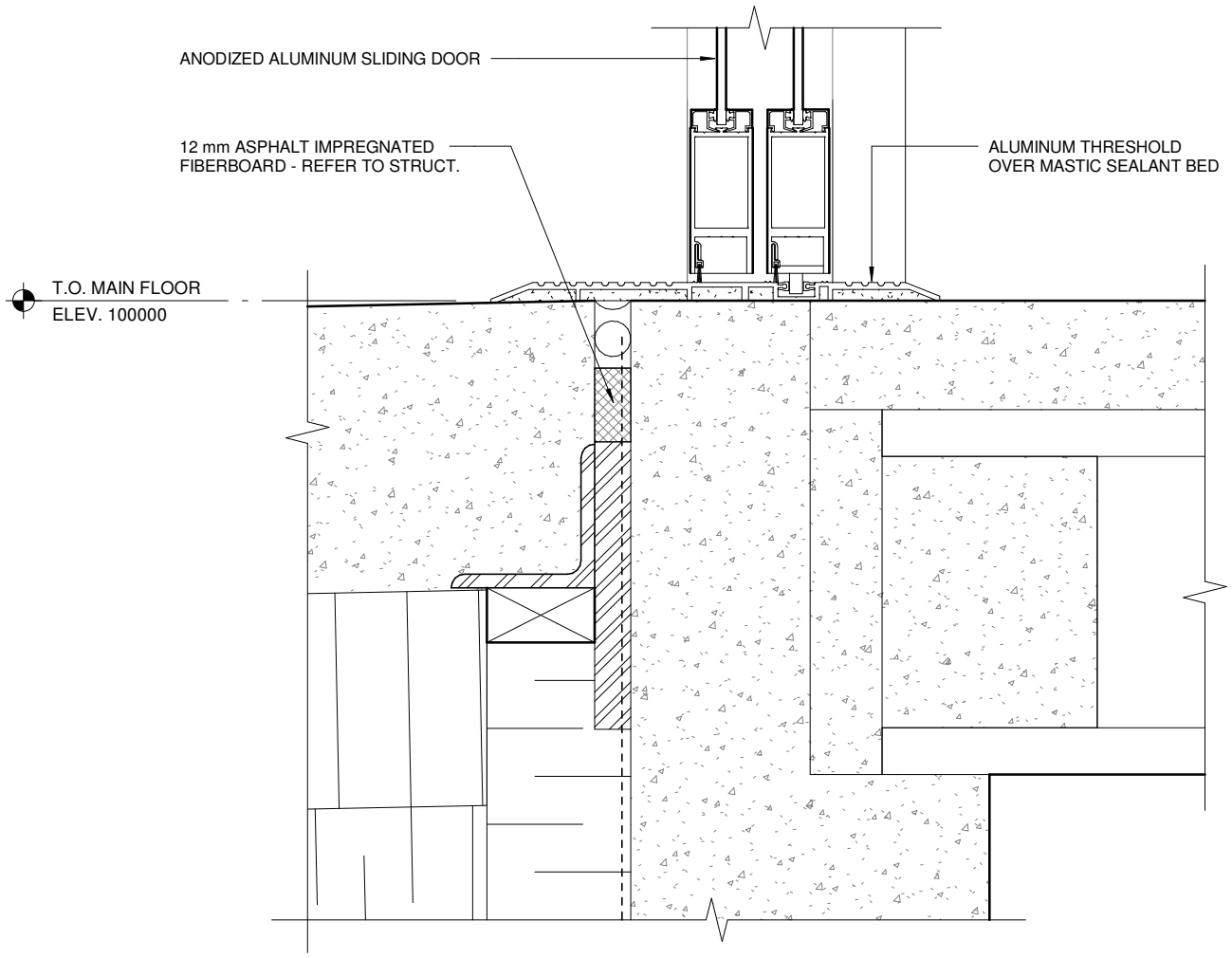
Refer to drawing: A5.1

DRAWN BY: HW DATE: 07.08.19

AP5.13

COMM. NO.: 1847

Plotted on: 7/24/2019 10:52:50 AM C:\Users\H.WEST\Documents\1847_BHN Library_H.West.rvt



VESTIBULE EXTERIOR THRESHOLD

SCALE 1 : 5

LM Architectural Group

500-136 Market Ave
Winnipeg Manitoba
Canada R3B 0P4
t: (204) 942.0681
f: (204) 943.8676
www.lm-architects.com

PROJECT:

Bill and Helen Norrie Library

Project Address: 15 Poseidon Bay, Winnipeg, MB.

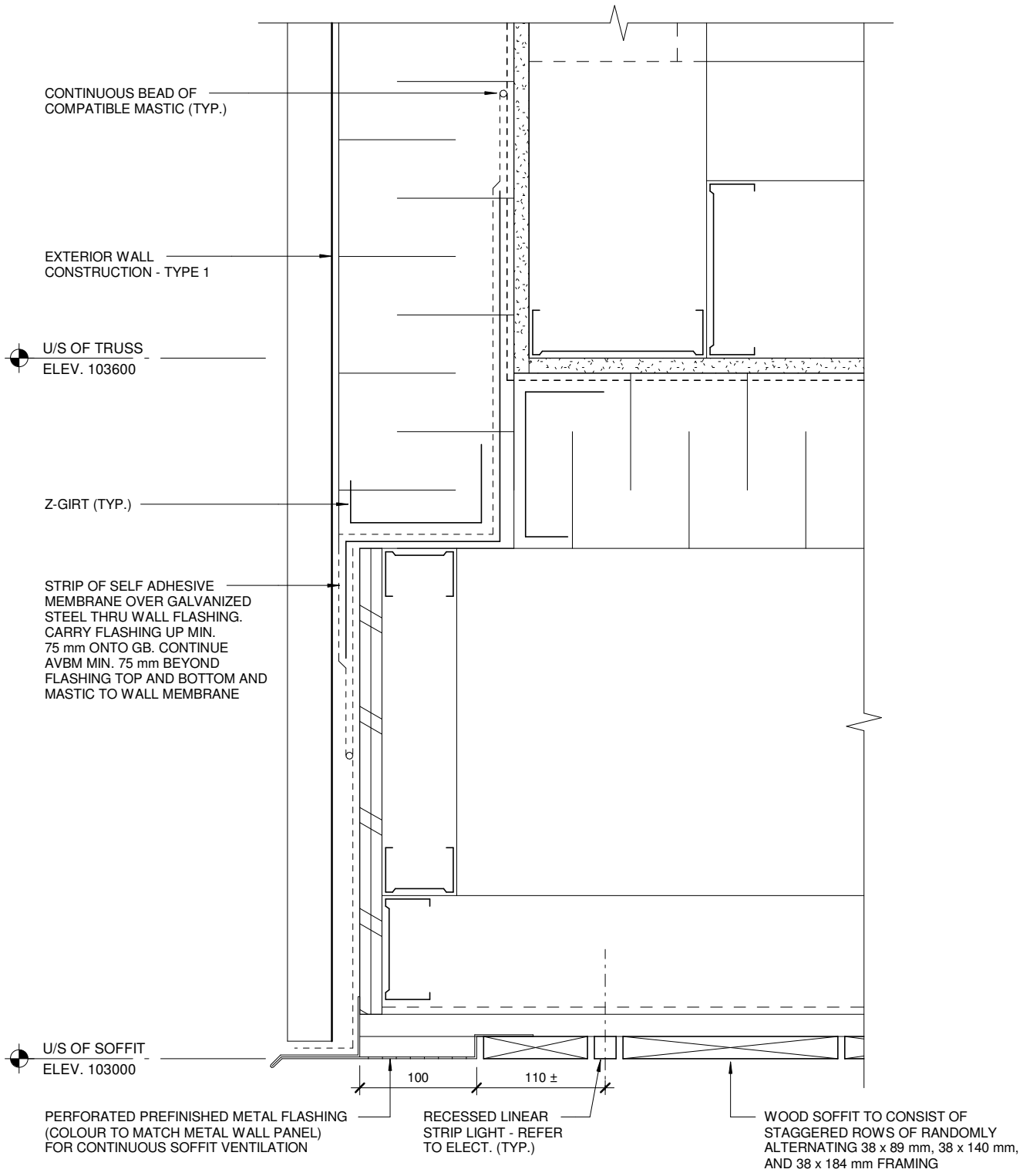
Refer to drawing: A5.1

DRAWN BY: HW DATE: 07.08.19

AP5.14

COMM. NO.: 1847

Plotted on: 7/24/2019 10:52:50 AM C:\Users\H.WEST\Documents\1847_BHN Library_H.West.rvt



TYP. SOFFIT DETAIL

SCALE 1 : 5

LM Architectural Group

500-136 Market Ave
Winnipeg Manitoba
Canada R3B 0P4
t: (204) 942.0681
f: (204) 943.8676
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PROJECT:

Bill and Helen Norrie Library

Project Address: 15 Poseidon Bay, Winnipeg, MB.

Refer to drawing: A5.1, A5.2

DRAWN BY: HW DATE: 07.08.19

AP5.15

COMM. NO.: 1847

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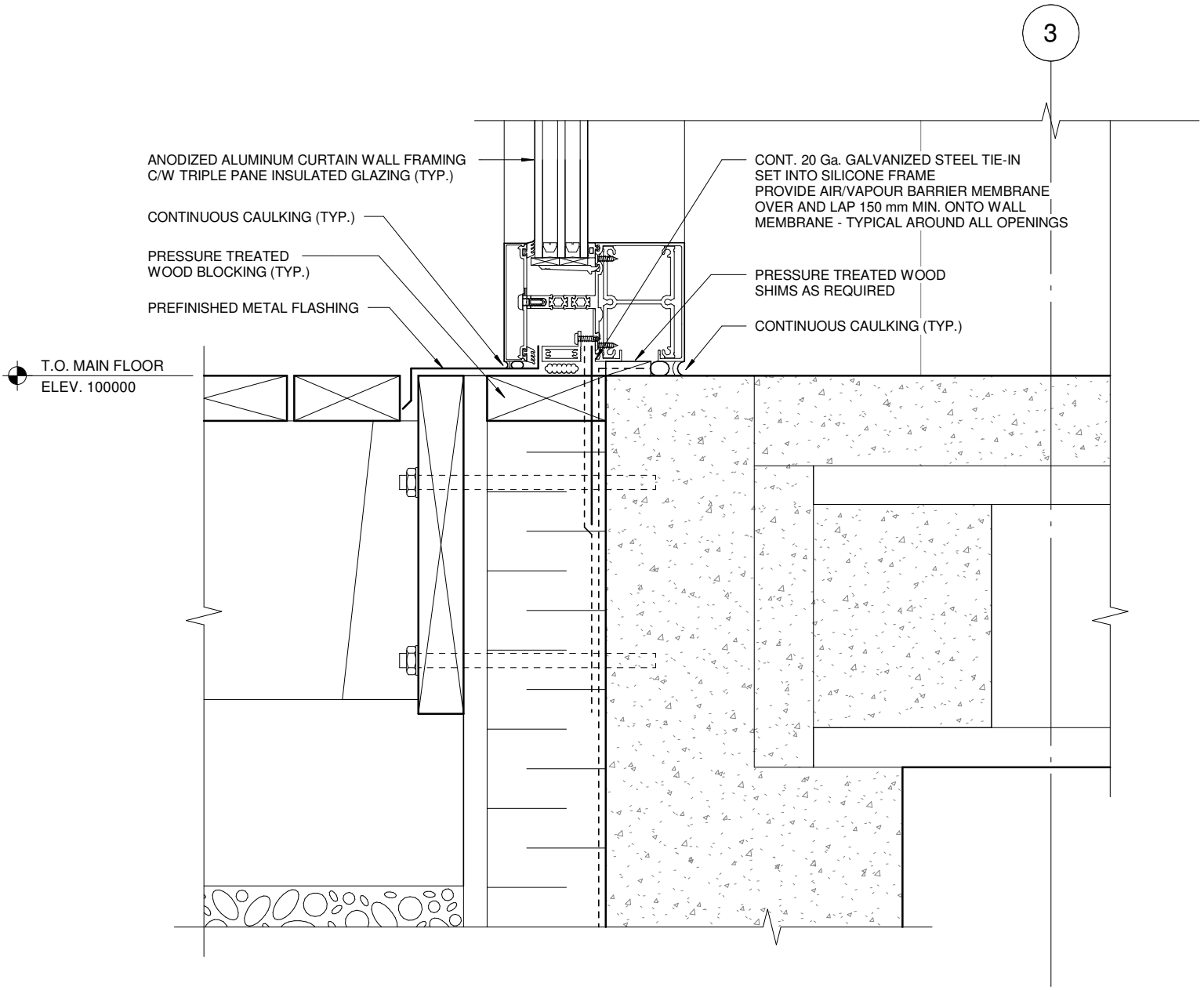


TYP. CURTAIN WALL BASE DETAIL AT PORCH

SCALE 1 : 5

LM Architectural Group

500-136 Market Ave
Winnipeg Manitoba
Canada R3B 0P4
t: (204) 942.0681
f: (204) 943.8676
www.lm-architects.com

PROJECT:

Bill and Helen Norrie Library

Project Address: 15 Poseidon Bay, Winnipeg, MB.

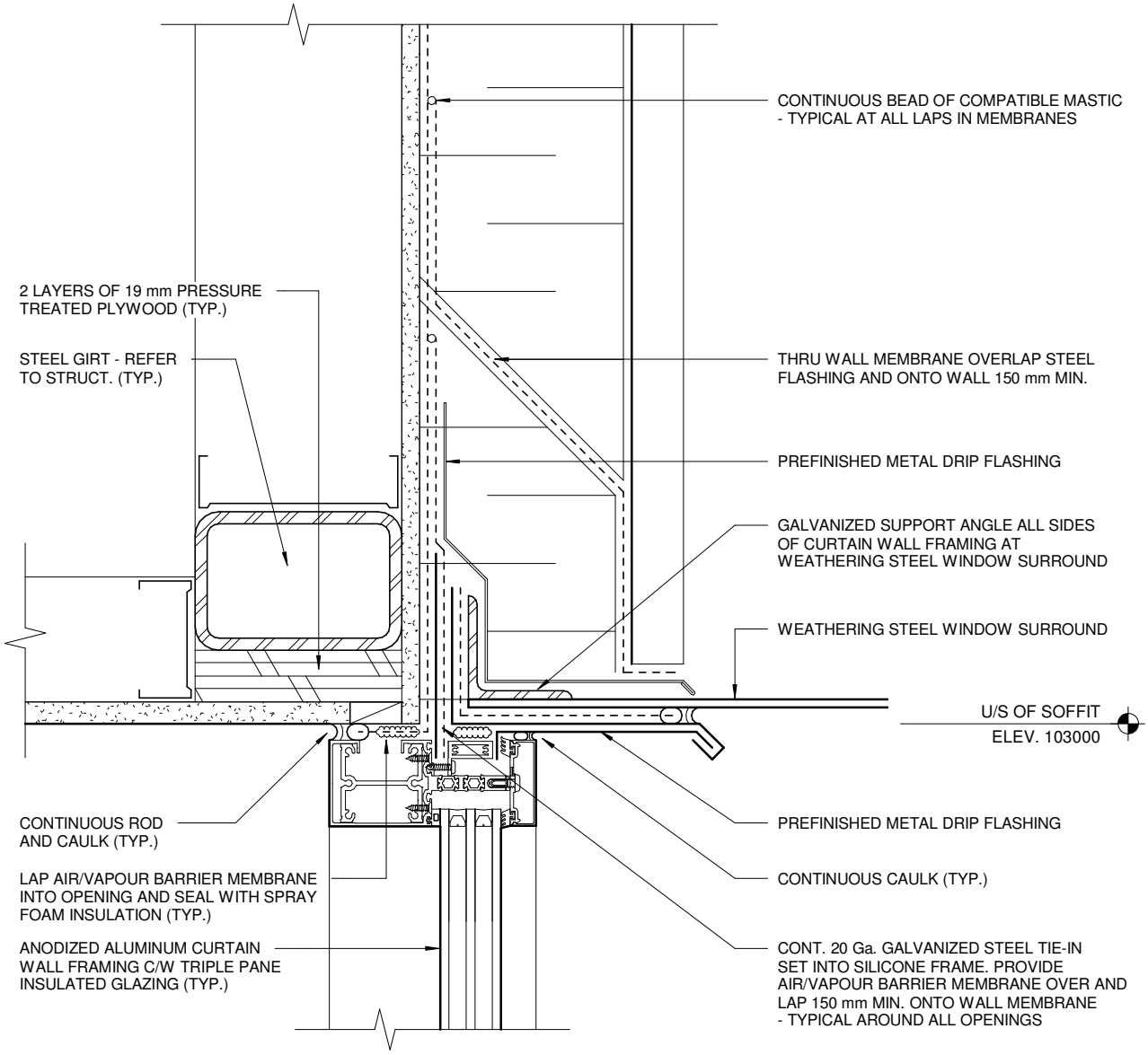
Refer to drawing: A5.2

DRAWN BY: HW DATE: 07.08.19

AP5.16

COMM. NO.: 1847

Plotted on: 7/24/2019 10:52:51 AM C:\Users\H.WEST\Documents\1847_BHN Library_H.West.rvt



CURTIAN WALL HEAD DETAIL

SCALE 1 : 5

LM Architectural Group
500-136 Market Ave
Winnipeg Manitoba
Canada R3B 0P4
t: (204) 942.0681
f: (204) 943.8676
www.lm-architects.com

PROJECT:

Bill and Helen Norrie Library

Project Address: 15 Poseidon Bay, Winnipeg, MB.

Refer to drawing: A5.2

DRAWN BY: HW DATE: 07.08.19

AP5.17

COMM. NO.: 1847

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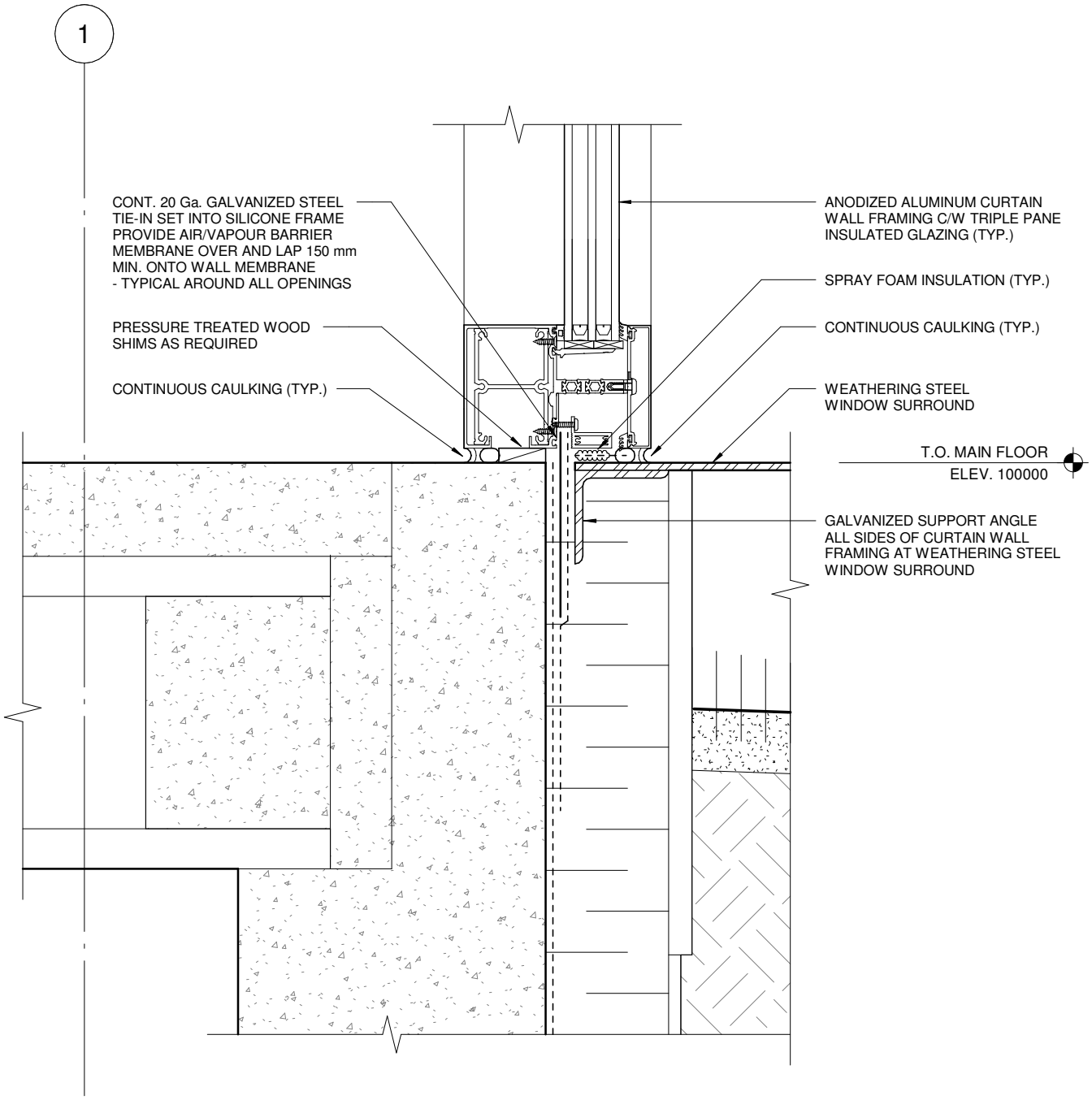

CURTAIN WALL BASE DETAIL

SCALE 1 : 5

LM Architectural Group
500-136 Market Ave
Winnipeg Manitoba
Canada R3B 0P4
t: (204) 942.0681
f: (204) 943.8676
www.lm-architects.com

PROJECT:

Bill and Helen Norrie Library

Project Address: 15 Poseidon Bay, Winnipeg, MB.

Refer to drawing: A5.2

DRAWN BY: HW DATE: 07.08.19

AP5.18

COMM. NO.: 1847

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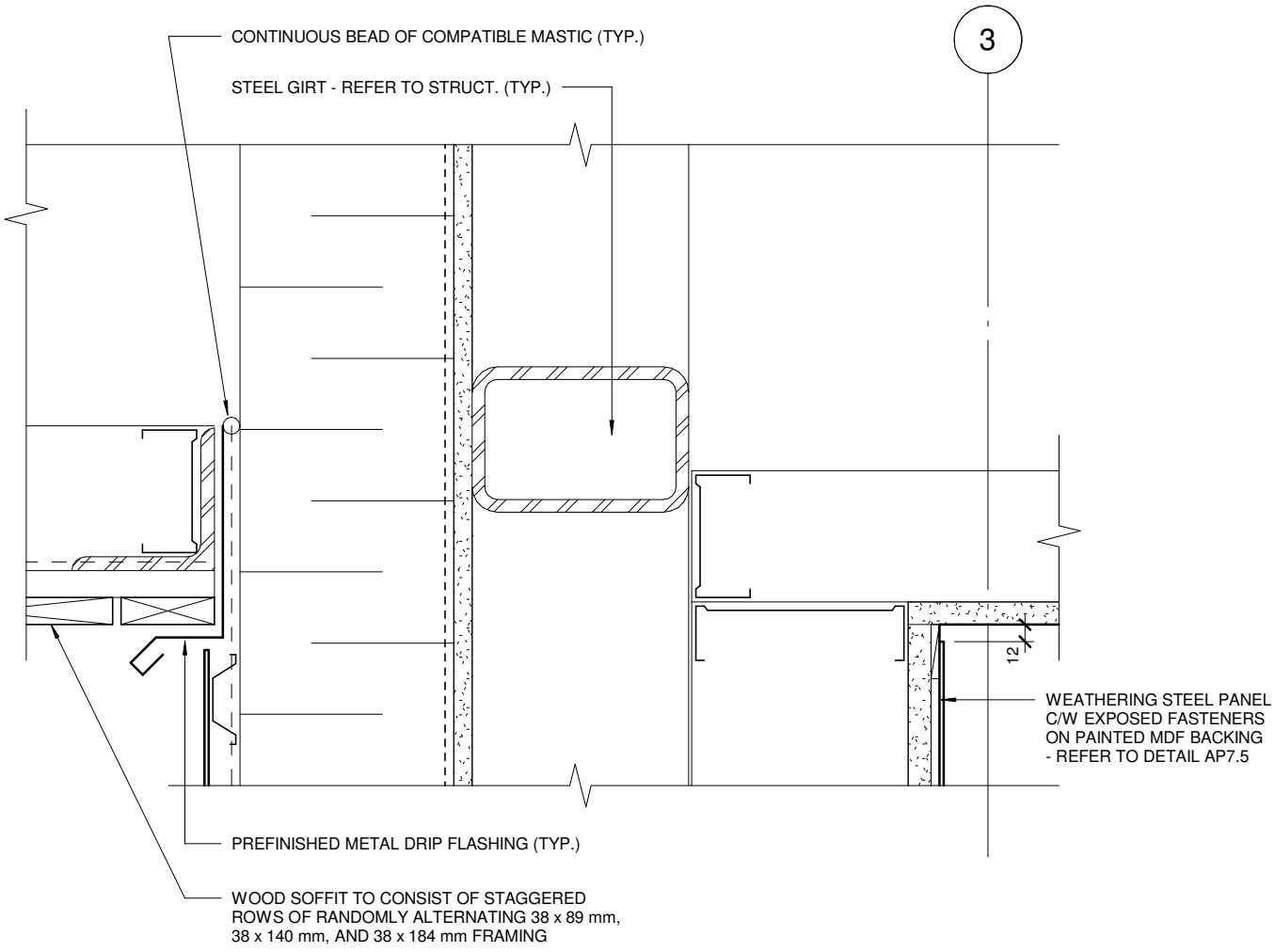

SOFFIT TRANSITION DETAIL

SCALE 1 : 5

LM Architectural Group

500-136 Market Ave
Winnipeg Manitoba
Canada R3B 0P4
t: (204) 942.0681
f: (204) 943.8676
www.lm-architects.com

PROJECT:

Bill and Helen Norrie Library

Project Address: 15 Poseidon Bay, Winnipeg, MB.

Refer to drawing: A5.2

DRAWN BY: HW DATE: 07.08.19

AP5.19

COMM. NO.: 1847

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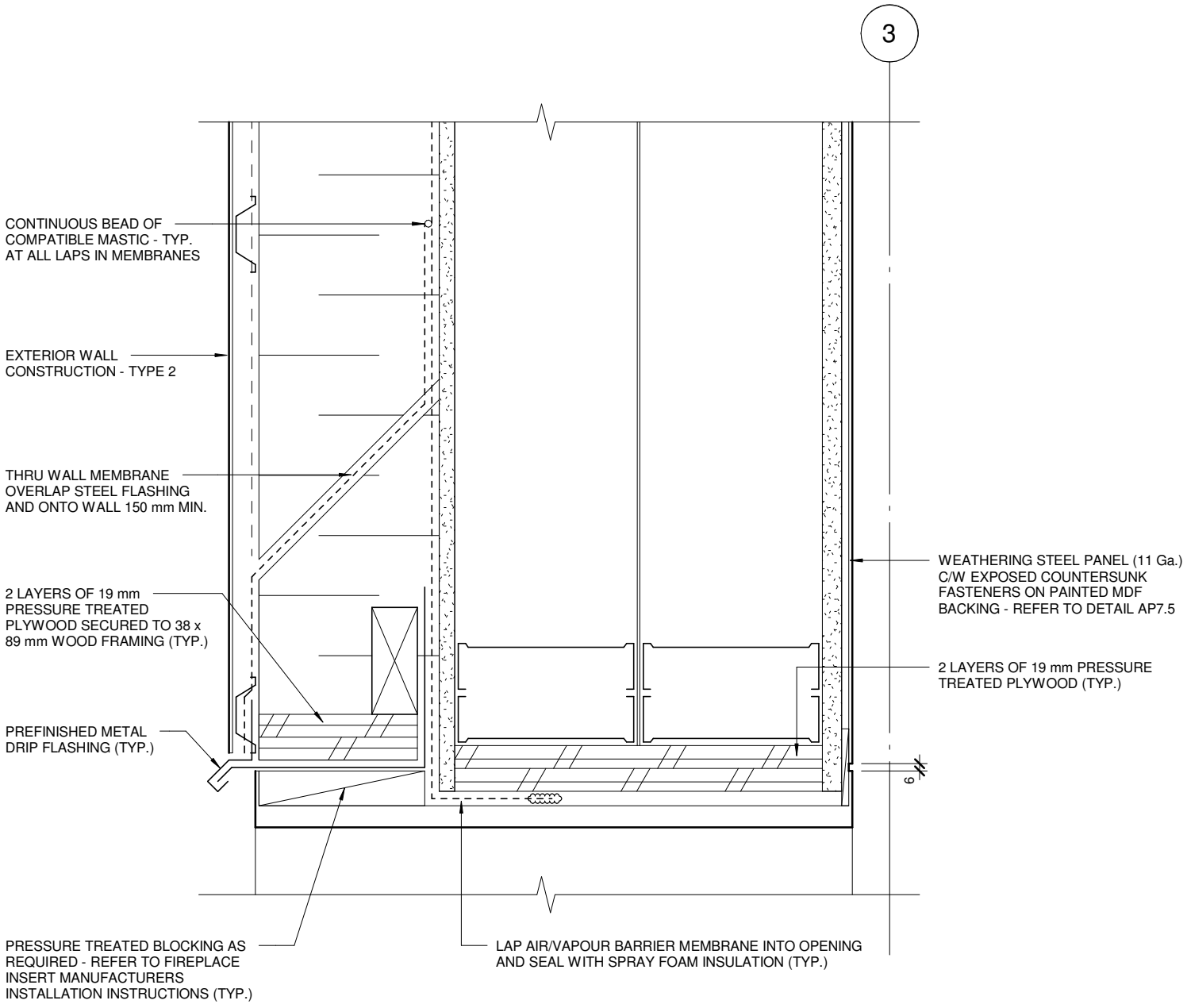

FIREPLACE INSERT DETAIL

SCALE 1 : 5

LM Architectural Group
500-136 Market Ave
Winnipeg Manitoba
Canada R3B 0P4
t: (204) 942.0681
f: (204) 943.8676
www.lm-architects.com

PROJECT:

Bill and Helen Norrie Library

Project Address: 15 Poseidon Bay, Winnipeg, MB.

Refer to drawing:

DRAWN BY: HW DATE: 07.08.19

AP5.20

COMM. NO.: 1847

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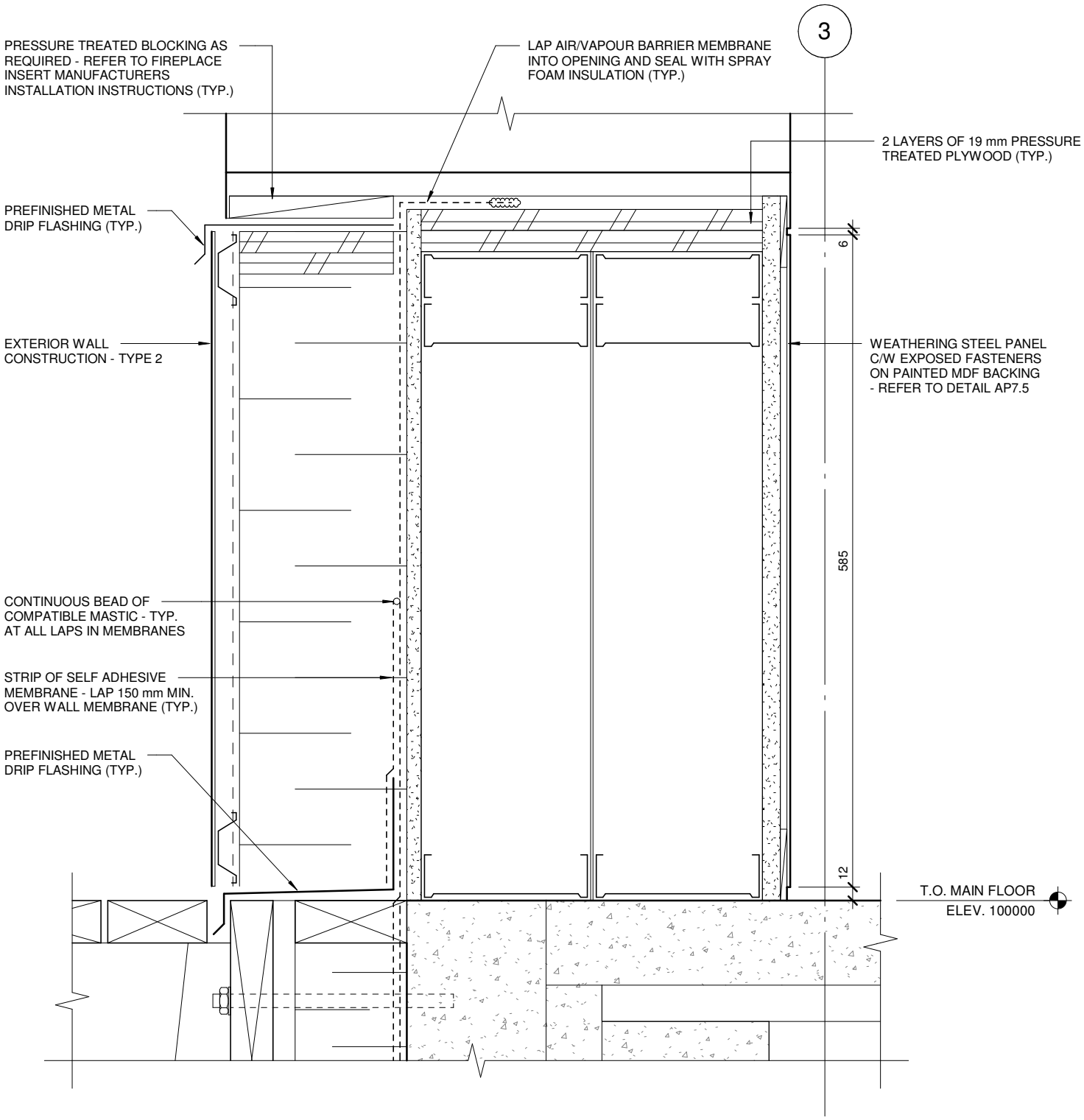

FIREPLACE INSERT DETAIL

SCALE 1 : 5

LM Architectural Group

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Winnipeg Manitoba
Canada R3B 0P4
t: (204) 942.0681
f: (204) 943.8676
www.lm-architects.com

PROJECT:

Bill and Helen Norrie Library

Project Address: 15 Poseidon Bay, Winnipeg, MB.

Refer to drawing: A5.2

DRAWN BY: HW DATE: 07.08.19

AP5.21

COMM. NO.: 1847

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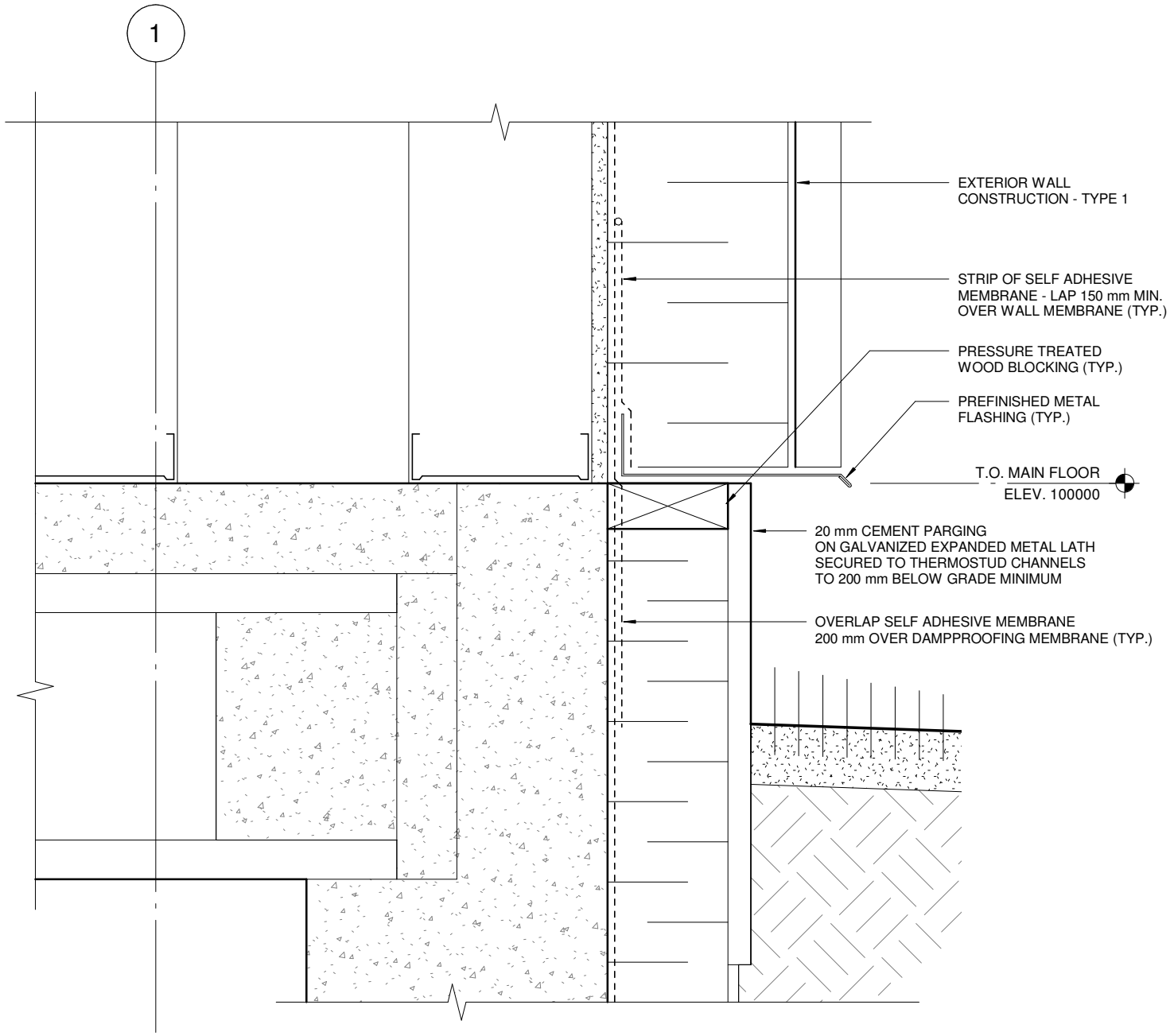

TYP. BASE DETAIL AT EXTERIOR WALL CONSTRUCTION - TYPE 1

SCALE 1 : 5

LM Architectural Group

500-136 Market Ave
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Canada R3B 0P4
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f: (204) 943.8676
www.lm-architects.com

PROJECT:

Bill and Helen Norrie Library

Project Address: 15 Poseidon Bay, Winnipeg, MB.

Refer to drawing: A5.2

DRAWN BY: HW DATE: 07.08.19

AP5.22

COMM. NO.: 1847

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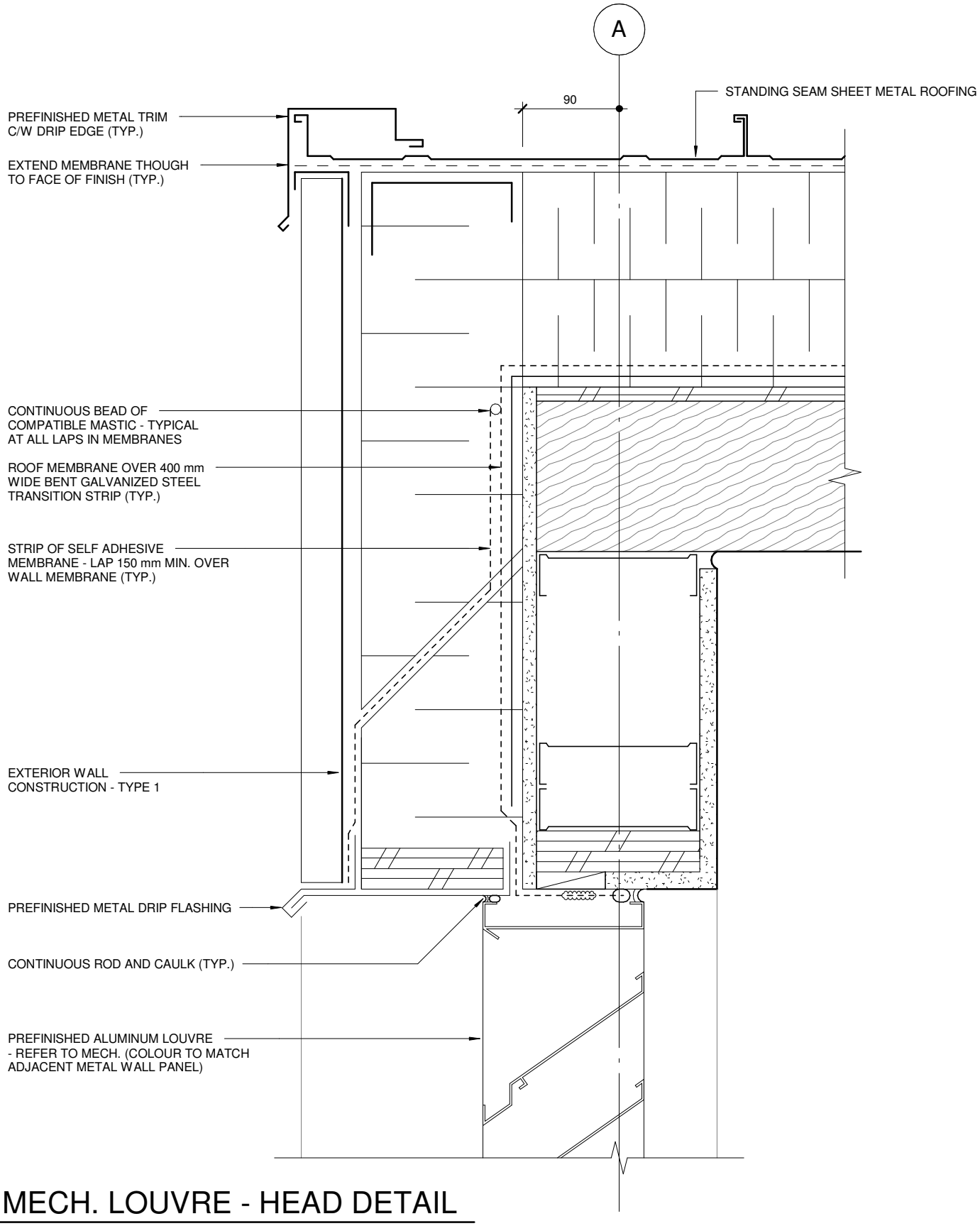

MECH. LOUVRE - HEAD DETAIL

SCALE 1 : 5

LM Architectural Group
500-136 Market Ave
Winnipeg Manitoba
Canada R3B 0P4
t: (204) 942.0681
f: (204) 943.8676
www.lm-architects.com

PROJECT:

Bill and Helen Norrie Library

Project Address: 15 Poseidon Bay, Winnipeg, MB.

Refer to drawing: A5.3

DRAWN BY: HW DATE: 07.08.19

AP5.23

COMM. NO.: 1847

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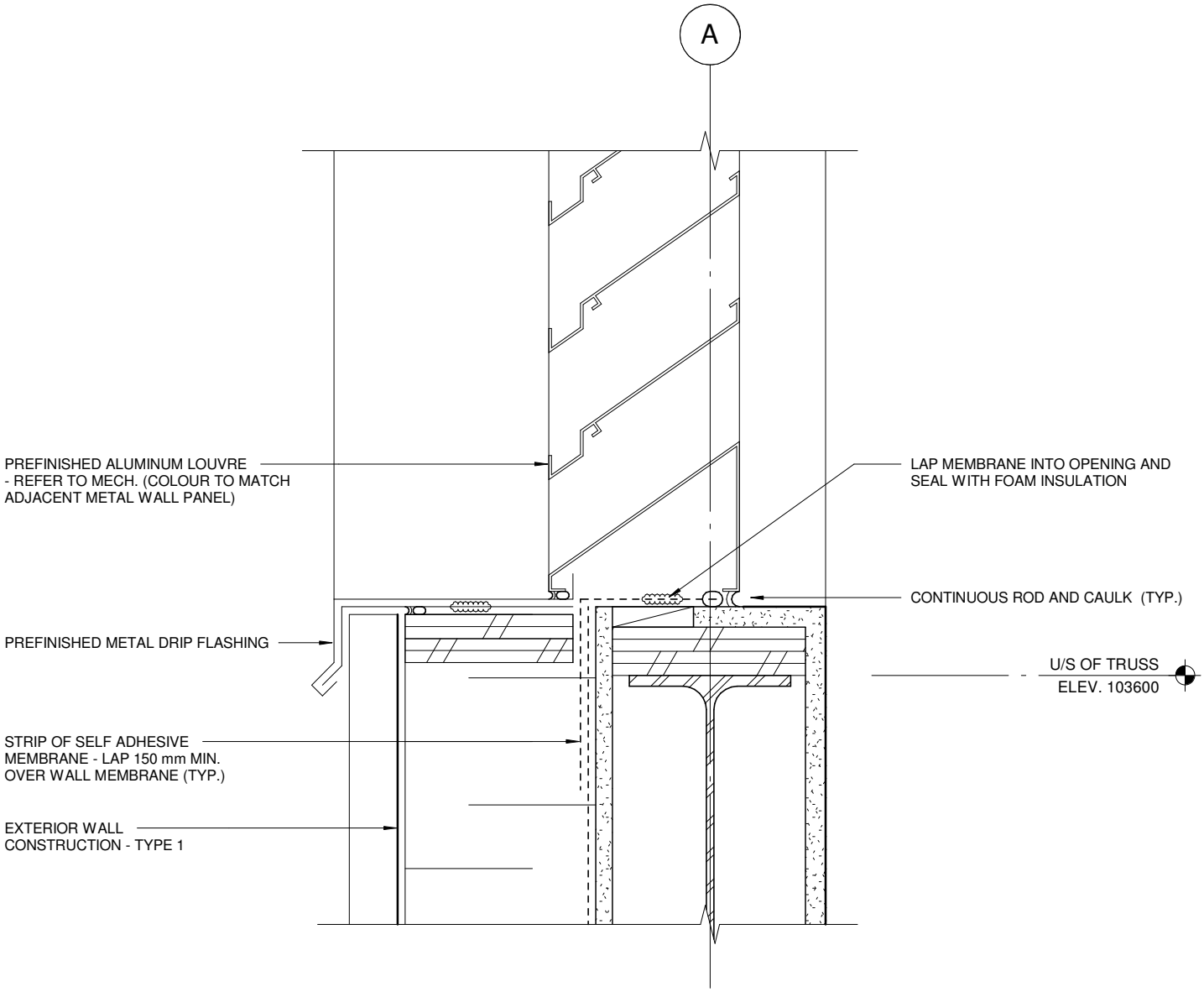

MECH. LOUVRE - SILL DETAIL

SCALE 1 : 5

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Winnipeg Manitoba
Canada R3B 0P4
t: (204) 942.0681
f: (204) 943.8676
www.lm-architects.com

PROJECT:

Bill and Helen Norrie Library

Project Address: 15 Poseidon Bay, Winnipeg, MB.

Refer to drawing: A5.3

DRAWN BY: HW DATE: 07.08.19

AP5.24

COMM. NO.: 1847

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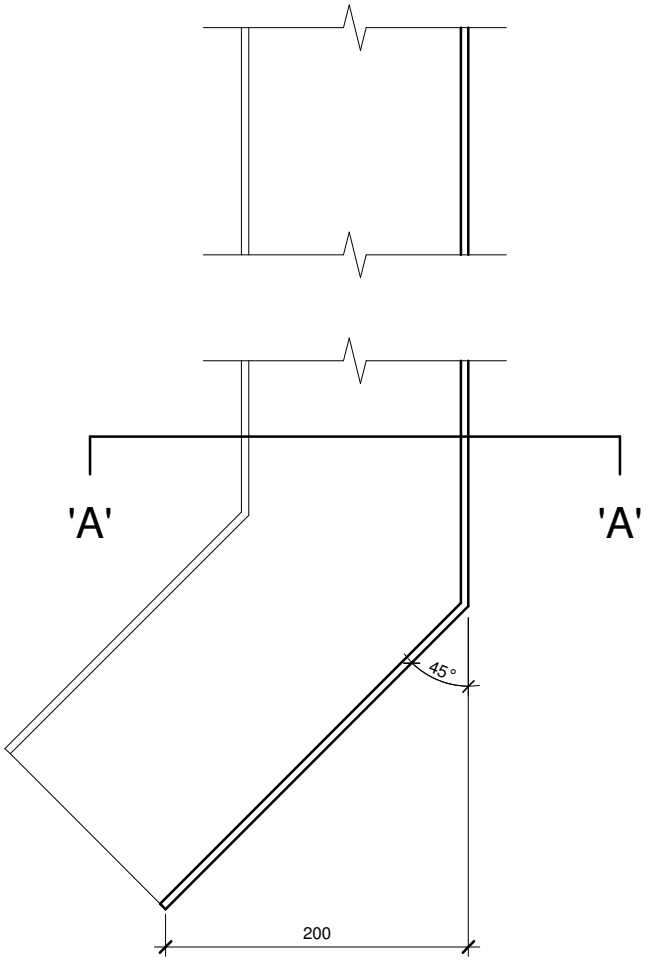
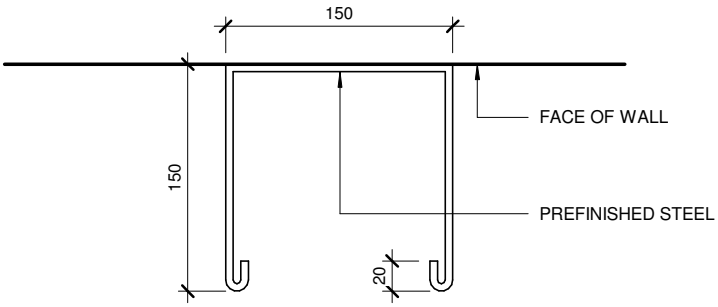


TYPICAL DOWNSPOUT

SCALE 1 : 5



SECTION 'A' THROUGH DOWNSPOUT

SCALE 1 : 5

LM Architectural Group

500-136 Market Ave
Winnipeg Manitoba
Canada R3B 0P4
t: (204) 942.0681
f: (204) 943.8676
www.lm-architects.com

PROJECT:

Bill and Helen Norrie Library

Project Address: 15 Poseidon Bay, Winnipeg, MB.

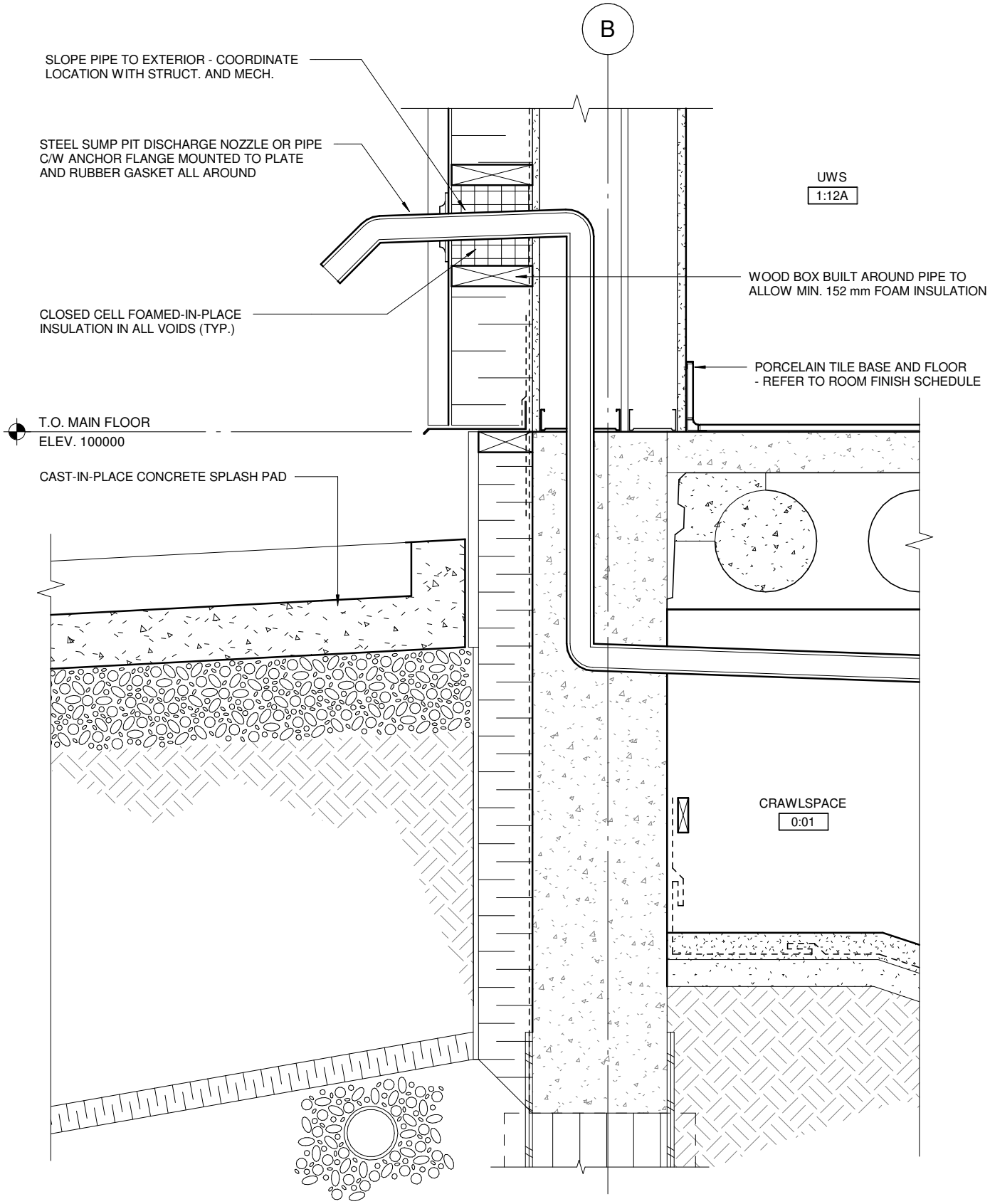
Refer to drawing: A2.1

DRAWN BY: RVB DATE: 07.08.19

AP5.25

COMM. NO.: 1847

Plotted on: 7/24/2019 10:52:52 AM C:\Users\H.WEST\Documents\1847_BHN Library_H.West.rvt



SECTION THRU SUMP PUMP DISCHARGE

1 : 10

LM Architectural Group
500-136 Market Ave
Winnipeg Manitoba
Canada R3B 0P4
t: (204) 942.0681
f: (204) 943.8676
www.lm-architects.com

PROJECT:

Bill and Helen Norrie Library

Project Address: 15 Poseidon Bay, Winnipeg, MB.

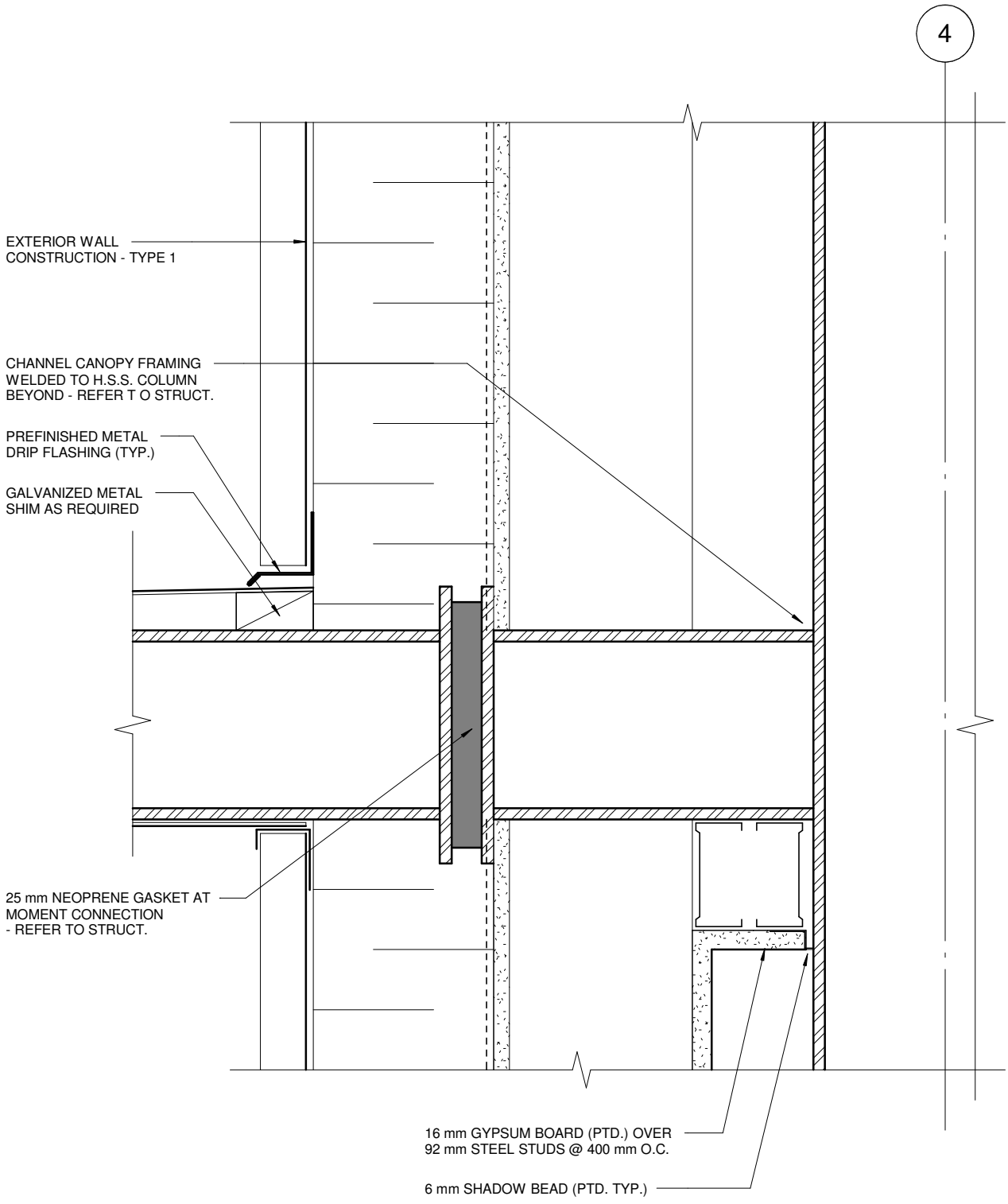
Refer to drawing: A2.1

DRAWN BY: HW DATE: 07.08.19

AP5.26

COMM. NO.: 1847

Plotted on: 7/24/2019 10:52:53 AM C:\Users\H.WEST\Documents\1847_BHN Library_H.West.rvt



TYPICAL SECTION THRU CANOPY FRAMING

SCALE 1 : 5

LM Architectural Group
500-136 Market Ave
Winnipeg Manitoba
Canada R3B 0P4
t: (204) 942.0681
f: (204) 943.8676
www.lm-architects.com

PROJECT:

Bill and Helen Norrie Library

Project Address: 15 Poseidon Bay, Winnipeg, MB.

Refer to drawing: A2.2

DRAWN BY: HW DATE: 07.08.19

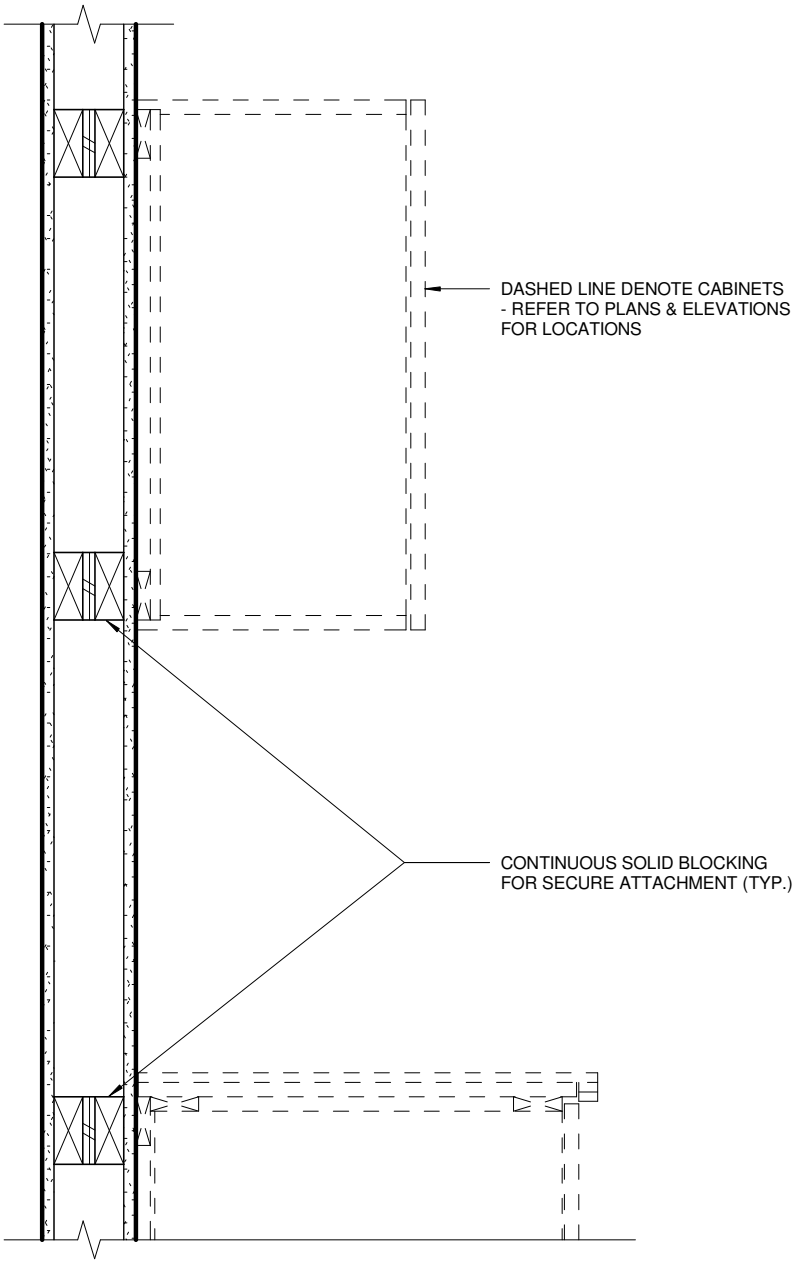
AP5.27

COMM. NO.: 1847

Plotted on: 7/24/2019 10:52:53 AM C:\Users\H.WEST\Documents\1847_BHN Library_H.West.rvt

AP7

TYPICAL MOUNTING DETAILS



TYPICAL CABINET BLOCKING DETAILS

SCALE 1 : 10

LM Architectural Group
500-136 Market Ave
Winnipeg Manitoba
Canada R3B 0P4
t: (204) 942.0681
f: (204) 943.8676
www.lm-architects.com

PROJECT:
Bill and Helen Norrie Library

Project Address: 15 Poseidon Bay, Winnipeg, MB.

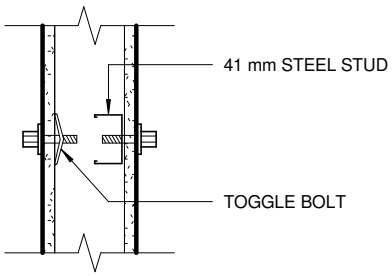
Refer to drawing: A7.1

DRAWN BY: DN DATE: 07.08.19

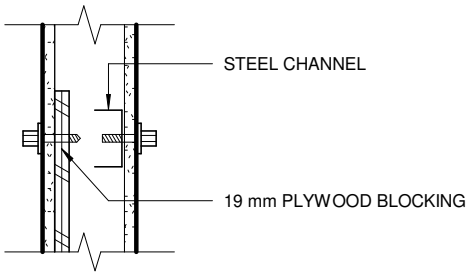
AP7.01

COMM. NO.: 1847

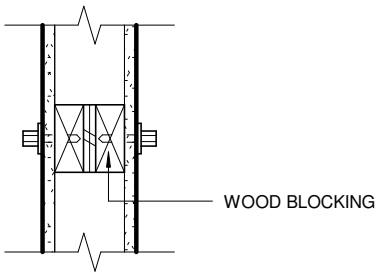
Plotted on: 7/24/2019 10:52:53 AM C:\Users\H.WEST\Documents\1847_BHN Library_H.West.rvt



LIGHT - WEIGHT
OBJECTS (4.5 kg.)



MEDIUM - WEIGHT
OBJECTS (11 kg.)



HEAVY - WEIGHT
OBJECTS (22.6 kg.)

TYPICAL WALL ATTACHMENT DETAILS

SCALE 1 : 10

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PROJECT:
Bill and Helen Norrie Library

Project Address: 15 Poseidon Bay, Winnipeg, MB.

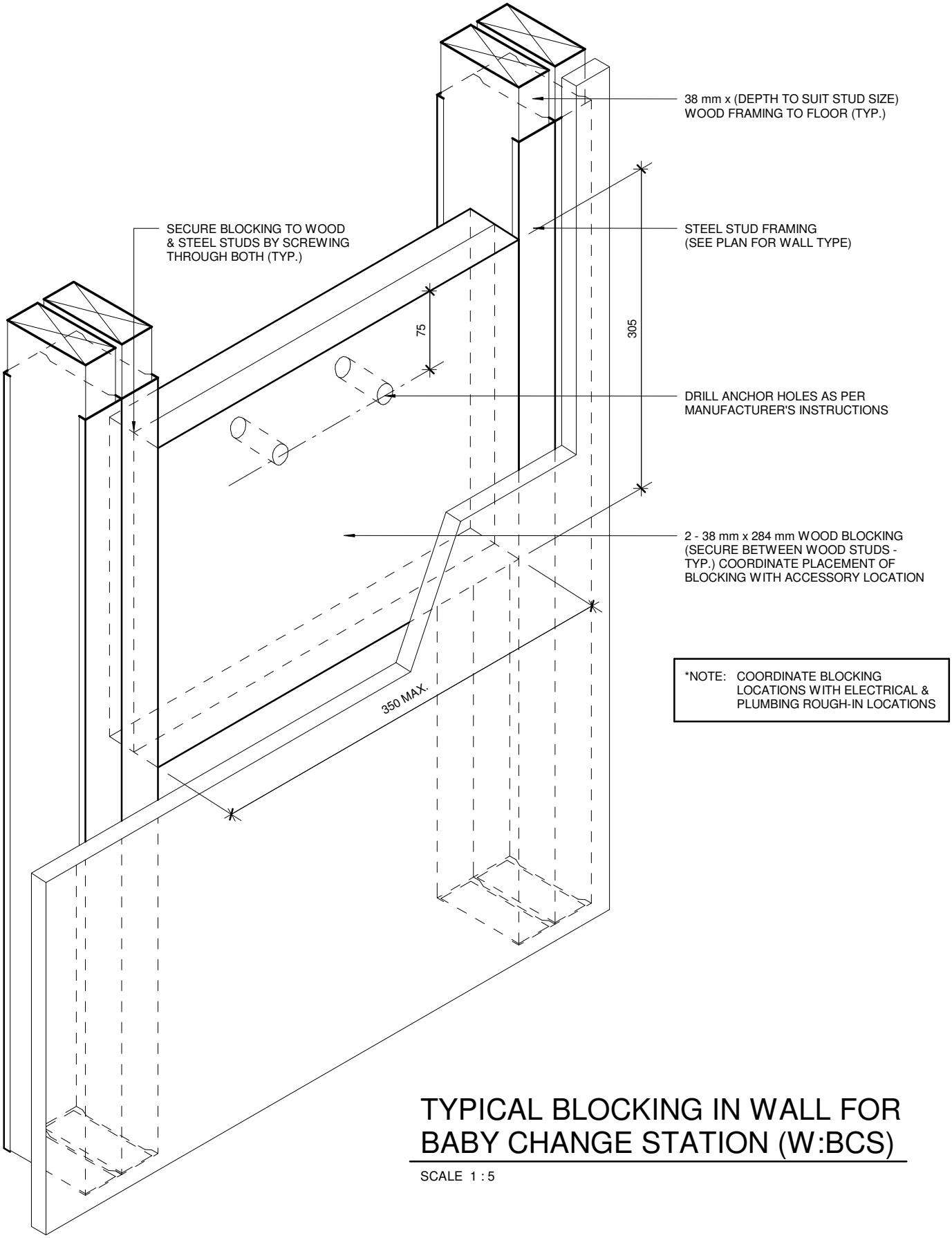
Refer to drawing: A7.1

DRAWN BY: DN DATE: 07.08.19

AP7.02

COMM. NO.: 1847

Plotted on: 7/24/2019 10:52:53 AM C:\Users\H.WEST\Documents\1847_BHN Library_H.West.rvt



*NOTE: COORDINATE BLOCKING LOCATIONS WITH ELECTRICAL & PLUMBING ROUGH-IN LOCATIONS

TYPICAL BLOCKING IN WALL FOR BABY CHANGE STATION (W:BCS)

SCALE 1 : 5

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PROJECT:

Bill and Helen Norrie Library

Project Address: 15 Poseidon Bay, Winnipeg, MB.

Refer to drawing: A7.1

DRAWN BY: HW DATE: 07.08.19

AP7.03

COMM. NO.: 1847

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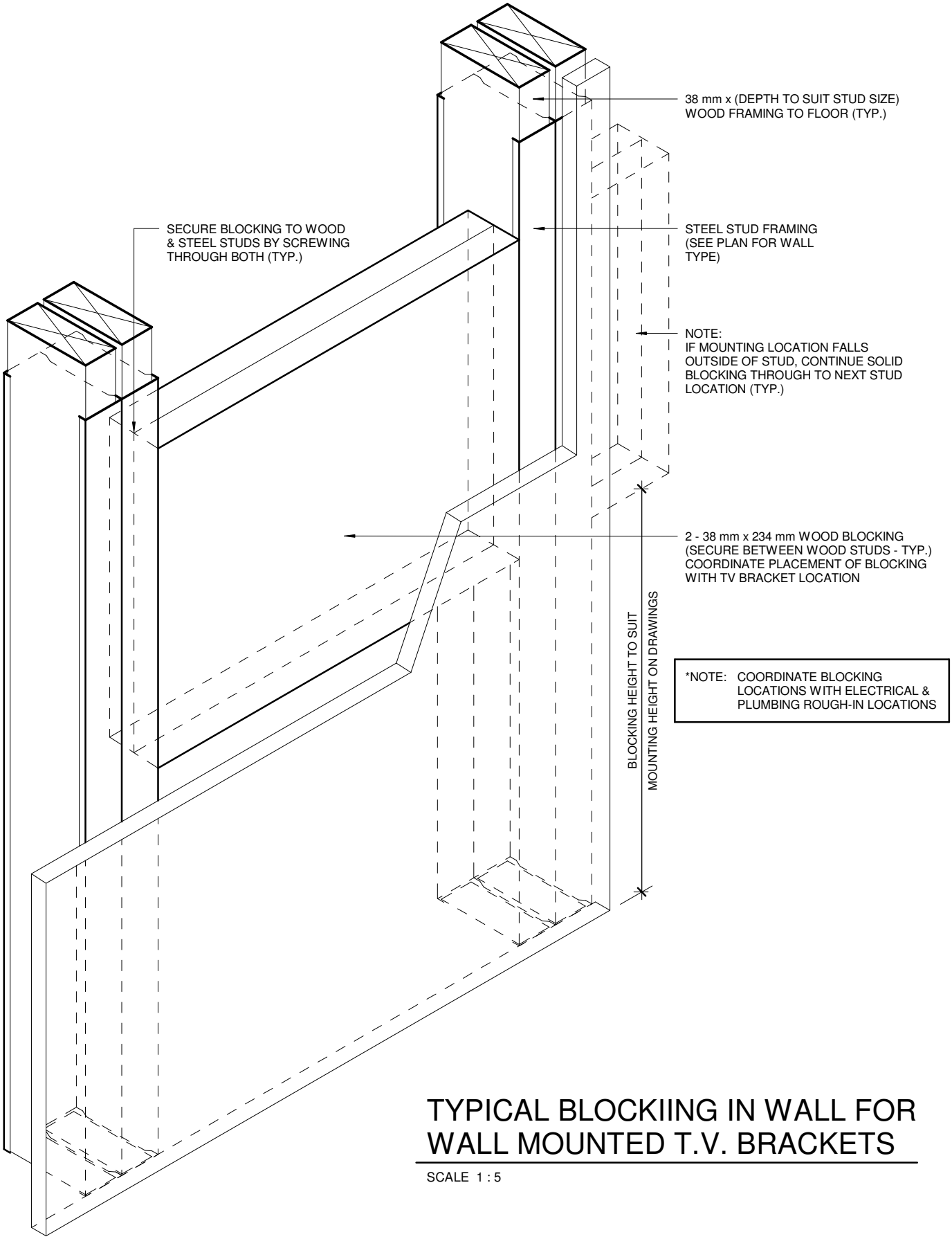

TYPICAL BLOCKIING IN WALL FOR WALL MOUNTED T.V. BRACKETS

SCALE 1 : 5

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PROJECT:

Bill and Helen Norrie Library

Project Address: 15 Poseidon Bay, Winnipeg, MB.

Refer to drawing: A8.1 & 8.2

DRAWN BY: HW DATE: 07.08.19

AP7.04

COMM. NO.: 1847

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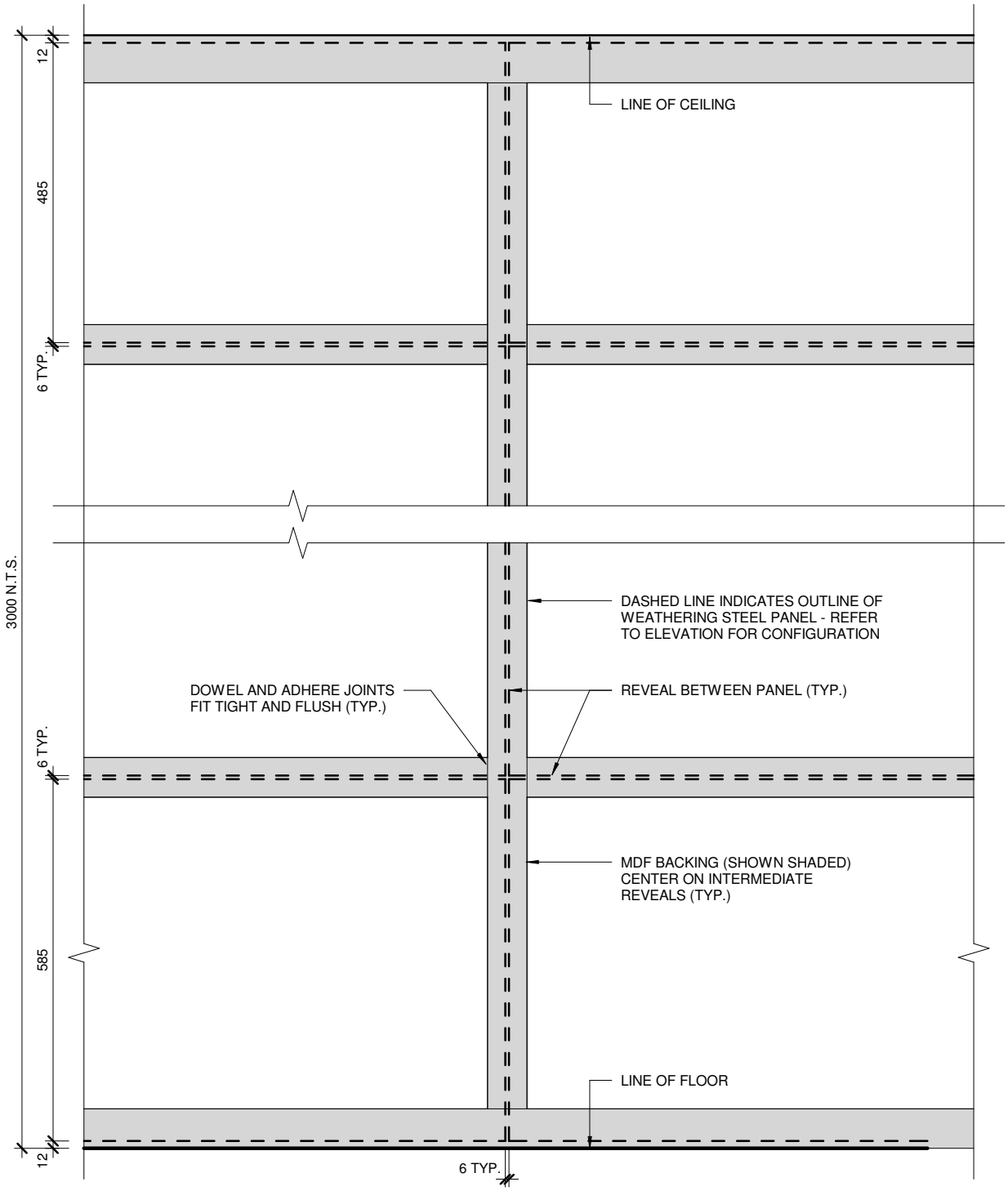

BLOCKING AT INTERIOR WEATHERING STEEL PANEL

SCALE 1 : 10

NOTE:

ALL INDICATED JOINTS IN REVEAL BACKING TO BE REVIEWED FOR ACCEPTANCE BY CONSULTANT PRIOR TO INSTALLATION OF FINISHED PANELING.

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PROJECT:

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Project Address: 15 Poseidon Bay, Winnipeg, MB.

Refer to drawing: A8.2

DRAWN BY: HW DATE: 07.08.19

AP7.05

COMM. NO.: 1847

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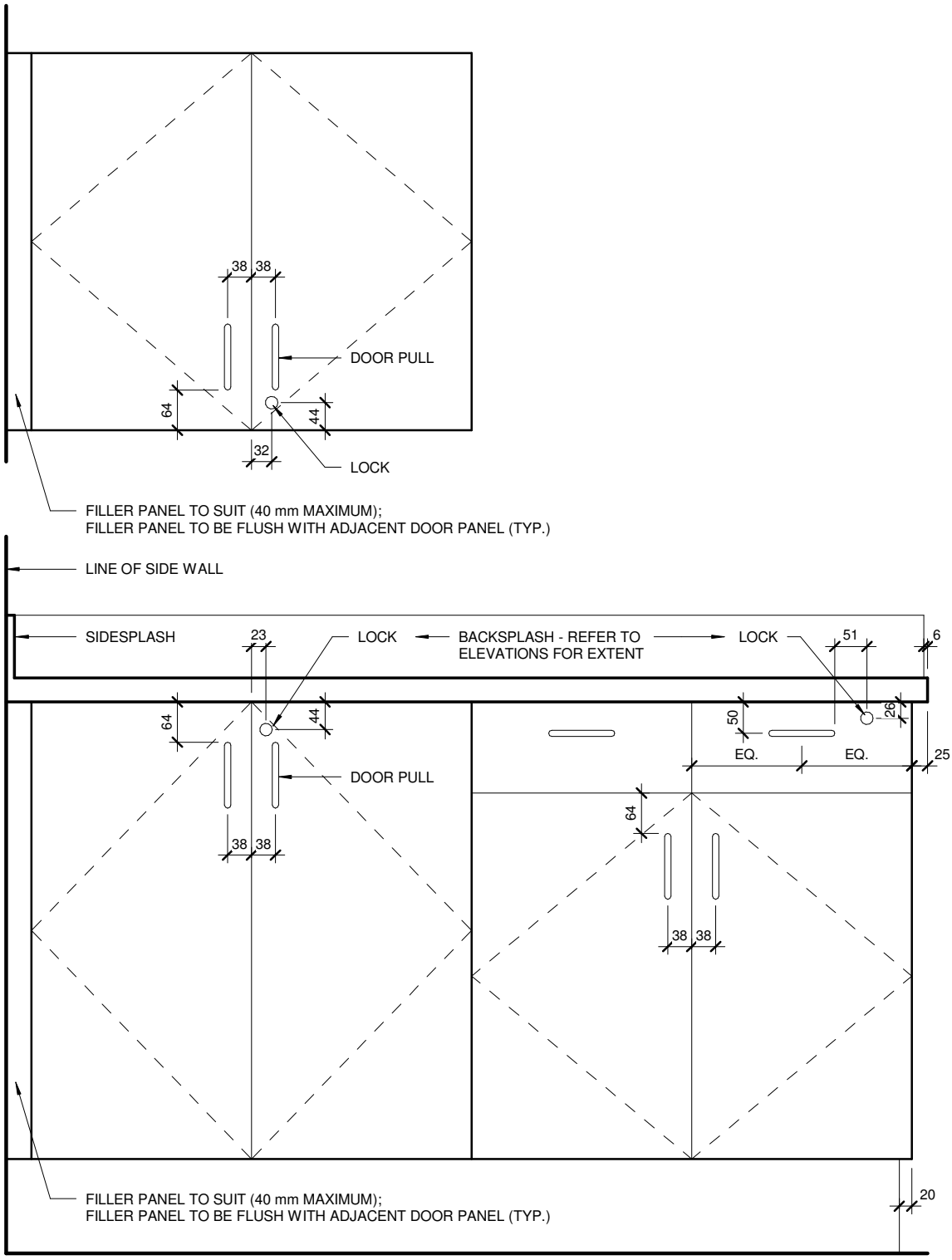
AP8

MILLWORK DETAILS



TYPICAL CABINET ELEVATION

SCALE 1 : 10

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PROJECT:

Bill and Helen Norrie Library

Project Address: 15 Poseidon Bay, Winnipeg, MB.

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DRAWN BY: DN DATE: 07.08.19

AP8.01

COMM. NO.: 1847

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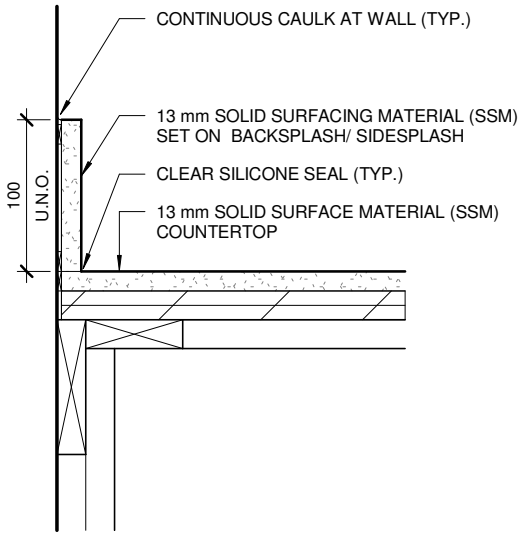
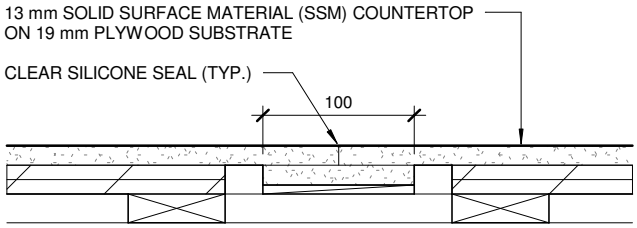


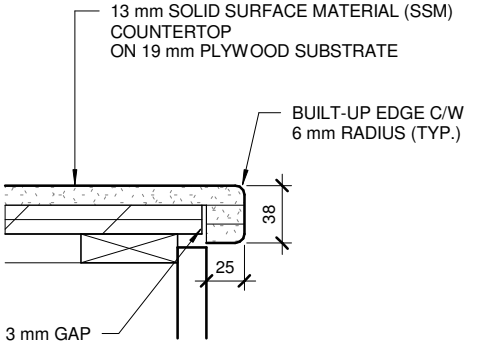
TYPICAL BACKSPLASH DETAIL

1 : 5



TYPICAL SEAM BLOCK DETAIL

1 : 5



TYPICAL EDGE DETAIL

1 : 5

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PROJECT:

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Refer to drawing:

DRAWN BY: DN DATE: 07.08.19

AP8.02

COMM. NO.: 1847

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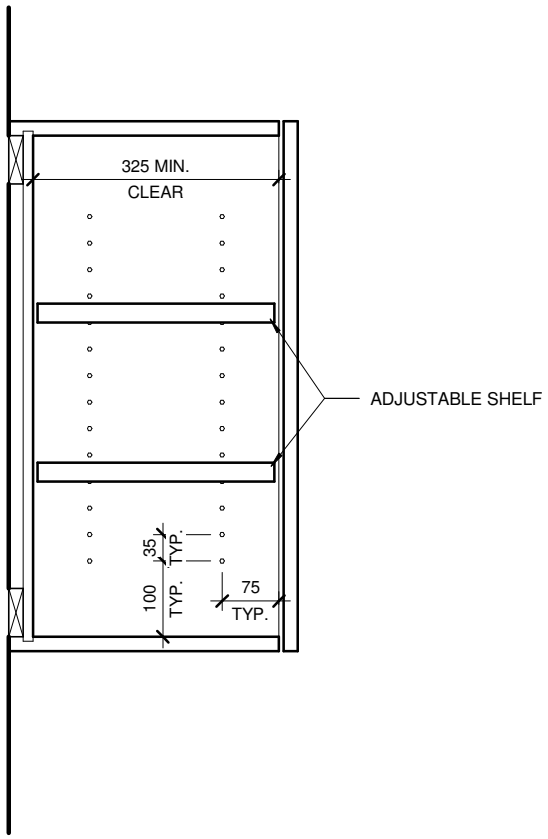

TYPICAL UPPER CABINET

SCALE 1 : 10

NOTE:

- PLASTIC LAMINATE FACED CASEWORK

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PROJECT:

Bill and Helen Norrie Library

Project Address: 15 Poseidon Bay, Winnipeg, MB.

Refer to drawing:

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AP8.03

COMM. NO.: 1847

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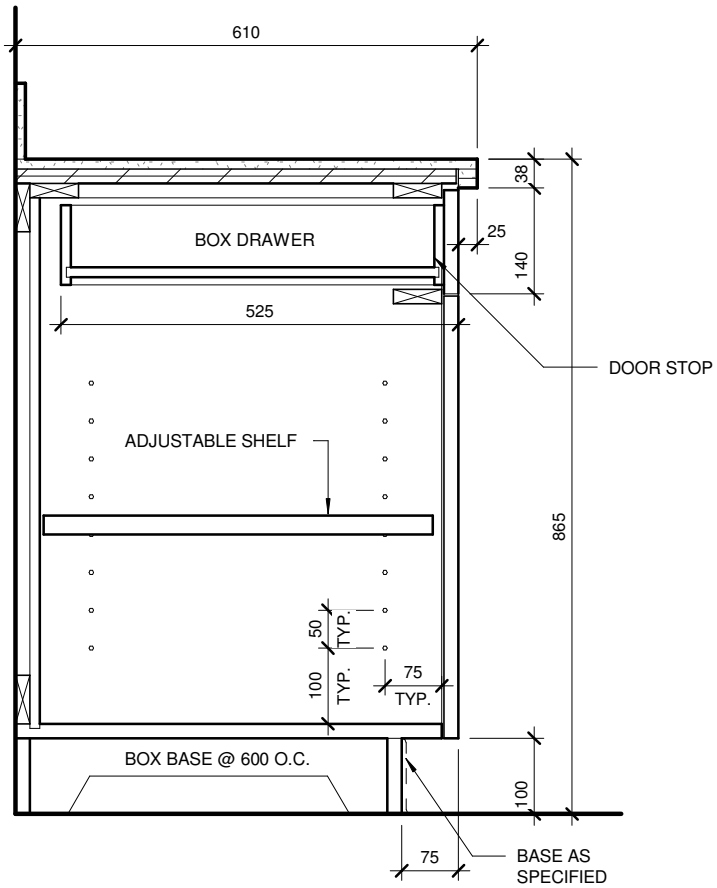

TYPICAL LOWER CABINET

SCALE 1 : 10

NOTE:

- PLASTIC LAMINATE FACED CASEWORK
- SOLID SURFACE MATERIAL COUNTERTOP, BACKSPLASH, & SIDESPLASH

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AP8.04

COMM. NO.: 1847

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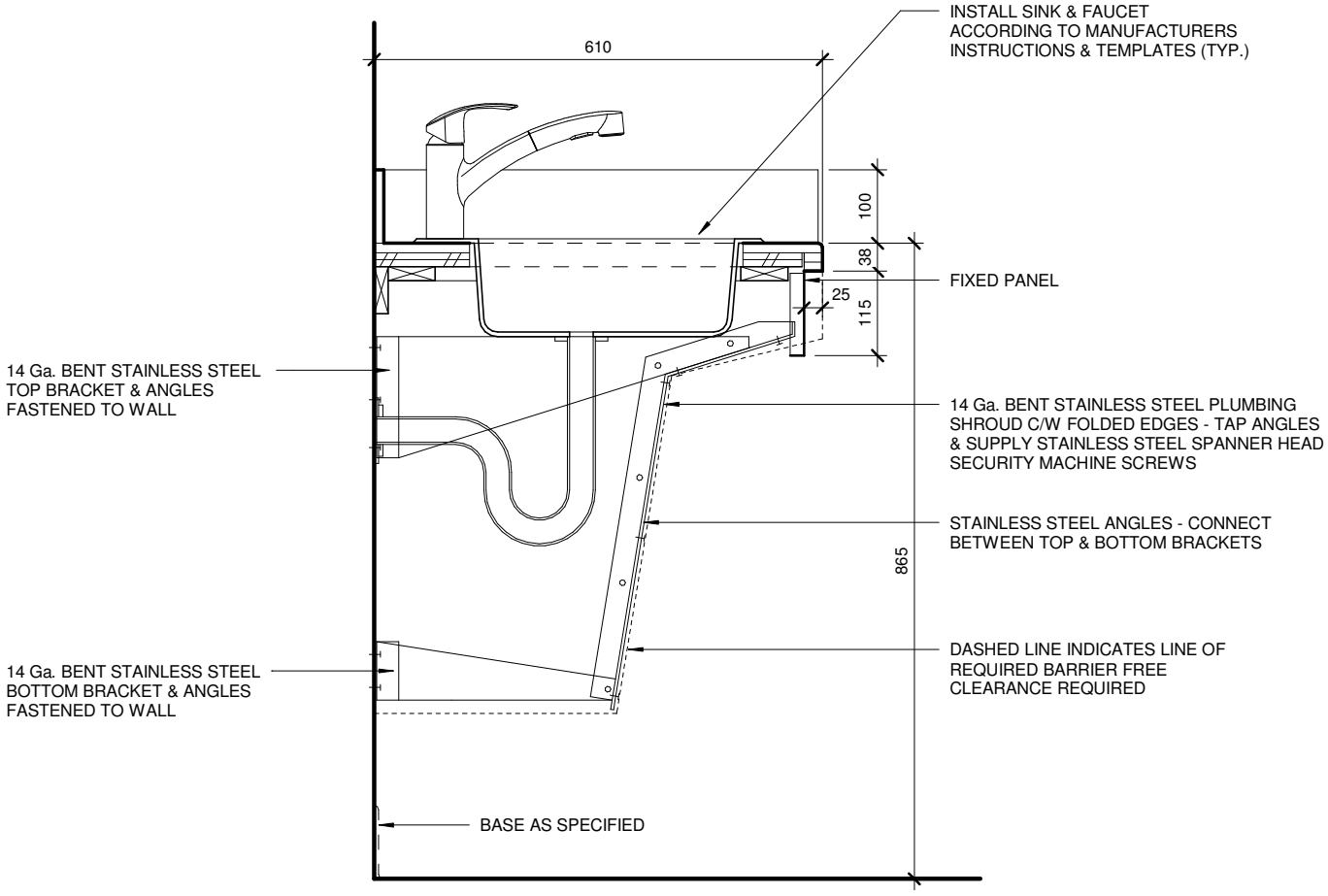

ACCESSIBLE SINK

SCALE 1 : 10

NOTE:

- SOLID SURFACE MATERIAL COUNTERTOP, BACKSPLASH, & SIDESPLASH
- SEMI-EXPOSED AND CONCEALED SURFACES TO BE PLASTIC LAMINATE FACED UNLESS OTHERWISE NOTED

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AP8.05

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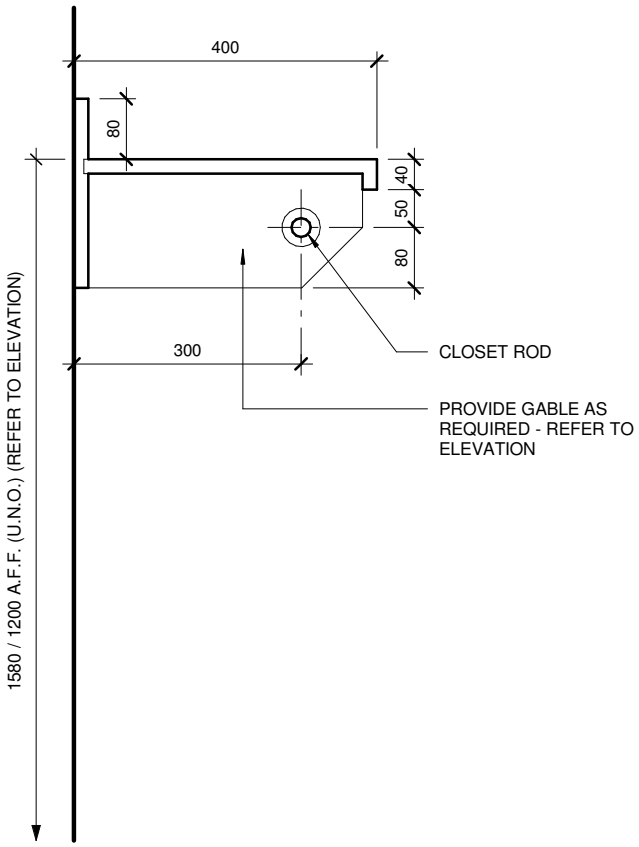

TYPICAL ROD AND SHELF

SCALE 1 : 10

NOTE:

- PLASTIC LAMINATE FACED CASEWORK

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AP8.06

COMM. NO.: 1847

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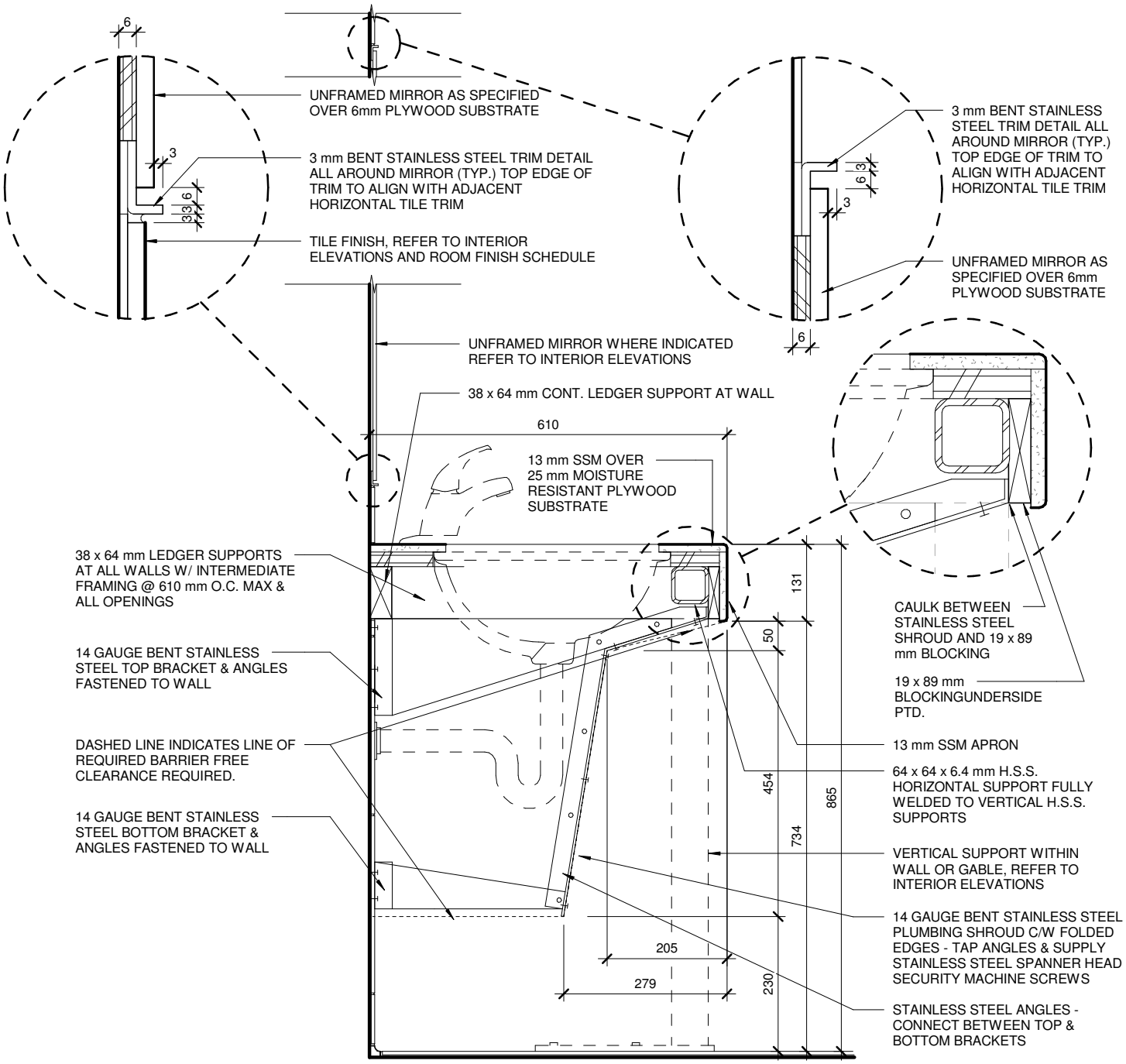

VANITY SECTION

SCALE 1 : 10

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PROJECT:

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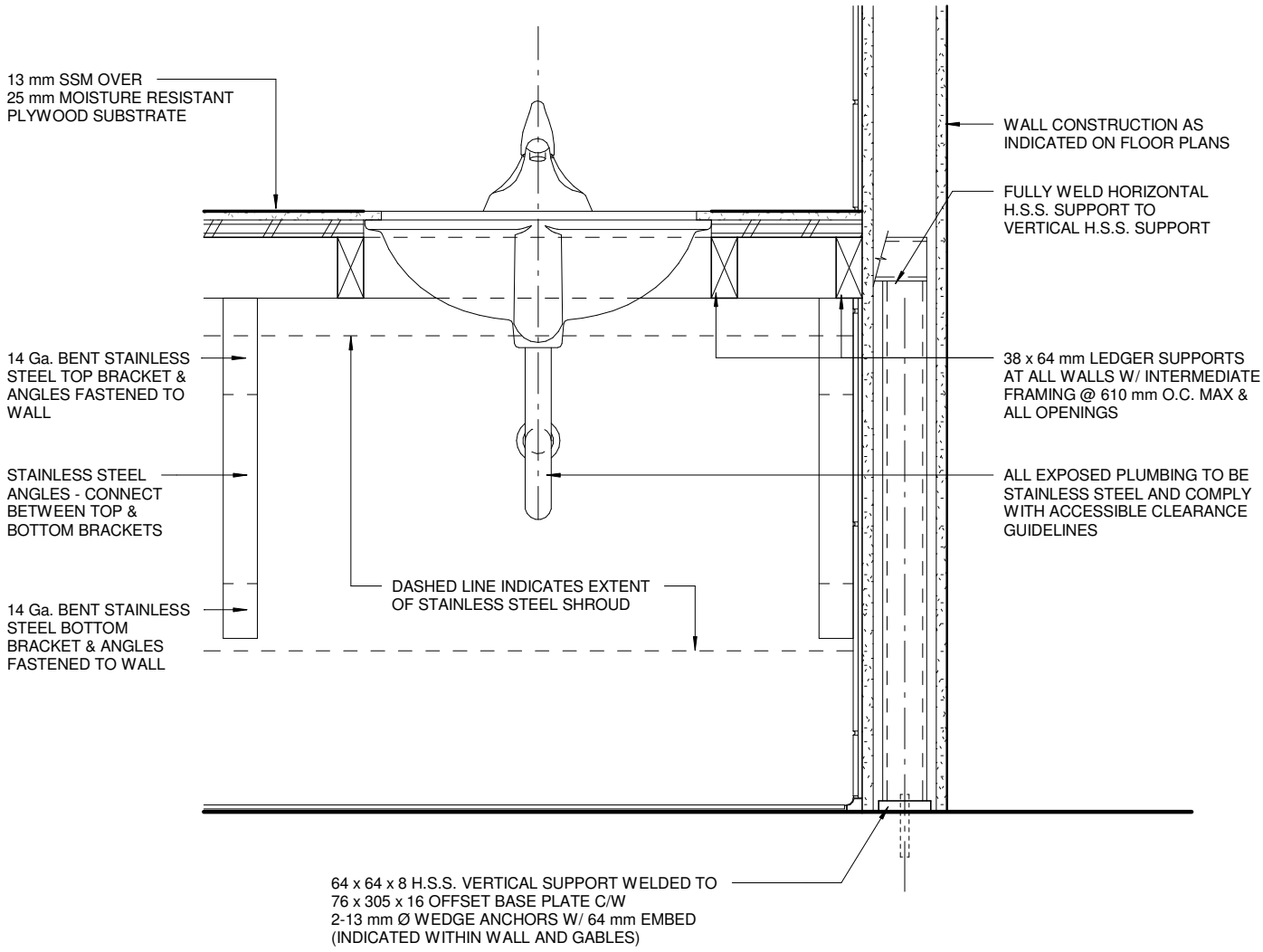
AP8.07

COMM. NO.: 1847

Plotted on: 7/24/2019 10:52:55 AM C:\Users\H.WEST\Documents\1847_BHN Library_H.West.rvt



VANITY SECTION @ WALL END

SCALE 1 : 10

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Refer to drawing:

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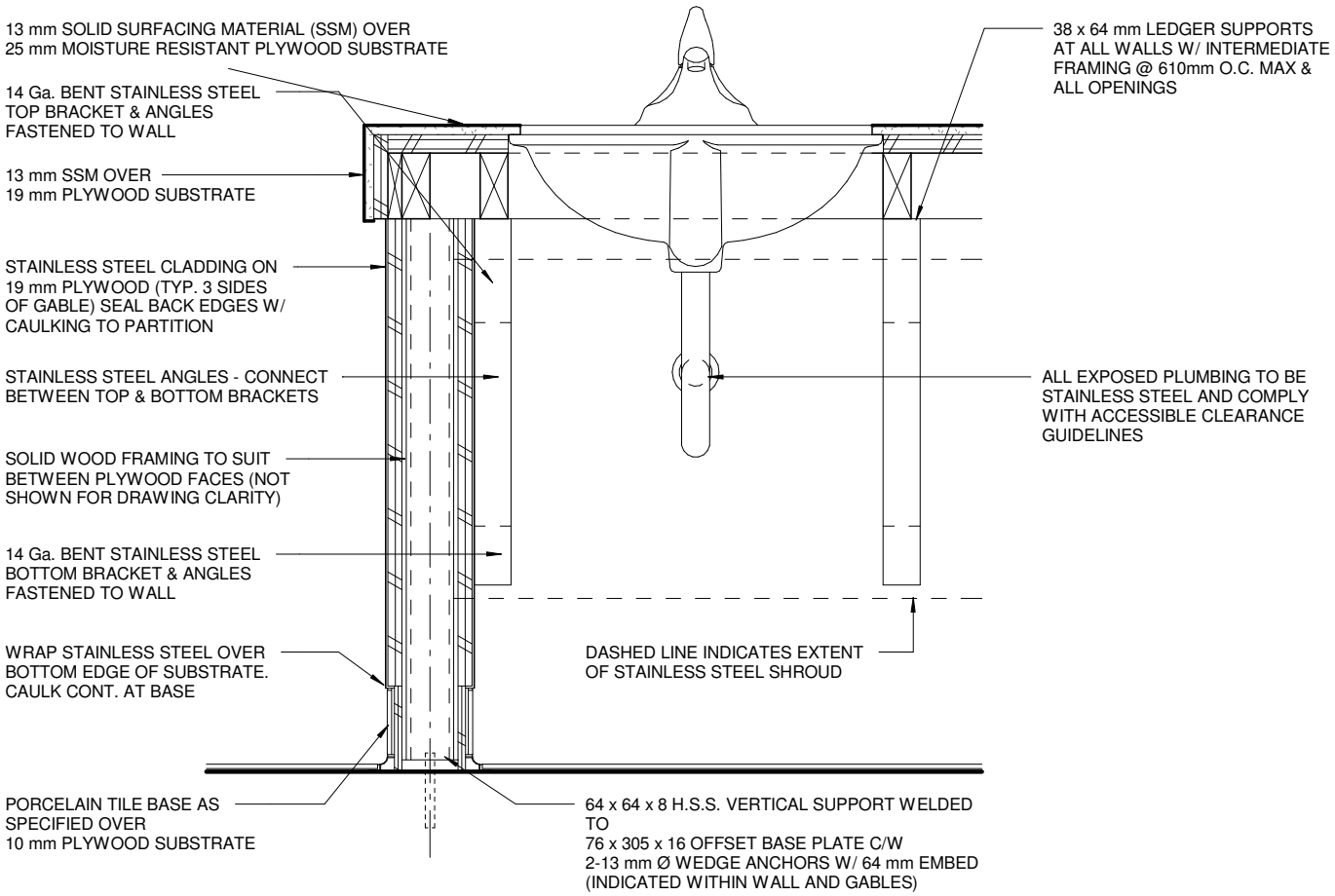
AP8.08

COMM. NO.: 1847

Plotted on: 7/24/2019 10:52:55 AM C:\Users\H.WEST\Documents\1847_BHN Library_H.West.rvt



VANITY SECTION @ GABLE END

SCALE 1 : 10

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PROJECT:

Bill and Helen Norrie Library

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Refer to drawing:

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AP8.09

COMM. NO.: 1847

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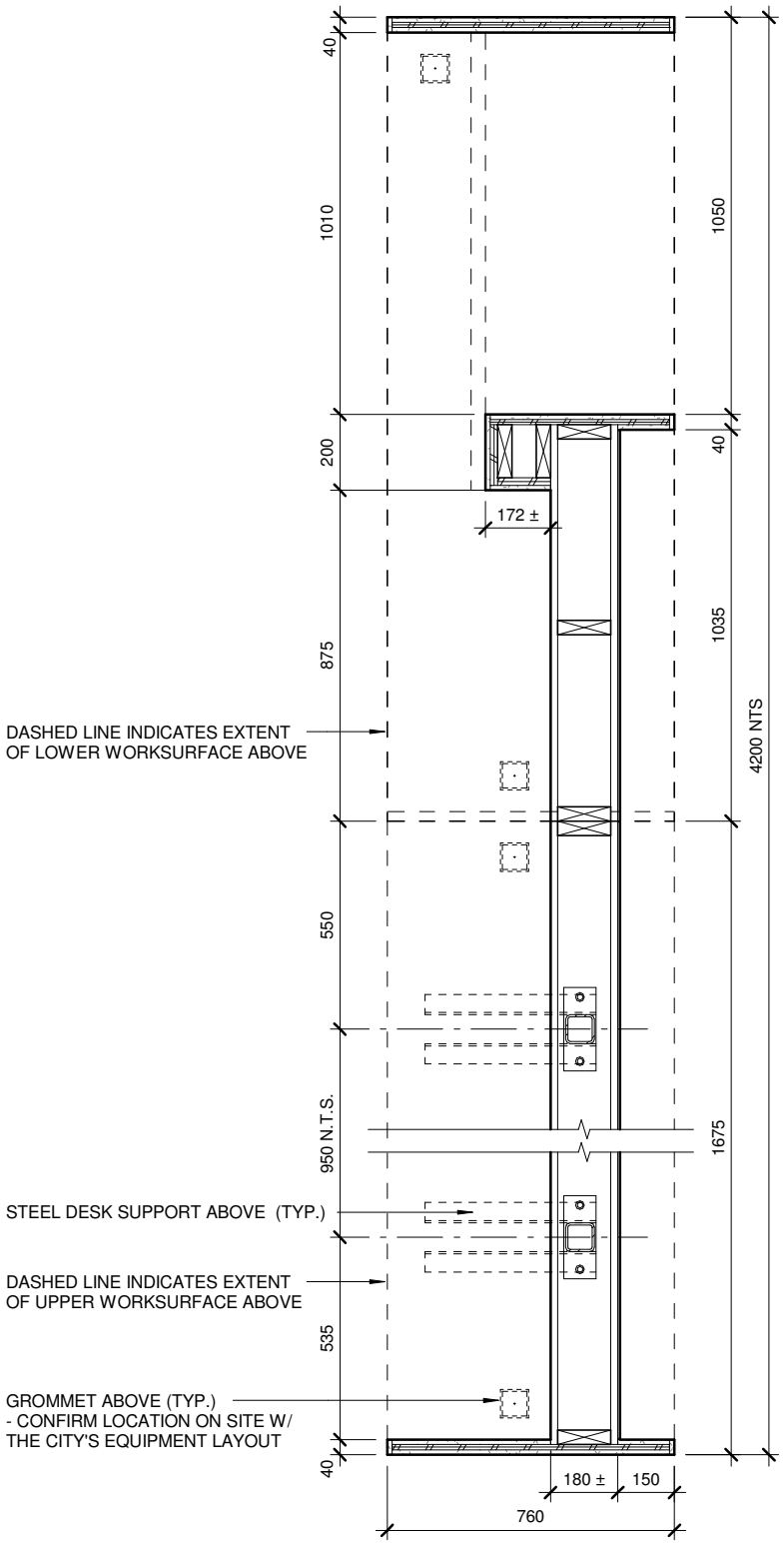

SERVICE DESK PLAN SECTION

SCALE 1 : 20

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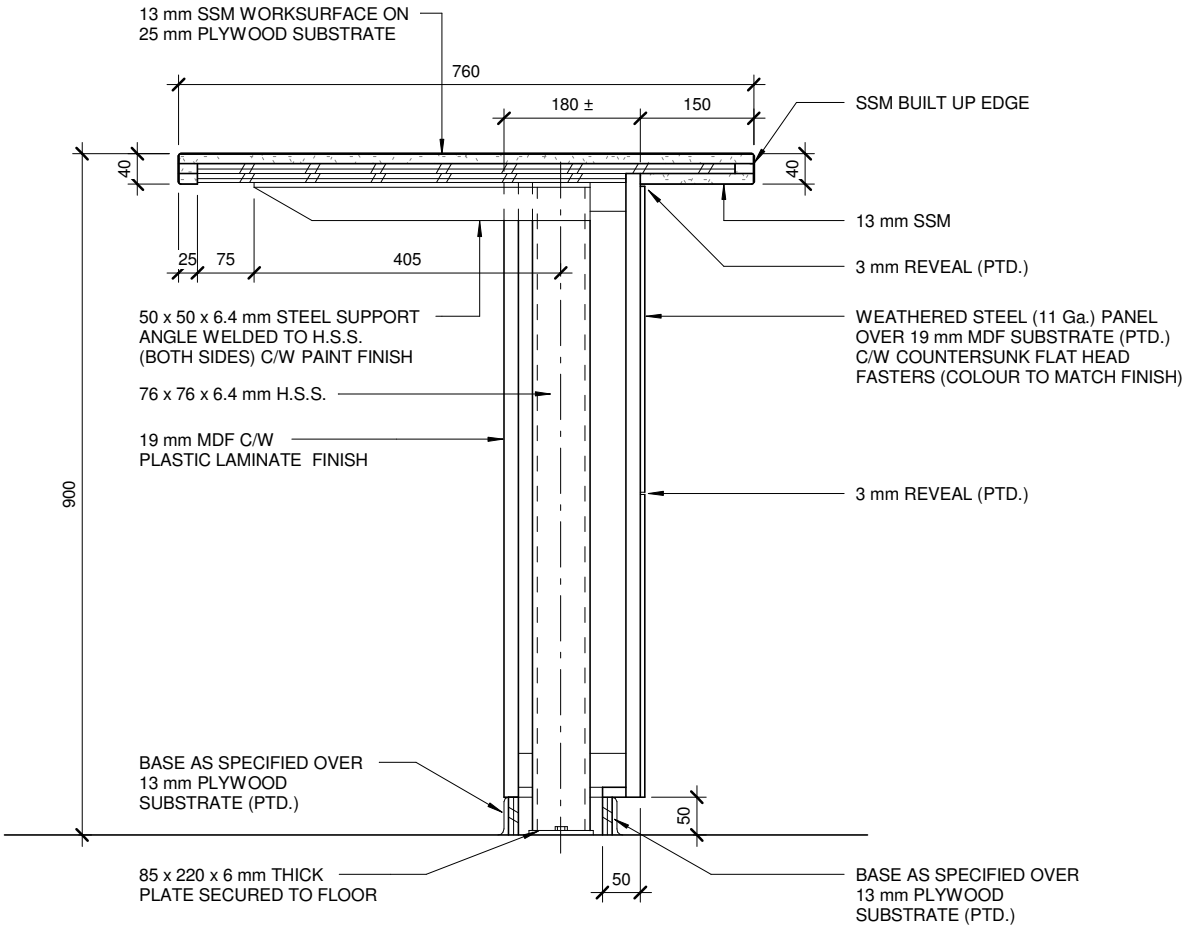
AP8.10

COMM. NO.: 1847

Plotted on: 7/24/2019 10:52:56 AM C:\Users\H.WEST\Documents\1847_BHN Library_H.West.rvt



RECEPTION DESK
SECTION AT SUPPORT

SCALE 1 : 10

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PROJECT:

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AP8.11

COMM. NO.: 1847

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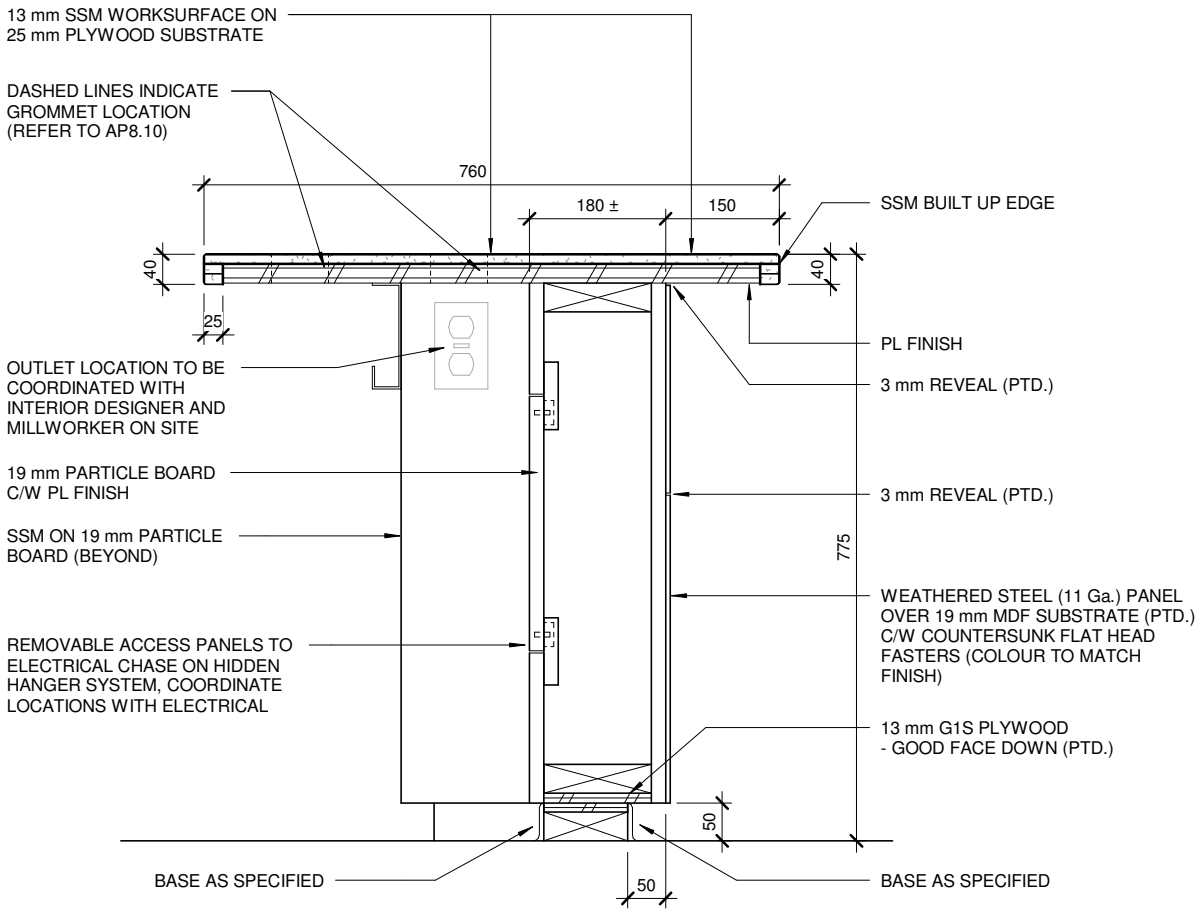

RECEPTION DESK SECTION AT SEATED WORKSTATION

12
8.1 AP8.12

SCALE 1 : 10

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PROJECT:

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AP8.12

COMM. NO.: 1847

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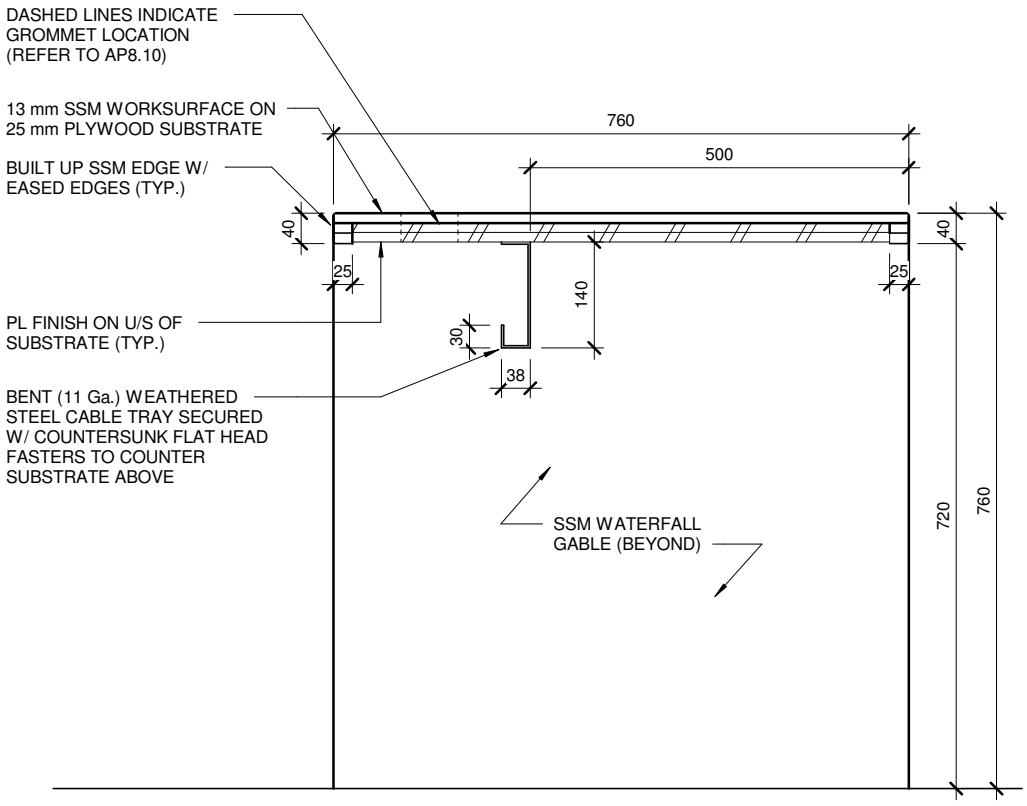

RECEPTION DESK
ACCESSIBLE SECTION

SCALE 1 : 10

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PROJECT:

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Project Address: 15 Poseidon Bay, Winnipeg, MB.

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AP8.13

COMM. NO.: 1847

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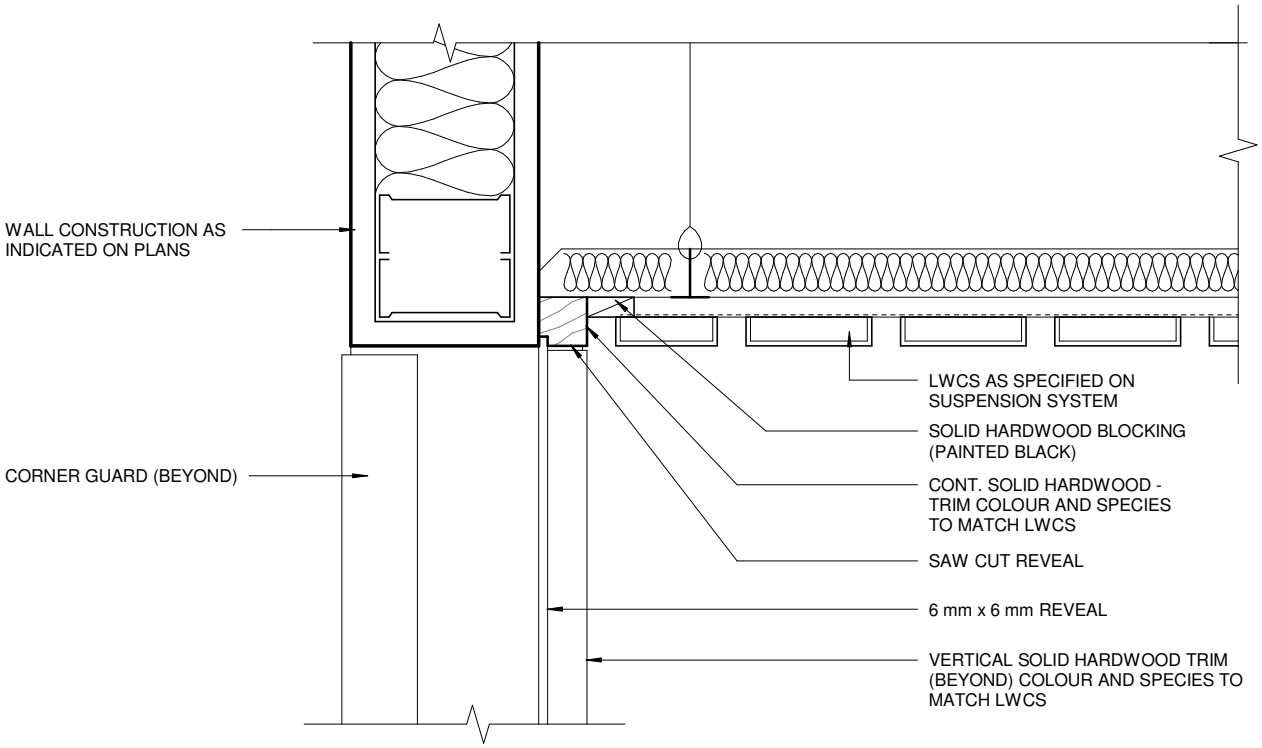

LWCS AT OPENING

SCALE 1 : 5

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PROJECT:

Bill and Helen Norrie Library

Project Address: 15 Poseidon Bay, Winnipeg, MB.

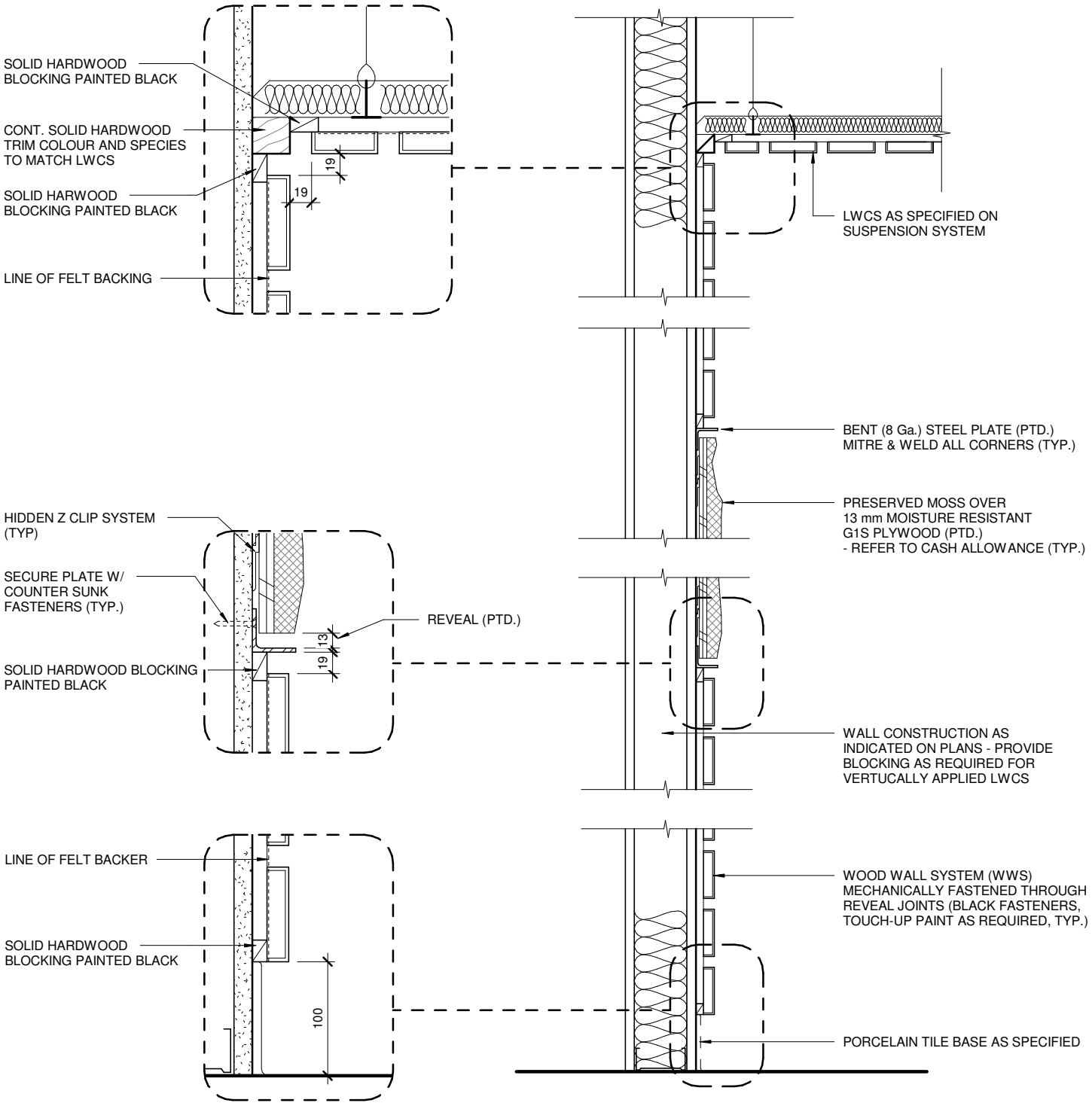
Refer to drawing:

DRAWN BY: DN DATE: 07.08.19

AP8.14

COMM. NO.: 1847

Plotted on: 7/24/2019 10:52:57 AM C:\Users\H.WEST\Documents\1847_BHN Library_H.West.rvt



LWCS WALL @ RECEPTION

SCALE 1 : 10

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PROJECT:

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Project Address: 15 Poseidon Bay, Winnipeg, MB.

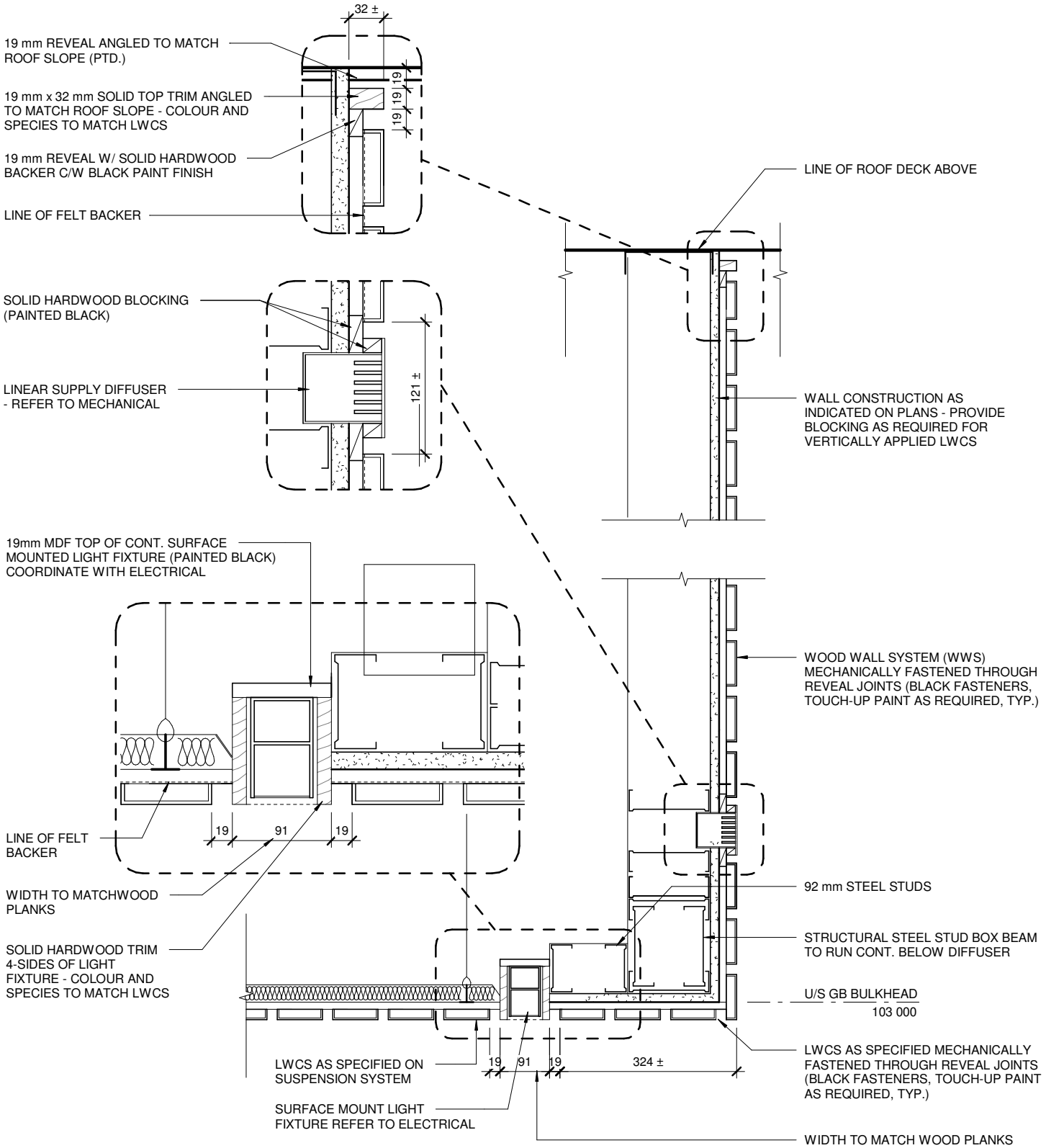
Refer to drawing:

DRAWN BY: DN DATE: 07.08.19

AP8.15

COMM. NO.: 1847

Plotted on: 7/24/2019 10:52:57 AM C:\Users\H.WEST\Documents\1847_BHN Library_H.West.rvt



LWCS CEILING & FEATURE WALL

SCALE 1 : 10

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PROJECT:

Bill and Helen Norrie Library

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Refer to drawing:

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AP8.16

COMM. NO.: 1847

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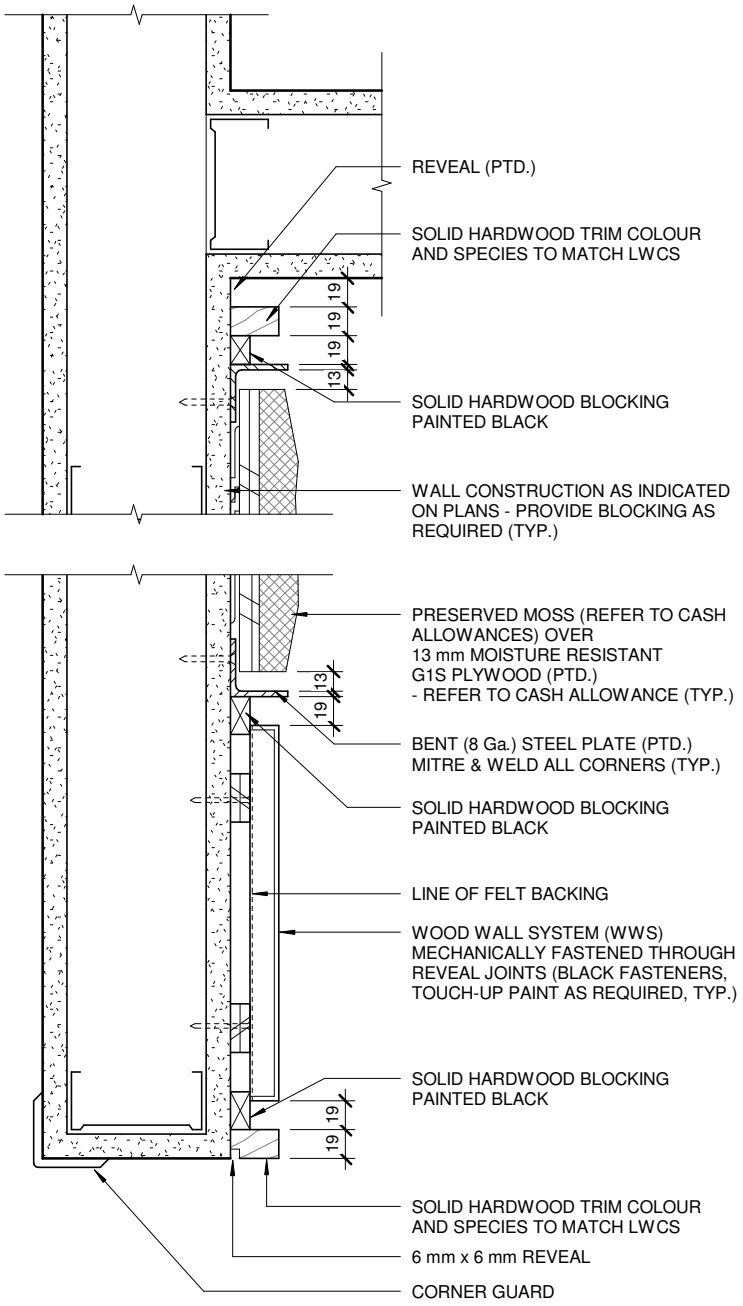

LWCS RECEPTION WALL PLAN SECTION

SCALE 1 : 5

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PROJECT:

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Refer to drawing:

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AP8.17

COMM. NO.: 1847

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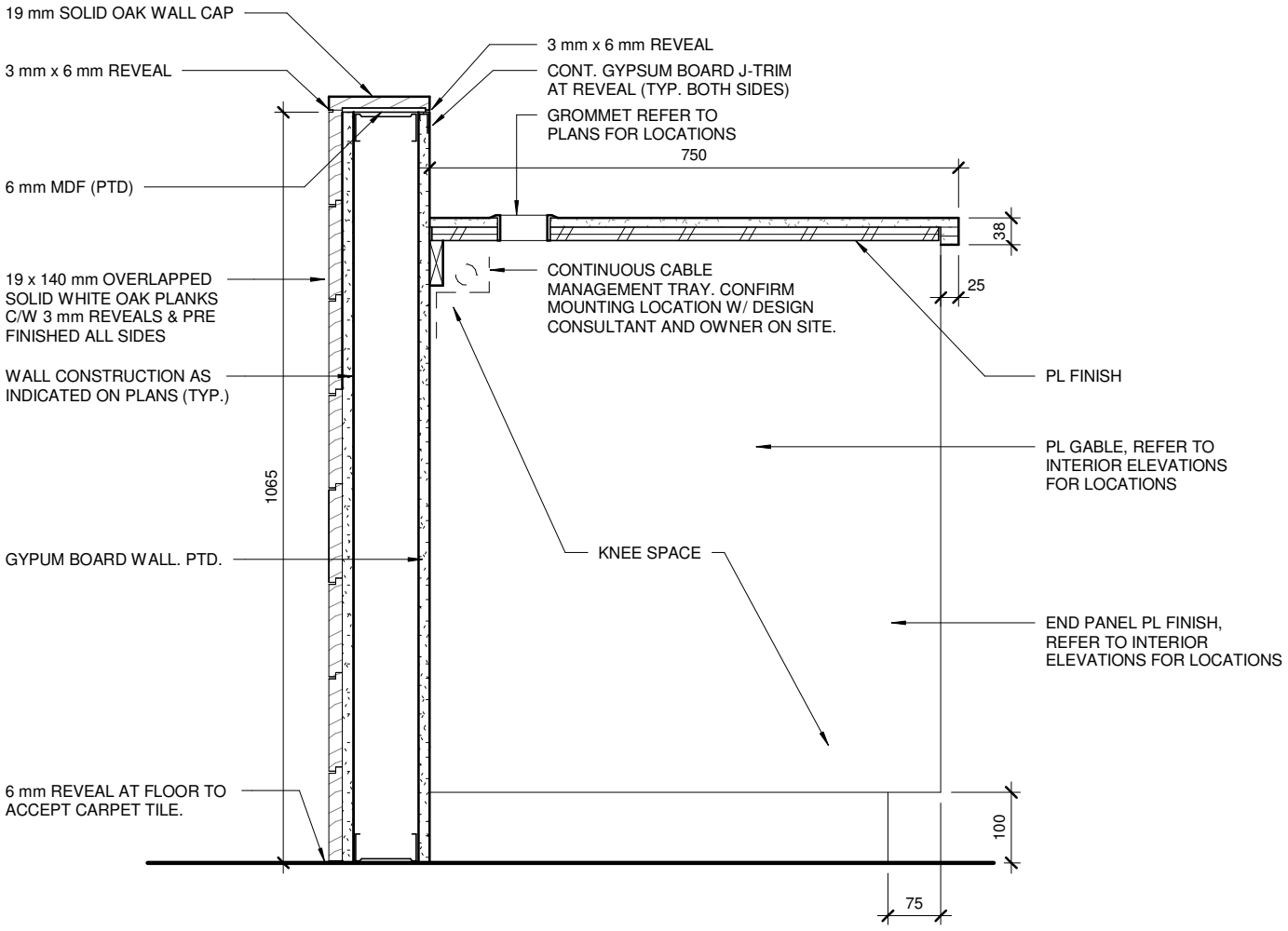

OPEN WORKSTATION

SCALE 1 : 10

NOTE:

- GYPSUM BOARD TO RECEIVE PAINT FINISH PRIOR TO INSTALLATION OF WOOD PLANK SYSTEM
- PLASTIC LAMINATE FACED CASEWORK
- SOLID SURFACE MATERIAL COUNTERTOP

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PROJECT:

Bill and Helen Norrie Library

Project Address: 15 Poseidon Bay, Winnipeg, MB.

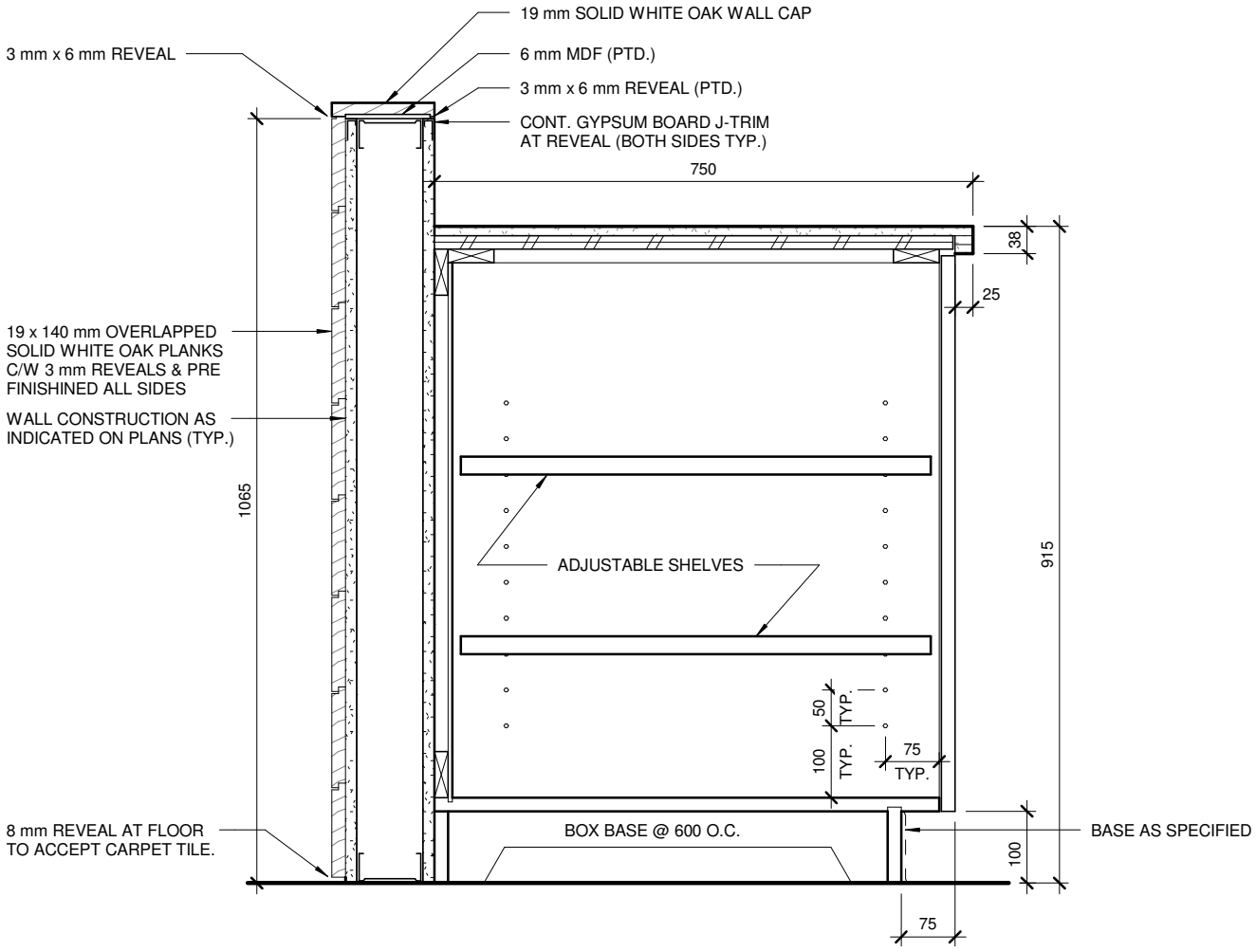
Refer to drawing:

DRAWN BY: DN DATE: 07.08.19

AP8.18

COMM. NO.: 1847

Plotted on: 7/24/2019 10:52:58 AM C:\Users\H.WEST\Documents\1847_BHN Library_H.West.rvt



SELF CHECKOUT CLOSED CABINET

SCALE 1 : 10

NOTE:

- GYPSUM BOARD TO RECEIVE PAINT FINISH PRIOR TO INSTALLATION OF WOOD PLANK SYSTEM
- PLASTIC LAMINATE FACED CASEWORK
- SOLID SURFACE MATERIAL COUNTERTOP

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PROJECT:

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AP8.19

COMM. NO.: 1847

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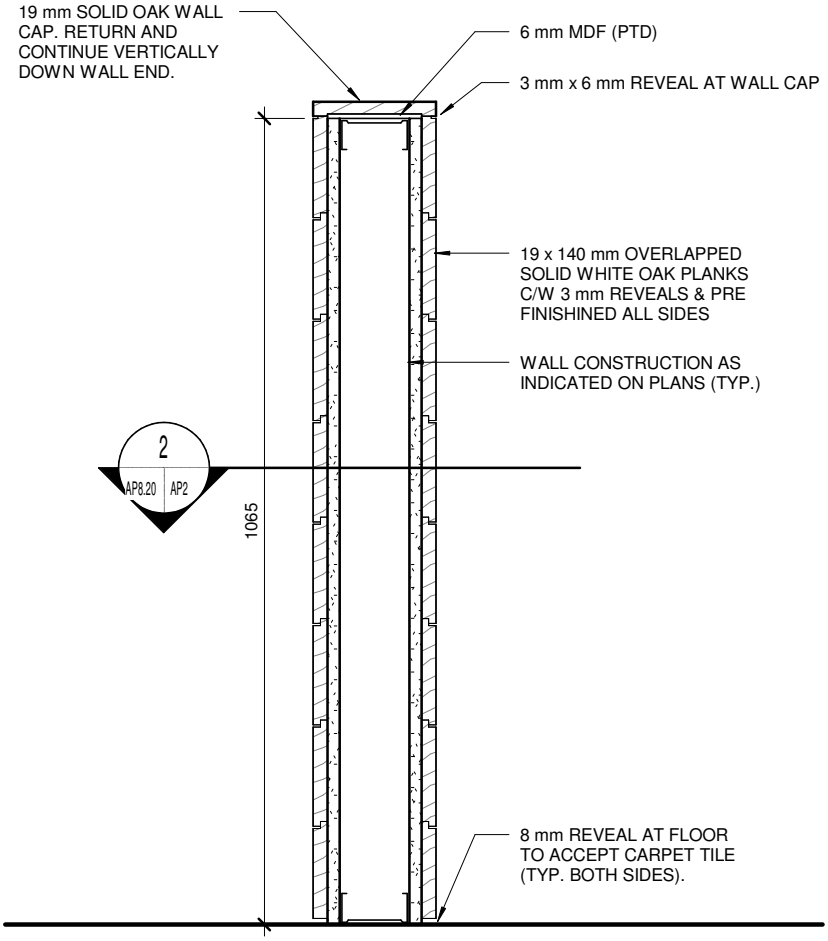

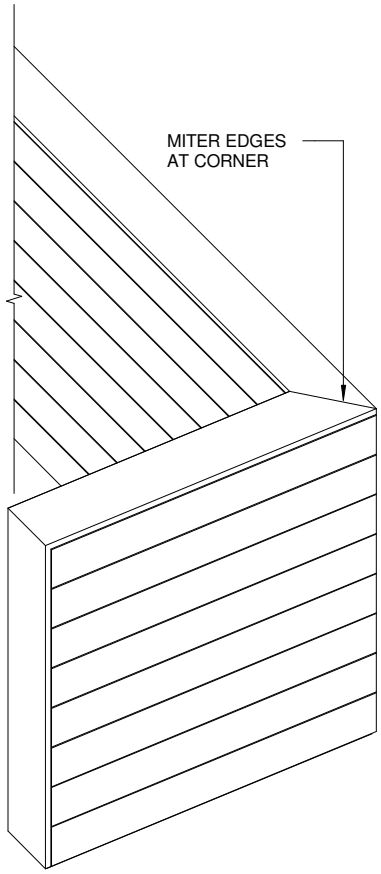

SELF CHECKOUT WOOD PLANKS - END WALLS

SCALE 1 : 10

NOTE:

- GYPSUM BOARD TO RECEIVE PAINT FINISH PRIOR TO INSTALLATION OF WOOD PLANK SYSTEM

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f: (204) 943.8676
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PROJECT:

Bill and Helen Norrie Library

Project Address: 15 Poseidon Bay, Winnipeg, MB.

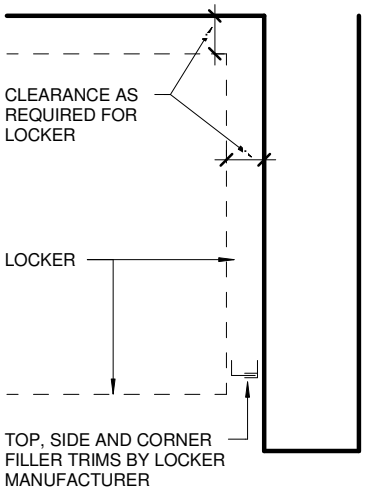
Refer to drawing:

DRAWN BY: DN DATE: 07.08.19

AP8.20

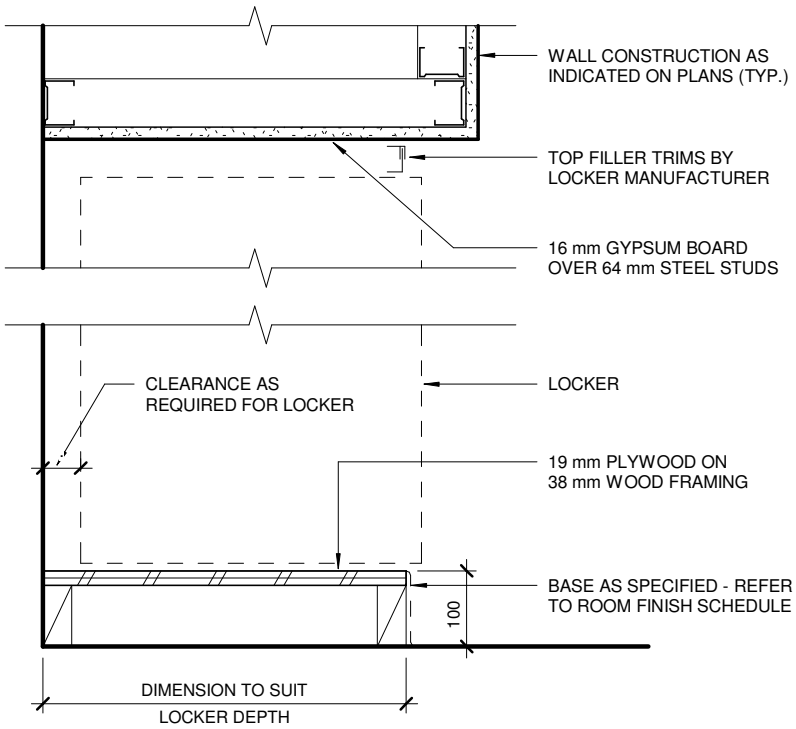
COMM. NO.: 1847

Plotted on: 7/24/2019 10:52:59 AM C:\Users\H.WEST\Documents\1847_BHN Library_H.West.rvt



TYPICAL LOCKER TRIM

1 : 10



TYPICAL LOCKER BASE

1 : 10

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PROJECT:

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AP8.21

COMM. NO.: 1847

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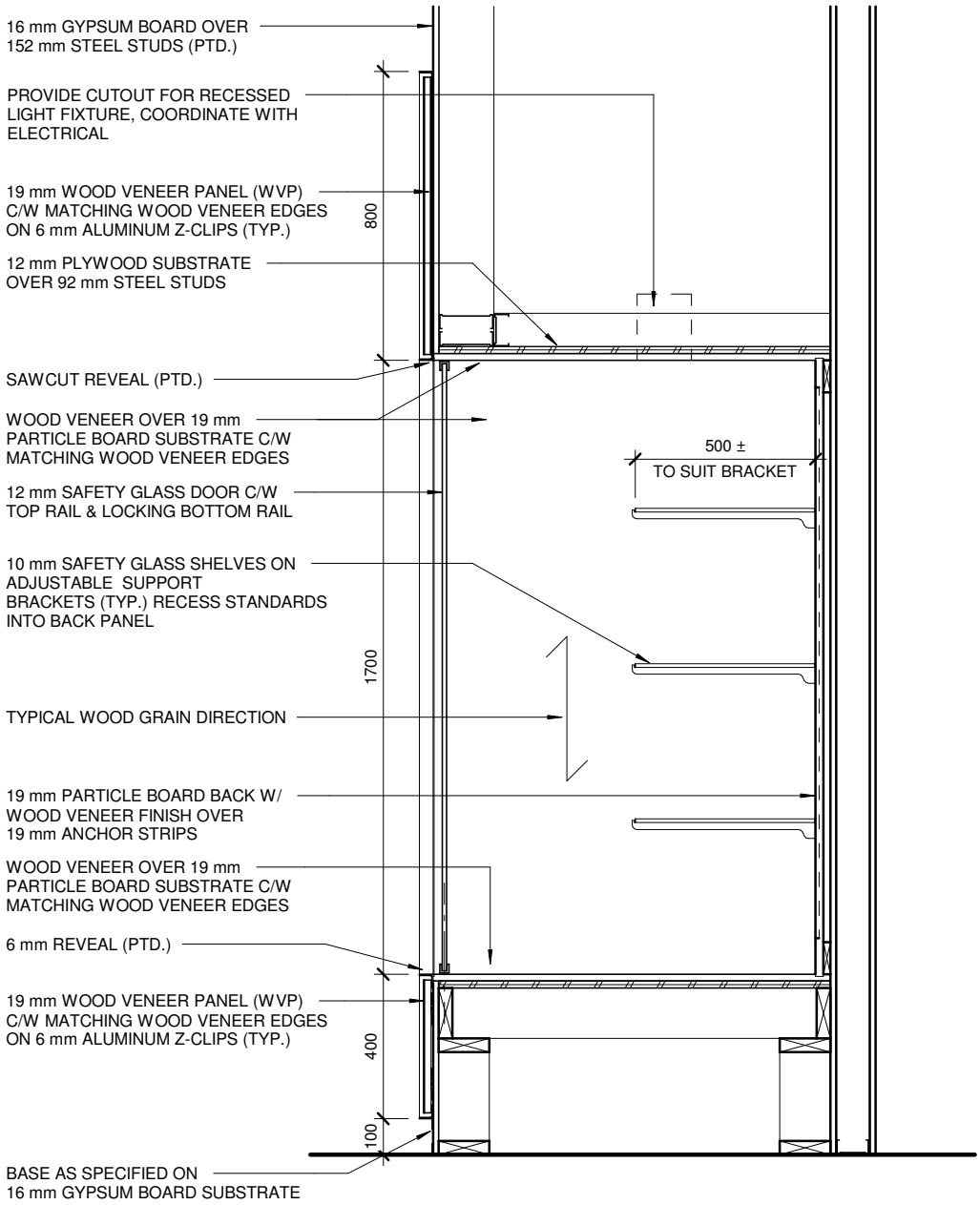

LIVING ROOM DISPLAY CASE

SCALE 1 : 20

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PROJECT:

Bill and Helen Norrie Library

Project Address: 15 Poseidon Bay, Winnipeg, MB.

Refer to drawing:

DRAWN BY: DN DATE: 07.08.19

AP8.22

COMM. NO.: 1847

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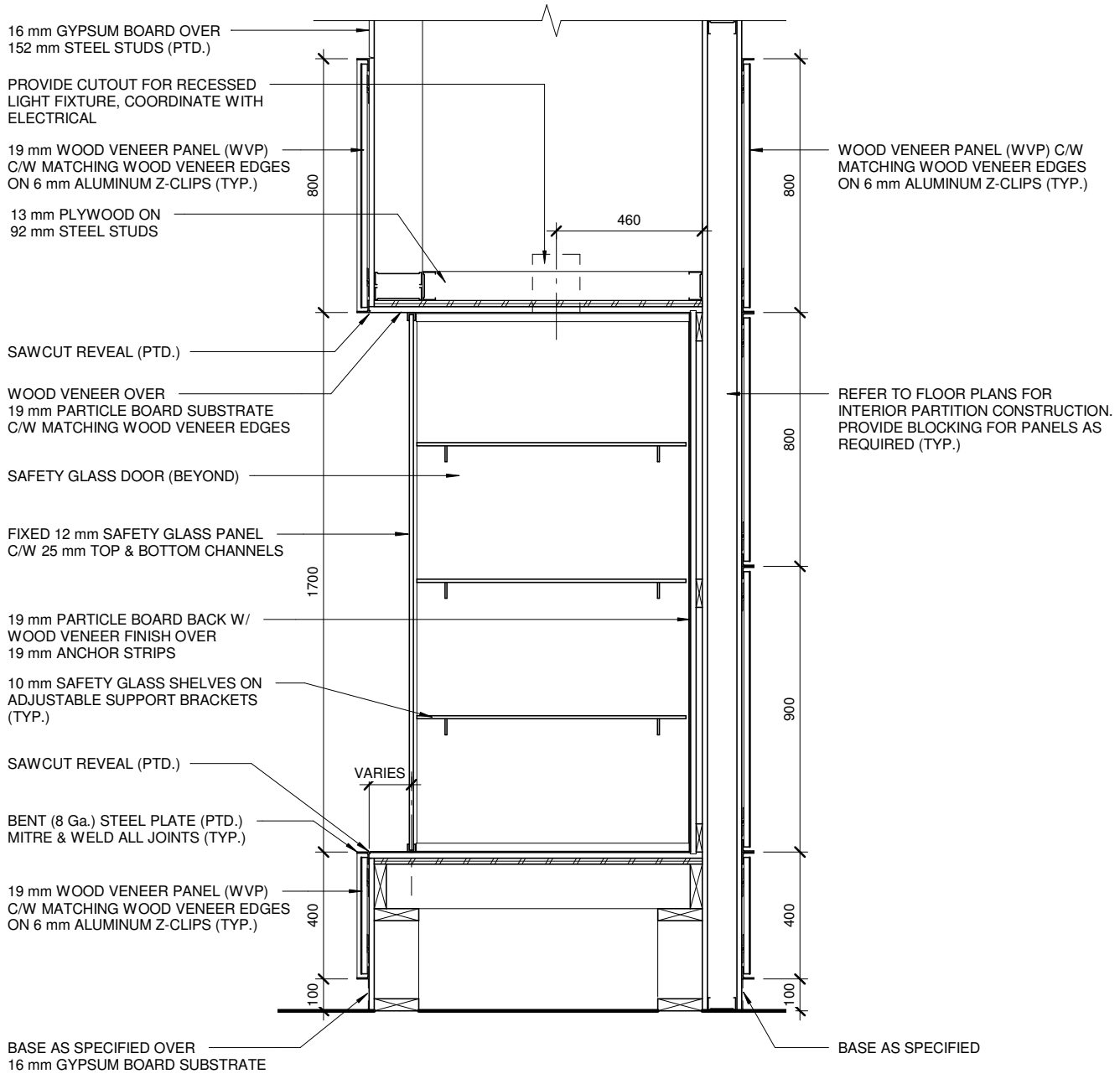

LIVING ROOM DISPLAY CASE

SCALE 1 : 20

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PROJECT:

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Refer to drawing:

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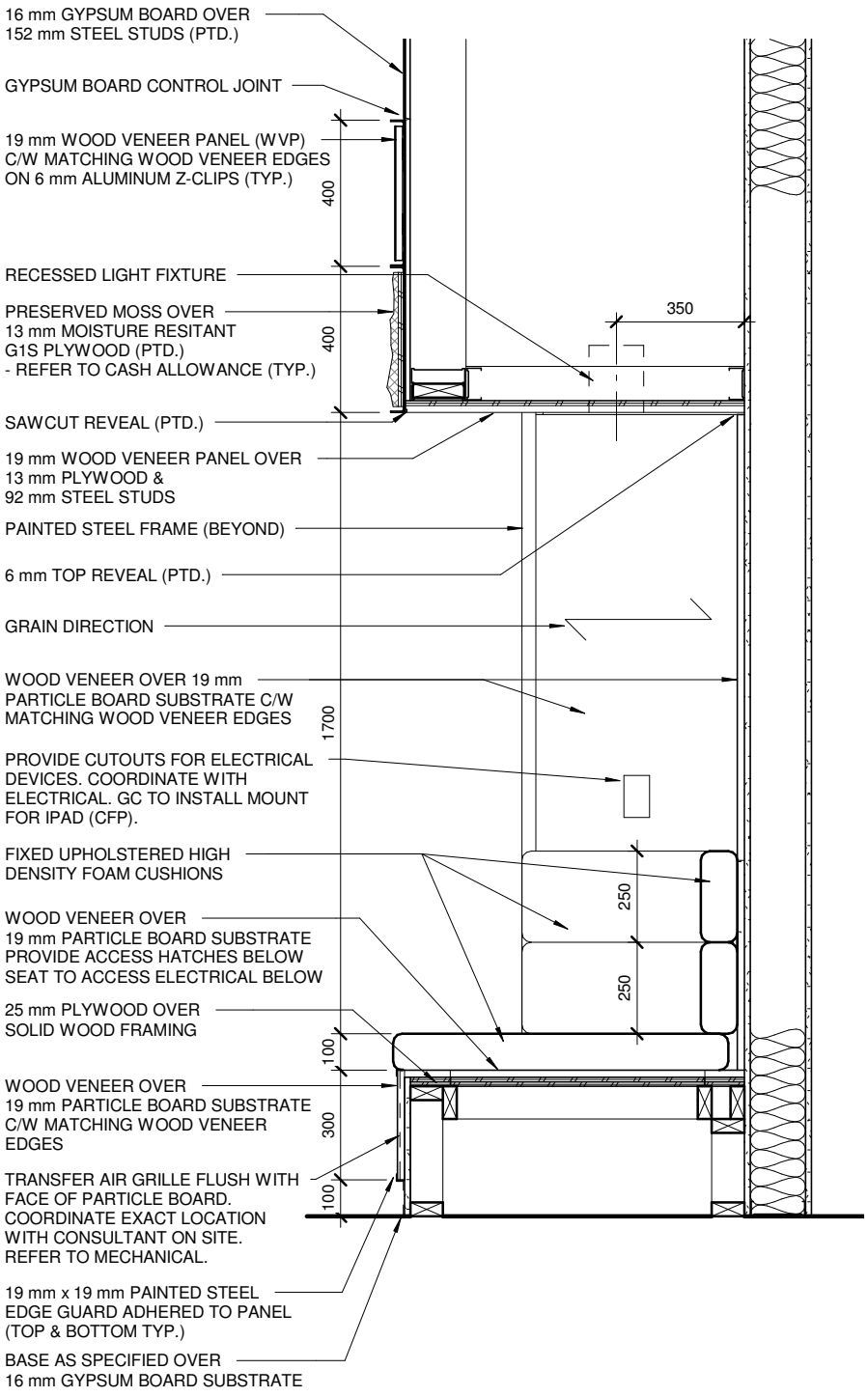
AP8.23

COMM. NO.: 1847

Plotted on: 7/24/2019 10:52:59 AM C:\Users\H.WEST\Documents\1847_BHN Library_H.West.rvt



LIVING ROOM SEATING ALCOVE

SCALE 1 : 20

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PROJECT:

Bill and Helen Norrie Library

Project Address: 15 Poseidon Bay, Winnipeg, MB.

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DRAWN BY: DN DATE: 07.08.19

AP8.24

COMM. NO.: 1847

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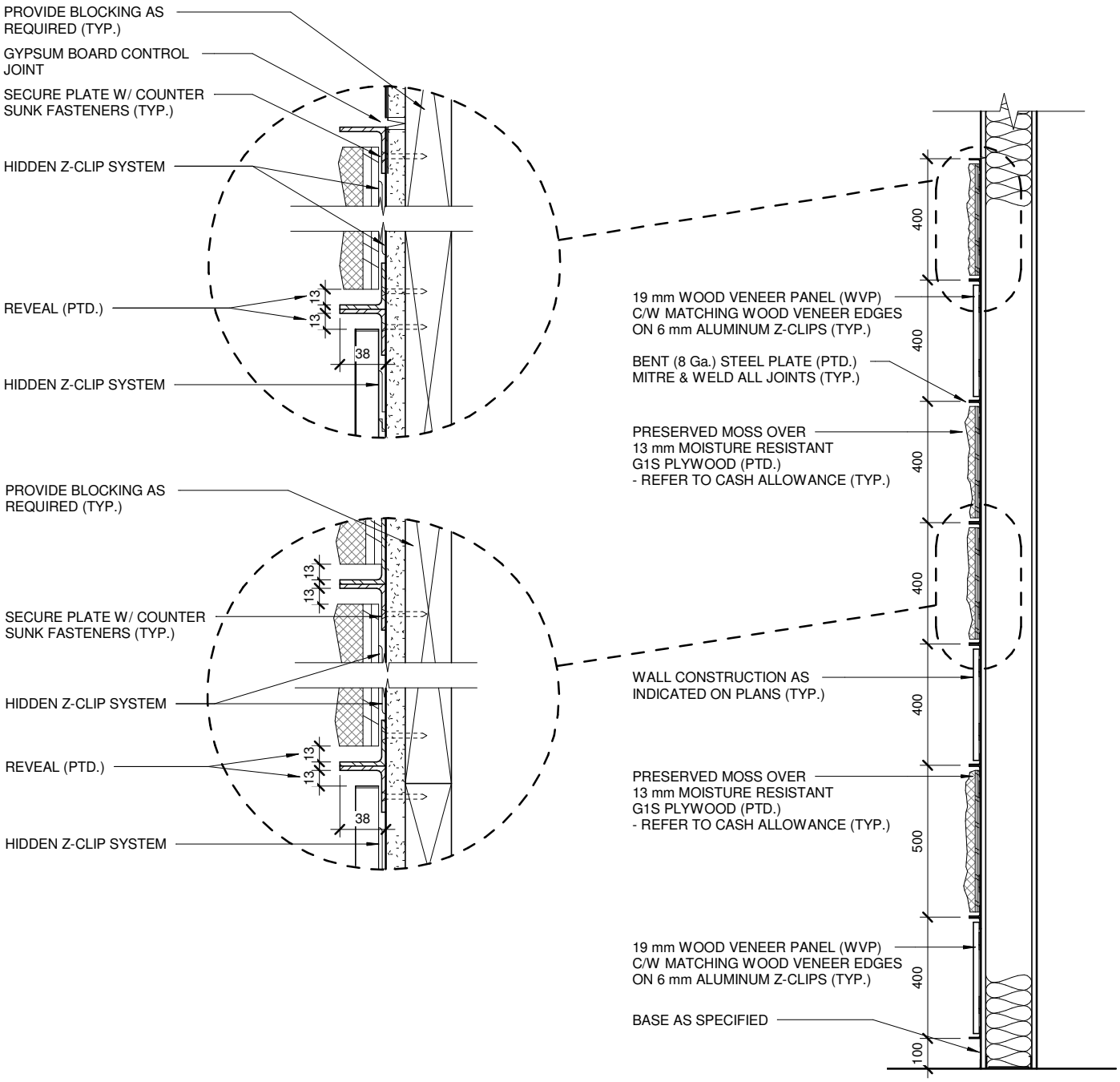

SECTION AT LIVING ROOM PANEL WALL

SCALE 1 : 20

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PROJECT:

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Project Address: 15 Poseidon Bay, Winnipeg, MB.

Refer to drawing:

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AP8.25

COMM. NO.: 1847

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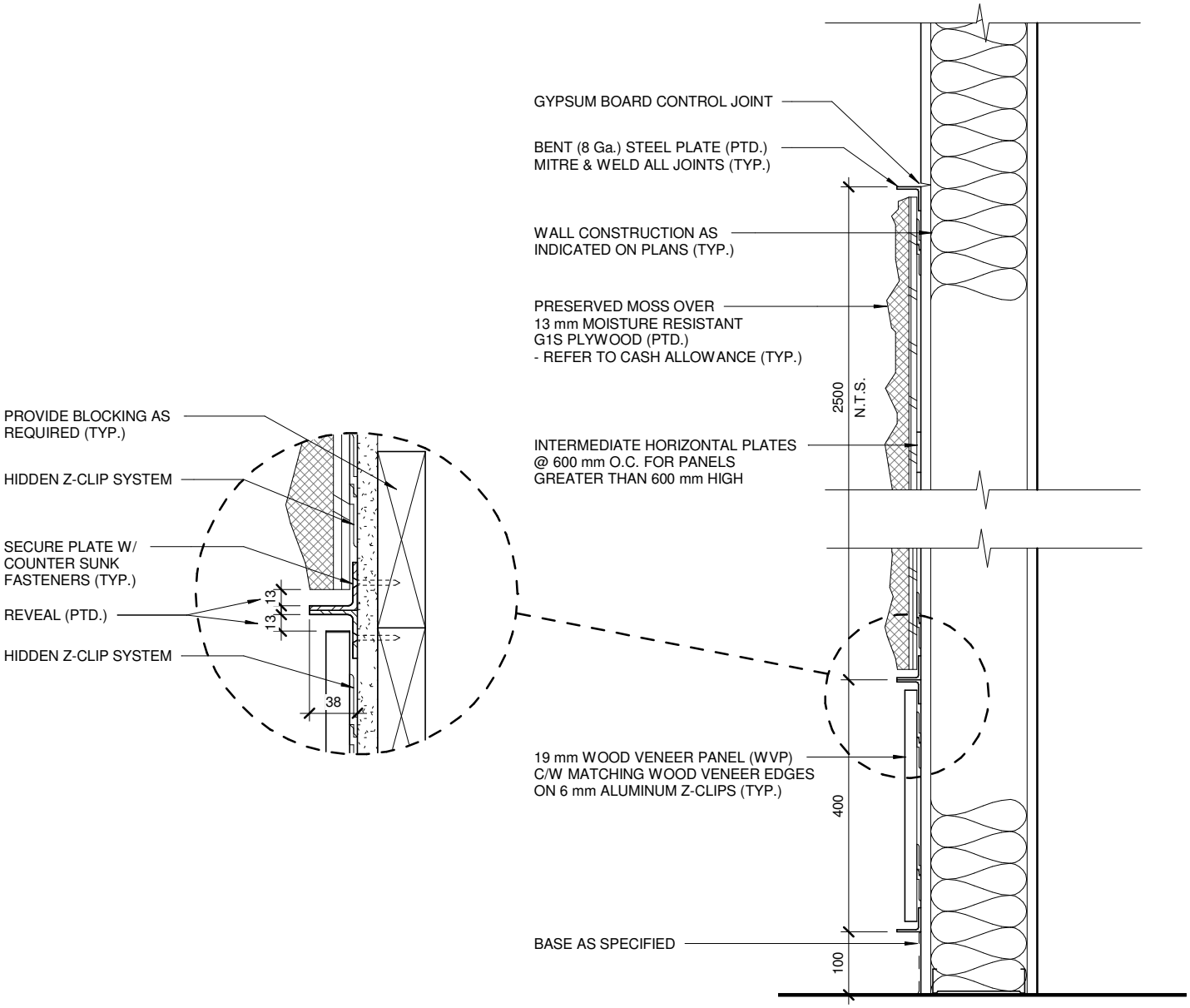

SECTION AT LIVING ROOM PANEL WALL

SCALE 1 : 10

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PROJECT:

Bill and Helen Norrie Library

Project Address: 15 Poseidon Bay, Winnipeg, MB.

Refer to drawing:

DRAWN BY: DN DATE: 07.08.19

AP8.26

COMM. NO.: 1847

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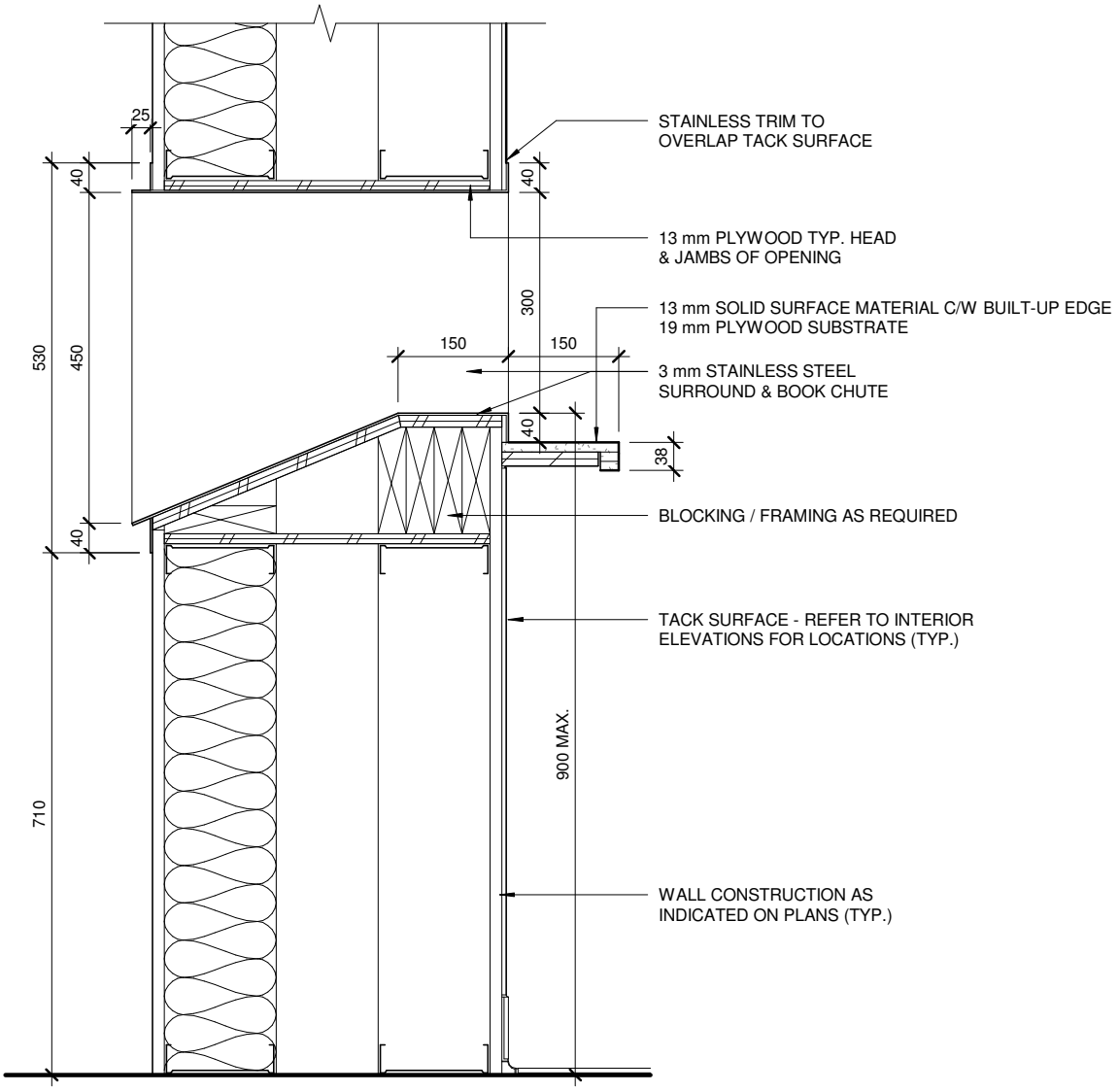

SECTION THRU BOOK RETURN CHUTE

SCALE 1 : 10

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PROJECT:

Bill and Helen Norrie Library

Project Address: 15 Poseidon Bay, Winnipeg, MB.

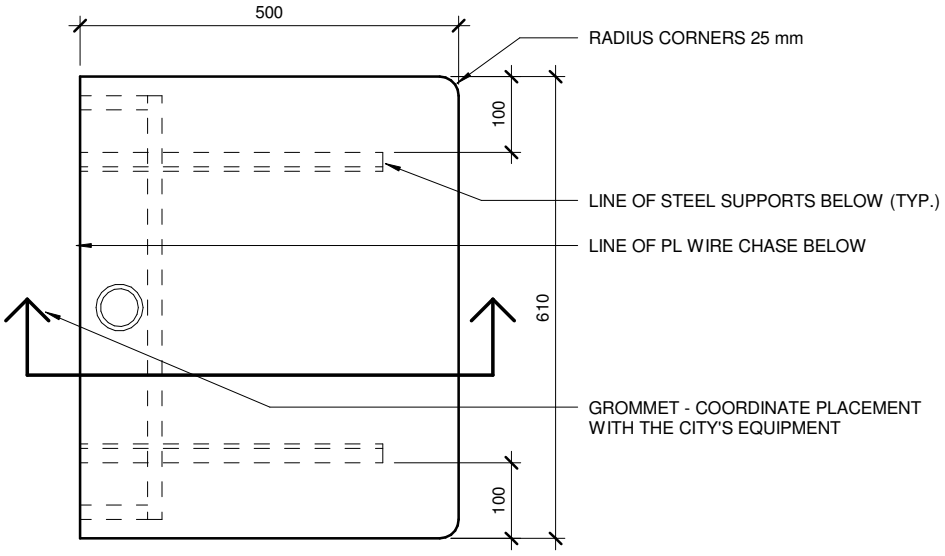
Refer to drawing:

DRAWN BY: DN DATE: 07.08.19

AP8.27

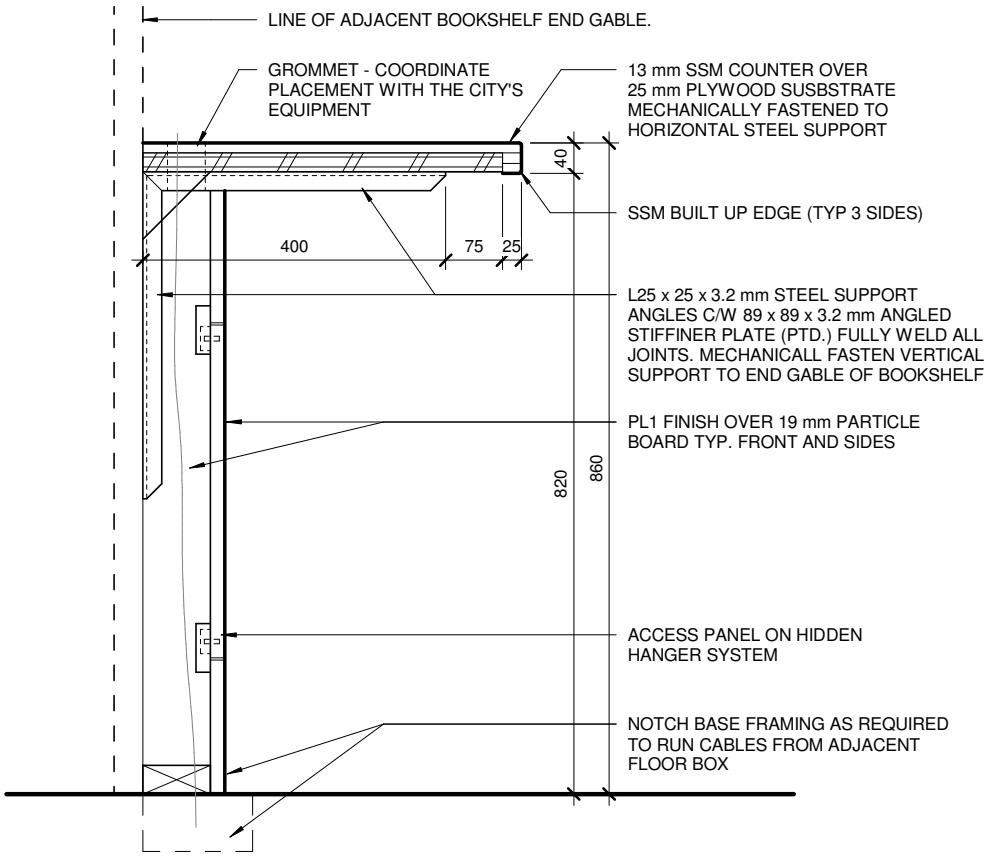
COMM. NO.: 1847

Plotted on: 7/24/2019 10:53:00 AM C:\Users\H.WEST\Documents\1847_BHN Library_H.West.rvt



OPAC COMPUTER STATION PLAN

SCALE 1 : 10



OPAC COMPUTER STATION SECTION

SCALE 1 : 10

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PROJECT:

Bill and Helen Norrie Library

Project Address: 15 Poseidon Bay, Winnipeg, MB.

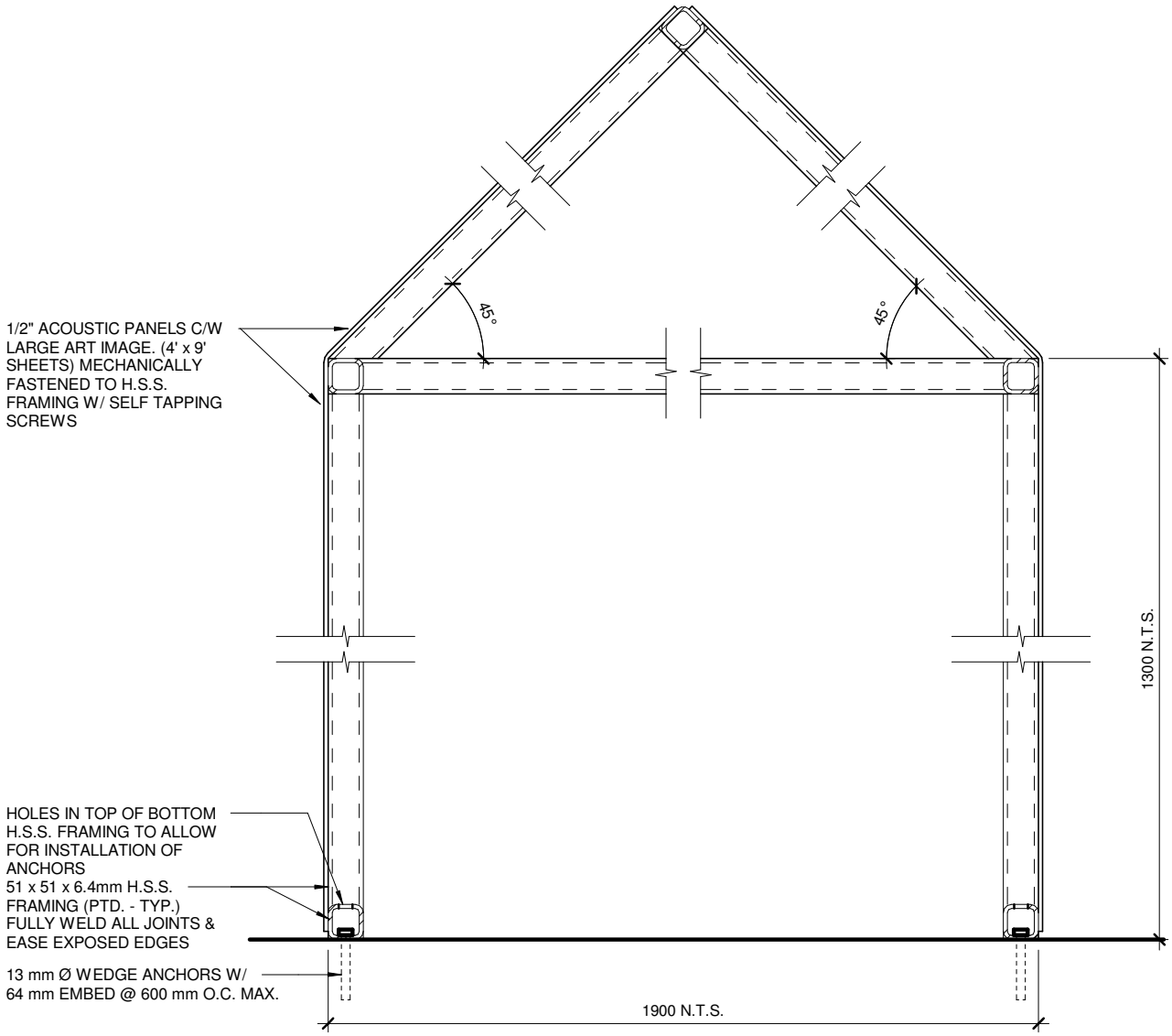
Refer to drawing:

DRAWN BY: Author DATE: 07.08.19

AP8.28

COMM. NO.: 1847

Plotted on: 7/24/2019 10:53:01 AM C:\Users\H.WEST\Documents\1847_BHN Library_H.West.rvt



CHILDREN'S PLAY HOUSE

1 : 10

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PROJECT:

Bill and Helen Norrie Library

Project Address: 15 Poseidon Bay, Winnipeg, MB.

Refer to drawing:

DRAWN BY: DN DATE: 07.08.19

AP8.29

COMM. NO.: 1847

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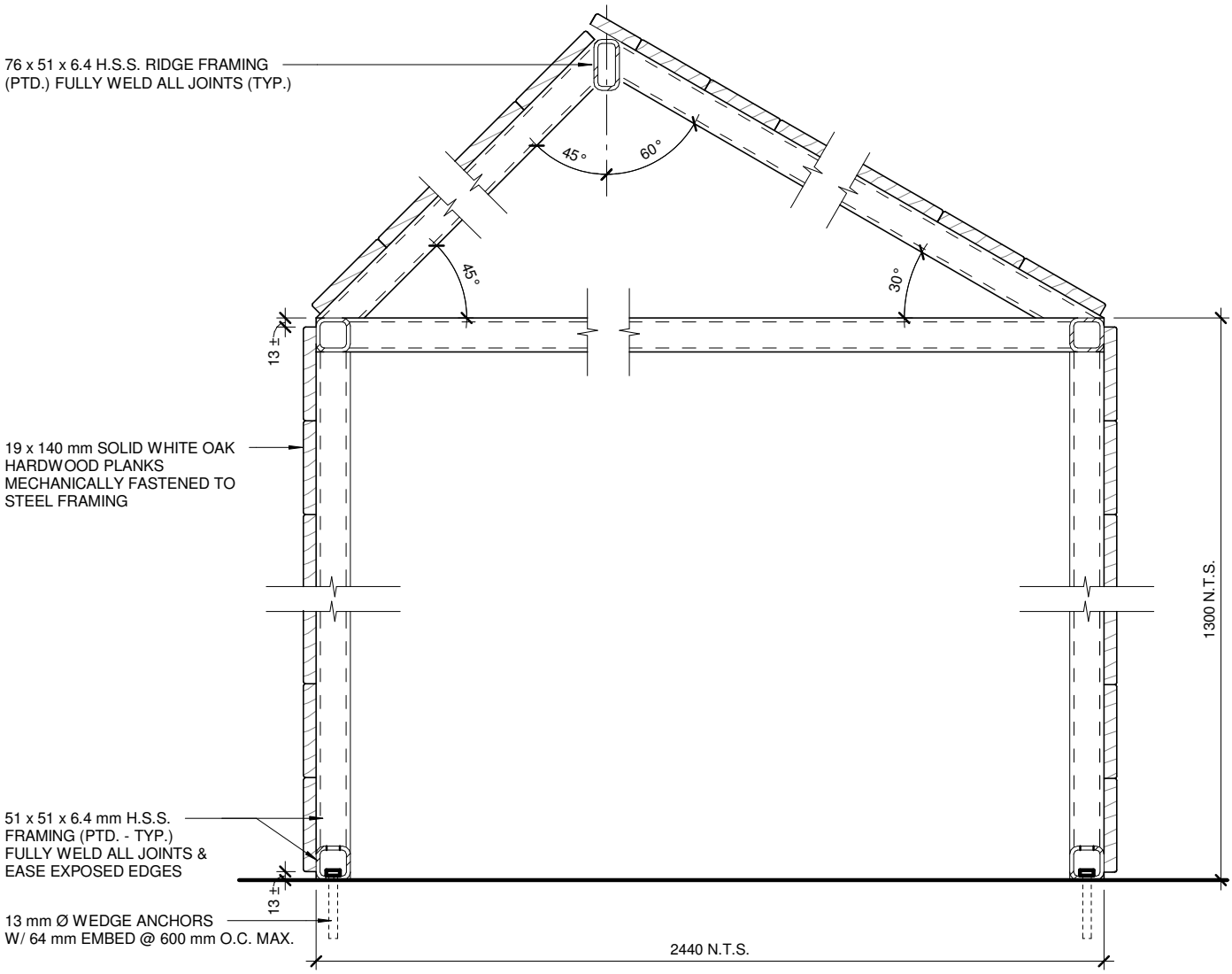

CHILDREN'S PLAY HOUSE

SCALE 1 : 10

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PROJECT:

Bill and Helen Norrie Library

Project Address: 15 Poseidon Bay, Winnipeg, MB.

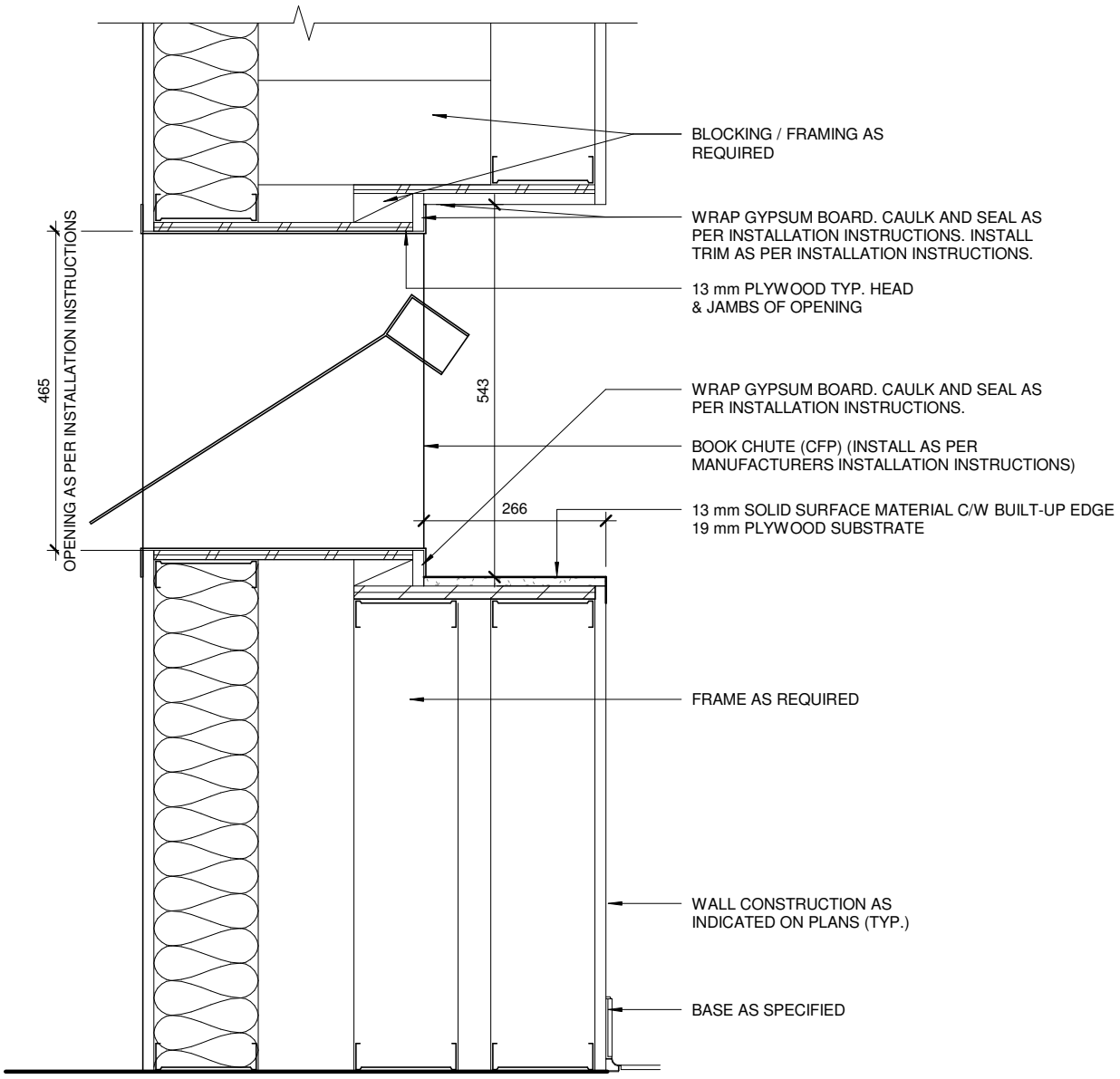
Refer to drawing:

DRAWN BY: DN DATE: 07.08.19

AP8.30

COMM. NO.: 1847

Plotted on: 7/24/2019 10:53:01 AM C:\Users\H.WEST\Documents\1847_BHN Library_H.West.rvt



SECTION THRU VESTIBULE BOOK RETURN CHUTE (OFP)

SCALE 1 : 10

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PROJECT:

Bill and Helen Norrie Library

Project Address: 15 Poseidon Bay, Winnipeg, MB.

Refer to drawing:

DRAWN BY: Author DATE: 07.08.19

AP8.31

COMM. NO.: 1847

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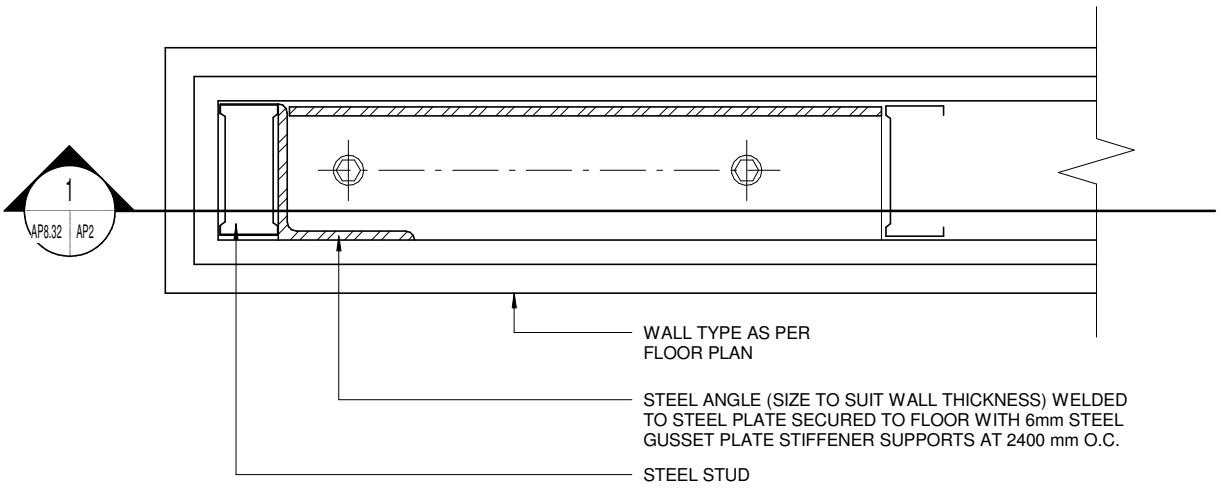
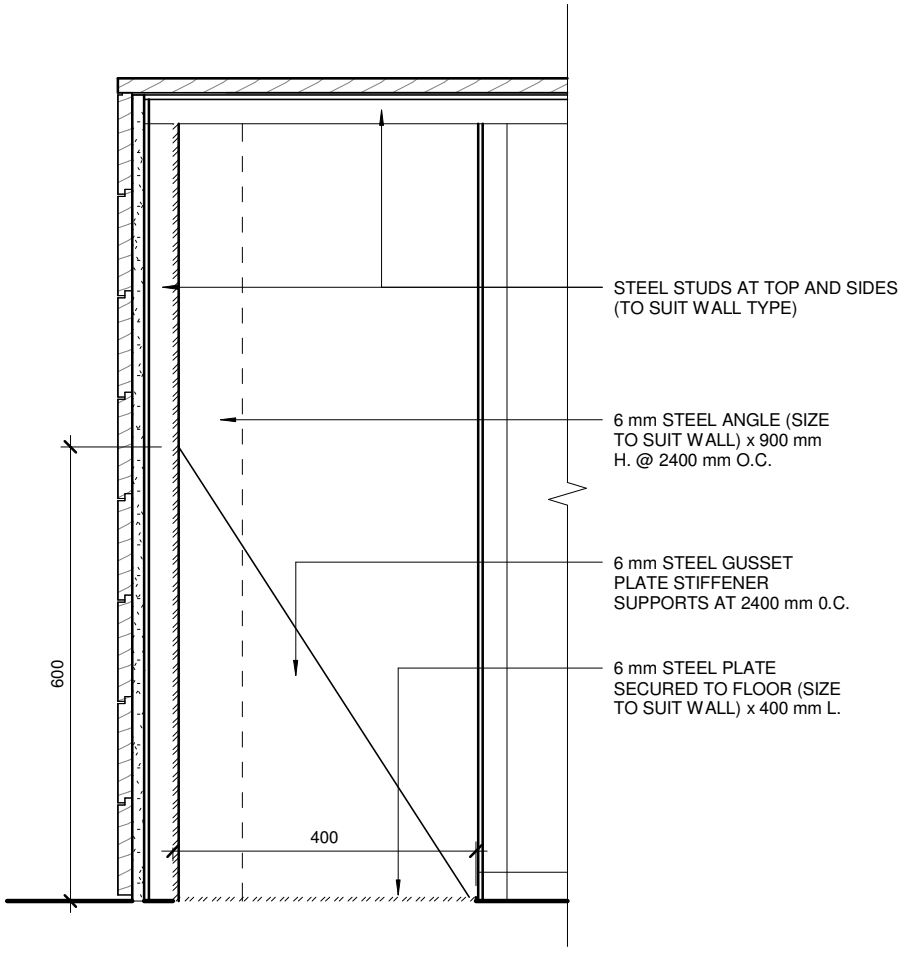


SELF CHECKOUT PLAN DETAIL

SCALE 1 : 5



SELF CHECKOUT TYPICAL SECTION

SCALE 1 : 10

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PROJECT:

Bill and Helen Norrie Library

Project Address: 15 Poseidon Bay, Winnipeg, MB.

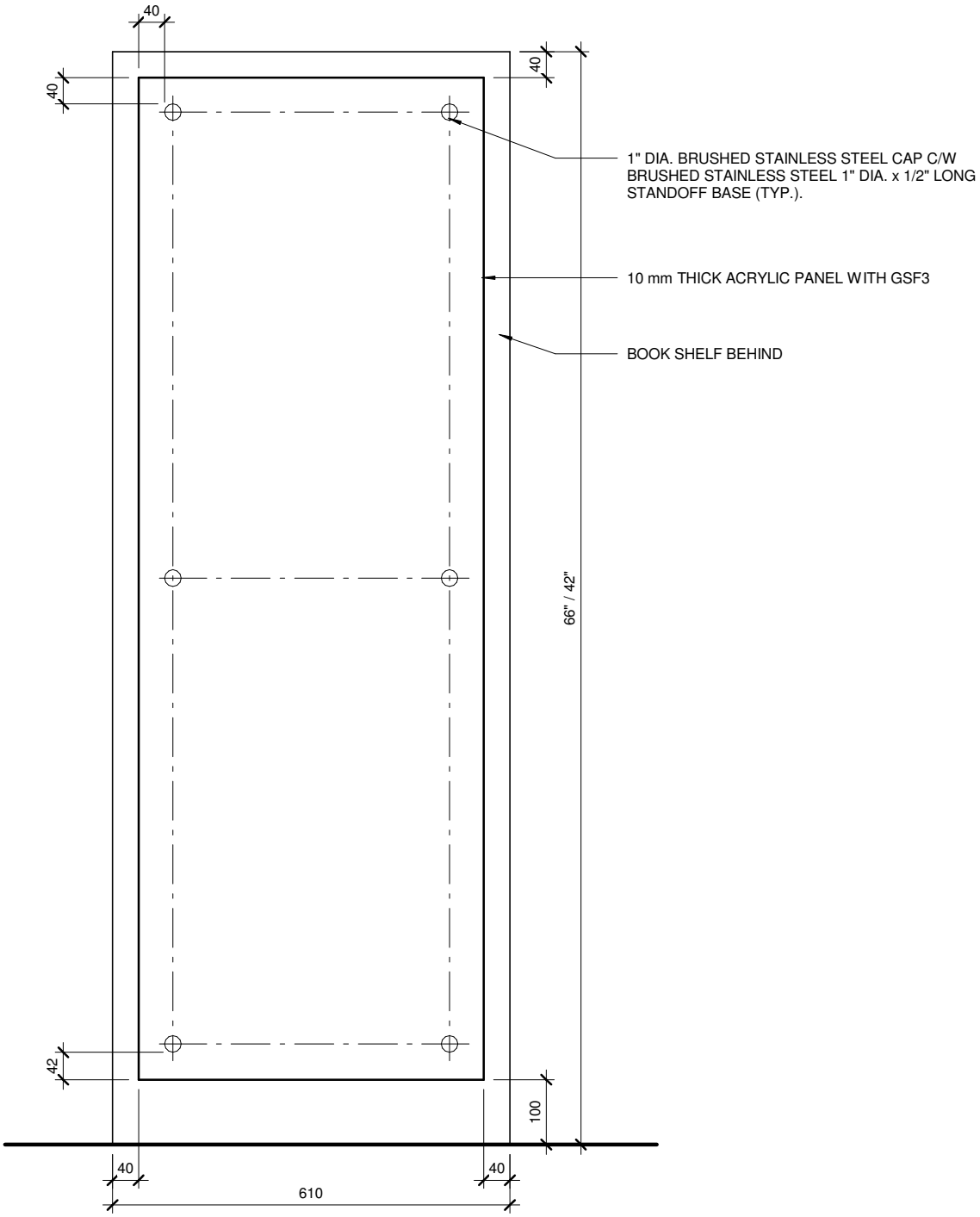
Refer to drawing:

DRAWN BY: RV DATE: 07/08/19

AP8.32

COMM. NO.: 1847

Plotted on: 7/24/2019 10:53:01 AM C:\Users\H.WEST\Documents\1847_BHN Library_H.West.rvt



BOOK SHELF END DISPLAY PANEL

SCALE 1 : 10

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PROJECT:

Bill and Helen Norrie Library

Project Address: 15 Poseidon Bay, Winnipeg, MB.

Refer to drawing:

DRAWN BY: RV DATE: 07/08/19

AP8.33

COMM. NO.: 1847

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THE CITY OF WINNIPEG

BILL AND HELEN NORRIE LIBRARY
15 POSEIDON BAY

TENDER NO. 542-2019

SPECIFICATIONS

ISSUED FOR CONSTRUCTION: JULY 10, 2019

VOLUME 2 of 2

FACILITY SERVICES SUBGROUP
SITE AND INFRASTRUCTURE SUBGROUP

VOLUME 1 of 2

Division 33 – Utilities

END OF SECTION

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Proposed Subdivision Plan

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L-200 Site Materials Plan
L-300 Site Layout Plan
L-400 Site Grading Plan
L-500 Site Planting and Signage Plan
L-601 Concrete & Timber Bench Details
L-602 Garbage Enclosure & Site Furniture Details
L-603 Hardscape Details

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A2.1 Main Floor Plan
A2.2 Roof Plan
A3.1 Main Floor Reflected Ceiling Plan
A4.1 Exterior Elevations
A4.2 Aluminum Window Types
A4.3 Building Sections
A5.1 Wall Sections
A5.2 Wall Sections
A5.3 Miscellaneous Sections
A5.4 Plan Details
A5.5 Plan Details
A7.1 Enlarged Floor Plan & Interior Elevations
A8.1 Interior Elevations
A8.2 Interior Elevations
A9.1 Furniture, Equipment & Floor Finishes Plan

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S2.2 Main Floor Framing Plan
S2.3 Roof Framing Plan
S3.1 Plan Details & Sections
S3.2 Sections & Details
A3.3 Sections and Details
A4.1 Framing Elevations

MECHANICAL
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M0.2 ASHRAE 62.1 Calculations
M0.3 Site Plan
M1.0 Crawlspace - Plumbing Layout

M1.1 Main Floor - Plumbing Layout
M1.2 Plumbing Details
M1.3 Plumbing Details
M2.0 Crawlspace - HVAC Layout
M2.1 Main Floor - HVAC Layout
M2.2 HVAC Details
M2.3 HVAC Sections
M3.1 Main Floor - Hydronic Layout
M3.2 Hydronic Details and Schematic
M3.3 Hydronic Details and Schematic
M4.1 Main Floor - Fire Protection Layout
M5.1 Mechanical Equipment Schedules
M5.2 Mechanical Equipment Schedules

ELECTRICAL
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E2.1 Lighting Layout - Main Floor
E3.0 Power & System Layout - Crawlspace
E3.1 Power & System Layout - Main Floor
E4.0 Life Safety Layout - Crawlspace
E4.1 Life Safety Layout - Main Floor
E5.1 Electrical Schedules
E5.2 Electrical Schedules
E6.1 Single Line Diagram, Riser Diagram & Details

END OF SECTION

PART 1 Mechanical General Provisions

1.1 GENERAL REQUIREMENTS

.1 Comply with the requirements set out for the General Contractor.

1.2 APPLICATION

.1 This Section applies to all parts of Division 22 and Division 23.

.2 Divisions 21, 22, 23, as well as 25 shall constitute the Mechanical Sections of work.

1.3 REFERENCE STANDARDS

.1 Conform with the requirements of the plans and specification, the local authorities having jurisdiction, and the Local Building Codes. In the case of conflicting requirements, be governed by the most severe regulations.

.2 Use latest edition of all referenced codes, standards, regulations, etc.

1.4 WASTE MANAGEMENT DISPOSAL

.1 Minimize construction waste sent to the landfill; separate and recycle materials as outlined in the Architectural specifications and Waste Management Plan.

.2 It is required that every effort be given to divert 100% of the following materials from the landfill.

- .1 Cardboard
- .2 Plastic Packaging
- .3 Rubble
- .4 Steel
- .5 Wood (uncontaminated)

1.5 DEFINITIONS

.1 Notwithstanding any definition elsewhere in the contract documents, wherever the term "Contractor" is used in the Division 21, 22, or 23 Specifications, it means the firm having a contract with the "City of Winnipeg" to perform, supervise and coordinate all work.

.2 Notwithstanding any definition elsewhere in the contract documents, wherever the term "Sub-Contractor" is used in the Division 21, 22, or 23 Specifications, it means the firm having a contract with the "Contractor" to perform, supervise and coordinate all work of that particular Division. This Sub-contractor shall be wholly responsible to the "Contractor" for all work of that Division.

.3 Notwithstanding any definition elsewhere in the contract documents, wherever the term "Engineer" is used in the Division 21, 22, or 23 specifications, it shall refer to Tower Engineering Group Limited Partnership, Unit 1 – 1140 Waverley St, Winnipeg, Manitoba, R3T 0P4, Telephone: (204) 925-1150, Fax: (204) 925-1155.

.4 Notwithstanding any definition elsewhere in the contract documents, wherever the term "Provide" is used in relationship to equipment, piping etc., in this Division, it shall mean "Supply, Install and Connect".

.5 Whenever "Drawings and Specifications" are referred to in these documents, it means "the Contract Drawings and Specifications" (including all addenda and post contract revisions) of all Disciplines (Architectural, Structural, Mechanical and Electrical).

1.6 TRADE DEFINITIONS

.1 All work called for in the Contract Documents shall be considered to be within the scope of the Contract, and shall be the responsibility of the Contractor.

.2 The arrangement of the Drawings and Specifications into Divisions, Sections, and Trades is purely arbitrary, with the sole intention of clarifying the scope and content of the work required to complete the project. The actual division of the work amongst the sub-contractors shall be the responsibility of the Contractor, and the actual division of the work between the sub-sub-contractors shall be the responsibility of the sub-contractors.

.3 The Contractor, at their option and as per their contracts with the Sub-Contractors, may delegate responsibility to the Sub-contractors for the division of the work.

.4 The Sub-contractors, at their option and as per their contracts with the sub-sub-contractors, may delegate responsibility to the sub-sub-contractors for the division of the work.

.5 Sections of the Mechanical specifications, and specific but arbitrary responsibility divisions noted in the Mechanical Specifications, are not intended to delegate functions nor to delegate work to any specific trade, but may be useful to the Contractor or Sub-contractor when dividing the work amongst the Trades and Sub-trades.

.6 In the event of a dispute regarding the responsibilities of the various trades and sub-trades, the Contractor and Sub-contractors may request information or a recommendation from the Engineers and/or Architect. However, the Contractor and Sub-contractor shall be responsible for determining the final division of work.

1.7 SCOPE OF WORK

.1 In general terms the scope of work includes all mechanical renovation work required for the new Bill and Helen Norrie Library project. Interior spaces included in the facility shall be as shown on the mechanical & architectural drawings. This shall include, but is not necessarily limited to the following:

.1 Provision & installation of fire extinguishers/cabinets to satisfy the requirements of the authorities having jurisdiction & NFPA 10 – Standard for Portable Fire Extinguishers.

.2 Provision of new plumbing services: including domestic cold & hot water systems; sanitary systems; plumbing venting systems; & natural gas piping systems as noted on the mechanical drawings/specifications. This includes the supply and installation of all plumbing fixtures & equipment outlined within the mechanical specifications.

.3 Provision of one (1) new high efficiency, natural gas fired point-of-use domestic hot water heater, recirculation pump, expansion tank, & all associated appurtenances.

.4 Provision of new Air Cooled Chiller & Boiler systems to serve radiant in-floor cooling & heating, active chilled beams, radiant panels, force flow heaters, fan coil units, & heating/cooling coils located throughout the facility.

.1 Supply & installation of central natural gas fired boiler systems & integral circulation pumps for heating of the main heat pump hydronic loop piping. Boilers to be located indoors within the main mechanical room.

.2 Supply & installation of an outdoor mounted air cooled chiller system & for providing chilled water to the hydronic loop piping systems. Air cooled chiller to be located outdoors on a concrete pad on grade within a fenced in enclosure provided by architectural.

.3 Supply & installation of circulation pumps c/w VFDs, expansion tank, valves, air vents, air purgers, piping, insulation, & all associated appurtenances. Equipment to be located indoors within the mechanical room.

.4 Provision of active chilled beams, radiant panels, fan coils, force flow heaters, & heating/cooling coils to heat & cool the building. Provide new supply & return/exhaust air distribution ductwork, piping connections, grilles, dampers, etc. as required for a fully operational system.

.5 Provision of demand controlled ventilation systems c/w zone mounted CO2 sensors and VAV boxes on the fresh air distribution ductwork.

.6 Provision of in-floor radiant piping to heat & cool the building. Provide manifolds, piping, and all appurtenances required for a fully operational system.

.7 Supply & installation of Fan Coil units installed at the east end of the library for supplemental heating/cooling of the MPR & Living Room areas. Provision of new supply & return air distribution ductwork for these systems as noted on the drawings.

.5 Provision of new Heating, Ventilation, & Air Conditioning (HVAC) systems for the building as noted on the mechanical drawings/specifications.

.6 Provision of new central, high efficiency, dual core, energy recovery ventilation unit (ERV-1) installed in mechanical room as noted on the mechanical drawings/specifications. ERV-1 will exhaust all washrooms, janitor/utility rooms, & provide some general exhaust from the building, recovering energy to pre-heat or pre-cool the outside air. Include for all exhaust ductwork distribution systems; ventilation (fresh air) distribution systems; grilles; dampers; etc… throughout the building.

.1 Ducted fresh air distribution systems for all active chilled beam and VAV box systems shall be provided throughout the building. Provide all ductwork, dampers, grilles, diffusers, registers, etc.

.2 Exhaust systems & ductwork shall be provided for: the washrooms, electrical rooms, & janitor rooms. Provide all ductwork, grilles, dampers, etc.

.3 Provide transfer air fan system (TF-1) & all associated ductwork, grilles, dampers, etc. to ventilate the crawlspace. Conditioned air from the main floor library areas shall be transferred down into the crawlspace for heating/cooling, which will then be exhausted back through the central ERV-1 unit to outdoors.

.7 Include for all balancing of air & hydronic systems.

.8 Include for all duct/equipment cleaning of air & hydronic systems.

.9 Ductwork acoustic & thermal insulation as noted on the mechanical drawings/specifications.

.1 The use of fiberglass liner is not allowed. All acoustic duct liner must be constructed of closed-cell, polymer sheet insulation materials. Shop drawings shall be submitted for review & approval by the Consultant & City of Winnipeg for all insulation materials.

.10 Provision of Direct Digital Controls (DDC) & systems for building as noted in the mechanical specifications.

.11 Connection to existing site services for the building.

.12 Start-up and commissioning of all mechanical equipment and systems.

.2 The Mechanical work shall include all labour, materials, equipment, and tools required to install, test and place into operation a complete and fully operational Mechanical System consisting of the various sub-systems as described in, but not necessarily limited to, the items in the following sections and equipment schedules:

21 05 01 Mechanical General Provisions

21 05 05	Basic Materials and Methods
21 07 01	Thermal Insulation
21 13 13	Fire Protection
22 05 05	Plumbing
22 06 01	Approved Substitutes for Plumbing
22 06 40.13	Plumbing Fixtures and Equipment Schedule
23 01 30.51	HVAC Duct Cleaning
23 05 53	Sound and Vibration Isolation
23 05 93	Testing and Balancing
23 06 01	Approved Substitutes for HVAC
23 09 00	DDC Systems (Controls)
23 21 05	Liquid Heat Transfer
23 23 13	Split Passive Energy Recovery Heat Pipes (RHP-1,2)
23 25 13	Pipe Cleaning and Chemical Treatment
23 30 00	Air Distribution
23 52 00	Boilers (B-1, 2)
23 72 00	Dedicated Outdoor Air System (ERV-1)
23 83 16.10	EPS Floor Panels for Radiant In-floor Heating/Cooling Piping

1.8 SEPARATE PRICES

.1 For additional information regarding Separate Pricing, refer to the Architectural Specifications & the Specification set out for the General Contractor.

1.9 UNIT PRICES

.1 For additional information regarding Unit Pricing, refer to the Architectural Specifications & the Specification set out for the General Contractor.

1.10 ALTERNATE PRICES

.1 For additional information regarding Alternate Pricing, refer to the Architectural Specifications & the Specification set out for the General Contractor. Refer to specification Section 01 23 00 – Alternates.

1.11 ALLOWANCES

.1 For additional information regarding Allowances, refer to the Architectural Specifications & the Specification set out for the General Contractor.

1.12 SITE EXAMINATION

.1 Visit and inspect the site of the work to verify the location and elevation of existing items and services (such as services, equipment, piping, conduit, etc.) which may affect the Tender and work of this Division, before submission of tender and proceeding with the work.

.2 Make allowance to relocate all existing items/services as required, or to provide alternate locations/routings of new items/services as required. Confirm alternate locations/routings with the City of Winnipeg/Architect/Engineer prior to submitting Tender Pricing.

.3 Claims for extra payments resulting from conditions which could have reasonably been foreseen during a pre-tender site examination will not be considered.

1.13 CONTRACT DRAWINGS

.1 The Drawings for the Mechanical work are performance drawings, diagrammatic and approximately to scale, intended to convey the scope of work and indicate the general arrangement and approximate location of apparatus, fixtures and pipe/duct runs. These Drawings do not intend to show Architectural and Structural details.

.2 Do not scale the Drawings. Obtain information involving accurate dimensions from dimensions shown on the Architectural and Structural drawings, and by site measurement.

.3 Even though some piping and/or ductwork is not completely shown or is shown schematically, and all details are not shown or specified, it is expected that the contractors be familiar enough with their fields of work to complete the project to the standards generally adhered to by the local industry, including good workmanship and common sense. The Engineer reserves the right to furnish any additional detail drawings, which, in the judgement of the Engineer, may be necessary to clarify the work, and such drawings shall form a part of this contract. The work for such Clarifications shall be at no cost to the City of Winnipeg.

.4 Make, at no additional cost, any changes or additions to materials, and/or equipment necessary to accommodate structural conditions (pipes or ducts around beams, columns etc.), and to provide complete and adequate service clearance.

.5 The exact location of the Mechanical components may be changed by the contractors to suit site conditions, provided the changes are reviewed with the Engineer, the changes are duly noted on the 'Record' drawings, and the changes do not affect the operation or code-compliance of the system(s). Any such changes shall be at no cost to the City of Winnipeg.

1.14 CHANGES TO THE SCOPE OF WORK

.1 From time to time during construction, changes to the scope of work may be proposed by the City of Winnipeg. These Proposed Changes are to be priced by the contractors in a timely manner. Only after the City of Winnipeg has reviewed and accepted the pricing, will these Proposed Changes be added to the contract.

.2 Pricing for the Mechanical portions of these Proposed Changes shall be submitted by the Sub-contractor to the Contractor complete with price breakdowns as follows:

.1 Sub-sub-contractors' prices c/w labor, material and overhead prices broken out.

.2 Sub-contractor's price c/w labor, material and overhead prices broken out.

.3 Pricing shall be submitted on an item-by-item basis. Each Proposed Change may contain more than one item.

.4 The City of Winnipeg/Engineer reserve the right to request detailed parts and materials breakdown pricing.

1.15 PHASING

.1 Refer to the Architectural Drawings and Specifications for exact requirements.

.2 During all phases of the work, certain portions of the facility must be kept fully functional. Re-route existing services and/or provide temporary service connections as required to meet this objective.

.3 Coordinate with the City of Winnipeg and other contractors as required for shut-down of services.

.4 Provide start-up, testing, verification and certification of the Mechanical Systems at the Occupancy Stage of each construction phase.

.5 The contractors shall be responsible for determining the exact requirements for Phasing.

1.16 LIABILITY

.1 Maintain all necessary insurance coverage to save and indemnify the City of Winnipeg.

.2 Protect and maintain the work until the project has been completed and turned over to the City of Winnipeg. Protect the building and contents from damage during the construction period. Repair all damages without additional cost to the City of Winnipeg.

.3 Special care shall be taken to insure that any existing equipment, structures, components and property are not damaged during the construction period. Repair all damages without additional cost to the City of Winnipeg.

1.17 WORK SCHEDULE

.1 Unless otherwise noted, the work shall be scheduled for normal hours. The contractors shall be aware that off-hour work may be necessary for certain locations or types of work, and shall include the extra costs in the tender price.

.2 Where the work requires the contractors to be in occupied areas, or where building services may be disrupted, the contractors shall closely coordinate the hours and areas of work with the City of Winnipeg’s and occupants.

.3 It shall be the responsibility of the Contractor to schedule the work to meet the City of Winnipeg's completion date. The Contractor shall coordinate the sub-trades and adjust the workforce as required to meet the schedule.

1.18 SUPERVISION

.1 Maintain at this job site qualified personnel and supporting staff with proven experience in erecting, supervising, testing and adjusting projects of comparable nature and complexity.

.2 Supervision personnel and their qualifications are subject to the approval of the Engineer.

1.19 ENGINEERING SITE REVIEWS

.1 The Sub-Contractor's work will be reviewed periodically by the City of Winnipeg, the Engineer, or their representatives, for the purpose of determining the general quality of the work. Guidance will be offered to the contractors in regard to interpretation of plans and specifications, to assist them in carrying out the work. Inspections, and directives given to the contractors, do not relieve the Contractor, and their agents, servants and employees, of their responsibility to provide the work in all of its parts, in a safe and workmanlike manner, and in accordance with the plans and specifications, nor impose upon the City of Winnipeg, and/or Engineer or their representatives, any responsibility to supervise or oversee the erection or installation of any work.

.2 The Engineer will issue inspection reports and deficiency lists from time to time. All deficiencies shall be cleared up to the satisfaction of the Engineer within a reasonably short time period.

1.20 PATENTS

.1 Pay all royalties and license fees, and defend all suits or claims, for infringement of any patent rights, and save the City of Winnipeg and Engineer harmless of loss or annoyance on account of suit, or claims of any kind for violation or infringement of any letters patent or patent rights, by this Contractor or anyone directly or indirectly employed by them, or by reason of the use of any part, machine, manufacture or composition of matter on the work, in violation or infringement on such letters patent or rights.

1.21 CONSTRUCTION DRAWINGS

.1 Where requested, prepare drawings in conjunction with all trades concerned, showing sleeves and openings for passage through structures, and all inserts, equipment bases, sumps and pits, supports, etc.

1.22 MUNICIPAL AND UTILITY SERVICES

.1 Coordinate, arrange, and pay for all municipal and utility relocations, terminations and connections as required and shown on the drawings, complete with all required metering.

.2 Install all metering equipment in accordance with municipal or utility requirements.

.3 Test all services and provide report(s) as required by the Authorities Having Jurisdiction.

1.23 CODES, PERMITS, FEES AND INSPECTIONS

.1 Comply with the most stringent requirements of the latest editions of the applicable C.S.A. standards; the requirements of the Authorities Having Jurisdiction; Federal, Provincial and Municipal Codes; and the applicable standards of the Underwriters' Association. These codes and regulations constitute an integral part of these specifications.

.2 In case of conflict, the codes take precedence over the Contract Documents. In no instance reduce the standard or scope of work or intent established by the drawings and specifications by applying any of the codes referred to herein.

.3 Before starting any work, submit the required number of copies of Drawings and Specifications to the Authorities for their approval and comments. Comply with any changes requested as part of the contract, but notify the Engineer immediately of such changes, for proper processing of these requirements. Prepare and furnish any additional drawings, details or information as may be required. Information such as heat loss calculations, and other data that may be required can be obtained from the Engineer. Should the authorities require the information on specific forms fill in these forms by transcribing the information provided by the Engineer.

.4 Apply for, obtain, and pay for all required permits, licenses, inspections, examinations, and fees.

.5 Arrange for the inspection of all the work by the Authorities Having Jurisdiction over the work. On completion of the work, present to the Engineer the final unconditional certificate of approval of the inspecting authorities. When the Authorities Having Jurisdiction do not normally issue certificates, provide a declaration confirming that the Authorities have inspected and accepted the work.

1.24 DESIGN NOISE LEVELS

.1 The maximum design noise levels for this project shall be as per ASHRAE Standards.

.2 All equipment, components and systems shall be selected and installed with the intent of not exceeding these noise levels.

.3 Where the equipment, components and systems fail to meet the noise level criteria, modifications shall be made as required, at no additional cost to the City of Winnipeg.

1.25 REQUESTS FOR USE OF SUBSTITUTE EQUIPMENT

.1 Manufacturers listed as acceptable “Substitutes” have been deemed by the Engineer as capable of producing equipment and/or material of comparable quality, performance and approximate dimensions, and can be used in the preparation of the tender.

.2 Manufacturers that are not listed are to review the tender specifications and determine if their products qualify as “equal” to the specified product in all respects.

.3 Manufacturers are to review all drawing and specifications and familiarize themselves with the project and the product's intended use, performance, physical dimensions, access and service requirements, etc.

.4 Submit for review no later than 5 working days before tender closing, three hard copies of the proposed product shop drawings. Catalogue cut sheets or sales brochures will not be accepted or reviewed. Digital copies of submitted shop drawings will be acceptable in lieu of hard copies.

.5 Submit the proposed product's shop drawing(s) along with a copy of the original product specification and indicate all areas of Compliance and Non-Compliance with respect to the proposed product. If non-compliance is indicated, state the variance and how it affects performance, physical dimensions, access and service requirements, installation, etc.

.6 If Compliance/Non-Compliance information is not provided the submission will not be reviewed and the proposed products will not be allowed for use.

.7 Products reviewed as being acceptable "substitutes" shall be listed by addendum. Products/Manufactures not listed, reviewed or as accepted may submit as "Alternates".

.8 Refer to Section 21 05 10 – Acceptable Equipment, Materials and Products for additional requirements.

1.26 SHOP DRAWINGS

.1 Present a schedule of shop drawings within two (2) weeks after the award of the contract, indicating the shop drawing submission and equipment delivery dates.

.2 Shop Drawings submitted by the Contractor shall contain:

.1 Project Information such as Name and Address;

.2 Contractor Information such as Name, Address, Phone Numbers;

.3 Supplier Information such as Name, Address, Phone Numbers;

.4 Equipment Identification using the same System Name and Identification Number as the Contract Documents;

.5 All Equipment Information required for the Engineer to assess the suitability such as:

.1 Make, Model, Size
.1 including schedules where numerous similar items are provided

.2 Physical Data such as:
.1 Dimensions
.2 Materials

.3 Weights
.4 Installation Requirements
.5 Installation Clearances

.3 Performance Data such as:
.1 Volume
.2 Pressure
.3 Capacity
.4 Performance Curves (with specified performance clearly marked)

.4 Motor Data such as:
.1 Horse Power
.2 Voltage/Phases
.3 Efficiency

.5 Specialty Items such as:
.1 Bearings
.2 Filters
.3 Internal Controls including safety lockouts
.4 Safety Items such as relief valves and regulators
.5 Options

.6 Wiring and Control Diagrams

.3 Equipment Information may contain standard manufacturer's brochures, catalogue sheets, schematics, diagrams performance charts, illustrations, etc., but must have:

.1 Information which is not applicable crossed off;

.2 Available listed options which are being provided clearly marked.

.4 Shop Drawing Review:

.1 In addition to project identification, date, etc., the form of stamp used in shop drawing review shall contain the following format:

.1 Drawing:

.1 Reviewed
.2 Reviewed As Noted
.3 Revise and Re-Submit
.4 Not Reviewed

.2 This review by the Engineer is for the sole purpose of ascertaining conformance with the general design concept.

.3 Review does not imply Engineer approved the detail design inherent in the shop drawings, this responsibility remains the Sub-contractor submitting same, and

such review shall not relieve the Sub-contractor of responsibility for errors or omissions in the shop drawings, or of their responsibility for meeting all the requirements of the contract documents. The contractors are responsible for confirming and correlating dimensions at the job site, for information that pertains solely to fabrication processes or to techniques of construction and installation, and for coordination of the work of all sub-trades, as well as compliance with codes and inspection authorities such as C.S.A.

.5 Bind one (1) complete set of final shop drawings in each Operating and Maintenance instruction manual.

.6 Refer to the Architectural General Specifications for additional information.

1.27 COORDINATION

.1 The Contractor shall be responsible for the complete coordination amongst all trades, including timing, completion, deliveries, interference of building components and sequencing of the trades.

.2 The Contractor shall coordinate the Mechanical and Electrical sub-contractors to ensure compatibility of the system components.

.3 The Contractor shall coordinate the Mechanical and Electrical sub-contractors to ensure access to control panels on mechanical equipment for the purpose of completing fire alarm panel connections.

.4 The Contractor shall coordinate all trades to ensure that access doors and panels are of the same manufacturer, and of a style appropriate for the intended use.

1.28 EXPEDITING

.1 Continuously check and expedite delivery of equipment and materials. If necessary, inspect at the source of manufacture.

.2 Continuously check and expedite the flow of necessary information to and from all parties involved.

.3 Immediately inform the General Contractor if information is required from them.

1.29 AS-BUILT DRAWINGS

.1 Obtain two (2) sets of white prints. Accurately record deviations from the contract documents caused by job conditions and ordered changes to indicate the installed work. Have prints available for inspection at Site at all times, and present at each meeting.

.2 At the completion of the work, submit these sets of "As-Built" Drawings to the Engineer for review. Make changes as requested by the Engineer and resubmit. This process will continue until the "As-Built" drawings are deemed complete by the Engineer.

.3 Arrange and pay for two (2) copies of the final "As-Built" Drawings to be produced and labeled "As-Constructed".

.4 Submit the "As-Built" and "As-constructed" drawings to the City of Winnipeg.

.5 Refer to the Architectural General Specifications for additional information.

.6 At project end, a complete set of as-built drawings should be furnished of the building's mechanical systems, and turned over to the City of Winnipeg by the contractor. Refer to Section 01 78 00 - Closeout Submittals for further information.

1.30 CUTTING AND PATCHING

.1 The cutting of openings not requiring lintels or other structural support will be the responsibility of the trade requiring the opening. The opening size shall be the minimum required. 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.

.2 Where openings require lintels or other structural support, or roofing work, such openings will be specified under other divisions of this specification.

.3 Cutting, patching, and repairs to existing surfaces required as a result of the removal and/or relocation of existing equipment, piping and/or ductwork, and/or installation of new equipment, piping and/or ductwork in existing buildings is to be included in the tender price.

1.31 TEMPORARY SERVICES

.1 Do not use any of the permanent mechanical systems during construction unless specific written approval is obtained from the Engineer and City of Winnipeg.

.2 The use of permanent facilities for temporary construction service shall not affect, in any way, the commencement date of the warranty period.

.3 If the permanent mechanical systems are used during construction, the equipment and systems shall be cleaned and refurbished as required to bring them back to a new/unused condition.

1.32 CHANGING OF EQUIPMENT DRIVES

.1 If required, as determined from the review of the preliminary balancing report, changes to the equipment drives shall be carried out as follows:

.1 The Balancing Contractor is responsible for calculating and obtaining the new drives.

.2 The contract shall include one drive change for each Air Handling Unit and each Fan with adjustable pulley drive.

1.33 TEMPORARY AND TRIAL USAGE

.1 Do not use permanent systems or equipment during construction period, without written permission from the Consultant & City of Winnipeg.

.2 The City of Winnipeg has the privilege of trial usage of mechanical systems, or parts thereof, for the purpose of testing and learning operational procedures.

.3 Assist in the trial usage over a length of time, as deemed reasonable by the Engineer, at no extra cost, without waiver of responsibility or warranty.

.4 Trial usage of systems or equipment is not warranty acceptance by City of Winnipeg.

.5 Provide and pay for all testing required on the system components where, in the opinion of the Engineer, Manufacturer's ratings or specified performance is not being achieved.

.6 Thoroughly clean & overhaul equipment used during construction period. Replace worn or damaged parts so equipment is in perfect condition, to entire satisfaction of the Consultant and City of Winnipeg. Routinely inspect all air filters. Clean or replace filters depending on filter type during period in which ventilation units are being used for temporary heat and/or commissioning of system. Contractor is responsible to pay all expenses for air filter cleaning service. Filters to operate between pressure drops noted in filter manufacturer's catalogue.

.7 Temporary use of equipment shall in no way relieve Contractor of providing twelve month guarantee on all equipment used. This guarantee period shall commence as of date of final acceptance of building by City of Winnipeg as interpreted by Consultant.

1.34 SAFETY DEVICE TESTING

.1 Make complete inspections of all safety devices such as: back flow preventors, freeze protection devices; fire dampers, smoke dampers, fire stops, and the like to ensure:

.1 That safety devices are complete in accordance with the specifications and Manufacturer's recommendations.

.2 That the safety devices are connected and operating according to all local regulations, and appropriate access is provided.

.2 On completion of the inspections, provide letters and/or certificates, confirming that inspections have been completed. Insert in each Operation and Maintenance (O & M) Manual.

1.35 CLEANING

.1 General Clean-up:

.1 The worksite shall be maintained in a condition of general cleanliness and tidiness.

.2 Provide, erect, maintain and remove temporary protective barriers and shelters. Use drop sheets, temporary walls or other means necessary to limit the spread of construction dirt and debris. Barriers shall be used to minimize the spread of dust, smoke, fumes and noise to other portions of the building.

.3 For renovation work, and for phased work where part of the building is occupied, coordinate and cooperate with the occupants throughout the duration of the project to maintain the site in a usable condition.

.4 For renovation work, and for phased work where part of the building is occupied, clean the site to the satisfaction of the occupants at the end of each work day, so as to neither inconvenience the occupants nor hinder the use of the facility.

.5 For renovation work, at the end of the project, provide cleaning services to leave the site in as clean a condition as existed before the commencement of the work.

.2 Mechanical Systems Clean-up:

.1 At the completion of the project, leave all systems in full operation, the exterior of all new and renovated systems clean, and the work areas cleaned to the satisfaction of the Engineer, City of Winnipeg and Occupants.

.2 Clean exposed surfaces of new and renovated mechanical equipment, ductwork, piping, etc.

.3 The level of cleaning shall be consistent with the intended use of the building and the mechanical systems.

.4 The City of Winnipeg reserves the right to inspect the Mechanical Systems to determine the effectiveness of the cleaning. Where cleaning is deemed to be unacceptable, the cleaning shall be re-done at no extra charge to the City of Winnipeg.

.3 Special Cleaning:

.1 Polish plated work.

.2 Vacuum clean and remove debris from the inside of all new air handling systems, fans, ducts, coils, terminal units, etc.

.3 Vacuum clean and remove debris from the inside of existing air handling systems, fans, ducts, coils, terminal units, etc., as noted on the floor plans.

.4 For New Ductwork, provide High Velocity Vacuum Cleaning. Provide Duct Access Doors as required.

.1 High Velocity Vacuum Cleaning shall be:

.1 Portable
.2 Capable of a minimum of 4,000 cfm
.3 Equipped with HEPA filtration which is 99.97% efficient for particles no greater than 0.3 microns in size, when system exhausts into the Workplace or Occupied Area

.5 Duct Cleaning Specialist(s) shall provide a report which shall include:

.1 Name, Address and Phone Numbers of the Company.

.2 Name(s) of Individuals Performing the Work.

.3 Description of the Work Performed, including methods, equipment, and extent of ductwork.

1.36 INSTRUCTIONS TO CITY OF WINNIPEG

.1 Prepare a List of the Systems, to be signed by the City of Winnipeg after instructions are received.

.2 Instruct the Contract Administrator's in all aspects of the operation of the systems and equipment. Prepare a List of the Systems, to be signed by the City of Winnipeg.

.3 Arrange and pay for the services of Manufacturers' representatives required for the instruction on specialized portions of the installation.

1.37 OPERATION AND MAINTENANCE MANUALS

.1 Assemble and submit to the City of Winnipeg/Architect/Engineer:

.1 One (1) hard-covered 3-ring binder with index tabs containing a complete set of manufacturers' operating and maintenance instructions showing all major equipment, and apparatus requiring maintenance for approval.

.2 One (1) electronic copy containing a complete set of manufacturers' operating and maintenance instructions showing all major equipment, and apparatus requiring maintenance for approval.

.2 Instructions shall be complete for installation, operation and maintenance and shall include pertinent information such as detailed drawings, maintenance schedules, and addresses. Instructions shall be reviewed with Contract Administrator to ensure a thorough understanding of the operation.

.3 The O & M Manuals shall each contain, but not be limited to the following information:

.1 Table of Contents,

.2 A certificate or letter stating that all systems have been commissioned and are operating as specified,
.3 Contractor Warranty letter and/or Contractor Sign-off Sheets,
.4 All sub-contractor's and suppliers names and telephone numbers,
.5 A brief description of systems,
.6 Overall Equipment Maintenance schedule with weekly, monthly, yearly maintenance instructions,
.7 Equipment Start-up reports,
.8 A complete set of reviewed shop drawings,
.9 Brochures,
.10 Data sheets,
.11 Wiring diagrams,
.12 Air and water testing and balance reports,
.13 Controls 'As-Built' shop drawings,
.14 Commissioning information,
.15 Valve tag schedule, valve position.
.16 Warranty certificates.

.4 Present all copies of the Operation and Maintenance Manuals to the Engineer for review. The Engineer will review the manuals and return them with comments. The Sub-contractor shall make all requested changes. This process shall continue until the Manuals are deemed complete by the Engineer. The Sub-contractor shall turn over the completed manuals to the City of Winnipeg.

1.38 SPECIAL TOOLS AND SPARE PARTS

.1 Refer to Section 21 05 20 – Mechanical Spare Parts & Maintenance Materials for further information & requirements.

1.39 WARRANTIES

.1 No certificate issued, payment made, or partial or entire use of the system(s) by the City of Winnipeg, shall be construed as acceptance of defective work or material.

.2 Include copies of all warranty and guarantee certificates and declarations in the O & M Manuals, in the appropriate sections.

.3 Provide a certificate or declaration indicating the warranty and conditions.

.4 Warranty satisfactory operation of all work and equipment installed under this contract. Repair or replace at no charge to the City of Winnipeg, all items which fail or prove to be defective within the Warranty period, provided that the failure is not due to improper usage by the City of Winnipeg. Make good all damages incurred as a result of the failure and of the repair of the system(s).

.5 The warranty shall be for all parts and labour. Do not expect any participation from the City of Winnipeg's personnel in the correction of warranty related work.

.6 For systems, equipment and components which are used continuously throughout the year, the standard warranty period shall be one calendar year from the date of Substantial Completion. For seasonal equipment, components and systems which are not normally used continuously throughout the year, the warranty period shall include at least one full season of satisfactory operation.

.7 When equipment or systems are put into use subsequent to the acceptance of the building, or a portion of the building, the warranty period for seasonally used equipment and systems shall be deemed to commence from the date of satisfactory operation, not from the date of final acceptance by the City of Winnipeg.

.8 The City of Winnipeg retains the right to demand, and to receive, an extension of the original construction warranty for any equipment, component or system which consistently fails to perform, or which requires repeated repair or adjustment.

.9 Wherever manufacturer's warranties in excess of the Contractor's Warranty are provided, furnish the City of Winnipeg with copies of the Certificates, dated and acknowledged, and inserted in the O & M Manuals. The Contractors Warranty shall include a list of the Manufacturer's extended warranties

.10 Warranty work shall be carried out within a reasonable time period following the reporting of the problem. Should the repair time for any failed component be unreasonably long, as determined by the City of Winnipeg, make alternate arrangements to have a temporary replacement component made available until such time that the original component is repaired and re-installed. There shall be no additional cost to the City of Winnipeg for any temporary replacement component or for any labour required to implement the work.

1.40 DOCUMENTATION AND SYSTEM(S) ACCEPTANCE

.1 The Contractor shall prepare a suitable document, to be signed by the City of Winnipeg or their representative, confirming:

.1 The City of Winnipeg has received satisfactory instruction in the operation and maintenance of all equipment and systems.

.2 The Operation and Maintenance Manuals have been received and reviewed by the City of Winnipeg.

.3 The "Record" and "As-Constructed" Drawings have been received and reviewed by the City of Winnipeg.

.4 Specified spare parts, components, keys, removable handles, tools and the like, have been received by the City of Winnipeg.

1.41 COMPLETION

.1 The Contractor shall be aware that it is the Engineer's intention to withhold recommendations for payment of progress claims totalling more than 95% of the mechanical contract until the project is declared Substantially Complete.

.2 The close-out procedure may entail a take-over and occupancy of the building in more than one stage, depending on the specified phasing and the City of Winnipeg's timetable.

.3 SUBSTANTIAL COMPLETION

.1 The Project will be ready for a Substantial Completion inspection only when it is ready for the City of Winnipeg to occupy and utilize the building for it's intended purpose.

.2 At Substantial Completion, the City of Winnipeg will realize that some deficiencies may still exist.

.3 In preparation for the inspection to determine Substantial Completion for all or a portion of the project, the Contractor shall ensure and declare in writing that:

.1 Except for seasonal deficiencies, the Start-up and Verification of the Commissioning Process has been completed, and all systems are fully functional.

.2 All systems and equipment have been cleaned.

.3 All systems and equipment have been identified and labelled.

.4 The preliminary Record drawings have been submitted for review.

.5 One (1) set of preliminary O & M Manuals have been submitted for review.

.6 One (1) copy of the preliminary Balancing Report has been submitted for review.

.7 Instructions to the Contract Administrator have been given.

.8 Maintenance Materials and Spare Parts have been provided.

.4 When the Contractor is satisfied that the entire Project is completed, and after making their own inspection, they shall apply, in writing, to the Consultant, for an inspection to determine if the project can be deemed Substantially Complete.

.5 In the Letter of Request, a date shall be specified upon which the Project can be delivered and be Substantially Complete.

.6 During the inspection, a deficiency list will be compiled and a report will be issued. These deficiencies shall be corrected or completed in a satisfactory and timely manner.

.7 Based on the inspection report, the City of Winnipeg will retain a sum of money, sufficient in their estimation to cover the cost of completing the deficiencies.

.4 TOTAL COMPLETION

.1 When the Contractor has determined that the deficiencies noted during the Substantial Completion inspection have been completed or corrected, they shall apply, in writing, to the Consultant, for a final inspection to determine if the Project is deemed Totally Complete.

.2 In the Letter of Request, a date shall be specified upon which the Project can be delivered Totally Complete.

.3 In preparation for the inspection to determine Total Completion for all or a portion of the Project, the Contractor shall ensure and declare in writing that:

.1 All aspects of the Commissioning Process have been completed.

.2 The final Record and As-Constructed drawings have been submitted, reviewed and accepted.

.3 The final O & M Manuals have been submitted, reviewed and accepted.

.4 The final Balancing Reports have been submitted, reviewed and accepted.

.5 The deficiencies noted during the Substantial Completion inspection have been corrected or completed.

.4 During the inspection, a deficiency list will be compiled and a report will be issued. These deficiencies shall be corrected or completed in a satisfactory and timely manner.

.5 Based on the inspection report, the City of Winnipeg will retain a sum of money, sufficient in their estimation to cover the cost of completing the deficiencies.

.6 Final Payment will only be made after the Project has been determined to be Totally Complete, with all deficiencies satisfactorily corrected.

END OF SECTION

PART 1 General

1.1 GENERAL REQUIREMENTS

.1 Comply with the requirements of:

.1 Section 21 05 01, Mechanical General Provisions.

.2 Section 21 05 05, Basic Materials and Methods.

.3 Section 21 05 10, Acceptable Equipment, Materials and Products.

.4 Section 23 30 00, Air Distribution.

1.2 INTENT

.1 Adopt an IAQ management plan to protect the HVAC system during construction, control pollutant sources and interrupt contamination pathways. Sequence the installation of materials to avoid contamination of absorptive materials such as insulation, carpeting, ceiling tile and gypsum wall board.

.2 Prevent indoor air quality problems resulting from the construction process in order to help sustain the comfort and well-being of construction workers and building occupants.

1.3 REFERENCES

.1 Sheet Metal and Air Conditioning Contractor's National Association (SMACNA) IAQ Guideline for Occupied Buildings Under Construction, 1995, Chapter 3.

.2 American Society of Heating, Refrigeration, and Air-Conditioning Engineers Inc. (ASHRAE)

.1 ASHRAE 52.2-2017: Methods of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size.

1.4 REQUIREMENTS

.1 The Contractor is to develop and implement an Indoor Air Quality (IAQ) Management Plan for the construction and pre-occupancy phases of the project. The IAQ Management Plan is to be approved by the City of Winnipeg and must include the following:

.1 During construction meet or exceed the recommended design approaches of the SMACNA IAQ Guideline for Occupied Buildings Under Construction, 1995, Chapter 3.

.2 Protect stored on-site or installed absorptive materials from moisture damage.

.3 If air handlers must be used during construction, filtration media with a Minimum Efficiency Reporting Value (MERV) of eight (8) must be used at each return air grill, as determined by ASHRAE 52.2-2017.

.4 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.

.5 Ensure all return and supply grills are completely sealed off in areas of high dust and pollution activities for the duration of the task.

1.5 SUBMITALS

.1 Submit the IAQ Management Plan to City of Winnipeg and consultants for approval.

.2 Submit a list of air filters to be used, include the MERV value, manufacture name and model number.

.3 Submit at least six (6) digital photographs of on a minimum of three (3) different occasions through-out the construction process. Include identification of the SMACNA approach featured by each photograph.

PART 2 Products And Materials

2.1 NOT USED

PART 3 Installation And Execution

3.1 IMPLEMENTATION

.1 The Contractor will implement and follow the IAQ Management plan.

.2 The Contractor is to provide at least six (6) digital photographs of on a minimum of three (3) different occasions through-out the construction process. Include identification of SMACNA approach featured by each photograph.

.3 To achieve equivalence in the absence of MERV 8 filters, document that none of the ductwork or air handlers were used during the construction process, and that all HVAC components were effectively sealed and protected from contamination through the construction process. Submission to include photographic documentation of these conditions and note any temporary HVAC units that are not connected to the permanent ductwork. Clarify how dust generated by construction is removed from all surfaces before occupancy.

END OF SECTION

PART 1 General

1.1 RELATED SECTIONS

.1 Section 21 05 01, Mechanical General Provisions.

.2 Section 21 07 01, Thermal Insulation.

.3 Section 21 13 13, Fire Protection.

.4 Sections 22 06 01 and 23 06 01, Approved Substitute Schedules.

.5 Section 22 02 00, Plumbing Site Services.

.6 Section 22 05 05, Plumbing.

.7 Section 23 21 05, Liquid Heat Transfer.

.8 Section 23 30 00, Air Distribution.

.9 Section 23 05 53, Vibration Isolation.

.10 Section 23 25 13, Pipe Cleaning and Chemical Treatment.

.11 Section 23 05 93, Testing and Balancing.

.12 Comply with the requirements of the Architectural Specifications.

1.2 SUBMITTALS

.1 Shop Drawing Submittals:

.1 Submit a list of all nameplates, tags and labels, including wording, size and construction.

.2 Submit shop drawings for access doors, air filters, valves, expansion joints, air vents, strainers, thermometers and gauges, flow measurement devices.

.2 Closeout Submittals:

.1 Provide maintenance data for incorporation into Operation and Maintenance Manuals.

.2 Provide Spare Parts

.3 Sustainability Submittals

.1 Conform to all of the requirements of the Architectural Specifications, but take special note in relation to Environmentally Friendly Materials, Garbage and Recycling, and Start-up and Commissioning.

1.3 SPECIAL TOOLS AND SPARE PARTS

.1 General

.1 Conform to the requirements of the Architectural Specifications.

.2 Prepare a Suitable List/Sign-off Sheet to indicate the Materials provided.

.1 List shall Include all Materials.

.2 List shall include spaces for Sign-off Names and Dates for the Contract Administrator.

.3 Identify spare parts containers as to contents and replacement parts number.

.4 Furnish a list of individual manufacturer's recommended spare parts for equipment such as belts, bearings and seals, including addresses of suppliers.

.5 Furnish a complete list and complete set of specialized tools necessary for adjusting, repairing or replacing the equipment

.2 Provide one set of all specialized tools required to service equipment as recommended by the Manufacturers.

.3 Furnish one grease gun, and specialized adapters to suit different types of grease and grease fittings.

.4 Provide spare parts as follows:

.1 Two screens for each size of strainer.

.2 One spare rim gasket for each Hydraulic Filter Housing Installed.

.3 For Valves

.1 Valve seats: one for every ten valves, each size. Minimum one.

.2 Discs: one for every ten valves, each size. Minimum one.

.3 Stem packing: one for every ten valves, each size. Minimum one.

.4 Valve handles: two of each size.

.5 Gaskets for flanges: one for every ten flanges.

.4 Packing Materials for Stuffing Boxes and Expansion Joints

.5 Additional Spare Parts as noted elsewhere throughout the Specifications.

1.4 STANDARD OF EQUIPMENT, MATERIALS AND COMPONENTS

.1 All equipment, materials and components shall be new and of first class quality.

.2 All equipment, materials and components shall be of proven design, and of current models with published ratings, for which replacement parts are available.

.3 Only use materials allowed by codes and the Authorities Having Jurisdiction.

.1 All equipment, materials and components shall be tested, certified and labeled by ULC and/or CSA for use in Canada. The certification and labeling shall be appropriate for the intended function of the item being supplied, as dictated by the relevant codes and standards.

.2 Where items are not adequately certified and labeled by the manufacturer, the contractor supplying the item shall be responsible for obtaining approval for the use of the item from the local Authority Having Jurisdiction, and shall bear all associated costs.

.4 Where a manufacturer's name, make or model is specified, it is for the sole purpose of setting a standard of quality, performance, capacity, appearance, size and/or serviceability. Refer to Specification Schedule for approved 'Substitutes' and 'Alternates'.

.5 Use only Copper, Bronze, Brass and Stainless Steel (no iron) for materials coming in contact with Domestic Water Systems.

1.5 IDENTIFICATION

.1 All equipment, including motors shall come with proper nameplates affixed thereto, showing the manufacturer, make, model, size, serial number, horsepower, voltage, cycles, and all other pertinent data usually provided.

.2 Identify all equipment, panels and controls with lamacoid nameplates indicating Identification Name and Number.

.3 Identify all piping with direction-of-flow-arrows and service.

.4 Identify all valves with metal (aluminum or brass) or lamacoid numbered tags with stamped code lettering and numbers filled with black paint and secured to items. Use for valves and operating controllers of all systems.

.5 Identify all new ductwork with direction-of-flow-arrows and service.

.6 Provide Special Signage as Specified or Noted on the Drawings.

1.6 CONSTRUCTION TECHNIQUES AND METHODS OF INSTALLATION

.1 Only use techniques and methods allowed by codes and the Authorities Having Jurisdiction.

.2 The selected techniques, methods of fabrication and installation, and the size of the labor force shall be suitable to meet the completion schedule.

.3 The contractors shall be responsible for determining the most appropriate construction techniques and methods of installation for their portions of the work.

.4 The contractors shall be responsible for laying out the systems, equipment, and components for their portions of the work.

.5 The contractors shall consult with the manufacturers to obtain their installation recommendations, and shall comply with such recommendations and/or with local code requirements, whichever is the most stringent.

.6 Patents

.1 Pay all royalties and license fees, and defend all suits or claims, for infringement of any patent rights, and save the City of Winnipeg and Engineer harmless of loss or annoyance on account of suit, or claims of any kind for violation or infringement of any letters patent or patent rights, by this Contractor or anyone directly or indirectly employed by him, or by reason of the use by him or them of any part, machine, manufacture or composition of matter on the work, in violation or infringement on such letters patent or rights.

.7 Construction Drawings

.1 Where requested, prepare drawings in conjunction with all trades concerned, showing sleeves and openings for passage through structures, and all inserts, equipment bases, sumps and pits, supports, etc.

1.7 FIRE STOPPING

.1 Conform to the requirements of the Architectural Specifications.

.1 Fire Stopping shall be carried out by a specific Sub-contractor to the General Contractor. Refer to the Architectural specifications.

.2 Fire Stop Materials shall be provided at all penetrations through fire and smoke separations. Refer to the Architectural Drawings for the locations of all separations.

.3 Fire Stop Materials shall be as approved by the Authorities Having Jurisdiction.

.4 Fire Stop Material installation shall be as per Manufacturer's recommendations.

1.8 PIPE HANGERS AND SUPPORTS

.1 Design Requirements:

.1 Construct pipe hanger and support to manufacturer's recommendations utilizing manufacturer's regular production components, parts and assemblies.

.2 Base maximum load ratings on allowable stresses prescribed by ASME B31.1 or MSS SP58.

.3 Ensure that supports, guides, anchors do not transmit excessive quantities of heat to building structure.

.4 Design hangers and supports to support systems under conditions of operation, allow free expansion and contraction, prevent excessive stresses from being introduced into pipework or connected equipment.

.5 Provide for vertical adjustments after erection and during commissioning.

1.9 ENVIRONMENTAL REQUIREMENTS

.1 All materials listed below that are used in the building interior, (i.e. inside of the exterior air barrier) must not exceed the following requirements:

.1 Adhesives, Sealants and Sealant Primers: South Coast Air Quality Management District (SCAQMD) Rule #1168 requirements in effect on January 1, 2003 and rule amendment dated October 2, 2003.

.2 Aerosol Adhesives: Green Seal Standard GS-36 requirements in effect on October 19, 2000.

.2 Adhesives must contain no urea-formaldehyde.

PART 2 Products And Materials

2.1 ACCESS PANELS AND DOORS

.1 The Contractor and Sub-contractor shall coordinate as required to ensure that access doors supplied by different sub- and sub-sub-contractors shall be of the same manufacturer and of a style appropriate for the intended use.

.2 Provide access doors equal to the fire rating of the wall or ceiling in which it is installed.

.3 Lay-in type tiles, properly marked, may serve as access panels.

.4 In concealed locations, and in rated walls and ceilings, provide access doors of welded 12 gauge steel, flush type with concealed hinges, lock and anchor straps, complete with factory prime coat.

.5 In exposed locations in non-rated partitions and ceilings, provide Bauco model Plus II 'Invisible Seam' type access doors as distributed by:

Bauco Products Incorporated
835 Devonshire Road – Unit 2
Victoria, B.C., V9A 4T5
Phone: 877-592-0033 – or – (250) 592-0033
Fax: 877-592-7587 – or – (250) 595-0513

.6 All access panels and doors shall be minimum 300 mm x 300 mm (12" x 12"). Where personnel entry is required, minimum size shall be 600 mm x 600 mm (24" x 24").

.7 Refer to Specification Section 23 30 00 (Air Distribution) for Duct Access Doors.

2.2 DUCT ACCESS PANELS AND DOORS

.1 Provide latched and gasketed access doors where required, constructed of 22 gauge materials with flat iron or angle iron stiffening forms, so constructed that the door can be operated without twisting or distortion.

.2 Doors in insulated ductwork: double panel construction with a 25 mm (1") insulating filler.

2.3 AIR FILTERS

.1 General:

.1 No filter shall contain asbestos, micro-glass of Urea-formaldehyde.

.2 Filters shall be listed at least Class II UL flammability.

.3 Media shall be suitable for air at 100% RH and air temperatures between minus 40°C and plus 50°C.

.4 Filter Banks shall be designed for maximum 0.25" S.P. clean, maximum 1.0" S.P. loaded

.5 All replaceable filter media shall be constructed of unbreakable synthetic micro-fibres in 3 stage variable density media.

.6 Access and servicing: through doors/panels on side

.7 Maximum 500 fpm face velocity.

.2 Amount of filter panels in banks, size and thickness of panels, overall dimensions of filter bank, configuration and capacities shall be as required, or as specified on the drawings or in the Filter Schedule.

.3 Unless specifically noted otherwise, all filters shall be replaceable panel type, for slide-in application, into galvanized steel racks.

.1 All filter panels shall be pleated media type in cardboard frames.

.4 Where replaceable media and removeable/reusable holding frames are specified:

.1 Holding Frames shall be suitable for slide-in application, into holding racks.

.2 All material shall be fabricated from galvanized steel or extruded aluminum.

.3 Frames shall be constructed of 'T' or 'U' channel construction, 1.6 mm thick.

.4 Frames shall have hold down bars/screens as required for easy change out of media

.5 Racks shall be channel section construction.

.6 Seals: to ensure leakproof operation.

.7 Blank-off plates: as required, to fit all openings and of same material as holding frames.

.5 If air handlers must be used during construction, filtration media with a Minimum Efficiency Reporting Value (MERV) of 8 (duct spot efficiency = 30-35%, arrestance >90%) must be used at each return air grill, as determined by ASHRAE 52.2-1999.

.6 All filter media used during "temporary heating" shall be replaced by new media at regular intervals during equipment use. Contractor shall allow for two (2) complete filter changes after substantial completion, ie. one set installed immediately prior to opening,

and a spare set handed over to City of Winnipeg. The Contractor shall coordinate with City of Winnipeg regarding timing. Install a new set of filter media and hand one spare set of media (for each filter) to the Contract Administrator at substantial completion. Upon turnover of spare filtration media to Contract Administrator, the Contractor shall submit request to Lead Consultant for written confirmation from the City of Winnipeg acknowledging the receipt of the spare sets.

.7 Provide shop drawings for all filtration media as outlined in the Mechanical General provisions section 21 50 01. Also, provide a schedule listing filtration media installed prior to occupancy, including its MERV value.

.8 Regardless of whether the base building HVAC equipment was used during construction or not, the Contractor shall allow for two (2) complete filter changes after substantial completion, ie. one set installed immediately prior to opening, and a spare set handed over to City of Winnipeg. The Contractor shall coordinate with the City of Winnipeg regarding timing. Install a new set of filter media and hand one spare set of media (for each filter) to the Contract Administrator at substantial completion. Upon turnover of spare filtration media to Contract Administrator, the Contractor shall submit request to Lead Consultant for written confirmation from the City of Winnipeg acknowledging the receipt of the spare sets.

2.4 IDENTIFICATION

.1 Match existing Identification System(s), or provide as detailed herin.

.2 Language: English

.3 Equipment, Panels and Controls:

.1 Colours:

.1 Hazardous: red letters, white background.

.2 Elsewhere: black letters, white background (except where required otherwise by applicable codes).

.2 Construction:

.1 3 mm (1/8”) thick lamacoid plastic, with square corners and beveled edges, letters accurately aligned and machine engraved into core.

.1 Alternate of white matte finish anodized aluminum will be allowed

.3 Sizes:

.1 Conform to the following table

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

.4 Use maximum of 25 letters/numbers per line.

.5 Identify the name of the equipment or equipment service and it's number, ie: 'Fume Hood Exhaust Fan EF-27'.

.1 The wording shall be the same as the Drawings and Specifications. Prior to ordering, the wording of all equipment tags shall be submitted to the Engineer for review.

.4 Locations:

.1 Terminal cabinets, control panels: use size # 5.

.2 Equipment in Mechanical Rooms: use size # 9.

.3 Equipment in Mechanical Room:

.1 Use arrangement of Main identifier, Source identifier, Destination identifier.

.2 Main identifier: size #9.

.3 Source and Destination identifiers: size #6.

.4 Terminal cabinets, control panels: size #5.

.4 Equipment elsewhere: sizes as appropriate.

.5 Valves:

.1 35 mm (1-3/8") diameter Laminated Plastic or Brass tags with 12 mm high identification data.

.1 Brass tags shall have the imprinted data filled with black paint.

.2 Brass Tags shall be secured by brass chains.

.3 Laminated Plastic Tags shall be secured by thick plastic straps.

.4 Tags shall be secured to the valves.

.2 Include a flow diagram for each system, of approved size, showing charts and schedules with identification of each tagged item, valve type, service, function, normal position, location of tagged item.

.6 Piping:

.1 Systems Governed By Codes:

.1 Natural gas: to CSA/CGA B149.1 and authority having jurisdiction.

.2 Sprinklers: to NFPA 13.

.2 Piping identification shall be pre-manufactured labels, suitably attached for permanence, or stencils with painted lettering. Painted stencils shall be of a suitable color to contrast with the pipe/insulation color.

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

.4 Pictograms:

.1 Where required: Workplace Hazardous Materials Information System (WHMIS) regulations

.5 Legend:

.1 Block capitals to sizes and colours listed in CAN/CGSB 24.3.

.6 Arrows showing direction of flow:

.1 Outside diameter of pipe or insulation less than 75 mm: 100 mm long x 50 mm high.

.2 Outside diameter of pipe or insulation 75 mm and greater: 150 mm long x 50 mm high.

.3 Use double-headed arrows where flow is reversible.

.7 Extent of background colour marking:

.1 To full circumference of pipe or insulation.

.2 Length to accommodate pictogram, full length of legend and arrows.

.8 Materials for background colour marking, legend, arrows:

.1 Pipes and tubing 20 mm and smaller: waterproof and heat-resistant pressure sensitive plastic marker tags.

.2 Other pipes: pressure sensitive plastic-coated cloth or vinyl with protective overcoating, waterproof contact adhesive undercoating, suitable for ambient of 100% RH and continuous operating temperature of 150 degrees C and intermittent temperature of 200 degrees C.

.9 Colours and Legends:

.1 Where not listed, obtain direction from Engineer

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

Background colour:	Legend, arrows:
Yellow	Black
Green	White
Red	White

.10 Background colour marking and legends for piping systems:

Contents	Background colour marking	Legend
Heating water supply	Yellow	HWS
Heating water return	Yellow	HWR
Domestic hot water supply	Green	DHW
DHW recirculation	Green	DHWR
Domestic cold water supply	Green	DCW
Sanitary	Green	SAN
Plumbing vent	Green	SAN VENT
Refrigeration suction	Yellow	REF. SUCTION
Refrigeration liquid	Yellow	REF. LIQUID
Refrigeration hot gas	Yellow	REF. HOT GAS
Natural gas	to Codes	
Gas regulator vents	to Codes	
Fire protection water	Red	FIRE PROT. WTR
Sprinklers	Red	SPRINKLERS

.7 Ductwork:

.1 Ductwork identification shall be painted stencils of a suitable color to contrast with the duct/insulation color.

.2 50 mm high stencilled letters and directional arrows 150 mm long x 50 mm high.

.3 Colours: black, or co-ordinated with base colour to ensure strong contrast.

.8 Special Signage:

.1 Supply a total quantity of thirty (30) signs for installation by the City of Winnipeg.

.2 Each shall be 3mm (1/8") thick lamacoid plastic name plates, 4" (high) x 6" (wide), with bevelled edges, having 1/2" high engraved white letters on a black background.

.3 Each shall be bi-lingual, indicating 'NON-POTABLE WATER'. Exact wording to be provided by City of Winnipeg prior to Ordering.

2.5 HANGERS AND SUPPORTS

.1 General

.1 Fabricate hangers, supports and sway braces in accordance with ANSI B31.1 and MSS SP58.

.2 Use components for intended design purpose only. Do not use for rigging or erection purposes.

.2 Pipe Hangers

.1 General:

.1 Provide adjustable Clevis type equal to Grinnell Fig. 65 for pipe sizes up to and including N.P.S. 2.5. For pipe sizes N.P.S. 3 and over, provide adjustable Clevis type equal to Grinnell Fig. 260. Use rod sizes as recommended by the manufacturer.

.2 On copper piping, provide copper plated type hanger or separate piping from hanger with an approved insulating tape or plastic coating.

.3 Provide oversized hangers to pass over insulation on all insulated water piping. Use insulation saddles to protect insulation.

.2 Finishes:

.1 Pipe hangers and supports: galvanized or painted with zinc-rich paint after manufacture.

.2 Ensure steel hangers in contact with copper piping are copper plated or epoxy coated.

.3 Upper attachment structural: suspension from lower flange of I-Beam:

.1 Cold piping NPS 2 maximum: malleable iron C-clamp with hardened steel cup point setscrew, locknut and carbon steel retaining clip.

.1 Rod: minimum 13 mm.

.2 Cold piping NPS 2 1/2 or greater, hot piping: malleable iron beam clamp, eye rod, jaws and extension with carbon steel retaining clip, tie rod, nuts and washers.

.4 Upper attachment structural: suspension from upper flange of I-Beam:

.1 Cold piping NPS 2 maximum: ductile iron top-of-beam C-clamp with hardened steel cup point setscrew, locknut and carbon steel retaining clip.

.2 Cold piping NPS 2 1/2 or greater, hot piping: malleable iron top-of-beam jaw-clamp with hooked rod, spring washer, plain washer and nut.

.5 Upper attachment to concrete:

.1 Ceiling: carbon steel welded eye rod, clevis plate, clevis pin and cotters with weldless forged steel eye nut. Ensure eye 6 mm minimum greater than rod diameter.

.2 Concrete inserts: wedge shaped body with knockout protector plate to MSS SP69.

.6 Shop and field-fabricated assemblies:

.1 Trapeze hanger assemblies.

.2 Steel brackets.

.3 Sway braces for seismic restraint systems.

.7 Hanger rods: threaded rod material to MSS SP58:

.1 Ensure that hanger rods are subject to tensile loading only.

.2 Provide linkages where lateral or axial movement of pipework is anticipated.

.8 Pipe attachments: material to MSS SP58:

.1 Attachments for steel piping: carbon steel.

.2 Attachments for copper piping: copper plated black steel.

.3 Use insulation shields for hot pipework.

.4 Oversize pipe hangers and supports.

.9 Adjustable clevis: material to MSS SP69, clevis bolt with nipple spacer and vertical adjustment nuts above and below clevis.

.1 Yoke style pipe roll: carbon steel yoke, rod and nuts with cast iron roll, to MSS SP69.

.2 U-bolts: carbon steel to MSS SP69 with 2 nuts at each end to ASTM A563.

.3 Finishes for steel pipework: black or galvanized.

.4 Finishes for copper, glass, brass or aluminum pipework: black or galvanized, with formed portion plastic or epoxy coated.

.10 Pipe rollers: cast iron roll and roll stand with carbon steel rod to MSS SP69.

.3 Riser Clamps

.1 Steel or cast iron pipe: galvanized carbon steel to MSS SP58, type 42

.2 Copper pipe: carbon steel copper plated to MSS SP58, type 42.

.3 Bolts: to ASTM A307.

.4 Nuts: to ASTM A563.

.4 Insulation Protection Shields

.1 Insulated cold piping:

.1 64 kg/m3 density insulation plus insulation protection shield to: MSS SP69, galvanized sheet carbon steel. Length designed for maximum 3 m span.

.2 Insulated hot piping:

.1 Curved plate 300 mm long, with edges turned up, welded-in centre plate for pipe sizes NPS 12 and over, carbon steel to comply with MSS SP69.

.5 Constant Support Spring Hangers

.1 Springs: alloy steel to ASTM A125, shot peened, magnetic particle inspected, with +/-5% spring rate tolerance, tested for free height, spring rate, loaded height and provided with Certified Mill Test Report (CMTR).

.2 Load adjustability: 10 % minimum adjustability each side of calibrated load. Adjustment without special tools. Adjustments not to affect travel capabilities.

.3 Provide upper and lower factory set travel stops.

.4 Provide load adjustment scale for field adjustments.

.5 Total travel to be actual travel + 20%. Difference between total travel and actual travel 25 mm minimum.

.6 Individually calibrated scales on each side of support calibrated prior to shipment, complete with calibration record.

.6 Variable Support Spring Hangers

.1 Vertical movement (13 mm minimum, 50 mm maximum): use single spring pre-compressed variable spring hangers.

.2 Vertical movement (greater than 50 mm): use double spring pre-compressed variable spring hanger with 2 springs in series in single casing.

.3 Variable spring hanger complete with factory calibrated travel stops.

.4 Steel alloy springs: to ASTM A125, shot peened, magnetic particle inspected, with +/-5 % spring rate tolerance, tested for free height, spring rate, loaded height and provided with CMTR.

.7 Equipment Supports

.1 Fabricate equipment supports not provided by equipment manufacturer from structural grade steel. Alternate construction using manufactured items from a supplier such as ‘Uni-strut’ will be acceptable.

.2 Submit shop drawings c/w calculations.

.8 Equipment Anchor Bolts And Templates

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

.9 House-Keeping Pads

.1 Provide 100 mm high concrete housekeeping pads for base-mounted equipment; size pads 150 mm larger than equipment; chamfer pad edges.

.10 Provide concrete thrust blocks at each change of direction for underground water piping, as per drawing details.

2.6 PUMPS – GENERAL

.1 Piping adjacent to pump to be supported from structure so no weight is carried on pump casings. Use long sweep elbows at pump.

.2 Provide coupling guards on all pumps.

.3 Submit certified pump curves with shop drawings. Pump impeller not to exceed size suitable for operating at 85% of maximum pumphead at specified flow rate, unless given specific written acceptance of deviation by Consultant.

.4 Mount on cast iron or heavy steel base, having drip lips and tapped drainage holes. Provide air cock on each pump.

.5 Pump bases to have type NSN vibration isolators of sizes recommended by manufacturer. Refer to standard details for installation and forming of pump bases.

.6 Manufacturer to include for checking and aligning pumps prior to start-up.

.7 Casing section below packing glands is to have a tapped drainage hole to allow packing gland leakage to be piped to drain.

.8 For all pump installations, present a written "Pump Performance Report", prior to substantial completion. This report will verify that pump meets design performance criteria; pressure, gpm, amp draw and correct impeller size.

2.7 SCREWS, BOLTS AND FASTENERS

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

.2 Use heavy hex heads, zinc plated unless otherwise specified. Use non-ferrous material throughout for plumbing services. Use type 304 stainless steel for exterior areas.

.3 Bolts used on fan equipment for access to motors, bearings, filters, etc. shall be heavy-duty.

.4 Bolts shall not project more than one (1) diameter beyond nuts (this includes threaded rod on hanger supports).

.5 For flanged connections on all other services, bolts shall be grade 5, nuts shall be grade 8.

.6 Apply liberal amount of never seize compound to all bolts used on exterior applications and all flanged connections within building (all services).

.7 Washers:

.1 Use zinc plated washers on equipment, sheet metal and soft gaskets lock type washers where vibration occurs, and resilient type washers with stainless steel.

2.8 INSERTS

.1 Use factory-made threaded or toggle type inserts as required for supports and anchors, properly sized for the load to be carried.

.2 Use factory made expansion shields where inserts cannot be placed, but only as approved by the Engineer in writing and for light weights.

.3 Do not use explosive powder activated tools except with the written permission of the Engineer.

2.9 SLEEVES

.1 Provide the following for pipe sleeves:

.1 Through interior walls, exterior walls above grade, interior non waterproof floors: Machine cut schedule 40 steel pipe, medium cast iron or 18 gauge galvanized steel or plastic.

.2 Through walls below grade, waterproof floors, floors in janitor's closets, equipment rooms, and kitchens: machine cut medium cast iron, D.W.V. copper or copper sheet extended 100 mm (4") above the floor and cut flush with the underside.

.3 Construction: Foundation walls and where sleeves extend above finished floors to have annular fins continuously welded on at mid-point.

.4 Sizes: 6 mm minimum clearance between sleeve and uninsulated pipe or between sleeve and insulation.

.2 Provide the following for ductwork:

.1 Where fire dampers are not required in poured walls:

removable wood box of required size.

.2 Where fire dampers are not required in block or brick walls:

masonry to be built around ducting.

.3 Where fire dampers are required:

18 gauge galvanized steel or heavier sleeves complete with steel angle framing both sides installed in accordance with requirements of Authorities.

.4 Through Equipment Room floors:

provide 100 mm (4") high curbs and install as described above.

2.10 ESCUTCHEONS

.1 Construction: One piece type with set screws. Chrome or nickel plated brass or type 302 stainless steel.

.2 Sizes: Outside diameter to cover opening or sleeve. Inside diameter to fit around pipe or outside of insulation if so provided.

2.11 PIPE AND FITTINGS

.1 Any piping located in vertical service spaces (i.e. vertical shafts c/w fire ratings) shall be installed with non-combustible piping material as per the Manitoba Building Code requirements.

.2 Domestic Cold, Hot and Tempered Water (above grade):

.1 Type L hard copper with wrought copper or cast bronze fittings using lead-free solder.

.3 Building Water Service (Domestic or Fire):

.1 PVC pressure water pipe.

.4 Compressed air, heating water and glycol piping:

.1 For pipe sizes up to and including DN 50 (NPS 2), type L hard copper with wrought copper or cast bronze fittings using lead-free solder. Rated at 860 kPa (125 P.S.I.).

.2 Schedule 40 ASTM A53 steel black pipe with standard black malleable screwed fittings rated at 860 kPa, (125 P.S.I.) for pipe sizes up to and including DN 50 (NPS 2).

.3 Schedule 40 ASTM A53 wrought steel black pipe with standard black steel welding fittings for pipe sizes DN 65 (NPS 2.5) and over.

.4 Mechanical Joints may be used on steel piping.

.5 Chilled water piping:

.1 Schedule 40 ASTM A53 steel black pipe with standard black malleable screwed fittings rated at 860 kPa (125 P.S.I.) for pipe sizes up to and including DN 50 (NPS 2).

.2 Schedule 40 ASTM A53 wrought steel black pipe with standard black steel welding fittings for pipe sizes DN 65 (NPS 2.5) and over.

.3 Mechanical Joints may be used on steel piping.

.6 Fire Protection (Sprinkler or Standpipe) piping (above grade):

.1 Wrought or black steel pipe, or copper piping, or plastic piping, with screwed, mechanical welded or soldered joints as allowed within the building construction criteria and by the Authorities Having Jurisdiction.

.7 Condensate drip drains:

.1 Drainage grade copper tubing with soldered copper drainage fittings.

.8 Sanitary Drainage and Vent - internal and within 1.52m (5'-0") of building line:

.1 Buried:

.1 Where approved by the Authorities Having Jurisdiction:

.1 PVC with fusion welded fittings.

.2 Suspended:

.1 DWV copper with soldered copper or cast bronze drainage fittings,

.2 Where approved by the Authorities Having Jurisdiction:

.1 PVC with fusion welded fittings.

.3 Vertical Risers in shafts below the top floor:

.1 Medium weight cast iron soil pipe with M.J. fittings with corrugated CSA approved M.J. clamp,

or

.2 DWV copper with soldered copper or cast bronze drainage fittings,

.9 Storm Drainage - internal and within 1.52m (5'-0") of building line:

.1 Buried:

.1 Where approved by the Authorities Having Jurisdiction:

.1 PVC with fusion welded fittings.

.2 Suspended:

.1 Where approved by the Authorities Having Jurisdiction:

.1 PVC with solvent welded fittings.

.3 Vertical Risers in shafts below the top floor:

.1 Medium weight cast iron soil pipe with M.J. fittings with corrugated CSA approved M.J. clamp,

.10 Sanitary Drainage - external beyond 1.52m (5'-0") of building line:

.1 PVC pressure sewer pipe.

.11 Sewage and Sump Pump discharge pipe:

.1 PVC pressure sewer pipe.

.2 DWV copper with soldered copper or cast bronze drainage fittings,

.12 Natural Gas, Fuel Oil and Propane Piping:

.1 As allowed by code and approved by the Authorities Having Jurisdiction.

.13 In-floor Heating Tubing:

.1 High Density, socket fused, poly pipe suitable for direct burial, equal to PEX with Oxygen Barrier.

2.12 VALVES

.1 General

.1 It is generally preferable that ball valves and butterfly valves be used in place of gate valves providing they meet the pressure, temperature, and fluid handling requirements of the system.

.2 Gate Valves

.1 Valves DN 50 (NPS 2) and smaller for threaded ends: Jenkins #810, Crane #428, Toyo 293, Lunkenheimer #2125, Kitz 24, Nibco T111, Milwaukee #148, Newman Hattersley T607M.

.2 Valves DN 50 (NPS 2) and smaller for soldered ends: Jenkins #813, Crane #1324, Toyo 299, Lunkenheimer #2131, Kitz 43, Nibco 5134, Milwaukee #149, Newman Hattersley T609M.

.3 Valves DN 65 (NPS 2.5) and larger: iron body non-rising stem, Jenkins #452, Crane #461, Toyo #415A Lunkenheimer #1428, Kitz 75, Nibco F619, Milwaukee F2882-M, Newman Hattersley T501.

.4 Lockshield valves DN 50 (NPS 2) and smaller: Crane 428 Lockshield, Toyo 293, Lunkenheimer #2127, Kitz 24, Nibco T111LS.

.3 Ball Valves:

.1 Valves DN 50 (NPS 2) and smaller for threaded ends: Bronze construction with TEF packing and seat, raised lever handle, Jenkins 33, Crane 9302, Toyo 5044A Lunkenheimer 747 F, Kitz 56, Nibco T580, Milwaukee BA100, Newman Hattersley 1969.

.2 Valves DN 50 (NPS 2) and smaller for soldered ends: Crane 9322, Toyo 5049, Kitz 57, Nibco S580, Milwaukee BA150, Newman Hattersley 1979.

.4 Check Valves:

.1 Spring checks at pumps DN 50 (NPS 2) and larger: Moyer and Groves Ltd. I512WM5S, Checkrite 12CBTU, APCO 300 & 600, Nibco W960; Crane Uni-chek

.2 Miscellaneous locations:

.1 Valves DN 50 (NPS 2) and smaller: Jenkins #4092, Crane #37, Toyo #236, Lunkenheimer #2144, Kitz 22, Nibco T433B, Milwaukee 509, Newman Hattersley 47.

.2 Valves DN 65 (NPS 2.5) and larger: Iron body flanged, Jenkins #587, Crane #373, Toyo #435A, Kitz 78, Lunkenheimer #1390; Victaulic 2.5" to 3" style 716, 4" to 8" style 715 and 8" to 12" style 711, Nibco F918B, Milwaukee F2474-M, Newman Hattersley 651.

.5 Drain Down Valves:

.1 DN 20 to 50 (NPS 3/4 to 2): Brass construction ball action valve complete with cap and chain rated 150 psi steam 600 w.o.g. Toyo 5046, Milwaukee BA100H.

.6 Balancing Cocks:

.1 Where gate valves are used for terminal isolation provide DeZurik series 425.

.7 Circuit Balancing Valves (Circuit Setters) (CBV) (FCV)

.1 General:

.1 Y style globe valve, designed to provide precise flow measurement and control, with valved ports for connection to differential pressure meter.

.2 Accuracy:

.1 Readout to be within plus or minus 2% of actual flow at design flow rate.

.2 1.7MPa, 121 degrees C, screwed ends, Teflon disc, screw-in bonnet.

.3 Flow control: at least four (4) full turns of handwheel, with digital handwheel and tamperproof concealed mechanical memory.

.4 Drain connection:

.1 DN 20 (NPS ¾) valved and capped, suitable for hose socket.

.2 Incorporated into valve body or provided as separate item.

.8 Butterfly Valves:

.1 Cast iron body, bronze or stainless steel discs, Buna N "O" rings, bronze bushings straight through or pinned shafts and stainless steel stem.

.2 EPDM rubber resilient seat with temperature range of -40° to 120°C.

.3 Tight shut-off to 1100 kPa (150 PSI) and 120°C (250°F).

.4 Lug type body tapped for 1100 kPa (150 psi) A.N.S.I. drilling may be used in lieu of spool pieces for equipment removal.

.5 Handles and operators: 50mm to 150mm (2" to 6"), use lever with multi-position adjustment. For DN 200 (NPS 8) and over use wheel operated, worm gear actuator.

.6 Acceptable Standard: Keystone F1000/F1020; Crane Quartermaster 44BXB; Jenkins 2232E; Victaulic "Vic 300"; Nibco LD2000-3; Milwaukee M; Newman Hattersley 45-31552; Toyo 918-BES-L; Centerline L200L

.9 Natural Gas, Propane and Fuel Oil valves:

.1 Approved plug type.

.10 Water Service Valves:

.1 DN 50 (NPS 2) and smaller - Mueller to utility standard.

.2 DN 50 (NPS 2) and larger - Mueller, McAvity, to utility standard.

.11 Fire Service:

.1 DN 100 (NPS 4) and larger above ground: iron body, bronze trim O S & Y, flanged 200 psi, U.L.C./FM approved. McAvity 10269, Nibco F6070TS ULC.

.2 DN 100 (NPS 4) and larger buried: non-rising stem, iron body bronze trim, S.S. bolts, integral bonnet, ULC/FM approved, McAvity series 616 or Nibco F609/M609 ULC to suit pipe connections.

.3 Indicator post to be cast iron body ULC/FM approved. McAvity 6225, Nibco NIPIAJ ULC.

2.13 EXPANSION FITTINGS AND LOOPS

.1 Provide manufactured units, or provide pipe loops.

.1 Contractors shall be responsible for determining the appropriate method(s) to allow for pipe expansion and contraction of their piping.

.2 Contractors shall be responsible for sizing their expansion fittings and loops.

.2 Slip Type Expansion Joints:

.1 Application: for axial pipe movement, as indicated.

.2 Repacking: under full line pressure.

.3 Body and packing housings: Class 150, 1MPa carbon steel pipe to ASTM A53/A53M, Grade B. Wall thickness and flanges to match pipe.

.4 Slip or traverse sleeves: carbon steel pipe to ASTM A53/A53M, Grade B.

.5 Anchor base: construction steel, welded to body.

.6 Guides (internal and external): embody into packing housing with concentric alignment of slip or traverse sleeve with packing housing.

.7 Extension limit stop: stainless steel, to prevent over-extension with accessible and removable pins.

.8 Packing rings: six (6) minimum, PTFE or graphite impregnated non-asbestos.

.9 Thermal plastic packing: PTFE or graphite impregnated non-asbestos slug supplied loose.

.10 Lubricating fittings: pet cocks with grease nipple.

.11 Plunger body and plunger:

.1 Plunger body: heavy wall carbon steel welded to body.

.2 Plunger: carbon steel with hex head for use with socket wrench.

.12 Lubricant: to manufacturer's recommendations.

.13 Lubricant gun: complete with hose assembly.

.14 Drip connection: 20 MPa forged steel to ASTM A105/A105M. Include half coupling with drain plug

.3 Bellows Type Expansion Joints:

.1 For axial, lateral or angular movements, as indicated.

.2 Type A: free flexing, factory tested to 1 1/2 times maximum working pressure. Furnish test certificates.

.3 Type B: externally pressurized, factory tested to 1 1/2 times maximum working pressure. Furnish test certificates.

.4 Bellows:

.1 Multiple bellows, hydraulically formed, for specified fluid, pressure and temperature, water treatment and pipeline cleaning procedures.

.5 Reinforcing or control rings:

.1 2 piece nickel iron.

.6 Ends:

.1 Flanges to match pipe.

.7 Liner:

.1 Austenitic stainless steel in direction of flow.

.8 Shroud:

.1 Carbon steel, painted.

.4 Flexible Connection:

.1 Application: to suit motion as required.

.2 Minimum length in accordance with manufacturer's recommendations to suit offset.

.3 Inner hose: bronze or stainless steel, corrugated.

.4 Braided wire mesh bronze or stainless steel outer jacket.

.5 Diameter and type of end connection: as required

.6 Operating conditions:

.1 To match system requirements.

.5 Anchors And Guides:

.1 Anchors:

.1 Provide as indicated, and as required.

.2 Alignment guides:

.1 Provide as indicated by conduit manufacturer.

.2 To accommodate specified thickness of insulation.

.3 Vapour barriers, jackets to remain uninterrupted.

2.14 AIR VENTS (AUTOMATIC)

.1 Provide air vents equal to Maid-O-Mist No. 7 series.

2.15 STRAINERS

.1 Provide blowdown valve(s) on strainers 38mm (1-1/2”) and larger.

.2 Provide where shown on the drawings, strainers equal to Toyo 380 for DN 15 to 50 (NPS 1/2" to 2") and Toyo 381 JA for DN 65 (NPS 2.5) and over, rated at 860 kPa (125 psi).

.3 Strainer baskets: Type 304 stainless steel or Monel, 1.14 mm (0.045") perforations for steam and 3 mm (0.125") perforations for water.

2.16 THERMOMETERS AND PRESSURE GAUGES

.1 General:

.1 Design point to be at mid-point of scale or range.

.2 Provide where shown on the drawings & as required.

.2 Thermometers

.1 Industrial, variable angle type, liquid filled, 125 mm (5”) scale length in 175 mm (7") case: to CAN/CGSB14.4 and ASME B40.200.

.1 Scale: Celsius and Fahrenheit to suit application.

.2 Ranges as required to suit systems.

.3 Thermometer Wells

.1 Equal to: Style 923 Viclets/Style 924 Vic-Wells from Victaulic.

.1 Copper pipe: copper or bronze.

.2 Steel pipe: brass or stainless steel.

.4 Pressure Gauges

.1 112 mm, dial type: to ASME B40.100, Grade 2A, stainless steel or phosphor bronze bourdon tube having 0.5% accuracy full scale unless otherwise specified.

.1 Scale: kPa and psi to suit application.

.2 Range: Indication at middle third of gauge.

.2 Provide:

.1 Snubber for pulsating operation.

.2 Gasketted pressure relief back with solid front.

.3 Bronze stop cock.

2.17 SENSOR WELLS

.1 Divisions 22 & 23 shall include installation of thermowells supplied by Division 25, at locations specified and/or as shown on detail sheets and drawings, or as directed by Consultant.

2.18 FLOW MEASUREMENT VENTURI

.1 Where flow measurement is required for equipment, pumps and coils, the use of Venturi's is needed. Victaulic Style 733 Venturi between 12mm (1/2") and 762mm (30"), or equal, is acceptable.

.2 Piping and Balancing Contractors shall coordinate for exact locations and requirements.

2.19 CONNECTIONS BETWEEN COPPER & STEEL (PIPING); USE OF DIELECTRIC CONNECTIONS/ UNIONS

.1 All connections between copper and carbon steel shall be joined with brass union(s) & brass nipple(s) minimum 152mm (6”) long. Dielectric unions are not acceptable.

.1 General: Compatible with system, to suit pressure rating of system.

.2 DN 50 (NPS 2) and under: isolating unions or bronze valves.

.3 Over DN 50 (NPS 2): Isolating flanges.

2.20 SUPPORTS, BASES, PITS

.1 Supply and erect all special structural work required for installation of tanks, pumps, fans, motors and other apparatus.

.2 Concrete pads, concrete for floating bases, curbs and pits to be supplied by Division 3. Supply all anchor bolts, fasteners and foundation drawings. Unless noted otherwise, all major pieces of equipment such as pumps, compressors, fans, etc. to be mounted on 100mm (4") concrete pad that extends a minimum of 150mm (6”) from edge of equipment.

.3 Mount equipment suspended above floor level but not detailed, on platform bracketted from wall. Where wall thickness is inadequate to permit such brackets, carry supports to either ceiling or floor, or both as required.

2.21 WIRING AND ELECTRIC MOTORS

.1 General:

.1 Permanently wired polyphase motors must comply with the relevant appliance or equipment efficiency act, or CAN/CSA-C390 clause 4.10.

.2 Electrically operated equipment shall bear a C.S.A. approval label.

.2 Wiring:

.1 Electric power wiring (110V and greater) for equipment provided by mechanical trades is specified in Division 26.

.2 Electric control wiring (regardless of voltage) for equipment provided by mechanical trades is specified in Section 25 10 10 – Controls/Instrumentation – General Requirements.

.3 Power and Control wiring (regardless of voltage) of all control panels and devices (temperature, pressure, level, flow, etc.) required for the operation or control of mechanical equipment provided under this division, shall be installed under the scope of work of Section 25 10 10 – Controls/Instrumentation – General Requirements, to the standards established under Division 26 and in accordance with code requirements.

.1 This is with the exception of line voltage control devices which are wired in-line in the power circuit for 120V or 208V single phase cycling such as force flow thermostats, level controls and the like which shall be wired under Division 26 scope of work.

.2 Refer to Section 25 10 10 – Controls/Instrumentation – General Requirements for additional information.

.3 Motors:

.1 All motors shall be high efficiency, in accordance with local Hydro company standards and to ASHRAE 90.1.

.2 Motors controlled by Variable Frequency Drives and intended for inverter duty, shall comply with NEMA MG-1, Part 31.

.3 Motors controlled by Variable Frequency Drives and intended for inverter duty, shall have integral overload/overheat protection.

.4 Generally, all motors 375 watt (1/2 H.P.) and smaller to be 120 volt, single phase, 60 cycle, unless otherwise specified or indicated.

.1 Single phase motors to be permanent split capacitor type.

.5 Generally, all motors larger than 375 watt (1/2 H.P.) to be 575 volt, three (3) phase, 60 cycle, unless otherwise specified or indicated.

.1 EEMAC Class B, squirrel cage induction

.2 Shall be Cema Design Normal torque, low starting current with Class B insulation for operation in maximum ambient of 40°C (105°F).

.3 Bearings to be rated for minimum B-10 life of 20,000 hours with a V-belt drive.

.6 General:

.1 Motors shall meet NEMA standard for maximum sound level ratings under full load

.2 Speed as indicated, continuous duty, built-in overload protection, resilient mount,

.3 1.15 service factor.

.4 Motors shall be drip proof unless otherwise specified.

.7 Motors shall meet or exceed the following efficiency and power factor criteria for 1800 RPM motors.

EFFICIENCY TIMES POWER FACTOR (Note: F.L. means Full Load)

H.P. (Kw)	F.L.	0.75 F.L.	0.50 F.L.
1.0 (0.75)	0.57	0.49	0.36
1.5 (1.12)	0.61	0.54	0.41
2.0 (1.50)	0.65	0.58	0.45

3.0 (2.25)	0.60	0.55	0.43
5.0 (3.75)	0.69	0.64	0.53
7.5 (5.62)	0.64	0.58	0.47
10 (7.50)	0.69	0.65	0.54
15 (11.25)	0.71	0.69	0.61
20 (15.00)	0.73	0.70	0.61
25 (18.75)	0.72	0.68	0.62
50 (37.50)	0.79	0.77	0.70

.4 Temporary Motors

.1 If delivery of specified motor will delay completion or commissioning work, install motor approved by Consultant for temporary use. Work will only be accepted when specified motor is installed.

.5 Belt Drives

.1 Fit reinforced belts in sheave matched to drive. Multiple belts to be matched sets.

.2 Fit reinforced belts in sheave grooves matched to drive.

.3 Obtain approval to use cast iron or steel sheaves secured to shafts with removable keys.

.4 For 1/3 hp (.25 kW) to 10 hp (7.46 kW) motors, use standard adjustable pitch drive sheaves, having plus/minus 10% range. Use mid-position of range for specified rpm.

.5 For over 10 hp (7.46 kW) motors, use sheave with split tapered bushing and keyway having fixed pitch unless specifically required for item concerned. Specifically refer to Section 23 80 10 for fan requirements relating to V-Belt, vari-pitch drives. Provide sheave of correct size as approved by Consultant to suit balancing.

.6 Correct size of sheave determined during commissioning.

.7 Use minimum drive rating of two times nameplate rating on motor. Keep overhung loads under manufacturer's requirements on all prime mover shafts.

.8 With belt drive, provide motor slide rail adjustment plates, allowing for 150mm (6”) minimum centre line adjustment.

.6 Drive Guards

.1 Provide guards for unprotected drives.

.2 Guards for belt drives;

.1 Expanded metal screen welded to steel frame.

.2 Minimum 1.2 mm thick sheet metal tops and bottoms.

.3 38 mm (1.5") dia holes on both shaft centres for insertion of tachometer.

.4 Removable for servicing.

.3 Provide means to permit lubrication and use of test instruments with guards in place.

.4 Belt guards to be positioned to allow movement of motors for adjusting belt tension.

.5 Guard for flexible coupling:

.1 "U" shaped, minimum 1.6 mm thick galvanized mild steel.

.2 Securely fastened in place.

.3 Removable for servicing.

.6 Unprotected fan inlets or outlets:

.1 Wire or expanded metal screen, galvanized, 19 mm (3/4") mesh.

.2 Net free area of guard: not less than 80% of fan openings.

.3 Securely fastened in place.

.4 Removable for servicing.

.7 Changing Of Equipment Drives

.1 If required, as determined from the review of the preliminary balancing report, changes to the equipment drives shall be carried out as follows:

.1 The Balancing Contractor shall be responsible for calculating the new drive requirements.

.2 For new equipment, the Contractor who supplied the equipment shall be responsible for obtaining and installing the new drive components.

.2 For existing equipment, the Balancing Contractor shall be responsible for obtaining and installing the new drive components.

.3 The contract shall include for one drive change for each New Unit with adjustable pulley drive.

.1 Additional changes shall be provided as specified in 'Phasing'.

PART 3 Installation And Execution

3.1 INSTALLATION - GENERAL

.1 Conform to the requirements of Section 21 05 01 – Mechanical General Provisions

.2 Install using Manufacturers Recommended Instructions

.3 Include in the work all requirements of manufacturers shown on the shop drawings.

.4 Coordinate and Verify spaces in which work is to be installed.

.1 Confirm on the site the exact location of outlets and fixtures.

.2 Confirm location of outlets for equipment supplied by other trades.

.5 Replace all work unsatisfactory to the Engineer without extra cost.

.6 Ductwork, Piping, Equipment, Conduit and Accessories:

.1 The piping, ductwork and equipment shown on the drawings is diagrammatic for clearness in indicating the general run and connections, and may or may not be, in all instances, shown in its true position. This does not relieve this Sub-contractor from the responsibility for the proper erection of systems of piping in every aspect suitable for the work intended and as described in the specifications.

.2 Install items concealed in chases, behind furrings or above ceilings wherever possible.

.1 Install exposed systems neatly, and group to present a neat appearance.

.2 Install exposed piping, ductwork, equipment, conduit, rectangular cleanouts and similar items parallel or perpendicular to building lines.

.3 Install concealed items close to building structure to keep furring space to a minimum.

.3 Install all ceiling mounted components (Diffusers, Grilles, Sprinklers) in accordance with reflected ceiling drawings, accepted by the Architect.

.4 Install items in a workmanlike manner to present a neat appearance and to function properly to the acceptance of the Engineer.

.5 Group items wherever possible and as indicated.

.1 Install groups of items parallel to each other on trapeze hangers, spaced to permit service access, application of insulation, and identification.

.6 Install items straight, parallel and perpendicular to building planes, and close to walls and ceilings, with specified pitch. Use manufactured fittings for direction changes.

.7 All openings in pipes, ducts and fittings shall be kept plugged or capped during installation, to prevent the entry of dirt and debris and other foreign material.

.7 Clearances:

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

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

.3 Install all equipment and apparatus requiring wiring, maintenance, adjustment or eventual replacement with due allowance therefore.

.4 Leave space clear and install all work to accommodate future materials and/or equipment as indicated and to accommodate equipment and/or materials supplied by other trades.

.5 Install pipe/duct runs etc., to maintain maximum headroom and clearances, and to conserve space in shaft and ceiling spaces.

.6 Provide clearance for installation of insulation, and access for maintenance of equipment, valves and fittings.

.8 Protection

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

.2 Cover openings in equipment, and cover equipment where damage may occur to the finish from weather or construction.

.3 Cover temporary openings in ducts and pipes with polyethylene sheets, until final connection is made.

.4 During welding or soldering procedures, provide a fire retardant cloth, mat or blanket to protect the structure, and adequate fire protection equipment at all locations where work is being done. Close off shaft or confined areas with a fire retardant mat or cloth to prevent sparks or pieces of hot metal from falling down the shaft or area way.

.9 Rigging Of Equipment

.1 Provide all rigging, hoisting and handling of equipment as necessary in order to place the equipment in the designated area in the building.

.2 Direct this work by qualified people normally engaged in rigging, hoisting and handling of equipment.

.10 Flashing

.1 Flash all mechanical parts passing through or built into an outside wall, or a waterproof floor.

.2 Provide copper flashing for sleeves passing through exterior walls or waterproof floors.

.3 Provide counterflashing on stacks, ducts and pipes passing through roofs to fit over curb flashing.

.11 Painting

.1 Provide all exposed ferrous metal work on equipment with at least one factory prime coat, or paint one prime coat on the job. Clean up or wire brush all equipment, etc., before painting. Finish painting will be by other Divisions unless otherwise noted.

.2 This Sub-Contractor is not required to prime coat or paint ductwork or piping, except to paint gas piping as per code requirements.

.3 For factory applied finishes, including prime coats, repaint or refinish surfaces damaged during shipment, erection or construction work.

3.2 EXCAVATION AND BACKFILL

.1 Do all excavation, bedding, backfill and related work required for mechanical work in accordance with the requirements of the General Contractor's specifications, except as varied by this article.

.2 Grade the bottom of the pipe trench excavation as required.

.3 In firm undisturbed soil, lay pipes directly on the soil and shape soil to fit the lower 1/3 segment of all pipes and pipe bells. Ensure even bearing along the barrels. Backfill excavation and compact to the following standard Proctor densities:

.1 Sodded area, excavated material to 50% P.D.
.2 Under paving, sand to 95% P.D.
.3 Under Floor slabs, sand to 100% P.D.

.4 In rock and shale excavate to 150 mm (6") below and a minimum of 200 mm (8") to either side of the pipe. Fill back with a bedding of 10 mm (3/8") crushed stone or granular 'A' gravel.

.5 Prepare new bedding under the pipe in unstable soil, in fill, and in all cases where pipe bedding has been removed in earlier excavation, particularly near perimeter walls of buildings, at manholes, catch basins and sumps. Compact to maximum possible density and support the pipe by 200 mm (8") thick concrete cradle, spanning full length between firm supports.

.1 Install reinforcing steel in cradle or construct piers every 2400 mm (8 ft.) or closer, down to solid load bearing strata. Provide a minimum of one pier per length of pipe. Use the same method where pipes cross.

.6 Where excavation is necessary in proximity to, and below the level of, any footing, provide a bed of 14,000 kPa (2000 psi) concrete to the level of the highest adjacent footing. Proximity is determined by the angle of response as established by the Engineer.

.7 Provide support over at least the bottom one third segment of the pipe in all bedding methods.

.8 Do not open trench ahead of pipe laying and bedding more than weather will permit.

.9 Break up rocks and boulders and remove these by drilling and wedging. Do not use blasting unless specifically approved by the Engineer. Do not use for backfill.

.10 Do all backfilling in 150 mm (6") layers with clean selected materials acceptable to the Engineer.

.11 During freezing weather or where frozen material is excavated, backfill with dry sand.

.12 Provide concrete thrust blocks at each change of direction for underground water piping, as per drawing details.

.13 Dispose of surplus excavated material as directed by the General Contractor.

3.1 DIRT ACCUMULATION UNDER CONTROL VALVES

.1 If dirt accumulates under the seats of automatic control valves, this Sub-Contractor is responsible, during the first year's operation, to remove the collected materials under the valve seats and if the seat is damaged, replace same, at no additional cost to the City of Winnipeg.

3.2 CONCRETE

.1 Concrete work required for mechanical work and shown on architectural or structural drawings: Provided by General Contractor.

.2 Concrete work required for mechanical work and not shown on Architectural of Structural drawings - to be provided by this Division.

.3 Provide in good time, all inserts, sump frames, anchors etc., for mechanical services, required to be built into the forming.

.4 Provide concrete thrust blocks at each change of direction for underground water piping, as per drawing details.

3.3 METALS

.1 Steel construction required solely for the work of mechanical trades and not shown on architectural or structural drawings: Provided by this Sub-contractor to the acceptance of the Engineer.

3.3 PREPARATION FOR FIRESTOPPING

.1 Material and installation within annular space between pipes, ducts, insulation and adjacent fire separation as per section 07 84 00 - Fire Stopping.

.2 Uninsulated unheated pipes not subject to movement: No special preparation.

.3 Uninsulated heated pipes subject to movement: Wrap with non-combustible smooth material to permit pipe movement without damaging firestopping material or installation.

.4 Insulated pipes and ducts: Ensure integrity of insulation and vapour barriers.

3.4 IDENTIFICATION

.1 General

.1 Install using manufacturer's recommended instructions.

.2 Provide identification only after painting has been completed.

.3 The wording shall be the same as the Drawings and Specifications. Prior to ordering, the wording of all equipment tags shall be submitted to the Engineer for review.

.2 Equipment, Panels and Controls:

.1 Identify all equipment, panels, automatic control devices, etc., with lamacoid name plates.

.2 Mechanically affix the tags to the equipment using pop rivets or sheet metal screws.

.3 Locations:

.1 In conspicuous location to facilitate easy reading and identification from operating floor.

.4 Standoffs:

.1 Provide for nameplates on hot and/or insulated surfaces.

.5 Protection:

.1 Do not paint, insulate or cover.

.3 Valves:

.1 Provide all major valves with brass or Lamacoid numbered tags,

.2 Prepare an approved list detailing the valve location, tag numbers and purpose it serves.

.3 Mount one (1) copy of the valve list in a glazed frame where advised by the City of Winnipeg and provide one additional copy in each O & M manual.

.4 The numbering system shall include the service designation (i.e.: DHW, DCW, HWS, HWR, etc.). The service designations shall be the same as the Drawings.

.5 Number valves in each system consecutively.

.4 Piping:

.1 Identify all piping as to service and direction of flow:

.2 The service designations (i.e.: DHW, DCW, HWS, HWR, etc.) shall be the same as the Drawings and Specifications.

.5 Ductwork:

.1 Identify all ductwork as to service and direction of flow.

.2 The service designations (i.e.: S/A, E/A, O/A, etc.) shall be the same as the Drawings and Specifications.

.1 Where there is more than One Fan System, or more than One Controlled Zone per System, include the Fan or Zone Designation.

.6 Location Of Identification On Piping And Ductwork Systems:

.1 On long straight runs in open areas in boiler rooms, equipment rooms, galleries, tunnels: at not more than 9 m (30') intervals and more frequently if required to ensure that at least one is visible from any one viewpoint in operating areas and walking aisles.

.2 Adjacent to each change in direction.

.3 At least once in each small room through which piping or ductwork passes.

.4 On both sides of visual obstruction or where run is difficult to follow.

.5 On both sides of separations such as walls, floors, partitions.

.6 Behind each access door

.7 Where system is installed in pipe chases, ceiling spaces, galleries, confined spaces, at entry and exit points, and at access openings.

.8 At beginning and end points of each run and at each piece of equipment in run.

.9 At point immediately upstream of major manually operated or automatically controlled valves, and dampers. Where this is not possible, place identification as close as possible, preferably on upstream side.

.10 Identification easily and accurately readable from usual operating areas and from access points.

.1 Position of identification approximately at right angles to most convenient line of sight, considering operating positions, lighting conditions, risk of physical damage or injury and reduced visibility over time due to dust and dirt.

.7 Special Signage

.1 Confirm wording of signage with City of Winnipeg prior to ordering.

.2 Supply Signage to City of Winnipeg for City of Winnipeg's installation.

3.5 ACCESS PANELS AND DOORS

.1 Install all concealed Mechanical equipment requiring adjustment or maintenance in locations easily accessible through access panels or doors. Install systems and components to result in a minimum number of access panels.

.2 Provide access doors in walls and ductwork at all fire dampers, motorized dampers, duct mounted coils, smoke detectors, fan inlets and outlets, etc. Indicate access panels on "Record" drawings.

.3 Access doors shall be supplied by the trade requiring the door, and shall be installed by the appropriate architectural or finishing trade. All pertinent information required for the installation of the access door shall be provided by the supplying trade to the installing trade.

.4 Prepare detail drawings showing location and type of all access doors in coordination with other trades before proceeding with installation and hand these to the Contractor for approval.

.5 Size access doors to provide adequate access and commensurate with the type of structure and architectural finish.

.6 Ensure proper rating of doors in fire separations.

3.4 H.V.A.C. BALANCE & TESTING

.1 Refer to Section 23 05 93 - Testing & Balancing.

.2 Award contract to Section 23 05 93 immediately upon award so Sub Contractor can schedule work and comply with completion date. Provide Section Sub Contractor with full set of drawings and specifications complete with addenda, copies of all change notices, change orders and site meeting minutes.

.3 Air balancing work shall not begin until system has been completed and in full working order. Divisions 23 and 25 shall put all heating, ventilating, and air-conditioning systems

and equipment into full operation, as season would demand, and shall continue operation of same during each working day of testing and balancing.

3.5 BUILDING ENVELOPE INTEGRITY

.1 Avoid penetrating through building envelope air barrier. Where penetrations are necessary, maintain integrity of air barrier using suitable materials.

.2 For additional requirements, see Section 07 26 00 – Vapour Retarders & 07 27 00.02 – Air Barriers-Performance.

.3 Coordinate with Architect for repair of building envelope at all locations where envelope has been penetrated as result of removal and/or relocation of existing equipment, piping, ductwork, conduit, cable, wiring, etc.

3.6 INSTALLATION OF MECHANICAL SERVICES

.1 Except for final runouts on sanitary waste piping to discharge from fixtures and floor drains, all mechanical services (ductwork, piping, tubing, etc.) shall be run on the square, parallel with building structure. Sanitary waste mains shall also be run in this manner, unless approved otherwise by Consultant.

3.7 ACCESSABILITY OF EQUIPMENT

.1 Safely and efficient access shall be provided to system equipment for replacement/repair.

.1 All equipment must be accessible,

.1 Ceiling mounted equipment shall only be considered accessible if a tradesman can place both hands on the component which requires servicing (i.e. fan motor, belt, pulley, bearings, fire damper linkage, valve/control valve, strainer or any other equipment component which requires periodic maintenance). The component must be in clear view, and access must be gained from an 8 foot step ladder.

.2 Access panels provided in drywall shall be sized and placed in such a manner that a manner that a tradesman can place two hands on the component as stated above. Equipment located above acoustic tile ceilings shall be positioned in such a manner that equipment and components can be accessed through a full tile which does not contain any building system services; notify the Consultant if unable to do so.

.2 Conduit, pipe, ducting and support members, or any other obstructions to accessibility shall be relocated at the Contractor's expense, by the contractor's forces.

3.8 COORDINATION DRAWINGS

.1 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.

.2 Prepare drawings in conjunction with other trades

.3 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.

.4 Submit drawings for Consultant's review.

.5 Drawings shall be to a scale sufficient to show the necessary details. Submit to the Consultant and City of Winnipeg for review. Distribute drawings after review, to trades affected.

.6 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.

.7 Base information used to prepare drawings on certified shop drawings.

.8 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 work and which are not shown on Architectural or Structural Drawings.

3.6 DUCT ACCESS PANELS AND DOORS

.1 Where ductwork has no internal acoustic insulation, new openings required for duct cleaning may be made by neatly cutting the sheet metal. The opening shall be closed by installing a manufactured duct access door or fabricating a sheet metal closure.

.1 A fabricated sheet metal closure shall be:

.1 of at least the same gauge as the duct

.2 at least 3/4" larger than the opening on all sides

.3 attached with sheet metal screws

.4 sealed with duct sealant

.2 Where ductwork has internal acoustic insulation, new openings required for duct cleaning shall be manufactured duct access doors with double panel construction and 1" insulating filler.

3.7 WIRING AND MOTORS

.1 Fasten motors securely in place.

.2 Make motors removable for servicing, easily returned into, and positively in position.

3.8 HANGERS AND SUPPORTS

.1 General:

.1 Install hanger so that rod is vertical under operating conditions.

.2 Adjust hangers to equalize load.

.3 Support from structural members. Where structural bearing does not exist or inserts are not in suitable locations, provide supplementary structural steel members.

.4 Hanger rods may be attached to beam or joist clamps, brackets, or concrete inserts. Explosive actuated tools are not permitted. Do not weld to structural steel unless Engineer's approval is given.

.5 Provide supplementary structural steelwork where structural bearings do not exist or where concrete inserts are not in correct locations.

.6 Use approved constant support type hangers where:

.1 vertical movement of pipework is 13 mm (1.2”) or more,

.2 transfer of load to adjacent hangers or connected equipment is not permitted.

.7 Use variable support spring hangers where:

.1 transfer of load to adjacent piping or to connected equipment is not critical.

.2 variation in supporting effect does not exceed 25 % of total load.

.2 Vibration Control Devices:

.1 Install on piping systems at pumps, boilers, chillers, cooling towers, and as indicated.

.3 Clamps on riser piping:

.1 Support independent of connected horizontal pipework using riser clamps and riser clamp lugs welded to riser.

.2 Bolt-tightening torques to industry standards.

.3 Steel pipes: install below coupling or shear lugs welded to pipe.

.4 Cast iron pipes: install below joint.

.4 Clevis plates:

.1 Attach to concrete with concrete inserts, one at each corner.

.1 Hanger Spacing

.1 Plumbing piping: to Plumbing Code and authority having jurisdiction.

.2 Fire protection: to applicable fire code.

.3 Gas and fuel oil piping: up to DN 15 (NPS ½): every 1.8 m.

.4 Copper piping: up to DN 15 (NPS ½): every 1.5 m.

.5 Within 300 mm of each elbow.

.6 The following tables will determine support points for all piping on this installation:

STEEL PIPE: SUPPORTS	NOMINAL SIZE	DISTANCE BETWEEN
	Up to DN 32 (NPS 1.25)	2,400 mm (8 ft.)
	DN 40 – 65 (NPS 1.5 - 2.5)	3,000 mm (10 ft.)
	DN 80 (NPS 3) and over	3,600 mm (12 ft.)

COPPER PIPE: SUPPORTS	NOMINAL SIZE	DISTANCE BETWEEN
	Up to DN 20 (NPS ¾)	1,800 mm (6 ft.)
	DN 20 – 25 (NPS 3/4 – 1)	2,400 mm (8 ft.)
	DN 32 – 50 (NPS 1.25 – 2)	3,000 mm (10 ft.)
	DN 65 (NPS 2.5) and over	3,600 mm (12 ft.)

.5 Horizontal Movement

.1 Angularity of rod hanger resulting from horizontal movement of pipework from cold to hot position not to exceed 4 degrees from vertical.

.2 Where horizontal pipe movement is less than 13 mm, offset pipe hanger and support so that rod hanger is vertical in the hot position.

.6 Final Adjustment

.1 Adjust hangers and supports:

.1 Ensure that rod is vertical under operating conditions.

.2 Equalize loads.

.2 Adjustable clevis:

.1 Tighten hanger load nut securely to ensure proper hanger performance.

.2 Tighten upper nut after adjustment.

.3 C-clamps:

.1 Follow manufacturer's recommended written instructions and torque values when tightening C-clamps to bottom flange of beam.

.4 Beam clamps:

.1 Hammer jaw firmly against underside of beam.

3.9 INSERTS, SLEEVES AND ESCUTCHEONS

.1 General:

.1 Supply and locate all inserts, holes, anchor bolts and sleeves in time when walls, floors and roof are erected.

.2 Inserts

.1 Place inserts only in portion of the main structure and not in any finishing material.

.2 Do not use explosive powder activated tools except with the written permission of the Engineer.

.3 Sleeves

.1 Install where pipes and ducts pass through masonry, concrete structures, fire rated assemblies, and elsewhere as indicated.

.2 Walls: Terminate flush with finished surface.

.3 Floors: extend 100 mm (4") above the floor, and cut flush with the underside.

.4 Before installation, paint exposed exterior surfaces with heavy application of zinc-rich paint to CAN/CGSB-1.181.

.5 Insulation:

.1 For interior, non-fire-rated walls and floors: Insulation shall be continuous through sleeve.

.2 For Exterior Walls and Fire-rated walls and floors: Stop insulation flush with wall surfaces.

.6 Sealing:

.1 Ensure no contact between pipe/tube and sleeve.

.2 Foundation walls and below grade floors:

.1 Fire retardant, waterproof non-hardening mastic.

- or -

.2 co-operate with the Waterproofing trade and apply an approved caulking compound over ram-packed mineral wool on both sides. Over this, on both sides, apply a layer of glassfab tape imbedded in two coats of an approved mastic compound.

- or -

.3 Provide a 'Link-Seal' gasket.

.3 Through Rated Shaft and Equipment Room walls and floors:

.1 seal space between duct/pipe and sleeve with ram packed mineral wool and apply an approved caulking compound over the mineral wool on both sides.

.2 Maintain fire rating integrity.

.1 Provide space for firestopping.

.2 Provide intumescent 'donut(s)' for piping.

.4 Through floors of Kitchens and Janitor's closets:

.1 seal space between duct/pipe and sleeve with ram packed mineral wool and apply an approved caulking compound over the mineral wool on both sides.

.2 seal as described above for Equipment Room Walls.

.5 Interior walls and floors not noted above:

.1 seal space between duct/pipe and sleeve with ram packed mineral wool.

.6 Sleeves installed for future use: Fill with lime plaster or other easily removable filler.

.7 Through all walls: Stop insulation flush with all wall surfaces and seal space between duct or pipe and sleeve with ram packed mineral wool.

.4 Escutcheons

.1 Install on pipes and ducts passing through walls, partitions, floors, and ceilings in finished areas.

.2 Cover sleeves and openings around exposed piping in all finished areas with split chrome plated escutcheons.

.3 Cover exposed duct sleeves in finished areas with an 18 gauge galvanized steel collar fixed to wall or floor.

3.10 PIPE INSTALLATION

.1 Install brass and copper pipe tubing free from surface damage. Replace damaged pipe or tubing.

.2 Lay copper tubing so that it is not in contact with dissimilar metal and will not be kinked or collapsed.

.3 Where steel piping is required to be buried, apply two coats of flint-guard 410-02 (or equal) bituminous paint to all buried surfaces after assembly and testing.

.4 Install piping to avoid any interference with the installation of equipment, other piping, ducts etc. Where it is necessary to offset piping to avoid obstructions, use 45 degree rather than 90 degree elbows.

.5 Provide long turn pipe fittings not less than pipe wall thickness. Provide line size tees, and where branch lines are more than two sizes smaller than the main, weldolets may be used.

.6 Install systems so that they can be thoroughly drained and all air eliminated. Install eccentric reducers in horizontal piping to permit drainage and eliminate air pockets.

.7 Provide hose end valves at all low points for complete system drainage, whether shown on the drawings or not.

.8 Slope all condensate drip drains, and provide suitable cleanouts on every other change in direction.

.9 Ream the ends of pipes and tubes before installation. Clean the ends of pipes/tubing, and the recesses of fittings to be brazed or soldered. Assemble joints without binding.

.10 Make all threaded pipe joints using a thread paste or teflon tape applied to the male thread. Use only non-toxic lubricants which are non-injurious to the gasket material, and suitable for the service for which the pipe is to be used. Use of hemp or similar materials on threaded joints will not be permitted.

.11 Place all valves and specialties to permit easy operation and access.

.12 Install gauges and thermostats to permit easy observance.

.13 Where pipe sizes differ from connection sizes of equipment, install reducing fittings close to equipment. Reducing bushings are not permitted.

.14 Regulate and adjust all packing glands, regulating valves and relief valves on completion of the work.

.15 Use eccentric reducers at pipe size changes to ensure positive drainage and venting.

.16 Assemble piping using fittings manufactured to ANSI standards.

.17 Install Cold piping below and away from hot piping so as to maintain temperature of cold water as low as possible.

.18 Buried tubing:

.1 Lay in well compacted washed sand in accordance with AWWA Class B bedding.

.2 Bend tubing without crimping or constriction. Minimize use of fittings.

.19 Screwed fittings jointed with Teflon tape.

.20 Saddle type branch fittings may be used on mains if branch line is no larger than half the size of main.

.1 Hole saw (or drill) and ream main to maintain full inside diameter of branch line prior to welding saddle.

.21 Slope piping, except where indicated, in direction of flow for positive drainage and venting.

.22 Install, except where indicated, to permit separate thermal insulation of each pipe.

.23 Ream pipes, remove scale and other foreign material before assembly.

.24 Provide for thermal expansion as required.

.25 Low Point Drain Valves:

.1 Install piping with grade in direction of flow except as indicated.

.2 Provide hose end valves at all low points for complete system drainage, whether shown on the drawings or not.

.3 Pipe each drain valve discharge separately to above floor drain. Discharge to be visible.

.4 Drain valves: DN 20 (NPS ¾) gate or globe valves unless indicated otherwise, with hose end male thread, cap and chain.

.26 Provide Dielectric Couplings where dissimilar metals are joined.

.27 Gas Piping

.1 Install drip points:

.1 At low points in piping system.

.2 At connections to equipment.

3.9 MISCELLANEOUS DRAINS

.1 Pipe all discharge from relief valves to the floor, in the vicinity of a floor drain.

.2 Pipe all discharge from drain pans and drain valves to the nearest floor drain or suitable receptacle.

.3 Provide DN 20 (NPS ¾) ball valves with hose end outlets at strainers, all low points, at pumps, coils and at each piece of equipment.

3.11 EQUIPMENT INSTALLATION

.1 General:

.1 Connect to fixtures and equipment in accordance with manufacturer's written instructions unless otherwise indicated.

.2 Allow for isolation and removal of equipment without interrupting operation of other equipment or systems.

.3 Install piping connections to pumps and all other equipment without strain at the pipe connection to this equipment. Where requested by the Engineer, remove the bolts in flanged connections, or disconnect the piping after the installation is complete, to demonstrate that the piping has been so connected.

.4 Provide double swing pipe joints.

.5 Clean finned tubes and comb straight.

.6 Provide supplementary suspension steel as required.

.7 Check final location with City of Winnipeg if different from that indicated prior to installation.

.1 Should deviations beyond allowable clearances arise, request and follow Engineer's Consultant's directive.

.2 Equipment Connections:

.1 Install isolation valve on inlet and outlet, balancing valve on outlet, and control valve (when specified) on inlet.

.2 Install drain valve at low point and manual air vent at high point. Install between equipment and isolation valves.

.3 Use valves and either unions or flanges for isolation and ease of maintenance and assembly.

.1 All fittings DN 50 (NPS 2) and below connecting to equipment: use unions, extra heavy duty pattern, having ground joints, brass seats and diagonal screw.

.2 Connections to equipment DN 65 (NPS 2.5) and above: Flanged, standard weight provided with ring gaskets.

.4 Install the shut-off valves and flanges/unions, in locations so as to permit the removal of the equipment without disturbing the piping systems.

3.12 VALVES

.1 General:

.1 Install in accessible locations.

.2 Valves accessible for maintenance without removing adjacent piping.

.3 Locations:

.1 Install gate, ball or butterfly valves at branch take-offs, and to isolate each piece of equipment, and as indicated.

.1 Install valves with unions at each piece of equipment arranged to allow servicing, maintenance, and equipment removal.

.2 Isolate equipment, fixtures and branches with valves.

.2 Install globe valves for balancing and in by-pass around control valves as indicated.

.1 Balance recirculation system using lockshield globe valves. Mark settings and record on as-built drawings on completion.

.3 Install silent check valves on discharge of pumps and in vertical pipes with downward flow and as indicated.

.4 Install swing check valves in horizontal lines on discharge of pumps and as indicated.

.5 Install plug cocks or ball valves for heating water service.

.4 Do not use gaskets between pipe flanges and valves unless instructed otherwise by valve manufacturer.

.5 Handle valve with care so as to prevent damage to disc and seat faces.

.6 Ensure that valves are centered between bolts before bolts are tightened and then opened and closed to ensure unobstructed disc movement. If interference occurs due, for example to pipe wall thickness, taper bore adjacent piping to remove interference.

.7 Install valves with stems upright or above horizontal unless otherwise approved by Engineer.

.8 Valves in horizontal pipe lines should be installed with stem in horizontal position to minimize liner and seal wear.

.9 Install rising stem valves in upright position with stem above horizontal.

.10 Install chain operators on valves DN 65 (NPS 2.5) and over where installed more than 2400 mm above floor in Mechanical Equipment Rooms.

.11 Preparation

.1 Inspect adjacent pipeline, remove rust, scale, welding slag, other foreign material.

.2 Ensure that valve seats and pipe flange faces are free of dirt or surface irregularities which may disrupt flange seating and cause external leakage.

.3 Verify suitability of valve for application by inspection of identification tag.

.4 Inspect valve disc seating surfaces and waterway and eliminate dirt or foreign material.

.5 Remove interior parts before soldering.

.2 Butterfly Valves

.1 Install butterfly valves with disc in almost closed position.

.2 Install butterfly valves between weld neck flanges to ensure full compression of liner.

.3 Lubricated Plug Valves

.1 Valve Operation:

.1 Determine the type of sealing compound for particular application.

.2 Open and close valve at least 3 times to ensure distribution of sealing compound evenly and to ensure tight shut-off.

.3 When operating valve, ease valve off body to ensure that plug is free to float.

.4 Determine frequency of re-lubrication during commissioning of remainder of system.

3.13 INSTALLATION - VALVE ACTUATOR

.1 Mount actuator on to valve prior to installation.

.2 Cycle valve operation from fully closed to fully open then back to fully closed.

.3 At same time, check travel stop settings for proper disc alignment.

3.14 CIRCUIT BALANCING VALVES

.1 Install flow balancing valves where indicated.

.2 Remove handwheel after installation and when TAB is complete.

3.15 EXPANSION FITTINGS AND LOOPS

.1 Provide expansion joints or loops as required, whether shown on the drawings or not.

.2 Install expansion joints with cold setting. Make record of cold settings.

.3 Install pipe anchors and guides where shown and where required. Anchors to withstand 150 % of axial thrust.

3.16 AIR VENTS

.1 Provide air vents on closed-loop water piping at all high points in the system and at each piece of equipment. Provide shut off cocks to automatic vents.

.2 Provide automatic air vents on piping mains except where a possibility from water damage would occur, in which case, use manual vents.

.3 Provide manual air vents at each piece of equipment.

.4 Install isolating valve at each automatic air valve.

.5 Install drain piping to approved location and terminate where discharge is visible.

3.17 THERMOMETERS AND PRESSURE GAUGES

.1 General:

.1 Install so they can be easily read from floor or platform. If this cannot be accomplished, install remote reading units.

.2 Install between equipment and first fitting or valve.

.2 Thermometers

.1 Install in wells on piping. Provide heat conductive material inside well.

.2 Install in locations as shown on the drawings and on inlet and outlet of:

.1 Heat exchangers.

.2 Water heating and cooling coils.

.3 Water boilers.

.4 DHW tanks.

.3 Use extensions where thermometers are installed through insulation.

.4 Commissioning

.1 Confirm thermometer readings.

.3 Pressure Gauges

.1 Install in locations as shown on drawings and in the following locations:

.1 Before & after strainers.

.2 Suction and discharge of pumps.

.3 Upstream and downstream of PRV's.

.4 Inlet and outlet of coils.

.5 Inlet and outlet of liquid side of heat exchangers.

.6 Inlet & Outlet of boilers.

.2 Install gauge cocks for balancing purposes, and as indicated.

.3 Use extensions where pressure gauges are installed through insulation.

.4 Commissioning

.1 Confirm pressure gauge readings.

.2 Leave snubber valve in final operating position (closed).

3.18 CONTROL COMPONENTS

.1 Mount all pipe line devices supplied by the control sub-contractor such as flow switches, valves, separable wells for temperature controllers and sensors.

.2 Install control devices to guarantee proper sensing. Shield elements from direct radiation and avoid placing them behind obstructions.

3.19 PRE-START-UP INSPECTIONS

.1 Systems to be complete, prior to testing, flushing/cleaning, and start-up.

.2 Verify that systems can be completely drained.

.3 Ensure that pressure booster systems are operating properly.

.4 Ensure that air chambers, expansion compensators are installed properly.

.5 Check vents from regulators, control valves, terminate outside building in approved location, protected against blockage, damage.

.6 Check gas trains, entire installation is approved by authority having jurisdiction.

3.10 PRESSURE PIPING QUALITY ASSURANCE MANUAL AND DOCUMENTATION

.1 Contractors working on pressure piping systems must be registered with the Office of the Fire Commissioner Inspection and Technical Services for work on Pressure Piping Systems and upon award of contract present a copy of their Quality Control Manual and Procedures for review by the Plumbing Shop Manager.

.2 The Mechanical Contractor shall provide one (1) copy of the Contractor's Certificate of Authorization issued by the Office of the Fire Commissioner Inspection and Technical Services, Mechanical & Engineering Branch (MLMEB). Include one (1) copy in O&M Manuals.

.3 Provide a complete copy of the Quality Assurance Manual registered with and approved by the MLMEB. Include one (1) copy in O&M Manuals.

.4 Provide all record information that is specified in the Quality Assurance Manual on pressure vessel and pressure piping systems under GSA-B51. Include one (1) copy in O&M Manuals.

.5 Information shall include, but is not limited to:

.1 Pipe and fitting mill certificates, metallurgy and heat numbers for traceability.
.2 Valve and pressure vessel ORN numbers.
.3 Fitting registrations where required.
.4 Welding procedures, records and inspection reports.
.5 MLMEB inspection reports.
.6 Quality control inspection reports.
.7 Hydrostatic test reports on each system subject to GSA – B51.
.8 Material acquisition data sheets.

3.20 PIPING SYSTEM TESTS

.1 After pre-start inspection, and prior to flushing and cleaning, systems shall be pressure tested.

.1 Advise Engineer prior to performance of pressure tests.

.2 Conduct tests in presence of Engineer.

.2 Do not insulate or conceal piping systems until completed, perfected, and proven tight.

.1 Pressure test buried systems before backfilling.

.2 Insulate or conceal work only after approval and certification of tests by Engineer.

.3 Should leaks develop in any part of the piping system, remove and replace defective sections, fittings, etc.

.1 Pay costs for repairs or replacement, retesting, and making good. Engineer to determine whether repair or replacement is appropriate.

.4 Prior to tests, isolate equipment and other parts which are not designed to withstand test pressure or media.

.5 Test piping systems and prove tight.

.1 Test piping system in sections as required by the progress of this and other contractors work and provide all required isolating valves.

.2 Test all drain and vent piping pneumatically to a pressure of 14 kPa (2 psi) and prove tight for a period of 1 hour.

.3 Test all domestic water piping hydraulically to a pressure of 518 kPa (75 psi) and prove tight for a period of 4 hours.

.4 Test all reverse osmosis water piping hydraulically to a pressure of 518 kPa (75 psi) and prove tight for a period of 4 hours.

.5 Test all chilled water, heating water, glycol, steam, and steam condensate piping hydraulically to a pressure of 690 kPa (100 psi) and prove tight for a period of 8 hours.

.6 Test all compressed air piping pneumatically to a pressure of 1035 kPa (150 psi) and prove tight for a period of 4 hours.

.7 For sprinkler, natural gas, propane and fuel oil piping, test as required to the satisfaction of the Authorities Having Jurisdiction.

.1 For Natural Gas piping, purge after pressure test in accordance with CAN/CSA B149.1.

.6 Maintain specified test pressure without loss for the time noted, unless a longer period of time is required by code.

.7 Drain Waste And Vent Piping:

.1 Use Ball Test, or Hydraulically test to verify grades and freedom from obstructions.

3.21 SAFETY DEVICE TESTING

.1 Make complete inspections of all safety devices such as: back flow preventors, fire extinguishers, hose cabinets; freeze protection devices; fire dampers, smoke dampers, fire stops, and the like to ensure:

.1 That safety devices are complete in accordance with the specifications and Manufacturer's recommendations.

.2 That the safety devices are connected and operating according to all local regulations, and appropriate access is provided.

.2 On completion of the inspections, provide letters and/or certificates, confirming that inspections have been completed. Insert in each O & M Manual.

3.22 START-UP OF HYDRONIC SYSTEMS

.1 Provide continuous supervision during start-up.

.2 After pressure tests, flushing, cleaning, filling and chemical treatment is completed:

.1 Fully open balancing valves (except those that are factory-set).

.2 Dismantle system pumps used for cleaning, inspect, replace worn parts, install new gaskets and new set of seals.

.3 Adjust alignment of piping at pumps to ensure flexibility, adequacy of pipe movement, absence of noise or vibration transmission.

.4 Check pumps to be free from air, debris, possibility of cavitation when system is at design temperature.

.5 Establish circulation and expansion tank level, set pressure controls.

.1 Check water level in expansion tank with cold water with circulating pumps OFF and again with pumps ON.

.2 Ensure air is removed.

.6 Check pressurization to ensure proper operation and to prevent water hammer, flashing, cavitation. Eliminate water hammer and other noises.

.7 Bring system up to design temperature and pressure slowly.

.8 Monitor piping systems for freedom of movement, and performance of expansion joints, loops, guides, anchors.

.1 Adjust pipe supports, hangers, springs as necessary.

.2 If sliding type expansion joints bind or if bellows type expansion joints flex incorrectly, shut down system, re-align, repeat start-up procedures.

.3 Re-tighten bolts using torque wrench, to compensate for heat-caused relaxation. Repeat several times during commissioning.

.9 Check operation of drain valves.

.10 Adjust valve stem packings as systems settle down.

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

.1 Measure and adjust pressure regulating valves and pressure relief valves.

.12 Check operation of over-temperature protection devices on circulating pumps.

.3 Rectify start-up deficiencies.

.4 After system start-up, perform TAB as specified in Section 23 05 93 – Testing& Balancing.

3.23 VIDEO INSPECTION (Sanitary/Storm Piping)

.1 Video inspection shall be carried out by a qualified contractor with a minimum of three (3) years previous experience, with the following equipment:

.1 Camera:

.1 High-resolution color with adjustable iris focus.
.2 Pan and tilt capabilities.
.3 Integral lighting suitable to provide illumination and a clear video image of the entire periphery of the pipe.
.4 Capable of operating in 100% humidity conditions.
.5 Produce a high quality video image.

.2 Provide closed-circuit video inspection equipment capable of displaying on-screen footage of distance measured to within 1% of actual distance.
.3 Record the inspection in color in the recording media specified. Forward the recording to the Consultant.

.2 General:

.1 Conduct video inspection of all new and rehabilitated interior/exterior sanitary & storm sewers after all backfill and compaction operations are completed, but prior to paving.
.2 Notify the Engineer the day prior to inspection so the Engineer may be present during the inspection.
.3 Low spots holding water in excess of 25mm (1”) or 5% of the pipe diameter, whichever is less, will be considered unacceptable.
.4 If unacceptable low spots exist, as indicated by standing water during video inspection, remove and replace sewer as necessary and re-inspect.

.3 Inspection Procedure:

.1 Prior to video inspection, run sufficient water through the pipe to saturate potential low spots so they may be detected during inspection.
.2 Inspect each pipe segment between manholes or access points in a single, continuous run. Progress through the entire project in a uniform direction.
.3 Inspect all lateral connections and other observations at right angles utilizing the pan and tilt capabilities of the camera.
.4 Center the video camera in the pipe during the inspection.
.5 Do not exceed 9.14m (30 feet) of inspection per minute.

.4 Inspection Reporting:

.1 Provide a copy of the video inspection including on-screen continuous footage, pipe diameter, direction of viewing, cleanout location reference and/or manhole and street location references in the recording. Affix labels to the recording media to include the name of the project, the date, and the location of the inspection.
.2 Provide a written report of the inspection. In the report, include true-to-scale drawings of all sewer defects and observation locations. Reference the time stamp on each line item entry on the written report.

3.24 WARNING LABELS FOR MECHANICAL EQUIPMENT SUPPLIED WITH ELECTRICAL POWER

.1 Mechanical equipment that is supplied with electrical power and is likely to require examination, adjustment, servicing, maintenance, etc. while energized, shall be labeled to warn persons of potential electric shock and arc flash hazards.

.2 Provide self-adhesive vinyl warning signs on each door or access panel to electrical components.

.3 Signs shall comply with the latest edition of ANSI Z535.4 - Product Safety Label Standard.

.4 Locate signs so they are clearly visible before performing work on electrical components.

.5 The signs shall state:

.1 Hazardous Voltage Sign:
Hazardous Voltage
Contact may cause electric shock or burn.
Turn off and lock out system power before servicing.

.2 Electric Arc Flash Hazard Sign:
Electric Arc Flash Hazard

Will cause severe injury or death. Wear proper protective equipment before opening or performing any work while energized. Refer to CSA Z462 - Workplace Electrical Safety.

3.25 COMMISSIONING

.1 Provide equipment, personnel, material and information necessary to assist the Commissioning Agent in completing the Commissioning Process.

.2 Piping:

.1 Test performance of all components.

.2 Ensure all Valves are installed correctly, located where required, are operational, and are left in their final operating position.

.3 Measure and Adjust Pressure Regulating and Pressure Relief Valves

.4 Monitor Piping systems for freedom of movement and pipe expansion.

.5 Ensure piping has applicable labels and flow arrows.

.3 Equipment:

.1 Ensure proper installation of controls.

.2 Before acceptance, set discharge patterns and fan speeds to suit requirements.

.3 Plumbing Fixtures:

.1 Test to ensure traps are fully and permanently primed.

.2 Ensure that fixtures are properly anchored, connected to system and effectively vented.

.4 Valves:

.1 Ensure Back Water Valves are located where required, are accessible and operational.

.2 Ensure Isolation Valves and Pressure Regulating Valves are installed correctly, located where required, are operational, and are left in their final operating position.

.3 Ensure Safety Valves such as Backflow Preventors and Relief Valves are installed correctly, located where required, are operational, and are left in their final operating position. Confirm provision of Testing Tag and information.

.4 As part of commissioning activities, develop schedule of valves and record thereon identifier, location, service, purchase order number and date, manufacturer, identification data specified above.

.5 Cleanouts:

.1 Ensure accessible and that access doors are correctly located.

.2 Open, cover with linseed oil and re-seal.

.3 Verify that cleanout rods can probe as far as the next cleanout, at least.

END OF SECTION

PART 1 General

1.1 RELATED SECTIONS

.1 Section 21 05 01, Mechanical General Provisions.

.2 Section 21 05 05, Basic Materials and Methods.

.3 Sections 22 06 01 and 23 06 01, Approved Substitute Schedules.

.4 Comply with the requirements of the Architectural Specifications.

1.2 WORK PERFORMED UNDER THIS SECTION

.1 Supply and installation of external thermal insulation for new piping, ductwork, and equipment.

.2 Provide insulation on the following systems:

- .1 Domestic cold water lines.
- .2 Domestic hot water supply & recirculation lines.
- .3 Outside/fresh air ductwork and plenums.
- .4 Exhaust air ductwork 3.048m (10'-0") back of building thermal envelope within building).
- .5 Sanitary vents.
- .6 Miscellaneous drain lines.
- .7 Rainwater leaders & piping 3.048m (10'-0" back of building thermal envelope within building).
- .8 Condensate & Indirect drain lines.
- .9 Sump pump lines within ceiling spaces.
- .10 Mixed & supply air ductwork plenums & run-outs.
- .11 Ductwork outside of building.
- .12 Refrigerant lines.

.3 Provide covering of insulation materials, ie. canvas, aluminum, or PVC Jacketing where specified.

.4 Prepare insulation surfaces to receive primer and finish painting.

.5 Insulate between protection saddles and piping.

.6 Refer to pipe insulation details on drawings for further information.

.7 All final pipe and duct installations including insulation, covering and adhesive shall have a flame spread rating of not greater than 25.

1.3 REFERENCE STANDARDS

.1 Conform with the requirements of the plans and specification, the local authorities having jurisdiction, and the Local Building Codes. In the case of conflicting requirements, be governed by the most severe regulations.

.2 Conform to the Manitoba Energy Code for Buildings (MECB). Where any discrepancies shall arise between this specification & the MECB, the MECB shall take precedence.

.3 Use latest edition of all referenced codes, standards, regulations, etc.

1.4 SUBMITTALS

.1 Submit WHIMIS MSDS – Material Safety Data Sheets in accordance with section 01330 Submittal Procedures, with the VOC levels highlighted.

1.5 ENVIRONMENTAL REQUIREMENTS

.1 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, October 2003.

.2 Adhesives must contain no urea-formaldehyde.

1.6 SAMPLES

.1 If requested by administrative authority or Architect, supply complete assembly of each type of insulation system, on 25 mm plywood board. Affix typewritten label beneath sample indicating service.

1.7 QUALITY ASSURANCE

.1 Qualifications: Execute work of this section only by skilled tradesmen regularly employed in the application of insulation of mechanical systems.

1.8 DEFINITIONS

.1 The term 'Mineral Fibre' includes glass fibre, mineral wool, slag wool.

.2 The term 'TIAC' and ‘TIAC Codes’ refers to the ‘Thermal Insulation Association of Canada’ and their associated ‘National Insulation Standards’.

.3 The word "exposed" where used in this section means any work which is not concealed in walls, shafts, cavities, ceilings or crawlspaces.

.1 Work behind doors, in closets or cupboards, or under counters is considered exposed.

.2 Work in Mechanical and Boiler Rooms is considered exposed.

.4 The word ‘concealed’ where used in this section means any work in suspended ceilings and non-accessible chases and furred-in spaces.

.5 The term 'cold piping' refers to the following systems: Chilled Water, Well/Ground Water, Domestic Cold Water, Plumbing Vents, Condensate Drip Drains, and any pipe within 2.4 m (8’-0”) of an exterior wall or roof penetration.

.6 The term 'hot piping' refers to Domestic Hot Water Supply and Recirc piping, Tempered Water Supply and Recirc piping, High Temperature Domestic Hot Water Supply and Recirc piping, Steam and Steam Condensate piping, Glycol Supply and Return piping, and Heating Water Supply and Return piping.

1.9 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 21 05 01 – Mechanical General Provisions.

.2 In addition to items noted in Section 21 05 01 – Mechanical General Provisions, submit manufacturer's catalogue information relating to the following:

.1 Installation techniques for pipe, fittings and valves.

.2 Jointing recommendations.

.3 Recommended adhesives.

PART 2 Products And Materials

2.1 GENERAL

.1 Fire and Smoke Rating:

.1 In accordance with CAN/ULC-S102

.1 Maximum Flame Spread Rating: 25

.2 Maximum Smoke Developed Classification: 50

.2 Thermal Conductivity ('K' factor) shall not exceed specified values at 24°C (75°F) mean temperature when tested in accordance with ASTM C335.

2.2 MATERIALS

.1 Meet NFPA Standard 90A-1990, and 255-1990: UL-723-1971 and 465-1972 unless non-conforming materials have been approved by the municipality for special applications and meet with the acceptance of the Architect.

.2 Underwriters' Laboratories of Canada label or satisfactory certified report from approved testing laboratory is required to indicate that fire hazard ratings of materials proposed for use do not exceed those specified.

.3 Flame-proofing treatments subject to deterioration due to effects of high humidity are not acceptable.

.4 Consultant reserves right to demand test samples of insulation systems and individual system components for fire hazard test rating. Contractor shall be responsible for cost of all testing.

2.3 COMPATIBILITY OF COMPONENTS

.1 Provide adhesives, sealers, vapour coating, mastics, laggings and bedding compounds, which are compatible with materials to which they are applied. Use components which shall not soften, corrode or otherwise attack other component material in either wet or dry state. Use materials recommended by manufacturer of insulation as suitable for application proposed. Apply all materials within ambient temperatures recommended by manufacturer.

2.4 STANDARD OF ACCEPTANCE

.1 Insulation materials: Only materials conforming to paragraph 2.1 & 2.2 are acceptable for use on this project.

.2 Coatings, sealers and adhesives: Benjamin Foster Co.; 3M; Jacob and Thompson; Duro-Dyne.

.3 Caulking compound: The Tremco Manufacturing Co; Thiokol; Benjamin Foster Co.

.4 Tape: Arno Dr. School's Tape Division; 3M; Duro-Dyne.

.5 Prefabricated fitting and equipment insulation, demountable: Insulacoustics Ltd., Ottawa.

.6 Insulation: Preformed fiberglass - Knauf, Armstrong, Armaflex or equal as manufactured by Imcoa.

2.5 PRE-MOLDED PIPE INSULATION FOR COLD PIPING

.1 Provide sectional rigid mineral fibre pipe insulation in pre-molded sections 915 mm (36") long; split and ready for application; with a maximum "K" factor of 0.035 at 24°C (75°F) mean temperature; and be capable of use on service from -40°C to 260°C (-40°F to 500°F); and with factory applied vapour seal jacket of foil craft laminate with reinforcing of open mesh glass fibre, and with lap seal adhesive.

.1 TIAC Code: A3

2.6 PRE-MOLDED PIPE INSULATION FOR HOT PIPING

.1 Provide sectional rigid mineral fibre pipe insulation in pre-molded sections 915 mm (36") long; split and ready for application; with a maximum "K" factor of 0.035 at 24°C (75°F) mean temperature; and be capable of use on service from -40°C to 260°C (-40°F to 500°F); and with factory applied all service jacket of paper with reinforcing of open mesh glass fibre, and with lap seal adhesive.

.1 TIAC Code: A3

2.7 INSULATION FOR HYDRONIC PIPING

.1 Except as provided in sentences .2 to .6 below, all hydronic piping shall be thermally insulated in accordance with Table 5.2.5.3. from the MECB, shown below.

Table 5.2.5.3. (MECB)
Minimum Pipe Insulation Thickness, mm

Design Operating Temperature Range, (ºC)	Insulation Conductivity		Nominal Pipe Diameter, inch (mm)				
	Conductivity Range, (W/m*ºC)	Mean Rating Temperature, (ºC)	Runouts[1] ≤ 2 (51)	≤ 1 (25.4)	1-1/4 to 2 (32 to 51)	2-1/2 to 4 (64 to 102)	≥ 5 (127)
Heating Systems (Steam, Steam Condensate & Hot Water)							
> 177	0.046-0.049	121	38.1	63.5	63.5	76.2	88.9
122-177	0.042-0.045	93	38.1	50.8	63.5	63.5	88.9
94-121	0.039-0.0.43	65	25.4	38.1	38.1	50.8	50.8
61-93	0.036-0.042	52	25.4	25.4	25.4	38.1	38.1
41-60	0.035-0.040	38	25.4	25.4	25.4	25.4	38.1
Cooling Systems (Chilled Water, Brine, & Refrigerant)[2]							
5-13	0.033-0.039	24	25.4	25.4	25.4	25.4	25.4
< 5	0.033-0.039	24	25.4	25.4	38.1	38.1	38.1

(1) Runouts to individual terminal units not exceeding 3.7m in length.
(2) The required minimum thicknesses do not consider water vapour transmission & condensation. Additional insulation, vapour barriers, or both, may be required to limit water vapour transmission & condensation.

.1 Piping that conveys fluids with a design operating temperature range of between 12 and 40 need not comply with Table 5.2.5.3. above.

.2 Where pipe insulation has a thermal conductivity of more than the range given in Table 5.2.5.3. above, the thickness given in the table shall be increased by the ratio u1/u2, where u1 is the higher end of the Conductivity Range for the operating temperature and u2 is the measured thermal conductivity of the insulation at the Mean Rating Temperature.

.3 Where pipe insulation has a thermal conductivity of less than the range given in Table 5.2.5.3. above, the thickness given in the table shall be decreased by the ratio u1/u2, where u1 is the lower end of the Conductivity Range for the operating temperature and u2 is the measured thermal conductivity of the insulation at the Mean Rating Temperature.

.4 The thermal conductivity of pipe insulation at the Mean Rating Temperature shall be determined in conformance with ASTM C 335, 'Standard Test Method for Steady-State Heat Transfer Properties of Horizontal Pipe Insulation.'

.5 Insulation material required as noted above shall be installed in accordance with good practice such as described in 'TIAC National Insulation Standards,' published by the Thermal Insulation Association of Canada.

2.8 INSULATION FOR SERVICE HOT WATER PIPING

.1 All hot service water piping in circulating systems, non-circulating systems w/o heat traps, & non-circulating systems w/ electric heating elements along the pipes to maintain temperature shall be thermally insulated in accordance with Table 6.2.3.1 from the MECB, shown below.

Table 6.2.3.1. (MECB)
Minimum Pipe Insulation Thickness for Service Hot Water Systems

Piping Location	Insulation Conductivity		Nominal Pipe Diameter, inch (mm)	Minimum Pipe Insulation Thickness (mm),(1)
	Conductivity Range, (W/m*ºC)	Mean Rating Temperature, (ºC)		
Conditioned Space	0.035-0.040	38	Runouts(1) ≤ 2 (51)	25.4
			≤ 1 (25.4)	
			1-1/4 to 2 (32 to 51)	
			2-1/2 to 4 (64 to 102)	38.1
			≥ 5 (127)	
Non-conditioned Space or Outside	0.046-0.049	121	Runouts(1) ≤ 2 (51)	38.1
			≤ 1 (25.4)	63.5
			1-1/4 to 2 (32 to 51)	
			2-1/2 to 4 (64 to 102)	76.2
			≥ 5 (127)	88.9

(1) Applies to recirculating sections of service hot water systems and the first 2.4m from storage tanks for non-recirculating systems.

.1 Where pipe insulation has a thermal conductivity of more than the range given in Table 6.2.3.1 above , the thickness given in the Table shall be increased by the ratio u1/u2, where u1 is the higher end of the Conductivity Range for the operating temperature and u2 is the measured thermal conductivity of the insulation at the Mean Rating Temperature.

.2 Where pipe insulation has a thermal conductivity of less than the range given in Table 6.2.3.1 above, the thickness given in the Table shall be decreased by the ratio u1/u2, where u1 is the lower end of the Conductivity Range for the

operating temperature and u2 is the measured thermal conductivity of the insulation at the Mean Rating Temperature.

.3 The thermal conductivity of pipe insulation at the Mean Rating Temperature shall be determined in conformance with ASTM C 335, 'Standard Test Method for Steady-State Heat Transfer Properties of Horizontal Pipe Insulation.'

.4 On non-circulating systems with heat traps, the inlet & outlet piping between the storage or heating vessel and the heat traps, and the first 2.4m of outlet piping downstream of the heat trap, shall be insulated in accordance with Table 6.2.3.1. above and sentences .4 to .6 of section 2.3 above.

2.9 INSULATION FOR DUCTWORK

.1 All air-handling ducts, plenums, & run-outs forming part of an HVAC system shall be thermally insulated in accordance with Table 5.2.2.5 from the MECB show below. Exhaust ducts & return ducts/plenums located within conditioned space need not comply.

Table 5.2.2.5. (MECB)
Insulation of Ducts

Temperature Difference,(1) (ºC)	Min. Thermal Resistance for Ducts & Plenums, (m^2*C/W)	Min. Thermal Resistance for Run-outs,(2) (m^2*C/W)
<5	0	0
5 to 22	0.58	0.58
>22	0.88	0.58

(1) The temperature difference at design conditions between the space within the duct is located & the design air temperature of the air carried by the duct. Where a duct is used for both heating & cooling purposes, the larger temperature difference shall be used.
(2) Ducts not exceeding 3m in length connecting to terminal grilles or diffusers.

.2 Insulation material required as noted above shall be installed in accordance with good practice such as described in 'TIAC National Insulation Standards,' published by the Thermal Insulation Association of Canada.

.3 Exposed rectangular:

.1 48 kg/m3 (3.0 lbs/ft^3) density per 25 mm (1") thickness, foil faced fibreglass board. (TIAC Code: C1).

.4 Concealed rectangular:

.1 48 kg/m^3 (3.0 lbs/ft^3) density per 25 mm (1") thickness, foil faced rigid mineral fibre board (TIAC Code: C1).

.2 12 kg/m^3 (0.75 lbs/ft^3) density per 25 mm (1") thickness, flexible mineral fibre blanket with open mesh, glass fibre reinforced, foil facing (TIAC Code C2).

.5 Round ductwork:

.1 12 kg/m^3 (0.75 lbs/ft^3) density per 25 mm (1") thickness, flexible mineral fibre blanket with open mesh, glass fibre reinforced, foil facing (TIAC Code C2).

.6 Ductwork exposed to outdoors or handling outdoor air:

.1 48 kg/m3 (3.0 lbs/ft^3) density per 25 mm (1") thickness, foil faced rigid mineral fibre board (TIAC Code C1).

2.10 ACOUSTIC INSULATION

.1 Coordinate all requirements with section 23 30 00 – Air Distribution.

.2 S/A, R/A, F/A, & E/A ductwork shall be internally lined with acoustic insulation for a minimum of 3.048m (10'-0") back from air handling equipment & heat/energy recovery ventilators unless a larger amount is shown on the drawings.

.3 Provide acoustic lining/insulation in all ductwork 3.048m (10'-0") from inlet & outlet on all fans (exhaust, transfer, supply, return, etc.), unless a larger amounted is shown on the drawings.

.4 Provide acoustic lining/insulation in all ductwork where indicated on the drawings at a thickness of 25mm (1").

.5 The use of fiberglass liner is not allowed. All acoustic duct liner must be constructed of closed-cell, polymer sheet insulation materials.

.6 Product must be cleanable and have a zero perm rating and zero water absorption.

.7 Installation shall not include any tapes, fabrics, cements or other materials which are not cleanable or which offer opportunity for mold growth.

.8 Installation shall be to Manufacturer's standards and shall withstand air velocities of 12.7 m/s (2500 feet per minute).

.9 Duct sizes shown on the drawings are clear inside dimensions. Sheet metal sizes shall increase as required to accommodate the thickness of the internal insulation, to maintain the equivalent free area noted on the drawings.

.10 Shop drawings shall be submitted for review & approval by the Consultant & City of Winnipeg for all insulation materials.

2.11 INSULATION FOR EQUIPMENT

.1 Water meters, roof drain bodies, domestic cold water booster pumps, and chilled water pumps:

.1 12 kg/m^3 (0.75 lbs/ft^3) density per 25 mm (1") thickness, flexible blanket with open mesh, reinforced, foil facing; or,

.2 Closed Cell Rubber (unicellular elastomer) Flexible Blanket

2.12 MISCELLANEOUS APPLICATIONS

.1 Provide insulation on Radiant Heating Panels as per Section 23 21 05 – Liquid Heat Transfer & Refrigeration.

.2 Provide 'Trap-Wrap' or equal insulation on all P-traps on all Lavatories, whether noted as handicap accessible or not.

.1 Not required where Lavatory is fed by Tempered Water.

.3 Refrigerant Systems:
Pre-formed, closed cell rubber (unicellular tubular elastomer) pipe insulation, with lap seal adhesive.

.1 TIAC Code: A6

.2 Equal to Armaflex or Imcolock

.4 Breechings:

.1 High temperature, segmented, Board with no combustible facing material.

2.13 JACKETS

.1 Polyvinyl Chloride (PVC):

.1 One-piece moulded type and sheet to CAN/CGSB-51.53

.1 with pre-formed shapes for piping as required.

.2 Colours: white.

.3 Minimum service temperatures: -20°C.

.4 Maximum service temperature: 65°C.

.5 Moisture vapour transmission: 0.02 perm.

.6 Fastenings:

.1 Use solvent weld adhesive compatible with insulation to seal laps and joints.

.2 Staples.

.3 Pressure sensitive vinyl tape of matching colour.

.7 Special requirements:

.1 Outdoor: UV rated material at least 0.5 mm thick.

.2 ABS Plastic (for Outdoor use Only):

.1 One-piece moulded type and sheet with pre-formed shapes as required.

.2 Colours: white.

.3 Minimum service temperatures: -40°C.

.4 Maximum service temperature: 82°C.

.5 Moisture vapour transmission: 0.012 perm.

.6 Thickness: 0.75 mm.

.7 Fastenings:

.1 Solvent weld adhesive compatible with insulation to seal laps and joints.

.2 Tacks.

.3 Pressure sensitive vinyl tape of matching colour.

.3 ULC Listed Canvas:

.1 220 (heavy) and 120 (light) gm/m2 cotton, plain weave, treated with dilute fire retardant lagging adhesive to ASTM C921.

.2 Lagging adhesive: Compatible with insulation.

.4 Aluminum:

.1 To ASTM B209.

.2 Thickness: 0.50 mm sheet.

.3 Finish: Smooth.

.4 Metal jacket banding and mechanical seals: stainless steel, 19 mm wide, 0.5 mm thick at 300 mm spacing.

.5 Pipe Joining: Longitudinal and circumferential slip joints with 50 mm laps.

.6 Pipe Fittings: 0.5 mm thick die-shaped fitting covers with factory-attached protective liner.

.5 Stainless steel:

.1 Type: 304 or 316.

.2 Thickness:

.1 Piping: 0.25 mm

.2 Ductwork: 0.50 mm sheet

.3 Finish:

.1 Interior locations: Smooth.

.2 Exterior locations: Dimple finish.

.4 Pipe Joining: Longitudinal and circumferential slip joints with 50 mm laps.

.5 Pipe Fittings: 0.5 mm thick die-shaped fitting covers with factory-attached protective liner.

.6 Metal jacket banding and mechanical seals: stainless steel, 19 mm wide, 0.5 mm thick at 300 mm spacing.

2.14 FINISHES

.1 Piping (concealed):

.1 Factory applied jacket.

.2 Piping (exposed):

.1 170 g/m^2 (6 oz/yd^2) U.L. labeled canvas with PVC fitting covers; or

.2 PVC, Stainless Steel or Aluminum pipe and fitting covers

.3 Ductwork (concealed):

.1 Factory applied jacket.

.4 Ductwork (exposed):

.1 170 g/m^2 (6 oz/yd^2) U.L. labeled canvas.

.5 Ductwork (exposed outdoors):

.1 Two layers of felt paper, tarred and sealed to make weatherproof; or, 'Blueskin' poly-type bitumen membrane.

.2 Dimple finish 016 aluminum jacket.

.6 Water meters and pump casings:

.1 Factory applied jacket.

.7 Roof Drain Bodies (exposed):

.1 170 g/m^2 (6 oz/yd^2) U.L. labeled canvas.

.8 Roof Drain Bodies (concealed):

.1 Factory applied jacket.

.9 Refrigerant Piping:

.1 For piping located outdoors, provide weather proof jacketing w/ UV protection where insulation is installed.

.10 Breechings:

.1 Cement layer

2.15 INSULATION SECUREMENT

.1 For Hot & Cold piping insulation:

.1 Provide staples for securement of all insulation seams. Foil/aluminum adhesive tape will not be allowed.

.2 For Ductwork:

.1 Tape: Self-adhesive, aluminum, reinforced, 50mm (2") wide minimum.

.3 Tape: Self-adhesive, aluminum, reinforced, 50 mm wide minimum.

.4 Contact adhesive: Quick setting.

.5 Canvas adhesive: Washable.

.6 Tie wire: 1.5 mm diameter stainless steel.

.7 Bands: Stainless steel, 19 mm wide, 0.5 mm thick.

.8 Fasteners for ductwork: 2 mm diameter pins with 35 mm square clips, length to suit thickness of insulation.

2.2 CEMENT

.1 Thermal insulating and finishing cement:

.1 Hydraulic setting or Air drying on mineral wool, to ASTM C449/C449M.

2.3 VAPOUR RETARDER LAP ADHESIVE

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

2.4 INDOOR VAPOUR RETARDER MASTIC

.1 Vinyl emulsion type acrylic, compatible with insulation.

2.5 OUTDOOR VAPOUR RETARDER MASTIC

.1 Vinyl emulsion type acrylic, compatible with insulation.

.2 Reinforcing fabric: Fibrous glass, untreated 305 g/m2.

PART 3 Installation And Execution

3.2 INSTALLATION - GENERAL

.1 Install using Manufacturers Recommended Instructions

.2 Install in accordance with TIAC National Standards.

.3 Pre-installation Requirements

.1 Pressure testing of pipe and ductwork systems and adjacent equipment is complete, witnessed and certified.

.2 Do not insulate ductwork prior to duct sealant being applied.

.3 Surfaces to be clean, dry, and free from foreign material.

.4 When two (2) or more layers are used, install with staggered joints.

.5 Use two (2) layers with staggered joints when required nominal thickness exceeds 50mm.

.6 Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes.

.1 Hangers, supports to be outside vapour retarder jacket.

.7 Sagging of duct insulation will not be acceptable.

3.3 INSTALLATION - PIPING

.1 Provide staples for securement of all insulation seams. Foil/aluminum adhesive tape will not be allowed. Review final requirements with HSC FM.

.2 Apply insulation at a temperature of approximately 18°C (65°F) over clean, dry surfaces. Butt adjoining sections of insulation firmly together with the longitudinal seam of the jacket located on the bottom half of the pipe.

.3 On cold piping, insulate and finish all valves, fittings and flanges in the same manner and same thickness as the piping. Use mitred sections of the specified pipe covering. Provide pre-manufactured valve, elbow, & fitting insulation covers; provide shop drawing submittal to the mechanical engineer for approval.

.4 On hot piping, insulate valves/valve bodies; do not insulate unions and flanges. Insulate elbows & fittings with the same thickness as the piping. Provide pre-manufactured valve, elbow, & fitting insulation covers; provide shop drawing submittal to the mechanical engineer for approval.

.5 For cold piping insulation, seal longitudinal lap joints with suitable vapour barrier adhesive.

.1 Provide Bakelite 120-12 vapor barrier coating at all joints.

.6 For hot piping insulation, seal longitudinal lap joints with a suitable adhesive/cement capable of withstanding the service temperature. Cover butt joints with a strip of the same material as the jacket, and cement as required.

.1 Provide Bakelite 120-18 white fire resistive lagging.

.7 Lag all open ends.

.8 Concealed insulated items require no further finish than provided in factory applied jacket.

.9 All adhesives and finishes: Fire retardant or fire resistant when dry, and acceptable to the Authorities Having Jurisdiction.

.10 For cold piping, seal end joints and perforations with factory furnished 100 mm (4") wide vapour barrier strips applied with the same adhesives and cements as previously specified.

.11 Seal valves, fittings and flanges on cold piping in a manner as specified for end joints.

.12 Supports, Hangers:

.1 Use oversized hangers on DCW piping DN 32 (NPS 1.25) and larger.

.2 On all cold piping where oversized hangers are used: Protect insulation with a sheet metal saddle installed over the vapour barrier.

.3 For piping DN 32 (NPS 1.25) and larger, provide a section of rigid insulation or non-compressible material under the vapour barrier, the same length as the saddle.

.13 Refrigerant piping:

.1 The insulation shall be installed as each section of the pipework is completed and each section of insulation shall be glued together.

.2 At each joint in the pipework, the insulation shall be neatly drawn back and secured to allow inspection of the joint during pressure/vacuum tests and system charging. Upon completion the insulation shall be released, jointed and vapour sealed.

.3 When the installation is complete, identification bands/tags complete with internal systems and indoor unit reference, shall be fitted at a maximum of 4 metre centres.

3.4 INSTALLATION OF ELASTOMERIC INSULATION

.1 Insulation to remain dry at all times. Overlaps to manufacturer’s instructions. Ensure tight joints.

.2 Provide vapour retarder as recommended by manufacturer.

3.5 INSTALLATION - DUCTWORK

.1 Do not insulate ductwork prior to duct sealant being applied.

.2 Exposed rectangular ductwork: Impale board on weld pins and speed washers 300 mm (12") o.c. with a minimum of two rows per side on any side greater than 300 mm (12"). Cut pins flush with surface of insulation and cover with foil faced tape. Cover all joints with foil faced adhesive tape.

.3 Concealed ductwork and exposed round: Apply flexible blanket insulation with an approved adhesive brushed on in 100 mm (4") wide strips 300 mm (12") o.c. and at all joints. Seal all joints and perforations with foil faced adhesive tape.

.4 Where interior lined ductwork is required to be insulated, the thickness of the liner may be deducted from the total thickness of the exterior insulation. This is with the exception of specific items such as exhaust plenums detailed on the drawings.

.5 Supports, Hangers:

.1 Apply high compressive strength insulation where insulation may be compressed by weight of ductwork.

.2 Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes.

.3 Hangers, supports to be outside vapour retarder jacket.

3.6 REMOVABLE, PRE-FABRICATED, INSULATION AND ENCLOSURES

.1 Application: At expansion compensators, valves, primary flow measuring elements, and flanges and unions at equipment.

.2 Design: To permit movement of expansion compensator and to permit periodic removal and replacement without damage to adjacent insulation.

.3 Insulation:

.1 Insulation, jackets, fastenings and finishes: same as system.

3.7 EQUIPMENT AND MISCELLANEOUS APPLICATIONS

.1 Water meters, Roof Drain bodies, and Pump Casings:

.1 Apply flexible blanket with suitable adhesive.

.2 Seal joints and edges with foil faced tape.

.2 Shell and Tube Heat Exchangers:

.1 Score and mitre the insulation to suit the contours of the equipment.
.2 Secure with adhesive and galvanized metal bands.

.3 Radiant Heating Panels:

.1 Refer to part 2.11 Miscellaneous Applications.

.4 P-traps:

.1 Refer to part 2.11 Miscellaneous Applications.

.5 Refrigerant piping:

.1 Install using self-locking plastic ties.
.2 Seal joints with suitable mastic.

.6 Breechings:

.1 Secure insulation in place with 20mm x 0.38mm (3/4" x 0.015") steel bands at 400mm (16") o.c. Butt the metal edges together and lace with 16 gauge galvanized wire. Apply a 12mm (1/2") thick coat of hydraulic-setting insulating cement, trowelled smooth over the metal mesh. Make allowance for expansion and contraction in the cement layer.

3.8 REMOVABLE, PRE-FABRICATED, INSULATION AND ENCLOSURES

.1 Application: At expansion compensators, valves, primary flow measuring elements, and flanges and unions at equipment.

.2 Design: To permit movement of expansion compensator and to permit periodic removal and replacement without damage to adjacent insulation.

.3 Insulation:

.1 Insulation, jackets, fastenings and finishes: same as system.

3.9 INSTALLATION OF ELASTOMERIC INSULATION

.1 Insulation to remain dry at all times. Overlaps to manufacturer's instructions. Ensure tight joints.

.2 Provide vapour retarder as recommended by manufacturer.

3.10 REPAIRS TO EXISTING

.1 Repairs to existing are only required within the immediate vicinity of the New Work. This includes locations where Tie-ins are made, where existing is to be removed and where nearby construction disturbs the existing.

.2 Repairs to existing are required within the entire Construction Zone. The Contractor shall review the existing site prior to tender to ascertain the exact requirements/scope of work.

.3 Existing insulation and covering may remain where it is in good condition.

.4 Existing insulation of lesser thickness than specified for new may remain.

.5 Cut and remove damaged portions of insulation to provide a neat surface/edge for connection of new insulation.

.6 Provide new insulation and coverings on existing bare pipes and ducts to meet new standards as specified.

.7 Provide new coverings on existing insulated pipes and ducts to meet new standards as specified.

3.11 RECOMMENDED INSULATION THICKNESS SCHEDULE

.1 General:

.1 Refer to Part 2 above for minimum acceptable requirements as per the MECB. The MECB shall dictate all final insulation thickness requirements for this project; where insulation thickness differs, the more stringent requirements shall be adhered to.

.2 Minimum insulation thickness shall not be less than 25mm (1”).

.2 Piping:

.1 Any pipe within 3.048m (10’-0”) of a penetration through an exterior wall or roof, or a penetration to another space of differing temperature: 25mm (1").

.2 Domestic Cold Water piping: 25mm (1").

.3 Domestic Hot or Tempered Water Supply and Recirc piping:

.1 25mm (1") for up to and including 50mm (2”) size
.2 40mm (1.5”) for pipe sizes over 50mm (2”)

.4 Heating Water or Glycol Supply and Return piping:

.1 For temperatures of 13-24°C (55-75°F): Not Required.
.2 For temperatures of 25-60°C (76-140°F):
.1 25mm (1") for up to and including 100mm (4") size
.2 40mm (1.5") for pipe sizes over 100mm (4")
.3 For temperatures of 61-93°C (141-200°F):
.1 25mm (1") for up to and including 50mm (2") size
.2 40mm (1.5") for pipe sizes over 50mm (2")

.5 Steam and Steam Condensate piping:

.1 For temperatures of 94-121°C (201-250°F):
.1 25mm (1") for runouts up to & including 50mm (2") size and 3.7m (12') long
.2 40mm (1.5") for pipe sizes up to and including 50mm (2")
.3 50mm (2") for pipe sizes over 50mm (2")

.6 Chilled Water Supply and Return piping:

.1 For temperatures of 5-13°C (41-55°F):
.1 25mm (1")
.2 For temperatures below 5°C (41°F):
.1 25mm (1") for runouts up to 50mm (2") size and 3.7m (12') long
.2 25mm (1") for pipe sizes up to and including 25mm (1")
.3 40mm (1.5") for pipe sizes over 25mm (1")

.7 Well/Ground Water Supply and Return piping (inside building): 25mm (1")

.8 Plumbing vents in attic spaces: 25mm (1")

.9 Condensate drip drains: 25mm (1")

.3 Ductwork:

.1 General:

.1 Where duct sections are lined with 25mm (1") thick acoustic duct liner, 25mm (1") may be deducted from the specified requirement for external thermal insulation

.2 Supply Ductwork:

.1 On all new ductwork whether specifically noted on the drawings or not: 25mm (1")

.3 Fresh Air Intake Ducts to air units: 50 mm (2")

.4 Combustion and Ventilation Air ducts for gas-fired equipment rooms: 25mm (1").

.5 Mixed Air ducts from Fresh Air duct to Heating Coil: 50mm (2")

.6 Exhaust/Relief Air ducts (from HRV/ERV's to outdoors): 50mm (2")

.7 Exhaust Air ducts (from Exhaust Fan Back Draft or Motorized Damper to outdoors): 25mm (1")

.8 Ducts penetrating an exterior building surface [for the last 3m (10'-0")]: 25mm (1")

.9 Ducts in attic space and outdoors: 50mm (2")

.10 Relief Air ducts: 50mm (2")

.11 Drip pans: 25mm (1")

.4 Equipment and Miscellaneous Applications:

.1 Water Meters, Roof Drain bodies, and Pump Casings: 25mm (1")

.2 Radiant Heating Panels:

.1 Refer to part 2.11 Miscellaneous Applications.

.3 P-traps:

.1 Refer to part 2.11 Miscellaneous Applications.

.4 Refrigerant Piping:

.1 25mm (1") for Cold Piping
.2 25mm (1") for Hot Piping, except outdoors

.5 Breechings: 50 mm (2")

3.12 COMMISSIONING

.1 Conform to the requirements of Section 21 05 01 – General Mechanical Requirements

.2 Conform to the requirements of the Architectural Specifications

.1 Provide equipment, personnel, material and information necessary to assist the Commissioning Agent in completing the Commissioning Process.

.3 Provide instructions to the City of Winnipeg as required. Refer to Specification Section 21 05 01.

END OF SECTION

PART 1 General

1.1 RELATED SECTIONS

.1 Section 21 05 01, Mechanical General Provisions.

.2 Section 21 05 05, Basic Materials and Methods.

.3 Section 22 06 01, Approved Substitute List.

1.2 WORK PERFORMED UNDER THIS SECTION

.1 This building is not sprinklered.

.2 Provide the following fire protection systems:

.1 Installation of hand held fire extinguishers & cabinets.
.2 Refer also to Architectural & Mechanical fire protection drawings for further requirements.

.3 Design Criteria: As required by N.F.P.A. Design Standards.

.4 Coordinate all work with all other trades. Confirm exact layouts and requirements with Architectural, Structural, Mechanical & Electrical drawings Outside Services Contractor.

1.3 START-UP AND COMMISSIONING

.1 Start-up and Commissioning shall be undertaken prior to the Occupancy stage of each Construction Phase.

.2 Provide the equipment, personnel and material necessary to put the Fire Protection Systems into operation.

.3 Provide the equipment, personnel, material and information necessary to assist the Mechanical Contractor in completing the Commissioning Process.

1.4 REFERENCE STANDARDS

.1 Do work to the following except where specified otherwise:

.1 Federal, Provincial, and Municipal building and fire regulations as approved by the Provincial Fire Marshal and/or the Fire Commissioner of Canada.

.2 National Fire Protection Association Standards:

.1 NFPA 10 "Standard for Portable Fire Extinguishers".

.3 All design criteria and acceptance to be confirmed with the City of Winnipeg's insurance company.

1.5 ENVIRONMENTAL REQUIREMENTS

.1 The use of Halons is prohibited in fire suppression equipment.

1.6 FIRE DEPARTMENT APPROVAL

.1 The Provincial and/or Municipal Fire Authorities shall approve the design, entire installation, equipment, and materials.

1.7 CERTIFICATES

.1 Provide written certificate that components are compatible, and where applicable, certified for intended use by nationally recognized testing agency.

1.8 SHOP DRAWINGS

.1 Submit shop drawings of the fire protection system for review. Make any requested changes and resubmit the revised shop drawings to the Authorities Having Jurisdiction, and obtain approvals prior to commencing the work. Contractor shall provide a draft copy of the shop drawings for review by the consultant team to coordinate work by other disciplines.

.2 Include portable extinguishers mounted in fully recessed cabinets, including wall brackets.

1.9 MAINTENANCE DATA

.1 Provide maintenance data for fire protection equipment for incorporation into the Operation and Maintenance manual.

.2 Attach bilingual tag or label to extinguishers, indicating month and year of installation. Provide space for service dates.

PART 2 Products And Materials

2.1 SIGNS

.1 Signs: bilingual fabricated from metal with chain suspension; white letters on red background.

2.2 HAND HELD FIRE EXTINGUISHERS (FE's):

.1 Fire extinguishers shall be provided in sufficient quantities to leave the City of Winnipeg with a fully code compliant space. As such, fire extinguishers shall be as follows:

.1 Multi-purpose dry chemical extinguishers in conformance with the latest edition of the National Fire code and NFPA 10: stored pressure type with hose and shut-off nozzle ULC labelled for A, B, and C fires for in-cabinet installation. Units to be installed with a maximum travel distance of 22.86m (75 feet) from any point on the floor.

.1 Size 4.5 Kg (10lb) shall be rated for minimum 4A : 60B : C.

.2 Locations of all fire extinguishers shall be provided on the sprinkler shop drawings for review by the Architect & Mechanical Engineer.

.1 In finished areas, extinguishers shall be mounted in fully recessed architectural style cabinets with finger latch on hinged door. Refer to Architectural specifications/drawings for further information.

.1 Extinguishers shall be mounted within an exit and/or access to exit or along a path of egress.

.2 Refer to Architectural drawings for locations of recessed cabinet mounted multi-purpose dry chemical extinguishers.

.1 Provide 4.5 Kg (10lb) CO_2 wall mount extinguishers in each electrical/IT/LAN Room.

.2 Provide one (1) 4.5 Kg (10lb) multi-purpose dry chemical wall mount extinguisher in mechanical/ boiler room.

.3 Attach bilingual tag or label to extinguishers, indicating month and year of installation. Provide space for service dates.

PART 3 Installation And Execution

3.1 INSTALLATION - GENERAL

.1 Install signs as required by the Authorities Having Jurisdiction. Secure outdoor signs with stainless steel bolts.

.2 Install fire extinguisher cabinets so the door, when open, does not obstruct any other door opening.

.3 Install or mount fully charged extinguishers in cabinets or on brackets provided by the extinguisher manufacturer, and as indicated.

3.2 ADJUSTMENT

.1 Adjust equipment to the satisfaction of the Authorities Having Jurisdiction and the Engineer.

3.3 START-UP AND COMMISSIONING

.1 Prior to the Occupancy Stage of each Construction Phase:

.1 Conform to the requirements of Section 21 05 01 –Mechanical General Provisions.

.2 Follow the start-up procedures as recommended by the equipment manufacturer unless specified otherwise.

.3 Follow the special start-up procedures specified elsewhere in these Specifications.

.4 Provide instructions to the City of Winnipeg as required. Refer to Specification Section 21 05 05.

.5 Start up and Commission the Equipment and Systems.

.6 Provide equipment, personnel, material and information necessary to assist the Mechanical Contractor in completing the Commissioning Process.

.7 Calibrate and adjust all items provided under this contract.

END OF SECTION

PART 1 General

1.1 GENERAL REQUIREMENTS

.1 Comply with the requirements of Section 21 05 01, Mechanical General Provisions.

.2 Comply with the requirements of Section 21 05 05, Basic Materials and Methods.

.3 Comply with the requirements of Sections 22 06 01 and 23 06 01, Approved Substitute Schedules.

1.2 WORK PERFORMED UNDER THIS SECTION

.1 As indicated on the Drawings and in the Specifications, provide complete plumbing systems with all necessary appurtenances, trim and piping, including, but not limited to:
- .1 Plumbing fixtures and trim;
- .2 Domestic cold water piping;
- .3 Domestic hot and recirculation water piping;
- .4 Sanitary drainage and venting piping;
- .5 Storm drainage piping;
- .6 Natural gas piping;
- .7 Condensate & indirect drain piping.
- .8 Coordinate installation of Sprinkler System drain down locations with Fire Protection/Sprinkler Contractor.

.2 Provide Equipment, Personnel and Material necessary to assist with Pipe Cleaning and Chemical Treatment.

1.3 START-UP AND COMMISSIONING

.1 Start-up and Commissioning shall be undertaken prior to the Occupancy stage of each Construction Phase.

.2 Provide the Equipment, Personnel and Material necessary to put the Plumbing Systems into Operation.

.3 Provide the Equipment, Personnel, Material and Information necessary to assist the Mechanical Contractor in completing the Commissioning Process.

1.4 QUALITY ASSURANCE

.1 Qualifications: Execute work of this section by skilled tradesmen regularly employed in the installation of plumbing and drainage systems.

1.5 SUBMITTALS

.1 Submit shop drawings on plumbing fixtures/trim, drains and associated accessories; and humidifiers and accessories.

PART 2 Products And Materials

2.1 PLUMBING FIXTURES AND BRASS

.1 Provide fixtures complete with all required trim. Fixtures shall be free from flaws or blemishes. Surfaces shall be clear, smooth and bright and have dimensional stability.

.2 Exposed visible parts of the fixture supply trim shall be chrome-plated, fixtures to be white unless otherwise noted.

.3 All fixtures shall bear C.S.A. approval.

.4 Install shut-off valves in all branches to fixtures or group of fixtures in same room, base of all risers, & horizontal take-offs.

.5 Provide individual stops on each fixture water supply. Exposed stops to be screw-driver type.

.6 Provide C.S.A. traps in required sizes with cleanout.

.7 All supplies to be flexible type.

.8 Fixture Schedule – Refer to Plumbing Fixture schedule in this specification.

.9 All fixtures and equipment for handicapped use shall be in complete accordance with all applicable codes and regulations.

2.2 SHOCK ABSORBERS

.1 Provide pre-manufactured shock absorbers equal to Zurn Z-1700. Fabricated pipe type shock absorbers will not be allowed.

.2 Shock absorbers shall be installed in the following locations and where indicated on the drawings:

.1 Top of each riser in buildings over one story.
.2 End of horizontal runs except where such runs end with a riser over one story.
.3 Fixture groupings not serviced by the above.
.4 At fast closing valves (Flush valve water closets & sinks, all electronic faucet sinks, etc…).

2.3 PRESSURE RELIEF AND REGULATING VALVES

.1 Where indicated or performance specified on the drawings, provide pressure relief and regulating valves as follows.

.2 Acceptable Manufacturers: Watts, Singer, Honeywell, Braukmann, Wilkins, Conbraco.

.3 For natural gas, provide CGA approved pressure regulating valves as manufactured by Fisher or Canadian Meter.

2.4 BACKFLOW PREVENTERS

.1 Where indicated or performance specified on the drawings, and where required by Authorities, provide backflow preventers as required.

.2 Backflow preventers shall be of a type and size as required by the Authority Having Jurisdiction.

.3 Provide a backflow preventer on any piping supplying potable water to a heating, chilled water, or any process piping system where chemical treatment or anti-freeze solution is used or where chemicals are conveyed. Backflow preventers are to be compliant with the latest edition of CAN/CSA B64 as published by CSA.

.4 Water service sizes ¾" and 1": Union bronze body construction, stainless steel replaceable check, relief seats, shafts and bolts, rubber check valve and relief valve assemblies, bronze body quarter-turn ball valves, bronze test cocks, bronze strainer. Unit to be equal to Watts C-U-909 QT-HW c/w Watts model 777 strainer.

.5 Water service sizes 32mm (1¼") to 50mm (2"): Bronze body construction, stainless steel replaceable check, relief seats, shafts and bolts, rubber check valve and relief valve assemblies, bronze body quarter-turn ball valves, bronze test cocks, bronze strainer. Unit to be equal to Watts 909 QT-HW, c/w Watts model 777 strainer. Provide union connections upstream and downstream of each backflow preventer.

.6 Water service sizes 65mm (2½ ") and larger: Interior epoxy coated cast iron body with stainless steel internal parts, replaceable bronze seals, bronze relief valve with stainless steel trim, epoxy coated strainer, OS & Y resilient seated gate valves, bronze test cocks. Unit to be equal to Watts 909 QT-HW, c/w Watts model 777 strainer. Provide union connections upstream and downstream of each backflow preventer.

.7 Double check valve with intermediate atmospheric vent: Watts #9D continuous pressure type with intermediate atmospheric vent. Chrome plated where exposed in finished areas.

.8 Backflow preventer drains: Pipe relief opening on backflow preventer to suitable drain. Diameter shall be a minimum of one pipe size larger than relief opening and be fitted with an approved air gap.

.9 Provide minimum 32mm (1¼") clearance between backflow preventer body and adjacent structure (wall, ceiling, etc.) and equipment to facilitate removal.

2.5 CLEANOUTS AND ACCESS COVERS

.1 All cleanouts and access covers shall be suitable for heavy duty traffic.

.2 Provide cleanouts and access covers suitable for the specified floor finish.

.3 All floor access covers shall be set flush with the finished floor.

.4 Access covers shall be polished nickel bronze with V.P. screws.

.5 Exposed cleanouts shall be standard M.J. or Bell and Spigot cleanout plugs with no access cover.

.6 Cleanouts concealed behind walls or above non-removable ceilings shall be standard M.J. or Bell & Spigot cleanout plugs with suitable access doors.

.7 Cleanouts in finished floors shall be standard M.J. or Bell & Spigot cleanout plugs with manufactured covers to suit the floor finish. Access covers equal to Ancon or Zurn will be acceptable. Access covers shall have recessed pans for accepting the floor finish (carpet or tile) in finished areas with flooring.

PART 3 Installation And Execution

3.1 GENERAL

.1 Install all fixtures, drains, cleanouts, equipment, etc., as per manufacturer's requirements.

3.2 FIXTURE INSTALLATION

.1 Connect fixtures, complete with supplies and drains, separately trapped, supported level and square.

.2 Provide supports required to set fixtures square and level.

.3 Mount wall hung water closets with rim at 425mm (17") A.F.F.

3.3 SPECIALTIES INSTALLATION

.1 Non-freeze wall hydrants:

.1 Install 600 mm (24") above finished grade unless otherwise noted
.2 Provide inside shut-off valve.

.2 Cleanouts:

.1 Install accessible cleanouts at traps where required.

.3 Backflow Preventers:

.1 Provide drain to nearest floor funnel drain.

.4 Pressure/Temperature Relief Valves:

.1 Provide drain to +/- 100mm (4") above finished floor.

3.4 EQUIPMENT INSTALLATION

.1 Provide all necessary indirect drains from all equipment, whether provided by this Contractor or not, including but not limited to:

.1 Heat/Energy Recovery Ventilator drain Pans and/or condensate drain lines.
.2 Humidifier drain & drain pan lines.
.3 Heat pump drain pans and/or condensate drain lines.
.4 Fan coil condensate drain lines.
.5 Boiler drain lines.
.6 Domestic Hot Water Heater drain & drip pan lines.
.7 Backflow Preventer drain lines.

.2 Indirect drains shall be piped to the nearest floor drain, floor sink, or other suitable location.

3.5 TESTING

.1 Test piping in accordance with the procedures outlined in Section 21 05 05 – Basic Materials and Methods.

.2 Ensure that insulated piping and equipment installed in concealed places is tested and inspected prior to permanent concealment.

3.6 START-UP AND COMMISSIONING

.1 Prior to the Occupancy Stage of each Construction Phase:

.1 Start up the Equipment and Systems as per Specification Section 23 08 05.

.2 Calibrate and adjust all items provided under this contract.

.3 Assist in the commissioning Process as required. Refer to Specification Section 23 08 05.

.4 Provide instructions to the City of Winnipeg as required. Refer to Specification Section 21 05 01 – Mechanical General Provisions.

END OF SECTION

PART 1 General

1.1 RELATED SECTIONS

.1 Section 21 05 01, Mechanical General Provisions.

.2 Section 21 05 05, Basic Materials and Methods.

1.2 APPROVED 'SUBSTITUTES' AND 'ALTERNATES'

.1 Where a Manufacturer's name, make, model, and/or size is specified, it is for the purpose of setting a standard of quality, performance, capacity, appearance and/or serviceability, and is acceptable without qualification. Manufacturers listed as acceptable 'Substitutes' have been deemed by the Consultant as capable of producing equipment and/or material of comparable quality, performance and approximate dimensions, and can be used in the preparation of the tender. Where no substitutes are indicated, provide the exact make specified or provide the necessary documents for review.

.2 'Substitute' equipment and material is deemed to be interchangeable with that specified, with little or no revisions required to the design intent and/or other items, equipment or connections.

.3 'Alternate' equipment and material is deemed to be acceptable but which will require major revisions to the design intent and/or other items, equipment or connections.

.4 Requests for approval of additional 'Substitutes' or 'Alternates' must be submitted not less than ten (10) days prior to closing date of the tender, and submissions must bear proof of acceptance by the Consultant if used in the tender. Requests shall include all performance, capacity, appearance, weight, connections, power and wiring requirements, etc required for the Consultant to make a complete evaluation.

.5 Assume full responsibility for ensuring that, when providing accepted 'Substitutes' and/or 'Alternates', all space, weight, connections, power and wiring requirements, etc. are considered and adjusted costs are included in the tender. The Mechanical systems have been designed based on the equipment/materials of the specified manufacturer(s). The onus shall be on the Subcontractor (along with his sub-sub-contractor and the supplier) to ensure that 'Substitute' or 'Alternate' equipment/materials will meet the required performance and electrical characteristics, as well as fit properly into the allotted space, including allowance for required access and servicing. Any additional costs incurred as a result of modifications to the system(s) or the room layout, or modifications required by other trades, shall be borne by the Subcontractor (along with his sub-sub-contractor and the supplier) and shall be deemed to be included in the tender price.

.6 Bidders must base their price on specified manufacturers or approved 'Substitutes'. 'Alternates', when allowed, must be listed separately, with the amount to be added or subtracted for each substitution. If in the preparation of the tender, this Subcontractor neglects to name the manufacturer of an accepted 'Alternate', it will be understood that specified or 'Substitute' equipment will be provided.

.7 If, in the opinion of the Consultant, 'Substitute' equipment/material submitted for review as Shop Drawings is not satisfactory, satisfactory equipment/material of the specified or an accepted 'Substitute' manufacturer must be re-submitted.

.8 If, in the opinion of the Consultant, 'Alternate' equipment/material submitted for review as Shop Drawings is not satisfactory, satisfactory equipment/material of the specified or an accepted 'Substitute' manufacturer must be re-submitted.

1.3 APPROVED 'SUBSTITUTES''

.1 The following is the list of pre-approved 'Substitutes':

.1 Access Doors: Lehage; Milcor; Acudor; Mifab;

.2 Air Vents: Hamlet and Garneau; Bell and Gossett; Dole; Maid-O-Mist; Armstrong; Braukman;

.3 Back Flow Preventors: Conbraco; Beeco; Febco; Watts; Kunkle; Taylor; Consolidated; Fisher; Singer; Crosby-Ashton; Boylston; Lonergan; Masoneilan; Wilkins

.4 Chemical Treatment: Bird Archer; Calgon; Dearborne; Mogul; Drew Chemical;

.5 Cleanouts: Ancon; Smith; Zurn; Mifab;

.6 Domestic Water Heaters (Tank type): Ruud/Rheem; AO Smith; John Woods; Jetglass/BradfordWhite;

.7 Insulation (General): Manson; Knauf;

.8 Insulation (Traps): TrapWrap (Brocar); LavGuard (TrueBro);

.9 Level and Flow Switches: Magnetrol;

.10 Plumbing Fixtures, Drains and Brass:

.1 Drinking Fountains: Oasis; Haws; Halsey Taylor; Crane; Franke; Elkay

.2 Electronic Faucets: Cambridge; Kohler; DMP Electronics; Zurn; Chicago; Sloan; Delta;

.3 Emergency Showers and Eyewashes: Guardian; Haws; Bradley

.4 Floor Drains, Grease Traps and Fixture Carriers: Ancon; Smith; Zurn/Watts; Mifab;

.5 Mixing Valves: Leonard; Powers/Crane;

.6 Plumbing Brass: Delta; Waltec; Symmons; Crane; Zurn; Emco; Sloan; PricePfister; Leonard; Mifab; Smith; Moen; Cambridge; Powers;

.7 Plumbing Fixtures (General): Crane; Kohler; American Standard; Toto; Caroma

.8 Plumbing Fixtures (Specialty): Fiat; Bradley; Metcraft;

.9 Showers and Tubs: Hytec; Fiat; Mirolin; Venco/Structural Glass;

.10 Stainless Steel Sinks: Steel Queen; KIL/Aristaline; Franke; Architectural Metals;

.11 Toilet Seats; Olsonite; Centoco; Bemis;

.11 Pressure Gauges: Taylor; Weiss; Marshalltown; Ashcroft; Duro; Lunkenheimer; Trerice; Ametek; Marsh; Winters;

.12 Pressure Relief Valves, Pressure Regulating Valves: Conbraco; Beeco; Febco; Watts; Kunkle; Taylor; Consolidated; Zurn; Fisher; Singer; Crosby-Ashton; Boylston; Lonergan; Masoneilan; Wilkins

.13 Pumps (Circulating): Armstrong; Grundfos; Bell and Gossett; Darling; Taco;

.14 Pumps (Domestic): Armstrong; Grundfos; Bell and Gossett; Wilo; Taco;

.15 Pumps (Domestic Booster): Armstrong; Bell and Gossett; Wilo;

.16 Pumps (Sump and Sewage): Armstrong; Grundfos; Bell and Gossett; Grinder; Myers; Hydromatic; Goulds; Barnes; Zoeller; Liberty

.17	Pumps (Condensate):	Armstrong; Sterling; Aspen
.18	Shock Absorbers:	Smith; Zurn;
.19	Sound and Vibration Isolation:	Vibron; Airmaster; Amber-Booth; Kinetics; Vibro-Acoustics; SVC Ind.;
.20	Strainers:	Armstrong; Crane; Mueller; Sarco; Streamflo; Kitz; Toyo
.21	Thermometers:	Taylor; Weiss; Marshalltown; Ashcroft; Duro; Lunkenheimer; Trerice; Ametek; Marsh; Winters;
.22	Vacuum Breakers:	Febco; Watts; Wilkins; Spirax/Sarco;
.23	Valves (General):	Crane; Kitz; Apollo; Newman-Hattersley; Nibco; Toyo; Jenkins; American Valve; Anvil; KVC;
.24	Valves (Ball):	Worcester; TrueLine;;
.25	Valves (Butterfly):	Kitz; Nibco; Jenkins; Newman-Hattersley; Apollo; Dezurik; Keystone; Crane; TrueLine; KVC; Challenger;
.26	Valves (Check):	Centerline; Hagen; Mueller; Moyer and Groves; Singer; Dezurik; Crane; Apco; KVC; Uni-chek
.27	Valves (PVC):	Chemline;

END OF SECTION

PART 1 General

1.1 GENERAL REQUIREMENTS

.1 Provide fixtures complete with all required trim.

.2 All exposed trim to be chrome plated, fixtures to be white.

.3 Provide individual stops on each fixture water supply. Exposed stops to be screw-driver type. Concealed stops to be wheel handle type.

.4 Provide C.S.A. traps in required sizes with cleanouts.

.5 Make provisions to supply & install all low voltage wiring required for all hands free electronic devices such as: flush valves, faucets, etc… Coordinate voltage requirements & transformer locations with division 26 00 00.

PART 2 Products and Materials

2.1 PLUMBING FIXTURES AND EQUIPMENT LIST

.1 **WC-1 - TOILET - FLOOR MOUNTED - VITREOUS CHINA - HARD-WIRED ELECTRONIC 'NO TOUCH' UNIT EXPOSED FLUSH VALVE**

American Standard Madera FloWise Elongated #3451.001.020 HET Toilet, 381 mm high, Vitreous china with EverClean antimicrobial surface which inhibits the growth of stain and odor causing bacteria mold and mildew, elongated bowl, White Finish, Floor Mounted, Siphon jet flush action, Operates in the range of 4.2 L to 6 L (1.1 US Gal to 1.6 US Gal) per flush, Condensate channel, 305 mm x 254 mm (12" x 10") water surface, Siphon jet flush action, Condensate channel, elongated bowl, 54 mm (2-1/8") fully glazed internal trapway, floor outlet, bolt caps, Toilet seat not included, 38 mm (1-1/2") dia. Top spud. **Centoco #500STSCCSS.001 Toilet Seat,** Heavy Duty, For elongated bowl, open front, Solid plastic, Less cover, Stainless steel self-sustaining check hinges, metal flat washers stainless steel posts and nuts. **Sloan Royal Optima #Royal Optima 111-1.28 ES-S-TMO-CP, Exposed Flushometer** For Top Spud Toilet, polished chrome finish, 4.8 L (1.28 US Gal) factory set flow, quiet action 'PERMEX' diaphragm type with dual filter by-pass, Infrared sensor located on a 125 mm x 125 mm (4-15/16" x 4-15/16") stainless steel plate with vandal-resistant screws, solenoid operated flush controller circuitry, provide c/w courtesy flush True Mechanical Over-ride (TMO) button on mounted on valve, V.P. Smooth design stop cap on bak-chek angle stop (screwdriver operated), Flush tube for 292 mm (11-1/2") rough-in, high pressure vacuum breaker, sensor located above the toilet (mount sensor to clear toilet seat), 5 VA Power Required per unit. **Provide 4" (102 mm) square electrical box for mounting sensor plate. Sloan #EL-154, Box Mount Hardwired Transformer,** 120 VAC/ 24 VAC, 50 VA. **Will**

operate up to 10 'Optima' flush valve units. Provide Floor Flange, (Same material as the connecting pipe drain), with all brass bolts and with rubber gasket.

.2 **WC-2 - TOILET - FLOOR MOUNTED - VITREOUS CHINA - HARD-WIRED ELECTRONIC 'NO TOUCH' UNIT EXPOSED FLUSH VALVE (BARRIER-FREE DESIGN / RIGHT HEIGHT)**

American Standard Madera FloWise Right Height Elongated #3461.001.020 HET Toilet, 419 mm high, Vitreous china with EverClean antimicrobial surface which inhibits the growth of stain and odor causing bacteria mold and mildew, elongated bowl, White Finish, Floor Mounted, Siphon jet flush action, Operates in the range of 4.2 L to 6 L (1.1 US Gal to 1.6 US Gal) per flush, Condensate channel, 305 mm x 254 mm (12" x 10") water surface, Siphon jet flush action, Condensate channel, elongated bowl, 54 mm (2-1/8") fully glazed internal trapway, floor outlet, bolt caps, Toilet seat not included, 38 mm (1-1/2") dia. Top spud. **Centoco #820STSS.001 Toilet Seat,** extra heavy duty, For elongated bowl, open front, Solid plastic, With cover, stainless steel self-sustaining check hinges, metal flat washers stainless steel posts and nuts. **Sloan Royal Optima #Royal Optima 111-1.28 ES-S-TMO-CP-YG, Exposed Flushometer** For Top Spud Toilet, polished chrome finish, 4.8 L (1.28 US Gal) factory set flow, quiet action 'PERMEX' diaphragm type with dual filter by-pass, Infrared sensor located on a 125 mm x 125 mm (4-15/16" x 4-15/16") stainless steel plate with vandal-resistant screws, solenoid operated flush controller circuitry, provide c/w courtesy flush True Mechanical Over-ride (TMO) button on mounted on valve, V.P. Smooth design stop cap on bak-chek angle stop (screwdriver operated), Flush tube for 292 mm (11-1/2") rough-in, high pressure vacuum breaker, sensor located above the toilet, 5 VA Power Required per unit. Sensor to clear toilet seat cover (mount sensor to clear toilet seat)**. Sloan YG** Extended seat bumper. **Provide 4" (102 mm) square electrical box for mounting sensor plate. Sloan #EL-154, Box Mount Hardwired Transformer,** 120 VAC/ 24 VAC, 50 VA. **Will operate up to 10 'Optima' flush valve units. Provide Floor Flange,** (Same material as the connecting pipe drain), with all brass bolts and with rubber gasket.

.3 **LAV-1 - COUNTER MOUNTED UNDERCOUNTER BASIN - SINGLE HANDLE FAUCET - BELOW DECK MECHANICAL WATER MIXING VALVE (BARRIER-FREE DESIGN & GENERAL USE)**

Kohler #K-20000 Caxton Rectangle, Under-mount Basin, center hole only, 20-9/16" x 15-15/16" x 5-5/16 - 7-5/16" (522mm x 405mm x 135-186mm) deep, under-counter mounted, vitreous china, front overflow, c/w basin clamps, white colour. Provide basin rim sealant. **GROHE Eurostyle Cosmopolitan #2304200A Single handle Faucet,** Starlight Chrome finish, Center hole only, SilkMove 35 mm ceramic cartridge, 4.5 L/min (1.2 gal/min) aerator outlet, 102 mm (4") projection reach, Single metal lever handle, Grid drain, EcoJoy technology for less water and perfect flow. **GROHE 48187000 Coupling** aerator, 102-Grohe, Aerator outlet, Pressure compensating, Grohe Single Handle Aerator, 0.5 GPM, 1.9 LPM. **Lawler #TMM-1070, Below Deck Mechanical Water Mixing Valve,** Bronze body, temperature adjusting dial, 10 mm (3/8") inlets and outlet compression fittings, high temperature thermostatic limit stop, shut-off with

automatic reset when temperature exceeds 120 ºF (48.8 ºC), Integral checks, offer temperature range from full cold through 46 °C (114.8 °F). **Provide tee, adaptors and flex. copper tubing to suit installation. McGuire #LFH165LKN3 Faucet Supplies,** Chrome plated finish polished brass, heavy duty angle stops, 10 mm (3/8") I.P.S. Inlet x 76 mm (3") long rigid horizontal nipples, V.P. Loose keys, Escutcheon and flexible copper risers. **McGuire #155WC Offset Open Grid Drain,** cast brass one piece top, 17 GA. (1.5 mm) mm tubular 32 mm (1-1/4") tailpiece. **McGuire #8872C P-Trap,** heavy cast brass adjustable body, with slip nut, 32 mm (1-1/4") size, Shallow wall flange and Seamless tubular wall bend. **McGuire PROWRAP #PW2000WC Sanitary Covering vandal-resistant,** flexible seamless moulded closed-cell PVC resin, formulated with anti-microbial additive to limit the growth of fungus and bacteria, to exposed piping (to protect against heat/contusions) as per local codes.

.4 **SK-1 - SINGLE BOWL SINK - COUNTERTOP WITH LEDGEBACK - STANDARD USE - 302/304 STAINLESS STEEL - SINGLE HANDLE FAUCET – (BARRIER-FREE DESIGN)**

Franke Commercial #ALBS4005P-1/1 Single Bowl Countertop Mount Sink, 1 hole, 562 mm (22-1/8") wide x 478 mm (18-13/16") long x 127 mm (5") high deep, Counter mounted, backledge, Grade 18-10 18 GA. (1.2 mm) type 304 stainless steel, self-rimming, Satin finish rim and bowls, Mounting kit provided, Fully undercoated to reduce condensation and resonance, factory applied rim seal, 3-1/2" (89 mm) crumb cup waste assembly with 1-1/2" (38 mm) tailpiece.
GROHE Eurosmart #30306000 Single handle Faucet, Starlight Chrome finish, Center hole only, Brass body, SilkMove 35 mm ceramic cartridge, 6.6 L/min (1.75 gal/min) aerator outlet, Swivel spout with dual spray - locking push button switches from regular water flow to spray, 225 mm (8-7/8") projection reach, Protected against backflow.
GROHE 64999000 Coupling Black / gray, 102-Grohe, GROHE Quick Connect Coupling with Flow-Restriction, Grohe Quick Connect Coupling With Flow Restriction, 1.5 GPM, 5.7 LPM. **McGuire #LFH165LKN3 Faucet Supplies,** Chrome plated finish polished brass, heavy duty angle stops, 10 mm (3/8") I.P.S. Inlet x 76 mm (3") long rigid horizontal nipples, V.P. Loose keys, Escutcheon and flexible copper risers. **McGuire #1000WC Sink Strainer Drain Offset,** cast brass one piece top, 17 GA. (1.5 mm) mm tubular 38 mm (1-1/2") tailpiece.**McGuire #8912CB P-Trap,** heavy cast brass adjustable body, with slip nut, 38 mm (1-1/2") size, Box flange and Seamless tubular wall bend. **McGuire PROWRAP #PW2000 Sanitary Covering vandal-resistant,** flexible seamless moulded closed-cell PVC resin, formulated with anti-microbial additive to limit the growth of fungus and bacteria, to exposed piping (to protect against heat/contusions) as per local codes.

.5 **SK-2 – MOP SERVICE SINK**

Stern Williams #MTB-2424 Square Service / Mop Sink, 610 mm (24") wide x 610 mm (24") long x 254 mm (10") high deep, Floor mounted, terrazzo composed of pearl gray marble chips and Portland cement ground smooth, sealed to resist stain finish, cast brass drain with stainless steel strainer, 3"(75 mm) outlet.
Complete with drain gasket. Chicago Faucets #897-CP Wall Mounted Two handles

Faucet, chrome plated finish, flexible installation within the range of 200 mm (7-5/8") to 213 mm (8-3/8") centerset, solid brass exposed body, 1/4 turn ceramic disc valve cartridges with integrated check valves, Unrestricted hose end outlet, 203 mm (8") projection spout with atmospheric vacuum breaker and bucket hook, 60 mm (2-3/8") metal vandal proof lever handles with blue and red index buttons, wall brace support. **Stern Williams A-20** Bumper Guard anodized aluminum cap. **Stern Williams T-35 Hose and Wall Hook** 36" (914 mm) long hose with 3/4" (19 mm) chrome coupling, stainless steel wall bracket. **Stern Williams #T-40 Mop Hanger,** stainless steel #4 finish, 24" (610 mm) long with 3 rubber spring loaded clips. **Stern Williams BP Back Splash Panel** 20 GA. (0.9 mm) type 304 stainless steel. **Provide P-Trap,** Same material as the connecting pipe drain.

.6 **SH-1 – SHOWER – BUILT-UP ON SITE - HAND SHOWER – (BARRIER FREE)**

.1 Built-up shower stall as specified by Architect/Interior Designer. Refer to Architectural drawings for floor and wall construction details. Refer to Architectural/Interior Design drawings for grab bar, seating, shower curtain, rod, & all other accessories. Design shall comply with CSA B651 Barrier Free requirements for a roll-in shower.

.2 Comply with local codes for grab bar requirements, shower control location and to verify threshold size. Confirm all final requirements with Architect/Interior designer.

.3 Provide **Delta model R10700-UNWS rough in c/w T13H332 Shower Valve, trim, & heads.** Shower Diverter Valve, 610mm (24") S/S Grab Bar with ADA slide & 1.5 USGPM (5.7 L/min.) hand shower. All parts replaceable from the front, C.P. pressure balancing controller, all bronze and stainless steel internal parts, integral volume control, maximum temperature limit stop, integral service stops, single control 85mm (3.33") metal lever handle. Provide c/w C.P. vacuum breaker in line (mounted in hose at wall supply fitting). C.P. wall hook/fixed wall bracket (for mounting hand shower head next to lift-up seat – where required by local codes.) Shower #: 3, **Delta** 1.5 USGPM (5.7 L/min.) Showerhead, c/w chrome finish, Arm & Set Screw Flange. Handle #2, 85mm (3.33") metal lever handle.

.4 **Watts #FD-100-C-A Floor Drain,** epoxy coated cast iron, anchor flange, 5" (127mm) adjustable round nickel bronze strainer, reversible clamping collar with primary & secondary weepholes. **Provide P-Trap,** same material as the connecting pipe drain.

.5 Provide all necessary piping, couplings and adaptors to connect shower valve, controls and showerhead. Provide adequate backing in wall for mounting head and valves.

.7 **DF-1 – DRINKING FOUNTAIN COOLER - STAINLESS STEEL RECEPTOR AND STAINLESS STEEL CABINET - WALL HUNG - BARRIER-FREE DESIGN**

Elkay EZH2O Bottle Filling Station with Single Filtered LZ Cooler #LZS8WSLP wall hung water cooler, sensor, touchless activation with auto 20-second shut off (bottle filler), single, 8 GPH of 50 ºF drinking water at 90 ºF ambient and 80 ºF inlet water, light gray granite vinyl clad steel cooler cabinet, galvanized structural steel cooler chassis frame provides structural integrity, laminar flow provides minimal back splash, lead-free design, easy-touch front and side pushbar controls (cooler), Flexi-Guard safety bubbler utilizes an infused anti-microbial pliable polyester elastomer to prevent mouth injuries, real drain system eliminates standing water, stainless steel bottle filler wrapper with ABS plastic alcove, quick fill rate of 1.1 gpm, Innovative Green Ticker counts bottles saved from waste. Compressor: hermetically-sealed, reciprotcating type, single phase. Sealed-in lifetime lubrication, condenser: fan cooled, copper tube with aluminum fins, fan motor is pemanently lubricated, cooling unit: combination tube-tank type, self-cleansing, continuous copper tubing with stainless steel tank, fully insulated with eps foam which meets UL requirements for self-extinguishing material, Chilling Capacity of 8GPH, Voltage Requirement: 115V at 60 Hz, current of 5.0 Amps, power consumption: 370W, refrigerant control: refrigerant R134a is controlled by accurately calibrated capillary tube, temperature control: easily accessible enclosed adjustable thermostat is factroy preset, WaterSentry Plus 3000-gallon capacity filtration system, NSF/ANSI 42 & 53 certified, LED Visual Filter Monitor shall automatically detect new filter and reset visual filter monitor while diagnosing system issues and relay related messages, Green Spec Listed. Integrated silver ion anti-microbial protection in key areas. **McGuire #LFHST11LK, Drinking Fountain Supply**, chrome plated polished brass, straight stops, 10 mm (3/8") I.P.S. Inlet, V.P. Loose key. **McGuire #8872C P-Trap**, heavy cast brass adjustable body, with slip nut, 32 mm (1-1/4") size, shallow wall flange and seamless tubular wall bend. **Watts #CA-311, Fixture Carrier**, mounted on concrete floor, universal steel hangar support plates with integral mounting brackets, heavy gauge epoxy coated steel offset uprights with welded feet supports. For one unit: 102 mm (4") for two to six units in a row: 152 mm (6") finished metal stud wall to back of pipe space.

.8 **FD-1 - FLOOR DRAIN FOR FINISHED AREAS**

.1 Provide cast iron body floor drains with nickel bronze strainers, clamping ring, drainage flange, weep holes, and reversible collars.
.2 Provide c/w membrane clamp to suit flooring (i.e. sheet vinyl, etc…)
.3 **Watts** FD-100-FC, **Zurn** ZN-211-R6.

.9 **FD-2 - FUNNEL FLOOR DRAIN**

.1 Provide cast iron body floor drains with nickel bronze strainers, clamping ring, drainage flange, weep holes, reversible collars, and funnel.
.2 **Watts** FD-100-EG, **Zurn** ZN-211-BF.

.10 **FD-3 - STANDARD FLOOR DRAIN FOR UNFINISHED AREAS**

.1 Provide cast iron body floor drains with nickel bronze strainers, clamping ring, drainage flange, weep holes, and reversible collars.

.2 **Watts** FD-100, **Zurn** ZXN-211-A.

.11 **DN-1 – WEEPING TILE SUMP PIT DISCHARGE NOZZLE**

.1 Provide discharge nozzle with all nickel bronze bronze body, decorative face of wall flange and outlet nozzle, anchor flange, counter-sunk mounting holes, with removable stainless steel screen.
.2 3" (76mm) pipe inlet size.
.3 **Zurn** ZANB199-SS.

.12 **WH-1 - EXTERIOR NON-FREEZE HOSE BIBB/WALL HYDRANT**

.1 Provide 20 mm (¾") non freeze wall faucet with nickel bronze face (and box), adjustable wall flange, vacuum breaker and operating key. Length to suit wall thickness.
.2 With Locking Box: **Ancon HY-700-VB**; **Zurn Z-1305-VB**

.13 **HB-1 HYDRANTS - INTERIOR - HOSE BIBB**
Acorn #8121CP 'NEPTUNE' Hose Valve, heavy duty polished chrome cast brass body with integral cast flange, vandal-resistant lock shield bonnet with removable wheel handle, 3/4" (19mm) NPT female inlet and hose end vacuum breaker.

.14 **DISHWASHER (DOMESTIC)**

.1 Dishwasher supplied & set in place by Others. Final plumbing connections to be made by Mechanical Contractor.
.2 Provide connection to sink trap-arm c/w fitting.
.3 Provide separate 1/2" (12mm), flex, hot water supply c/w shut-off valve.

.15 **WSP-1,2 – SUMP PIT & DUPLEX PUMP SYSTEMS (Weeping Tile)**

.1 General: The contractor shall provide labor, material, equipment, and incidentals required for a two (2) centrifugal pump system as specified herein. The pump furnished for this application shall be model 280-2 as manufactured by LIBERTY PUMPS. The pump, level sensor, control panel and alarm shall be shipped unassembled for installation in the field. All internal piping by others. Lifting chains shall be provided.

.2 Operating Conditions: Each submersible pump shall be rated for 1/2 hp, 115V/1ø, single phase, 60 Hz, & 3450 RPM. The unit shall produce 30 G.P.M. at 20 feet of total dynamic head. The submersible pump shall be capable of handling water with 3/4" solid handling capability. The submersible pump shall have a shut-off head of 37 feet and a maximum flow of 62 GPM @ 5 feet of total dynamic head. The pump shall be controlled with a NEMA 1 indoor duplex control panel with three float switches and a high water alarm, Liberty AE21L=3.

.3 Construction: Each submersible pump shall be equal to the certified Series 280 SERIES pumps as manufactured by Liberty Pumps, Bergen NY. The castings shall be constructed of class 25 cast iron. The motor housing shall be oil filled to dissipate heat. Air filled motors shall not be considered equal since they do not properly dissipate heat from the motor. All mating parts shall be machined and sealed with a Buna-N o-ring. All fasteners exposed to the liquid shall be stainless steel. The motor shall be protected on the top side with sealed cord entry plate with molded pins to conduct electricity eliminating the ability of water to enter internally through the cord. The motor shall be protected on the lower side with a unitized ceramic/carbon seal with stainless steel housings and spring. The pump shall be furnished with stainless steel handle.

.4 Electrical Power Cord: The submersible pump shall be supplied with 25 feet of multiconductor power cord. It shall be cord type SJTW, or SJTOOW capable of continued exposure to the pumped liquid. The power cord shall be sized for the rated full load amps of the pump in accordance with the National Electric Code. The power cable shall not enter the motor housing directly but will conduct electricity to the motor by means of a water tight compression fitting cord plate assembly, with molded pins to conduct electricity. This will eliminate the ability of water to enter internally through the cord, by means of a damaged or wicking cord.

.5 Motors: Single phase motors shall be oil filled, permanent split capacitor, class B insulated NEMA B design, rated for continuous duty. At maximum load the winding temperature shall not exceed 130 degrees C unsubmerged. Since air filled motors are not capable of dissipating heat they shall not be considered equal. The pump motor shall have an integral thermal overload switch in the windings for protecting the motor. The capacitor circuit shall be mounted internally in the pump.

.6 Bearings and Shaft: An upper and lower ball bearing shall be required. The ball bearing shall be a single ball / race type bearing. Both bearings shall be permanently lubricated by the oil, which fills the motor housing. The motor shaft shall be made of 300 or 400 series stainless steel and have a minimum diameter of .311".

.7 Seals: The pump shall have a unitized carbon / ceramic seal with stainless steel housings and spring equal to Crane Type 6A. The motor plate / housing interface shall be sealed with a Buna-N o-ring.

.8 Impeller: The impeller shall be vortex style made of an engineered polymer, with pump out vanes on the back shroud to keep debris away from the seal area. It shall be threaded to the motor shaft.

.9 Controls: The Liberty AE21L=3 will provide alternating operation of the two pumps. The enclosure shall be Nema 1 for indoor use. The 3 floats shall provide stop, lead, lag/alarm control. The panel shall include magnetic motor contacts, HOA switches, green pump run indicators, control on/off switch, float switch terminal block, control/alarm fuse, control/alarm power on indicator, float status indicators, circuit breaker and auxiliary contacts.

.10 Paint: The exterior of the casting shall be protected with powder coat paint.

.11 Support: The pump shall have cast iron support legs, enabling it to be a free standing unit. The legs will be high enough to allow 3/4" solids to enter the volute.

.12 Sump Pit: The tank/pit shall be concrete cast-in-place , coordinate with the structural engineer. Pit shall come complete with a bolted & sealed steel cover. The pit shall be 36" diameter (or 30"x30"), with height to be determined by contractor & structural. Any inlet hubs shall be field installed. Discharge piping shall be through the cover of the sump pit.

.13 Testing: The pump shall have a ground continuity check and the motor chamber shall be Hi-potted to test for electrical integrity, moisture content and insulation defects. The motor and volute housing shall be pressurized, and an air leak decay test is performed to ensure integrity of the motor housing. The pump shall be run, voltage and current monitored, and the tester checks for noise or other malfunction.

.14 Quality Control: The pump shall be manufactured in an ISO 9001 certified Facility.

.15 Warranty: Standard limited warranty shall be 3 years

END OF SECTION

PART 1 GENERAL

1.1 RELATED SECTIONS

.1 Section 21 05 01, Mechanical General Provisions.

.2 Sections 22 06 01 & 23 06 01, Approved Substitute List.

.3 Section 21 05 05, Basic Materials and Methods.

.4 Section 23 30 00, Air Distribution.

1.2 WORK PERFORMED UNDER THIS SECTION

.1 As indicated on the Drawings and in the Specifications, provide complete duct cleaning service, including:

.1 Cleaning of Air Handling Equipment

.2 Cleaning of Heating Coils

.3 Cleaning of HVAC Ductwork

.4 Provision of new access panels and doors as required

1.3 QUALITY ASSURANCE

.1 Qualifications: Execute work of this section by skilled tradesmen regularly employed in:

.1 The cleaning of duct systems

.2 The installation of duct access doors and panels

.3 The installation of ceiling access doors

PART 2 PRODUCTS AND MATERIALS

2.1 CEILING ACCESS PANELS AND DOORS

.1 The Contractor and Sub-contractor shall coordinate as required to ensure that ceiling access doors supplied by different sub- and sub-sub-contractors shall be of the same manufacturer, and of a style appropriate for the intended use.

.2 Provide ceiling access doors equal to the fire rating of the ceiling in which it is installed.

.3 Lay-in type tiles, properly marked, may serve as access panels.

.4 In concealed locations, and in rated ceilings, provide access doors of welded 12 gauge steel, flush type with concealed hinges, lock and anchor straps, complete with factory prime coat.

.5 In exposed locations in non-rated partitions and ceilings, provide Bauco model BP 'Invisible Seam' type access doors as distributed by:

Bauco Products Incorporated
407 St. Charles Street
Victoria, B.C., V8S 3N4
Phone: 1-877-592-0033 – or – (205) 592-0033
Fax: 1-877-592-7587 – or – (205) 595-0513

.6 All access panels and doors shall be minimum 300 mm x 300 mm (12" x 12"). Where personnel entry is required, minimum size shall be 600 mm x 600 mm (24" x 24").

2.2 DUCT ACCESS PANELS AND DOORS

.1 Provide latched and gasketed access doors where required, constructed of 22 gauge materials with flat iron or angle iron stiffening forms, so constructed that the door can be operated without twisting or distortion.

.2 Doors in insulated ductwork: double panel construction with a 25 mm (1") insulating filler.

PART 3 INSTALLATION AND EXECUTION

3.1 CEILING ACCESS PANELS AND DOORS

.1 Ceiling access doors shall be supplied by the trade requiring the door, and shall be installed by the appropriate architectural or finishing trade. All pertinent information required for the installation of the access door shall be provided by the supplying trade to the installing trade.

.2 Prepare detail drawings showing location and type of all access doors in coordination with other trades before proceeding with installation and hand these to the Contractor for approval.

.3 Size access doors to provide adequate access and commensurate with the type of structure and architectural finish.

.4 Ensure proper rating of doors in fire separations.

3.2 DUCT ACCESS PANELS AND DOORS

.1 Where ductwork has no internal acoustic insulation, new openings required for duct cleaning may be made by neatly cutting the sheet metal. The opening shall be closed by installing a manufactured duct access door or fabricating a sheet metal closure.

.1 A fabricated sheet metal closure shall be:

.1 of at least the same gauge as the duct

.2 at least 3/4" larger than the opening on all sides

.3 attached with sheet metal screws

.4 sealed with duct sealant

.2 Where ductwork has internal acoustic insulation, new openings required for duct cleaning shall be manufactured duct access doors with double panel construction and 1" insulating filler.

3.3 CLEANING

.1 Responsibility:

.1 It is the responsibility of the sheet metal sub-trade to ensure that all ductwork installed or modified under this contract is internally and externally clean when handed over to the City of Winnipeg. It includes all ductwork whether lined or not, all plenums and all equipment within duct and plenums.

.2 Installation Procedure:

.1 Wipe or brush ducts clean immediately before installation. Close all dampers immediately following installation thus checking the operation and preventing the movement of contaminants through the system. Seal all openings at the end of each day and at such other time as site conditions dictate. Openings to be covered with 0.15 mm thick poly sheet, taped so as to be air tight. Floor openings to be capped with sheet metal or floor grilles plus 0.15 mm thick poly. The ducts must remain sealed until the systems area is ready to be started up and must be resealed if subsequent construction creates a risk of dust entering the ductwork.

.3 Cleaning Procedure:

.1 On completion of the duct and plenum installation and prior to the installation of grilles, registers and diffusers and the use of air systems:

.1 Vacuum clean all plenums.
.2 Install air filters of the specified performance.
.3 Blow-out all supply ducts by operating the supply fan.
.4 Install grilles, registers and diffusers.

.2 Prior to balancing the air systems, but not until authorized by the Design Authority:

.1 Vacuum clean all supply and return air ducts, all plenums and all coils.
.2 Submit a report that certifies all specified air systems have been cleaned. The Design Authority will inspect for cleanliness of ductwork at Substantial Performance.

.3 The cleaning shall be to the satisfaction of the Design Authority and City of Winnipeg.

.4 General Clean-up:

.1 The worksite shall be maintained in a condition of general cleanliness and tidiness.

.2 Provide, erect, maintain and remove temporary protective barriers and shelters. Use drop sheets, temporary walls or other means necessary to limit the spread of construction dirt and debris. Barriers shall be used to minimize the spread of dust, smoke, fumes and noise to other portions of the building.

.3 For renovation work, and for phased work where part of the building is occupied, coordinate and cooperate with the occupants throughout the duration of the project to maintain the site in a usable condition.

.4 For renovation work, and for phased work where part of the building is occupied, clean the site to the satisfaction of the occupants at the end of each work day, so as to neither inconvenience the occupants nor hinder the use of the facility.

.5 For renovation work, at the end of the project, provide cleaning services to leave the site in as clean a condition as existed before the commencement of the work.

.5 Mechanical Systems Clean-up:

.1 At the completion of the project, leave all systems in full operation, the exterior of all new and renovated systems clean, and the work areas cleaned to the satisfaction of the Engineer, City of Winnipeg and Occupants.

.2 Clean exposed surfaces of new and renovated mechanical equipment, ductwork, piping, etc.

.3 The level of cleaning shall be consistent with the intended use of the building and the mechanical systems.

.4 The City of Winnipeg reserves the right to inspect the Mechanical Systems to determine the effectiveness of the cleaning. Where cleaning is deemed to be unacceptable, the cleaning shall be re-done at no extra charge to the City of Winnipeg.

.6 Special Cleaning:

.1 Polish plated work.

.2 Vacuum clean and remove debris from the inside of air handling systems, fans, ducts, coils, terminal units, etc.

.3 Duct Cleaning Specialist(s) shall provide a report at the Occupancy Stage of each Construction Phase, which shall include:

.1 Name, Address and Phone Numbers of the Company.

.2 Name(s) of Individuals Performing the Work.

.3 Description of the Work Performed, including methods, equipment, and extent of ductwork.

.4 A Video Tape showing the Complete Interior of the Full Length of all Main Ducts, with camera angles looking down each Branch Duct.

END OF SECTION

PART 1 General

1.1 RELATED SECTIONS

.1 Section 21 05 01, Mechanical General Provisions.

.2 Section 21 05 05, Basic Materials and Methods.

.3 Sections 22 06 01 and 23 06 01, Approved Substitute Schedules.

.4 Section 23 05 93, Testing and Balancing.

.5 Section 23 21 05, Liquid Heat Transfer.

.6 Section 23 30 00, Air Distribution.

.7 Comply with the requirements of the Architectural Specifications.

1.2 WORK FURNISHED BUT NOT INSTALLED

.1 The materials and systems specified in this Section shall be purchased from a single vibration isolation materials manufacturer to assure single source responsibility for the performance of isolation materials used.

.2 The materials and systems specified in this section can, at the sub-contractor's option, be installed by the sub-sub-contractors who install the mechanical equipment, piping or ductwork.

1.3 DESCRIPTION OF SYSTEM

.1 The work under this section shall include furnishing all labor, materials, tools, appliances and equipment, and performing all operations necessary for the complete execution of the installation of vibration isolation devices and systems as shown, detailed, and/or scheduled on the drawing and/or specified in this section of the specifications. This work in general shall include but not necessarily be limited to the following:

.1 All motor driven mechanical equipment shall be isolated from the building structure by means of vibration isolators.

.2 All piping connected to isolated equipment shall be supported on the first three support points by spring hangers.

.3 All ductwork connected to isolated equipment shall be isolated using flexible duct connectors, provided under Section 23 30 00 – Air Distribution.

.2 Equipment Isolation Schedule

.1 Air Cooled Chiller:

.1 Heating/cooling Water piping connections.
.2 Internal Isolation/attenuation by supplier/manufacturer.

.2 Energy Recovery & Dedicated Outdoor Air Units (ERV-1):

.1 Flexible Duct Connections,
.2 Internal Fan Isolation/attenuation by ERV supplier/manufacturer.

.3 Exhaust, Supply, & Transfer Fans:

.1 Suspended Spring Isolation,
.2 Flexible Duct Connections.

.4 Unit Heaters:

.1 Suspended Spring Isolation,

.5 Active Chilled Beams & Radiant Panels:

.1 Suspended Spring Isolation,

.6 VAV terminals:

.1 Suspended Spring Isolation,

.7 Incremental Heat Pumps & Fan Coil Units:

.1 Suspended Spring Isolation,
.2 Flexible Duct Connections.

.8 Heating/Cooling Circulation Pumps (CP-1A, CP-1B, CP-2A, CP-2B):

.1 Piping connections,
.2 Base/floor isolation.

1.4 SYSTEM DESIGN

.1 The isolation materials manufacturer shall be responsible for the proper selection of isolators to accomplish the specified minimum static deflections, for all isolators, based on the actual weight distribution of the equipment and pipe to be isolated, and the piping layout.

.2 The sub-contractor shall furnish to the vibration isolation supplier, a complete set of approved shop drawings of all mechanical equipment to receive vibration isolation devices to the vibration isolation materials manufacturer, based upon which the selection

of vibration isolators will be completed. The shop drawings to be furnished shall include operating weights of the equipment to be isolated and the distribution of weight at the support points.

.3 The sub-contractor shall furnish to the vibration isolation supplier, a complete layout of the piping to be isolated, showing the size and/or weight, and the support points of the piping system.

.4 It is a requirement of this Specification that the Mechanical equipment be designed and installed so that the average noise criteria curves as outlined in the latest edition of the ASHRAE guide for this type of project are not exceeded. Where objectionable noise or vibration is encountered due to faulty equipment or inefficient vibration reduction devices, as determined by the Engineer, make necessary tests, change and provide additional equipment as may be required and approved, without extra charge.

.5 Give consideration to side loading of equipment when calculating maximum loads on isolators; provide pairs of side snubbers and/or restraining springs where side torque or thrust may develop. When properly adjusted, the equipment shall be level when operating.

.6 Provide all spring isolators with height and levelling adjustment and set on neoprene antisound pads 6 mm (1/4") or thicker. Do not use sponge rubber for side snubbers.

.7 All hardware shall be corrosion resistant.

1.5 SUBMITTALS

.1 Submit data for Vibration Isolation Materials and Components.

.2 Submit shop drawings showing:

.1 The construction of the isolation devices to be used, including specific selection of isolators for the equipment to be furnished for this project,

.2 A tabulation of the design data for each isolator, including spring O.D., free operating, and solid heights,

.3 Ratio of horizontal to vertical stiffness,

.4 Isolator location,

.5 Load forces,

.6 Anchor positions,

.7 Installation and adjustment instructions,

.8 Other required data to clearly indicate that the specified isolator types and minimum static deflections are provided by the system submitted.

.3 Samples:

.1 The sub-contractor shall submit samples, for approval, of isolation devices offered as substitutions to those specified, on the request of the Engineer. The sub-contractor shall also submit samples, for approval, of specified isolation devices, on the request of the Engineer.

.4 Closeout Submittals:

.1 Provide maintenance data for incorporation into Operation and Maintenance Manual.

.5 Sustainability Submittals:

.1 Conform to all of the requirements of the Architectural Specifications, but take special note in relation to Environmentally Friendly Materials, Garbage and Recycling, and Start-up and Commissioning.

PART 2 Products And Materials

2.1 SOURCE OF MATERIALS

.1 All vibration isolation materials shall be provided by a single manufacturer to assure single source responsibility for the proper performance of materials used.

.2 Materials and systems specified herein and as detailed or scheduled on the drawings are based on materials manufactured by Kinetics Noise Control, Inc.

2.2 ISOLATOR TYPES

.1 Type 1, Floor-Mounted Equipment:

.1 Vibration isolation pads shall be pre-compressed molded fiber glass pads individually coated with a flexible, moisture impervious elastomeric membrane. Vibration isolation pads shall be molded from glass fibers with fiber diameters not exceeding 0.00027 in. and with a modulus of elasticity of 10.5 million PSI. Natural frequency of fiberglass vibration isolation pads shall be essentially constant for the operating load range of the supported equipment. Vibration isolation pads shall be color coded or otherwise identified to indicate the load capacity. Vibration isolation pads shall be Model KIP, as manufactured by Kinetics Noise Control, Inc.

- or -

.2 Vibration isolators shall be as described above but bonded to a steel load transfer plate and a formed steel bolt-down bracket, and shall also include an equipment mounting bolt with an anti-short-circuit neoprene grommet. Anchored vibration isolators shall be Model AC as manufactured by Kinetics Noise Control, Inc.

- or -

.3 Vibration Isolators shall be neoprene, molded from oil-resistant compounds, with cast-in-top steel load transfer plate for bolting to supported equipment, and a bolt-down plate with holes provided for anchoring to supporting structure. Top and bottom surfaces shall have non-skid ribs. Neoprene vibration isolators shall have minimum operating static deflections not exceeding published load capabilities. Neoprene vibration isolators shall be Model RD, as manufactured by Kinetics Noise Control, Inc.

.2 Type 1, Suspended Equipment:

.1 Vibration isolators with maximum static deflection requirements under operating load conditions not exceeding 0.40" shall be hangers consisting of an elastomer-in-shear insert encased in a welded steel bracket and provided with a stamped load transfer cap.

.2 The elastomer insert shall be neoprene, molded from oil resistant compounds and shall be color-coded to indicate load capacity and selected to operate within its published load range.

.3 The hanger bracket shall be designed to carry a 500% overload without failure and to allow a support rod misalignment through a 30 degree arc without metal-to-metal contact or other short circuit.

.4 Vibration isolation hanger assembly shall be Model RH, as manufactured by Kinetics Noise Control, Inc.

.3 Type 2, Floor-Mounted Equipment:

.1 Vibration isolators shall be free standing, unhoused, laterally stable steel springs wound from high strength spring steel. Springs shall have a lateral stiffness greater than 0.8 times the rated vertical stiffness and shall be designed to provide up to 50% overload capacity. Springs shall be selected to provide operating static deflections not exceeding published load capabilities. Springs shall be color coded or otherwise identified to indicate load capacity.

.2 Springs shall be assembled between a top and bottom steel load plate. The upper load plate shall be provided with a steel leveling bolt lock-nut and washer for attachment to the supported equipment.

.3 The lower load plate shall have a non-skid noise isolation pad bonded to the bottom and have provisions for bolting the isolator to the supporting structure.

.4 Spring isolation mounts for floor mounted equipment shall be Model FDS, as manufactured by Kinetics Noise Control, Inc.

.4 Type 2, Suspended Equipment, Piping, Ductwork:

.1 Vibration isolators for suspended equipment, with minimum static deflection requirement exceeding 0.4", shall be hangers consisting of a free-standing laterally stable steel spring and elastomeric washer in series, assembled in a stamped or welded steel bracket.

The spring element shall have a lateral stiffness greater than 0.8 times the rated vertical stiffness and shall be designed to provide up to 50% overload capacity. Springs shall be selected to provide operating static deflections not exceeding published load capabilities. Springs shall be color coded or otherwise identified to indicate load capacity.

Vibration isolation hangers shall be Model SH, as manufactured by Kinetics Noise Control, Inc.

- or -

.2 Vibration isolators for suspend equipment with minimum static deflection requirement exceeding 0.4", and where both high and low frequency vibrations are to be isolated, shall be hangers consisting of a laterally stable steel spring in series with a pre-compressed molded fiberglass insert, complete with load transfer plates and assembled in a stamped or welded steel bracket.

The fiberglass insert element shall be molded from glass fibers with fiber diameters not exceeding 0.00027 in. and with a modulus of elasticity of 10.5 million PSI. Natural frequency of fiberglass vibration isolation pads shall be essentially constant for the operating load range of the supported equipment. Vibration isolation pads shall be color coded or otherwise identified to indicate the load capacity.

The spring element shall have a lateral stiffness greater than 0.8 times the rated vertical stiffness and shall be designed to provide up to 50% overload capacity. Springs shall be selected to provide operating static deflections not exceeding published load capabilities. Springs shall be color coded or otherwise identified to indicate load capacity.

The stamped or welded hanger bracket shall be designed to carry a 500% overload without failure and to allow a support rod misalignment through a 30 degree arc without metal-to-metal contact or other short circuit.

The combination isolation hanger assembly with fiberglass inserts shall be Model SFH, as manufactured by Kinetics Noise Control, Inc

2.3 VIBRATION ISOLATOR SELECTION

.1 Selection of vibration isolator types, and minimum operating static deflections, shall be the responsibility of the isolation materials manufacturer/supplier.

.2 Isolator natural frequency to be 40% of the lowest equipment operating speed.

.3 Provide HSR thrust restraints for air moving equipment operating at 2.1" static pressure and above.

.4 Vibration isolator types and minimum operating static deflections for suspended or floor mounted piping shall be as follows:

.1 Types 1 and 2 hangers, or Type 2 floor mounts, with minimum operating static deflections equal to 50% of connected equipment isolator deflection, or one (1) inch, whichever is greater, shall be used to support all piping for a minimum of three support locations.

.5 Vibration isolator types and minimum operating static deflections for suspended air distribution elements shall be as follows:

.1 Type 2 hangers, or Type 2 floor mounts with minimum operating static deflections equal to 50% of connected equipment isolator deflection.

.6 Isolator types are scheduled to establish minimum standards. At the contractor's option, labor saving accessories can be an integral part of the isolators supplied, to provide initial lift of equipment to operating height, to hold piping at fixed elevations during installation and initial system filling operations, and for similar installation advantages, provided the isolators supplied incorporate the specified isolator type, and do not degrade the noise and vibration isolation of the equipment.

2.4 HANGERS

.1 Colour coded springs, rust resistant, painted box type hangers. Arrange to permit hanger box or rod to move through a 30 degrees arc without metal to metal contact.

.2 Type H1 - neoprene - in-shear, moulded with rod isolation bushing which passes through hanger box.

.3 Type H2 - stable spring, elastomeric washer, cup with moulded isolation bushing which passes through hanger box.

.4 Type H3 - stable spring, elastomeric element, cup with moulded isolation bushing which passes through hanger box.

.5 Type H4 - stable spring, elastomeric element with precompression washer and nut with deflection indicator.

2.5 ACOUSTIC BARRIERS FOR ANCHORS AND GUIDES

.1 Acoustic barriers: between pipe and support, consisting of 25 mm minimum thick heavy duty duck and neoprene isolation material.

2.6 HORIZONTAL THRUST RESTRAINT

.1 Spring and elastomeric element housed in box frame; assembly complete with rods and angle brackets for equipment and ductwork attachment; provision for adjustment to limit maximum start and stop movement to 9 mm.

.2 Arrange restraints symmetrically on either side of unit and attach at centerline of thrust.

PART 3 Installation And Execution

3.1 GENERAL

.1 Isolator natural frequency to be 40% of the lowest equipment operating speed.

.2 Provide HSR thrust restraints for air moving equipment operating at 2.1" static pressure and above.

3.2 INSTALLATION

.1 Install vibration isolation equipment in accordance with manufacturer’s instructions and adjust mountings to level equipment.

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

.3 Unless indicated otherwise, support piping connected to isolated equipment with spring mounts or spring hangers with 25 mm (1”) minimum static deflection as follows:

.1 Up to DN 100 (NPS 4): first 3 points of support. DN 125 (NPS 5) to DN 200 (NPS 8): first 4 points of support. NPS10 and Over: first 6 points of support.

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

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

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

.6 On completion of the installation of all isolation materials, and before start-up of isolated equipment, all debris shall be cleared from the areas surrounding, and from beneath, all isolated equipment, leaving the equipment free to move on the isolation supports.

.7 No rigid connections between the equipment and the building structure shall be made that degrades the noise and vibration isolation system herein specified. Electrical conduit connections to isolated equipment shall be looped to allow free motion of isolated equipment.

3.3 FIELD QUALITY CONTROL

.1 Inspection

.1 The sub-contractor shall notify the local representative of the vibration isolation materials manufacturer prior to installing any vibration isolation devices. The sub-contractor shall seek the representative's guidance in any installation procedures with which he is unfamiliar.

.2 The local representative of the vibration isolation materials manufacturer shall conduct periodic inspections of the installation of materials herein specified, and shall report in writing to the sub-contractor any deviations from good installation practice observed.

.3 On completion of the installation of all noise and vibration isolation devices herein specified, the local representative of the isolation materials manufacturer shall inspect the completed system and report in writing any installation errors, improperly selected isolation devices, or other fault in the system that could affect the performance of the system.

.4 The installing contractor shall submit a report to the Engineer, including the manufacturer representative's final report, indicating all isolation material is properly installed or the steps to be taken by the sub-contractor to properly complete the isolation work as per the specifications.

.2 Manufacturer's Field Services:

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

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

.3 Submit manufacturer's reports to Consultant for review.

.4 Make adjustments and corrections in accordance with written report.

.3 Inspection and Certification:

.1 Experienced and competent sound and vibration testing professional engineer to take vibration measurement for HVAC systems after start up and TAB of systems.

.2 Take vibration measurements for equipment as required

.3 Provide notice in advance of commencement of tests.

.4 Establish adequacy of equipment isolation and acceptability of noise levels in occupied areas and where appropriate, remedial recommendations (including sound curves).

.5 Submit complete report of test results.

3.4 START-UP AND COMMISSIONING

.1 Start-up and Commissioning shall be undertaken prior to the Occupancy Stage of each Construction Phase.

.2 Conform to the requirements of the manufacturer's recommendations.

.1 Follow the start-up procedures as recommended by the equipment manufacturer unless specified otherwise.

.3 Follow the special start-up procedures specified elsewhere in these Specifications.

.4 Conform to the requirements of Section 21 05 01 – General Mechanical Requirements.

.5 Assist in the Start-up and Commissioning of the Equipment and Systems.

.1 Assist with the Balancing of the Hydronic Equipment and Systems as required.

.6 Provide equipment, personnel, material and information necessary to assist the Mechanical Contractor in completing the Commissioning Process.

.7 Provide equipment, personnel, material and information necessary to assist the Commissioning Agent in completing the Commissioning Process.

.8 Provide instructions to City of Winnipeg as required. Refer to Specification Section 21 05 01 – Mechanical General Provisions.

END OF SECTION

PART 1 General

1.1 RELATED SECTIONS

.1 Section 21 05 01, Mechanical General Provisions.

.2 Section 21 05 05, Basic Materials and Methods.

.3 Sections 22 06 01 and 23 06 01, Approved Substitute Schedules.

1.2 REFERENCE STANDARDS

.1 Conform with the requirements of the drawings and specifications, the local Authorities Having Jurisdiction and the Building Code. In the case of conflicting requirements, be governed by the most severe regulations.

.2 Conform to the most recent Associated Air Balance Council's 'National Standards for Field Measurement and Instrumentation - Total System Balance'.

1.3 QUALIFICATIONS OF TESTING AGENCY

.1 Minimum qualifications shall be General Membership Standards of Associated Air Balance Council, as published in the AABC 'National Standards for Field Measurement and Instrumentation - Total System Balance'.

.2 Testing Agency must be independent of affiliation with manufacturers and contractors.

.3 The testing agency shall be a certified member of Associated Air Balance Council (AABC).

1.4 ACCURACY OF INSTRUMENTATION

.1 Measuring instruments shall be accurate. Factory re-calibrate and/or recheck calibration of equipment immediately prior to use on this project.

.2 Include in the final air balance report, separate test results indicating accuracy of instrumentation.

.3 Consultant may request re-calibration or use of other instruments where accuracy is questionable.

.4 When requested by the Consultant, provide certified proof of accuracy of instrumentation at no extra cost.

1.5 GENERAL SCOPE OF WORK

.1 Provide personnel for the purpose of making site visits, preparing reports and taking responsibility for ensuring that the specified air and water systems operate in accordance with specified requirements, within a tolerance of plus or minus 5%.

.2 Review and check the Contract Drawings and specifications, and installed work, to ensure that modifications, if required, are implemented prior to the execution of the work. Provide a report to the Consultant as required, making whatever recommendations are necessary in the interests of ensuring proper system balance.

.3 After the installation is adequately completed, inspect, test and balance the specified air and water systems. Co-operate with the Controls Contractor to achieve required air quantities where modulating dampers etc., are installed.

.4 After inspecting, testing and balancing the systems, provide a preliminary written report to the Consultant.

.5 Make any modifications to the systems as recommended by the Consultant, Retest and Rebalance the System(s) as required, and submit a final report to the Consultant.

.6 In general terms, the scope of work is comprised of the following:

.1 Preliminary leak testing - Prior to the final installations perform a preliminary air system leak test after the related systems are complete and before final testing is done. If necessary sections of large ductwork systems may be tested at a time.

.2 After the installations, Balance/Rebalance/Measure/Test the Systems, and provide a Report to the Consultant.

.1 Perform all necessary testing, balancing and adjustments to provide peak performance of systems.

.2 Perform all necessary testing to confirm system conformance to the specifications and drawings.

.3 Items to be balanced, rebalanced, measured and tested include:

.1 Test all fire dampers.

.2 Balance the Air Volumes for all Fans and Air Handling equipment including motorized mixed air damper systems.

.3 Balance the air volumes for all Heat Pump Units.

1.6 START-UP AND COMMISSIONING

.1 Start-up and Commissioning shall be undertaken prior to the Occupancy Stage of each Construction Phase.

.2 Provide the Equipment, Personnel, Materials and Information necessary to assist the Mechanical Contractor in completing the Commissioning Process. Refer to Specification Section 23 08 05.

.3 Assist in completing the required Forms as set forth in Specification Section 23 08 05.

.4 Provide instructions to City of Winnipeg as required. Refer to Specification Section 21 05 01.

PART 2 Products And Materials

2.1 REPORTS - GENERAL

.1 The Contractor shall provide two copies of the preliminary Testing/Balancing Report directly to the Consultant's office for review and comment. Make any changes requested by the Consultant, and re-submit two copies. Submission and re-submission shall continue in this manner until the preliminary Testing/Balancing Report has been accepted by the Consultant. Copies of the final Testing/Balancing Report shall be included in the Operation and Maintenance Manuals.

.2 Allow for technically qualified personnel to attend meetings at the Consultant's office to discuss and clarify the preliminary Testing/Balancing Report.

.3 The review of the Testing/Balancing Report is for the sole purpose of ascertaining conformance with the general design concept. The review shall not mean approval of the detailed testing and balancing procedures inherent in the work, the responsibility for which shall remain with the contractor. The review shall not relieve the contractor of the responsibility to meet the requirements of the contract documents. The contractor shall remain responsible for confirming and correlating the information on the jobsite, and for coordinating the work with the other contractors.

2.2 REPORTS

.1 Reports shall contain the following:

.1 Preliminary Air System Leak testing.

.2 Installed Equipment Identification including:

.1 Location and Unit Identification data.

.2 Nameplate Data: Manufacturer, Model, Size, Discharge arrangement and class, HP, voltage, phase, cycles, and full load amps.

.3 Installed overload heater size and manufacturer.

.4 Identify all required pulleys, sheaves, belts, and adjustments, including sizes and quantities.

.3 Specified design data and achieved performance data, including:

.1 General: HP, voltage, phase, cycles, and full load amps.

.2 Air Systems: Total air flow, individual air flow per outlet with supporting schematic diagrams, fan total static pressures with breakdown showing inlet and discharge pressures, fan R.P.M., O/A and R/A and REL/A air volumes, and inlet and outlet dry bulb and wet bulb temperatures across thermal transmission and mixing equipment.

.3 Duct Systems: Air volumes and velocities at equipment and main branches.

.4 Hydronic Systems: Total fluid flow, Individual fluid flow of each pump, individual fluid flow per outlet with supporting schematic diagrams, pump total static pressures with breakdown showing inlet and discharge pressures, pump R.P.M., and inlet and outlet temperatures across thermal transmission and mixing equipment.

.4 Verification of fire protection equipment, including:

.1 Permanent location number (eg. Rm-M02) where access to fire damper is possible including description as to which wall in that location fire damper is located (eg. north wall), verification that unit is accessible and has been tested and reset, and date of successful test.

PART 3 Installation And Execution

3.1 LEAK TESTING

.1 Perform preliminary duct system leak test:

.1 Test after installation of related systems are complete, and before final balancing is done. If necessary sections of large ductwork systems may be tested at a time.

.2 Leak test low pressure ductwork in accordance with AABC standards. Leak test medium pressure ductwork at 1.5 times the normal duct operating pressure with leakage not to exceed 5% of design CFM for duct branch under test.

.3 Leak testing shall be performed prior to the installation of insulation. Insulation shall not be applied until duct system is tested and proven to be tight.

.4 Coordinate with Ventilation Contractor for installation of required equipment.

.5 Submit a report with results for review.

3.2 AIR SYSTEM PROCEDURE

.1 Prior to final inspection, adjust air systems to provide required or specified design air flow quantities. Balance systems to suit space cooling requirements, unless otherwise specified.

.2 Measure air flow in ducts by velocity traverse of entire cross-sectional area of duct. Measure air flow with appropriate micro-manometers and/or state of the art instruments. Instrument test holes must be approved by Consultant.

.3 Measure air quantities at each inlet and outlet. Use approved tube or vane type meters.

.4 Use volume control devices to regulate air quantities at supply air inlets and exhaust air outlets without creating objectionable air motion or sound levels.

.5 Make final measurements only after air inlets and outlets are adjusted for optimum air distribution patterns.

.6 Vary total system air quantities by adjustment of fan speeds. Vary branch duct air quantities by damper regulation.

.7 Air inlet and outlet air quantities shall be within +/- 10% of specified values. Fan air quantities shall be +/- 5% of specified values.

3.3 FIRE DAMPER TESTING

.1 Testing shall be performed before air balancing has been started.

.2 Testing shall include the following:

.1 Visual inspection to confirm:

.1 Appropriately rated unit has been installed and CSA/ULC label is affixed and visible through duct/ceiling access door.

.2 Appropriate duct and/or ceiling access door is installed to permit servicing of unit. Confirm duct access door is openable without interference from adjacent ceiling, pipes, ducts, etc.

.3 Unit has been installed in accordance to specifications and codes. Confirm clearances, angle framing in place, fire rated material in wall opening, breakaway joints, unit not painted.

.2 Operational inspection to include:

.1 Manual release of fusible link allowing unit to close. Confirm tight fit closure without binding.

.2 Confirm that appropriate fusible link is installed.

.3 Re-open unit and reset fusible link connection.

.3 Balancing Contractor shall instruct Ventilation Contractor to repair all fire dampers that have been identified as being faulty. After faulty fire dampers have been repaired, retest them, as indicated above.

3.4 FINAL INSPECTION AND ACCEPTANCE

.1 At final inspection, recheck to the approval of the Consultant, data recorded in certified report. Points or areas for check shall be selected by the Consultant.

.2 If report is rejected, re-balance systems, submit new certified reports, and make re-inspection at no extra cost.

.3 After acceptance of certified reports by the Consultant, permanently mark settings of valves, splitters, dampers and other adjustment devices so that adjustments can be restored if disturbed.

END OF SECTION

PART 1 General

1.1 RELATED SECTIONS

.1 Section 21 05 01, Mechanical General Provisions.

.2 Section 21 05 05, Basic Materials and Methods.

1.2 APPROVED 'SUBSTITUTES' AND 'ALTERNATES'

.1 Where a Manufacturer's name, make, model, and/or size is specified, it is for the purpose of setting a standard of quality, performance, capacity, appearance and/or serviceability, and is acceptable without qualification. Manufacturers listed as acceptable 'Substitutes' have been deemed by the Consultant as capable of producing equipment and/or material of comparable quality, performance and approximate dimensions, and can be used in the preparation of the tender. Where no substitutes are indicated, provide the exact make specified or provide the necessary documents for review.

.2 'Substitute' equipment and material is deemed to be interchangeable with that specified, with little or no revisions required to the design intent and/or other items, equipment or connections.

.3 'Alternate' equipment and material is deemed to be an acceptable 'Substitute' which will require major revisions to the design intent and/or other items, equipment or connections.

.4 Requests for approval of additional 'Substitutes' or 'Alternates' must be submitted not less than ten (10) days prior to closing date of the tender, and submissions must bear proof of acceptance by the Consultant if used in the tender. Requests shall include all performance, capacity, appearance, weight, connections, power and wiring requirements, etc required for the Consultant to make a complete evaluation.

.5 Assume full responsibility for ensuring that, when providing accepted 'Substitutes' and 'Alternates', all space, weight, connections, power and wiring requirements, etc. are considered and adjusted costs are included in the tender. The Mechanical systems have been designed based on the equipment/materials of the specified manufacturer(s). The onus shall be on the Subcontractor (along with his sub-sub-contractor and the supplier) to ensure that 'Substitute' or 'Alternate' equipment/materials will meet the required performance and electrical characteristics, as well as fit properly into the allotted space, including allowance for required access and servicing. Any additional costs incurred as a result of modifications to the system(s) or the room layout, or modifications required by other trades, shall be borne by the Subcontractor (along with his sub-sub-contractor and the supplier) and shall be deemed to be included in the tender price.

.6 Bidders must base their price on specified manufacturers or approved 'Substitutes'. 'Alternates', when allowed, must be listed separately, with the amount to be added or subtracted for each substitution. If in the preparation of the tender, this Subcontractor neglects to name the manufacturer of an accepted 'Alternate', it will be understood that specified or 'Substitute' equipment will be provided.

.7 If, in the opinion of the Consultant, 'Substitute' equipment/material submitted for review as Shop Drawings is not satisfactory, satisfactory equipment/material of the specified or an accepted 'Substitute' manufacturer must be re-submitted.

.8 If, in the opinion of the Consultant, 'Alternate' equipment/material submitted for review as Shop Drawings is not satisfactory, satisfactory equipment/material of the specified or an accepted 'Substitute' manufacturer must be re-submitted.

1.3 APPROVED 'SUBSTITUTES''

.1 The following is the list of pre-approved 'Substitutes' for HVAC:

.1	Access Doors:	Lehage; Milcor; Acudor; Mifab; Bauco
.2	Actuators for Valves and Dampers:	Belimo
.3	Air Cooled DX Condensing Units:	Keeprite; Carrier; Lennox; McQuay; York; Engineered Air;
.4	Air Filters:	Farr; AAF; Continental; Fantech
.5	Air Purgers & Air Vents:	Hamlet and Garneau; Bell and Gossett; Dole; Maid-O-Mist; Armstrong; Braukman; Taco;
.6	Back Flow Preventors:	Conbraco; Beeco; Febco; Watts; Kunkle; Taylor; Consolidated; Fisher; Singer; Crosby-Ashton; Boylston; Lonergan; Masoneilan; Wilkins; Zurn;
.7	Boilers (Condensing):	Camus
.8	Chemical Treatment:	Bird Archer; Calgon; Dearborne; Mogul; Drew Chemical;
.9	Chimneys:	Metal-Fab; Ampco; Cleaver Brooks; Selkirk; Chiminee;
.10	Closed-cell Acoustic Duct Liner:	K-flex Gray Elastomeric Duct Liner; AP Armaflex Elastomeric Insulation
.11	Dampers (Backdraft):	Ventex; Alumavent;
.12	Dampers (Motorized):	Alumavent; Tamco

.13	Dampers (Fire & Smoke):	NCA; Nailor; AMI;
.14	Direct Digital Controls (Building):	Johnson Controls
.15	Electric Duct Coils;	Nailor Hart; PM Wright; Price; Thermolec;
.16	Energy Recovery Ventilators (ERV):	Tempeff
.17	Expansion Tanks:	Taco; Bell & Gossett; Hamlet & Garneau; Amtrol; Calefactio; Armstrong; Flexicon; Wessels;
.18	Fans (Centrifugal and Axial):	Greenheck; Penn; New York Blower; Twin City; Delhi; Barry Blower; Fantech; Woods; Cook; Northern Blower;
.19	Fans (Downdraft/Ceiling):	Pleasantaire; Banvil; Canarm;
.20	Fans (Fume Exhaust Systems):	Plymovent; Belnor; Monoxivent; Nederman;
.21	Fans (Washroom and Cabinet):	Greenheck; Penn; Reversomatic; Fantech Broan; Delhi; Cook; Abreezo;
.22	Filter Gauges:	Dwyer;
.23	Fire Stop Flaps:	NCA; Nailor; AMI;
.24	Fume Detection Systems:	ACME; CET;
.25	Glycol Feed Systems:	Axiom; Hamlet and Garneau;
.26	Grilles and Diffusers:	Carnes; Kreuger; E.H. Price; Titus; Nailor Hart; Hart and Cooley;
.27	Heat Pumps:	Daikin/McQuay; Trane;
.28	Hydronic Coils:	Carrier; Heatcraft; Engineered Air; Trane; Daikin/McQuay; York;

.29	Hydronic System Accessories:	Bell and Gosset; Taco; Armstrong; Spirax/Sarco;
.30	In-floor heating PEX piping & Manifolds:	Watts; Viega; Uponor; Rehau;
.31	Insulation (General):	Manson; Knauf;
.32	Level and Flow Switches:	Magnetrol;
.33	Louvres:	Airolite; Carnes; Greenheck; Ruskin; Ventex; Westvent; Penn;
.34	Pressure Gauges:	Taylor; Weiss; Marshalltown; Ashcroft; Duro; Lunkenheimer; Trerice; Ametek; Marsh; Winters;
.35	Pressure Relief Valves, Pressure Regulating Valves:	Conbraco; Beeco; Febco; Watts; Kunkle; Taylor; Consolidated; Fisher; Singer; Crosby-Ashton; Boylston; Lonergan; Masoneilan;
.36	Pumps (Circulating):	Armstrong; Bell and Gossett; Taco; Wilo; Grundfos; Darling
.37	Silencers:	VAW; Vibro-Acoustics; Price
.38	Sound and Vibration Isolation:	Vibron; Airmaster; Amber-Booth; Kinetics; Vibro-Acoustics; SVC Industries; California Dynamics;
.39	Special Duct Cleaning:	Power-Vac; Advance Robotic;
.40	Steam System Accessories:	Watson McDaniel; Armstrong;
.41	Strainers:	Armstrong; Crane; Mueller; Sarco; Streamflo; Kitz; Toyo
.42	Thermometers:	Taylor; Weiss; Marshalltown; Ashcroft; Duro; Lunkenheimer; Trerice; Ametek; Marsh; Winters;
.43	Unit Heaters (Hydronic):	Engineered Air; Trane; McQuay/Daikin;

Rosemex; Modine; Reznor; Beacon-Morris;

.44 Unit Heaters (Gas Fired): Modine; Reznor; Sterling; Beacon-Morris;

.45 Vacuum Breakers: Febco; Watts; Wilkins; Spirax/Sarco;

.46 Valves (General): Crane; Kitz; Apollo; Newman-Hattersley; Nibco; Toyo; Jenkins; American Valve; Anvil; KVC;

.47 Valves (Ball): Worcester; TrueLine;;

.48 Valves (Butterfly): Kitz; Nibco; Jenkins; Newman-Hattersley; Apollo; Dezurik; Keystone; Crane; TrueLine; KVC; Challenger;

.49 Valves (Check): Centerline; Hagen; Mueller; Moyer and Groves; Singer; Dezurik; Crane; Apco; KVC; Uni-chek

.50 Valves (PVC): Chemline;

.51 Valves (Radiation): Griswold; Sarco; Red and White; Danfoss; Dahl; ASCO;

.52 Valves (Solenoid): ASCO;

.53 Ventilation Specialties: Nailor Hart; Greenheck; Ruskin; Carnes; Titus; EH Price

END OF SECTION

PART 1 General

1.1 RELATED SECTIONS

.1 Comply with the requirements of Section 21 05 01, Mechanical General Provisions.

.2 Comply with the requirements of Section 21 05 05, Basic Materials and Methods.

.3 Comply with the requirements of Section 22 05 05, Plumbing.

.4 Comply with the requirements of Section 23 06 01, Acceptable Substitute List.

.5 Comply with the requirements of Section 23 21 05, Liquid Heat Transfer.

.6 Comply with the requirements of Section 23 33 00, Air Distribution.

1.2 SCOPE OF WORK

.1 The new BHN Library facility shall be interconnected with the City of Winnipeg's existing Metasys ADX Extended Application and Data Server.

.1 The Contractor must become familiar with the existing system and must be capable of connecting to this existing system.
.2 The new BHN Library DDC system shall tie into the existing City of Winnipeg system.

.2 Include complete system of temperature control/indication, hardware, software. Control components and interconnecting systems to be installed by trained control mechanics, regularly employed by Division 23 & 25.

.3 Refer to control sequences and/or input/output schedules for points to be connected to existing City of Winnipeg system.

.4 Refer to drawings, detail sheets and individual clauses in this section for points to be connected to control system. All points connected to DDC control panels shall be connected to existing City of Winnipeg system.

.5 The DDC control systems shall allow for remote connection & full control via the internet.

.1 Provide a dedicated internet connection and secure remote access to the DDC system through the internet.

.2 The DDC system shall be complete with web server capability, where the system shall be capable of being accessed by authorized users via internet browser software. The system shall have the ability to allow authorized users to adjust

and control set points of the mechanical controls and to monitor mechanical equipment.

.3 Provide all necessary software.

.6 Provide labour, materials, equipment and services necessary for, and incidental to the supply and installation of the Direct Digital Controls (DDC) systems shown on the drawings and described in this specification, so as to leave the City of Winnipeg with a complete and functioning system.

.1 The Contract Documents are performance based, diagrammatic and approximately to scale, intended to convey the scope of work and indicate the general arrangement and approximate location of equipment and components. Not all accessories and components have been shown or specified.

.2 Even though the work is not completely shown, or is shown schematically, and all details are not shown or specified, it is expected that the contractor be familiar enough with his field of work to complete the project to the standards generally adhered to by the local industry, including good workmanship and common sense.

.3 Provide both office and field engineering to develop a complete and comprehensive control system, based on the outline specifications and system schematics.

.4 It shall be the responsibility of the Controls Contractor to provide the detailed sequence of operation and the appropriate equipment and accessories, subject to acceptance by the Consultant.

.5 Provide all necessary BACnet-compliant hardware and software to meet the system's functional specifications. Provide Protocol Implementation Conformance Statement (PICS) for Windows-based control software and every controller in system, including unitary controllers.

.6 Prepare individual hardware layouts, interconnection drawings, and software configuration from project design data.

.7 Implement the detailed design for all analog and binary objects, system databases, graphic displays, logs, and management reports based on control descriptions, logic drawings, configuration data, and bid documents.

.8 Design, provide, and install all equipment cabinets, panels, data communication network cables needed, and all associated hardware.

.9 Provide and install all interconnecting cables between supplied cabinets, application controllers, and input/output devices.

.10 Provide and install all interconnecting cables between all operator's terminals and peripheral devices (such as printers, etc.) supplied under this section.

.11 Provide complete manufacturer's specifications for all items that are supplied. Include vendor name of every item supplied.

.12 Provide supervisory specialists and technicians at the job site to assist in all phases of system installation, startup, and commissioning.

.13 Provide a comprehensive operator and technician training program as described herein.

.14 Provide as-built documentation, operator's terminal software, diagrams, and all other associated project operational documentation (such as technical manuals) on approved media, the sum total of which accurately represents the final system.

.15 Provide new sensors, dampers, valves, and install only new electronic actuators. No used components shall be used as any part or piece of installed system.

.7 In general terms, the scope of work comprises the provision of a complete DDC system, integrated with local digital controls, and allowing for automatic functioning, manual override, and monitoring of the following:

.1 Central Dedicated Outdoor Air System (ERV-1) c/w intake/exhaust motorized air dampers, heating/cooling coil (H/CC-1), DX energy Recovery Heat Pipe coils (RHP-1 & RHP-2), air filters, & heating/cooling coil circulation pumps (CP-2A & CP-2B).

.2 Hydronic System Heating/Cooling 3-way changeover control valve.

.3 Hydronic System Terminal Units Loop Temperature Heating/Cooling system 3-way mixing control valve and circulation pumps CP-3A & CP-3B

.4 In-Floor Heating & Cooling System control including manifold 3-way valves.

.5 Terminal units: Active Chilled Beams (ACB), Fan Coil Units (FC), Re-heat Coils (RHC), & Unit Heater (UH) control including 2-way valves.

.6 Hydronic central plant loop systems including: Air Cooled Chiller (ACH-1 & ACHE-1), Central Boilers (B-1, & B-2) c/w packaged internal circulation pumps, & Circulation Pumps (CP-1A & CP-1B) c/w VFDs.

.7 Electric domestic Hot Water Heater DWH-1 and domestic hot water Recirculation Pump RCP-1.

.8 Entrance Electric Force Flow Heaters (EFFH) & crawlspace Electric Unit Heaters (EUH).

.9 Crawlspace transfer fan (TF-1).

.10 Electrical room cooling transfer fan (TF-2) & cooling coil (CC-TF-2).

.11 Mechanical room Hydronic Unit Heater (UH-1).

.12 Soffit/overhang transfer fans (TF-3 & TF-4) and respective heating coils (HC-TF-3 & HC-TF-4).

.13 Alarm of miscellaneous points.

.14 Monitoring of miscellaneous points including but not limited to: temperature, humidity, condensate sensors, Current Sensing/Current Transformers (CT), & building pressure as shown on the mechanical drawings and described throughout Section 23 09 00.

.1 Provide building static pressure monitoring and sensors/transmitters for spaces/zones as noted below:

.1 Main Open Library Area.
.2 Living Room Area.
.3 MPR Room.
.4 Library Services & Service Desk Main Entry Lobby Areas.

.2 Provide radiant floor slab temperature & condensate monitoring and sensors/transmitters for spaces/zones as noted on the drawings & schematics.

.3 Provide condensate monitoring and sensors/transmitters for each ACB and radiant device as noted on the drawings & schematics.

.4 Provide monitoring/alarm of exterior doors in the following areas by means of door contacts:

.1 Open Library 1:18
.2 Living Room 1:19
.3 MPR Room 1:20 (both doors).

.5 Provide monitoring/alarm of exterior doors in the following areas by means of door contacts:

.1 Vestibule A - 1:01

.2 Vestibule B - 1:14

.6 Provide monitoring/alarm of exterior operable windows in the following areas by means of window contacts:

.1 Staff Room 1:08
.2 Library Services Workroom 1:04
.3 Branch Head Office 1:22

.15 Weeping Tile Sump Pits & Pumps (WSP-1,2) c/w duplex pump control panel.

.8 Provide equipment, personnel and materials necessary to assist with air and hydronics balancing.

.9 Provide all miscellaneous devices such as relays, positioners, time-clocks, transformers, etc. as required to interface with the building mechanical systems and to make a complete operable system.

.10 Implement D.D.C. software upgrades on the anniversaries of the start of the warranty period. Provide all the enhancements offered by the software manufacturer(s).

1.3 GENERIC INPUT/OUTPUT FOR METASYS CONTROL

.1 Controls must be able to interface to MSEA technology on the field device network using BACnet Protocols. See sentence 2.

.2 Field Controllers shall be Johnson Controls.

.1 VAV Modular Assemblies
.2 Terminal Equipment Controllers
.3 Input/Output Modules
.4 Network Sensors
.5 Field Advanced Controllers
.6 Field Equipment Controllers

.3 Field Controllers shall communicate through MSTP bus to a Johnson Controls supervisory controller.

.1 NAE
.2 NCE

.4 Supervisory Controller to be integrated to existing City of Winnipeg ADX server.

.5 No LON protocols are to be accepted.

.6 Controls contractor to provide commissioning sheets for all points on field devices.

.7 Controls contractor to communicate with equipment provider to ensure proper field point integration as well as controllability of the equipment, if not package controls.

.8 Controls contractor to supply all drawings/graphics/sequence of operations in both a hard and soft copy. Drawings and graphics to be able to be read and be modified by City of Winnipeg Staff. User interface graphics to be completed using Graphic Generation Tool software. Graphics must use City of Winnipeg graphic templates. Contractor to supply As-Built drawings in an editable format, able to be easily edited by City of Winnipeg Staff.

.9 If the construction is a brand new facility then BACnet shall be used. The term BACnet should then be defined properly in it's use, see sentence 1.

.10 If other vendor (non-JCI) controls are to be used then a seamless integration must be proven before approval will be given.

.11 A complete list of set-points for all controlled equipment must be provided.

.12 A points list is to be provided for all controlled objects.

.13 The controls spec must be complete so that there is no interpretation required on behalf of the controls contractor so that the control system is built to meet the specific needs of the complete mechanical plan and design.

.14 Alarm Messages. All objects that must be alarmed will have in the alarm message text the following information as per the included example. Alarm Message: Building Address, What is in alarm, see graphic for Instruction Example: 251 Donald SF-1 VFD Common Alarm, see graphic for Instruction.

.15 General:

.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 controls contractor 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 Metasys Network Automation Engines (NAE/NIE/NCE) 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 contractor must co-ordinate with City staff to determine the correct version to be

installed. All user views and graphics must not be installed in the local supervisory controller (NAE/NIE/NCE). All such items must be programmed into the existing ADX server. User views and graphics must be approved for use by City staff before implementation of such items.

.3 All monitored points that have alarms must have operating instructions and alarm messages. These will be co-ordinated with the tech shop and operations supervisor.

1.4 SYSTEM DESCRIPTION

.1 A distributed logic control system complete with all software and hardware functions shall be provided and installed. System shall be completely based on ANSI/ASHRAE Standard 135, BACnet and achieved listing under the BACnet Testing Laboratories BACnet - Advanced Workstation Software (B-AWS). This system is to control all mechanical equipment, including all unitary equipment such as terminal devices, heating coils, heaters, AC units, ERV units, boilers, fluid cooler, heat pumps, circulation pumps, and any other listed equipment using native BACnet-compliant components. Non-BACnet-compliant or proprietary equipment or systems (including gateways) shall not be acceptable and are specifically prohibited.

.2 The system shall directly control HVAC equipment as specified in the sequence of operations controls section. Each zone controller shall provide occupied and unoccupied modes of operation by individual zone. Furnish energy conservation features such as optimal start and stop, night setback, request-based logic, and demand level adjustment of set-points as specified in the sequence.

1.5 ALTERNATE CONTRACTORS

.1 This specification is prepared on the basis that the specified BAS/BMS/DDC system shall be capable of the control and monitoring of mechanical and electrical systems as outlined.

.2 Alternate Suppliers/Contractors will be required to submit qualifications, product data or all other pertinent information to prove ability and competency in the provision of a fully integrated and functional system.

1.6 QUALITY ASSURANCE

.1 The Building Automation System (BAS) system shall be designed, installed, commissioned, and serviced by manufacturer authorized and trained personnel.

.1 The contractor shall provide full-time, on-site, experienced project manager for this work, responsible for direct supervision of the design, installation, start-up and commissioning of the BAS system.

.2 The controls contractor shall be regularly engaged in the design, installation and maintenance of BAS systems and shall have demonstrated technical expertise and experience in the design, installation and maintenance of BAS systems similar in size and complexity to this project.

.2 Materials and equipment shall be manufacturer's latest standard design that complies with the specification requirements.

.3 All BAS peer-to-peer network controllers, central system controllers and local user displays shall be UL Listed under Standard UL 916, category PAZX.

.4 All electronic equipment shall conform to the requirements of FCC Regulation, Part 15, Governing Radio Frequency Electromagnetic Interference and be so labeled.

.5 All equipment and materials shall be new and C.S.A. approved, unless specifically noted otherwise.

.6 All similar equipment and or materials shall be by the same manufacturer.

.7 All aspects of the installation must comply with the most stringent of the applicable building codes, local regulations, and by-laws.

1.7 REFERENCE STANDARDS

.1 The latest edition of the following standards and codes in effect and amended as of supplier's proposal date, and any applicable subsections thereof, shall govern design and selection of equipment and material supplied:

.1 American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE).

.2 ANSI/ASHRAE Standard 135, BACnet.

.3 Uniform Building Code (UBC), including local amendments.

.4 UL 916 Underwriters Laboratories Standard for Energy Management Equipment. Canada and the US.

.5 National Electrical Code (NEC).

.6 FCC Part 15, Subpart J, Class A.

.7 EMC Directive 89/336/EEC (European CE Mark).

.8 UL-864 UUKL listing for Smoke Controls for any equipment used in smoke control sequences.

.2 City, provincial, and federal regulations and codes in effect as of contract date.

.3 Except as otherwise indicated, the system supplier shall secure and pay for all permits, inspections, and certifications required for his work, and arrange for necessary approvals by the governing authorities.

1.8 SUBMITTALS & SHOP DRAWINGS

.1 Submit shop drawings prior to installation, consisting of product and sizing data for all equipment and components, and proposed control software and sequences including, but not limited to:

.1 Drawings:

.1 The system supplier shall submit engineered drawings, control sequence, and bill of materials for approval.

.2 Drawings shall be submitted in the following standard sizes: 11” x 17” (ANSI B).

.3 Drawings shall be available electronically in PDF format.

.2 System Documentation:

Include the following in submittal package:

.1 System configuration diagrams in simplified block format showing the system architecture;

.2 System schematic diagrams and wiring layouts;

.3 All input/output object listings and an alarm point summary listing;

.4 Electrical drawings that show all system internal and external connection points, terminal block layouts, and terminal identification;

.5 Complete bill of materials, valve schedule and damper schedule;

.6 Manufacturer's instructions and drawings for installation, maintenance, and operation of all purchased items;

.7 Overall system operation and maintenance instructions—including preventive maintenance and troubleshooting instructions;

.8 Provide complete description and documentation of any proprietary (non-BACnet) services and/or objects used in the system;

.9 A list of all functions available and a sample of function block programming that shall be part of delivered system;

.10 Sensors and control components;

.11 Valves, dampers and actuators;

.12 Miscellaneous components;

.13 Control panel locations and layout;

.14 List of packaged software;

.15 Detailed written sequences of operation;

.16 Logic flow charts;

.17 Lists of menus and alarms;

.18 Sample menu and alarm formats.

.2 The Logic Flow Charts submitted as part of the shop drawings, using computer industry standard symbols and nomenclature, shall be developed so as to:

.1 Clarify the program code for the Consultant and the City of Winnipeg;

.2 Demonstrate that the programmer understands the intent of the specifications;

.3 Clearly indicate the programming sequences.

.2 Submit with the shop drawings a Project Test Plan, indicating how the installed system will be tested and verified to be found operating in accordance with the plans and specifications. Include a sample of the trend logs and check sheets to be submitted.

.3 The Contractor shall provide a copy of the preliminary shop drawings directly to the Consultant's office for review and comment, make any changes requested by the Consultant, and re-submit copies. Submission and re-submission shall continue in this manner until the preliminary shop drawings have been accepted by the Consultant. Seven copies of the final shop drawings shall be prepared and submitted through the normal channels of communication.

.4 Allow for technically qualified personnel to attend meetings at the Consultant's office to discuss and clarify the preliminary shop drawings.

.5 The review of the shop drawings is for the sole purpose of ascertaining conformance with the general design concept. The review shall not mean approval of the detailed design inherent in the equipment, the responsibility for which shall remain with the Contractor. The review shall not relieve the Contractor of the responsibility to meet the requirements of the contract documents. The Contractor shall remain responsible for confirming and correlating the dimensions on the jobsite, and for information that pertains to the fabrication process, construction techniques, and installation details, and for coordinating the work with the other Contractors.

1.9 IDENTIFICATION OF EQUIPMENT - GENERAL

.1 Refer to Section 21 05 05 – Basic Materials & Methods.

.2 Provide identification plastized "luggage tag" for field devices (not local thermostats) which are part of control systems.

.3 All manual switches, unless they come with standard nameplates, shall be labelled with lamacoid.

.4 Equipment installed on surface of local panels shall be labelled with lamacoid identification plates.

.5 Equipment mounted inside local panels, must have permanent labels 13mm white with black lettering. i.e. P-Touch labels.

.6 Lamacoid plates shall be black background with minimum 5mm high white letters, unless specified otherwise.

.7 Lamacoids shall be of size to accommodate lettering.

.8 Fasten lamacoid identification plates with rivets or self-tapping screws. Locate adjacent to device if there is not adequate space.

.1 Plastized "Luggage Tag" to list:

.1 Point Keyname
.2 Point Technical Address
.3 Point Type
.4 Point Description
.5 Device Part Number

.9 In general, information on lamacoid identification plates and plastized “luggage tag” to be consistent with `as-built' control drawings.

.10 Prior to lamacoid and plastized “luggage tag” fabrication, submit copies of control drawings and complete list of proposed wording for each lamacoid and plastized “luggage tag”, for approval by Consultant and City of Winnipeg. Include copy of approved lamacoid and plastized “luggage tag” list in each Maintenance/Operating Manual.

.11 Electrical systems identification to be as per electrical specifications.

1.10 IDENTIFICATION OF DDC PANELS

.1 Provide lamacoid nameplates to identify following:

.1 Controller address.
.2 Controller name.

.2 Fasten nameplates with rivets or self-tapping screws to exterior of DDC Panel door.

.3 Refer to subsection "Identification of Equipment - General", and comply with all requirements related to lamacoid nameplates.

1.11 CONTROL VALVE AND VAV ACCESS IDENTIFICATION

.1 Points of access to radiant panel reheat coil, and VAV box control valves shall be identified with 13mm white with black lettering. i.e. P-Touch labels fastened either onto ceiling T-bar grid or onto access door.

.2 Label shall state:

.1 "RAD. HTG. PANEL"
.2 "HTG. COIL HC- (STATE NO.)
.3 "VAV" BOX - (STATE NO.)

1.12 INSTRUMENT MOUNTING

.1 Mount transmitters and sensing elements on pipe work at location where temperature is to be sensed. Care shall be taken to prevent breaking of insulation barrier and where practicable instruments shall be stood off on sheet metal brackets to allow installation of insulation behind instrument. Pipe wells as required shall be furnished to Sections 22 05 05 - Plumbing and Section 23 21 05 – Liquid Heat Transfer & Refrigeration for installation at appropriate sensing points in pipe work. Void between inside of well and outside of sensing bulb shall be filled with heat transmission grease.

.2 Provide at each system or groups of systems, a cabinet type metal control panel with all instruments mounted inside locking cover. All panels shall have same key. Temperature indication and control point adjustments and gauges labelled as to function with lamacoid nametags fixed to panel face with self-tapping screws. All electrical equipment mounted in cabinet to be pre-wired to labelled terminal strips. Mount panels in Electrical/Mechanical rooms at 1.12m (44") above floor level upon City of Winnipeg approved locations.

1.13 CALIBRATION AND ADJUSTMENT OF CONTROLS SYSTEMS

.1 All components shall be calibrated before the areas are occupied in order to minimize the disruption to the occupants following the takeover the building.

.2 Upon completion of the installation phase of the project, calibrate and adjust all controls systems and components installed under this contract to provide acceptable space conditions and proper functioning of the systems. Keep a written log of the calibration data for each device, including the instrumentation against which the equipment is calibrated. Include this log in the Operation and Maintenance manuals.

.3 If requested, the Contractor shall be prepared to provide written documentation of recent calibration checks for all instrumentation and sensors.

1.14 START-UP AND COMMISSIONING

.1 Provide equipment, personnel and material necessary to put the Control Systems into operation.

.2 Coordinate and cooperate with all the other Contractors to place the Mechanical Systems into operation to the satisfaction of the City of Winnipeg.

.3 Provide equipment, personnel, material and information necessary to assist the Mechanical Contractor in completing the Commissioning Process.

.4 The Contractor and his sub-contractors must assist the Commissioning Agent to the extent required to complete the Commissioning requirements.

1.15 VERIFICATION AND OPTIMIZATION OF THE OPERATION OF THE MECHANICAL SYSTEMS

.1 The installation shall be completely tested, demonstrating that the equipment and systems installed are performing in the manner intended.

.2 Provide equipment, personnel and materials necessary to produce written records for verification of the operation of all control systems and all equipment.

.3 Provide equipment, personnel and materials necessary to adjust the controls systems as part of the overall optimization of the mechanical systems.

.4 Adjust control set points and tune control algorithm performance to optimize the operation of the systems.

.5 Provide records consisting of computer generated trending logs, snap shot readings of set points and settings of variables, and any other method capable of demonstrating to the Consultant that the systems are operating optimally.

.6 At the time of completion, provide trend logs for each and every system to demonstrate the satisfactory operation of each system and each component.

.7 The Contractor shall provide analysis of the trend log data and shall make any and all changes to the controls systems as required to correct deficiencies or to optimize the operation of the systems.

.8 Trend logs shall be printed on 8-1/2" x 11" paper, clearly labeled for time, date, system and variables tracked. Trend log data shall be stored in a file format capable of being imported into a spreadsheet program for graphing.

.9 The Contractor shall be aware that additional trend logs may be required to be submitted during the warranty period to troubleshoot system deficiencies. Prepare and submit this data as required.

1.16 OPERATION AND MAINTENANCE DATA

.1 Provide detailed operation and maintenance data.

.2 The shop drawings shall be enhanced and revised to 'as-built' status, and shall include the following:

.1 List of all software programs including versions and dates;

.2 One spare copy of all software on disk;

.3 Printed copies of all computer programs;

.4 Details of adjustments of devices and components;

.5 All information necessary for the operation, maintenance, parts procurement and replacement for each component of the entire system;

.6 Specific part numbers;

.7 Complete recommended spare parts inventory list, with lead time and expected frequency of use;

.8 Instructions and schedules for inspection, cleaning, lubrication and calibration.

.3 At the completion of the installation, provide one marked-up copy of the tender drawings for record purposes. Provide three sets of operation and maintenance manuals. Pay all costs associated with the production of the "record" drawings and the manuals. Prior to system acceptance testing, submit the documents to the Consultant for review, and make any requested changes before delivering them to the City of Winnipeg.

1.17 SYSTEM ACCEPTANCE

.1 Complete the system installation, start-up, calibration and verification prior to acceptance testing by the City of Winnipeg. Submit a letter to the Consultant certifying that the controls have been installed, the software programs have been exercised, and requesting system acceptance. Include all verification data and certificates confirming that the work has been installed to the satisfaction of the authorities having jurisdiction.

.2 Acceptance testing will commence on a mutually agreeable time within 14 calendar days of request.

.3 At the time of acceptance testing, turn over to the City of Winnipeg the revised Operation and Maintenance data and a pre-paid Warranty and Service Agreement. The system will not be accepted without complete documentation.

.4 Provide operating and maintenance personnel, and tools and material, as required to operate and adjust the system(s), and coordinate with the City of Winnipeg and Consultant, to completely test and verify the operation of the system(s). It is expected that this testing will take place during the cooling season. Allow for additional testing and verification at the beginning of the next heating/cooling season.

.5 When the system has been deemed satisfactory for beneficial use, the warranty period will commence.

1.18 INSTRUCTIONS TO CONTRACT ADMINISTRATOR'S

.1 Provide the services of qualified personnel to instruct the City of Winnipeg's personnel in the complete operation and maintenance of every aspect of the controls systems, including recalibration of sensors.

.2 Review the operation and maintenance of the systems with the City of Winnipeg's maintenance personnel and provide written and/or verbal instructions as required.

.3 Within the scope of the contract, on-site instructions are to be scheduled as follows:

.1 For two full working days (total 16 hours) within one month of Final Acceptance. This may be scheduled as two consecutive days, two non-consecutive days, four half days or other as mutually agreeable to suit both parties.

.2 Follow up instructions of 3 days during the first year following Final Acceptance. This can be done in conjunction with regularly scheduled maintenance service.

.3 One additional day following the next heating/cooling season testing and verification (as applicable).

1.19 WARRANTY/SERVICE AGREEMENT

.1 Provide a written warranty, signed and issued to the City of Winnipeg, stating that the control systems are warranted against faulty material and/or workmanship for a period of one (1) year from the date of Final Acceptance.

.2 No certificate issued, payment made, or partial or entire use of the systems by the City of Winnipeg, shall be construed as acceptance of defective work or materials.

.3 Promptly correct any defects in workmanship or material during the warranty period at no charge to the City of Winnipeg, provided that the failure is not due to improper usage by the City of Winnipeg. Make good all damages incurred as a result of the failure and of the repairs. When correcting defects and maintaining the system, take precautions to minimize disruption to the tenants.

.4 Provide preventative maintenance at 3 month intervals. Coordinate exact dates and times with the City of Winnipeg, to allow for the maintenance personnel to be present. Maintain a log on site, accessible to authorized personnel, of tasks performed at each visit. The Contract Administrator shall sign the log at the time of the visit as evidence that the Warranty Service Agreement is being maintained.

.5 Incorporate system hardware and software modifications, operating parameter changes and setpoint changes into the Operating and Maintenance manuals. Save database changes on disk for backup.

.6 Implement DDC software upgrades on the anniversaries of the start of the warranty period. Provide all the enhancements offered by the software manufacturer(s).

.7 Use service personnel directly in the employ of the Controls Contractor to perform service work.

.8 Provide warranty and maintenance service under ‘emergency repair’ service provisions. Third party service or services only during specific working hours is not acceptable.

.9 Provide 'on-site' service for the computer hardware and software.

1.20 VARIABLE FREQUENCY DRIVES (VFD)/ VARIABLE SPEED DRIVES (VSD)

.1 Related Work

.1 Common Work Results - Electrical Section 26 05 01

.2 Submittals

.1 Submit shop drawings and product data in accordance with Sections 26 05 01 & 21 05 05.

.2 Indicate:

.1 Mounting method and dimensions.
.2 Layout of identified internal and front panel components.
.3 Enclosure types.
.4 Wiring and schematic diagrams for each type of VFD/VSD.
.5 Interconnection diagrams.

.2 Operations and Maintenance Data

.1 Provide data for incorporation into Maintenance Manual specified in Sections 26 05 01 & 21 05 05.

.2 Include operation and maintenance data for each type and style of VFD/VSD Controller.

.3 Provide full commissioning report documenting all programmable settings, AC input voltage, DC Bus voltage, current draw at maximum speed, and a description of ambient conditions.

PART 2 Products And Materials

2.1 GENERAL

.1 The controls system shall be designed, and components selected, so as to be fail-safe, operating to protect the building, the occupants and vulnerable equipment from harm or damage in the event of a failure of the controls system or the power system.

.2 The control system shall include all necessary and specified control equipment properly installed in accordance with specifications and drawings.

.3 All equipment and materials shall be new and C.S.A. approved, unless specifically noted otherwise.

.4 All similar equipment and or materials shall be by the same manufacturer.

.5 Components and software shall be of the latest available model and version. Replacement parts shall be readily available from local dealers.

2.2 BUILDING CONTROLLER

.1 General Requirements

.1 BACnet Conformance

.1 Building Controller shall be approved by the BTL as meeting the BACnet Building Controller requirements.

.2 Please refer to section 22.2, BACnet Functional Groups, in the BACnet standard, for a complete list of the services that must be directly supported to provide each of the functional groups listed above. All proprietary services, if used in the system, shall be thoroughly documented and provided as part of the submittal data. All necessary tools shall be supplied for working with proprietary information.

.2 Building controller shall be of modular construction such that various modules may be selected to fit the specific requirements of a given project. At a minimum, modules shall consist of a power supply module, a BACnet Ethernet-MS/TP (master slave token passing) module, a BACnet MS/TP-only module, and a modem module for telephone communication. However, all Ethernet communications and all controllers—including central plant controllers, advanced application controllers and unitary controllers—supplied by BAS manufacturer shall utilize the BACnet protocol standard.

.3 Modules shall be selected to fit the particular project application. Up to seven modules shall be powered by a single power supply module. All modules shall be panel-mounted on DIN rail for ease of addition and shall be interconnected using a simple plug-in cable. A module in the middle shall be replaceable without removing any other modules.

.4 All modules shall be capable of providing global control strategies for the system based on information from any objects in the system, regardless if the object is directly monitored by the building controller module or by another controller. The software program implementing these strategies shall be completely flexible and user-definable. All software tools necessary for programming shall be provided as part of project software. Any systems utilizing factory pre-programmed global strategies that cannot be modified by field personnel on-site,

using a WAN or downloaded through remote communications are not acceptable. Changing global strategies using firmware changes is also unacceptable.

.5 Programming shall be object-oriented using control function blocks, and support DDC functions, 1000 Analog Values and 1000 Binary Values. All flowcharts shall be generated and automatically downloaded to controller. Programming tool shall be supplied and be resident on workstation. The same tool shall be used for all controllers.

.6 Provide means to graphically view inputs and outputs to each program block in real-time as program is executing. This function may be performed using the operator's workstation or field computer.

.7 Controller shall have sufficient memory to ensure high performance and data reliability. Battery shall provide power for orderly shutdown of controller and storage of data in nonvolatile flash memory. Battery backup shall maintain real-time clock functions for a minimum of 20 days.

.8 Global control algorithms and automated control functions shall execute using 32-bit processor.

.9 Schedules

.1 Each building controller module shall support a minimum of 80 BACnet Schedule Objects and 80 BACnet Calendar Objects.

.2 Building controller modules shall provide normal seven-day scheduling, holiday scheduling and event scheduling.

.10 Logging Capabilities

.1 Each building controller shall log as minimum 320 values. Any object in the system (real or calculated) may be logged. Sample time interval shall be adjustable at the operator's workstation.

.2 Logs may be viewed both on-site or off-site using WAN or remote communication.

.3 Building controller shall periodically upload trended data to networked operator's workstation for long-term archiving if desired.

.4 Archived data stored in database format shall be available for use in third-party spreadsheet or database programs.

.11 Alarm Generation

.1 Alarms may be generated within the system for any object change of value or state (either real or calculated). This includes things such as analog object value changes, binary object state changes, and various controller communication failures.

.2 Each alarm may be dialed out as noted elsewhere.

.3 Alarm log shall be provided for alarm viewing. Log may be viewed on-site at the operator's terminal or off-site using remote communications.

.4 Controller must be able to handle up to 320 alarm setups stored as BACnet event enrollment objects, with system destination and actions individually configurable.

.12 Demand Limiting

.1 Demand limiting of energy shall be a built-in, user-configurable function. Each controller module shall support shedding of up to 200 loads using a minimum of two types of shed programs.

.13 Tenant Activity Logging

.1 Tenant Activity logging shall be supported by building controller module. Each independent module shall support a minimum of 80 zones.

.2 Ethernet – MS/TP Module

.1 Ethernet – MS/TP Module shall support every function as listed throughout section 23 09 00 and the following.

.2 All communication with operator's workstation and all application controllers shall be through BACnet. Building controller Ethernet – MS/TP module shall incorporate as a minimum, the functions of a 2-way BACnet router. Controller shall route BACnet messages between the high-speed LAN (Ethernet 10/100MHz) and MS/TP LAN. Ethernet – MS/TP module shall also route messages from all other building controller modules onto the BACnet Ethernet network.

.1 MS/TP LAN must be software-configurable from 9.6 to 76.8Kbps.

.2 The RJ-45 Ethernet connection must accept either 10Base-T or 100Base-TX BACnet over twisted pair cable (UTP).

.3 BACnet Conformance

.1 Ethernet – MS/TP module shall, as a minimum, support MS/TP and Ethernet BACnet LAN types. It shall communicate directly using these BACnet LANs as a native BACnet device and shall support simultaneous routing functions between all supported LAN types. Global controller shall be approved by the BACnet Testing Laboratory (BTL) as meeting the BACnet Building Controller requirements.

.2 All proprietary object types, if used in the system, shall be thoroughly documented and provided as part of the submittal data. All necessary tools shall be supplied for working with proprietary information.

.3 The building controller shall comply with Annex J of the BACnet specification for IP connections. This device shall use Ethernet to connect to the IP internetwork, while using the same Ethernet LAN for non-IP communications to other BACnet devices on the LAN. Must support interoperability on WANs and CANs and function as a BACnet Broadcast Management Device (BBMD).

.3 MS/TP Module

.1 MS/TP Module shall support every function as listed under paragraph A, General Requirements, of this section and the following.

.2 Building controller MS/TP module communications shall be through BACnet MS/TP LAN to all advanced application and application-specific controllers. MS/TP module shall also route messages to Ethernet - MS/TP module for communication over WAN.

.1 MS/TP LAN must be software configurable from 9.6 to 76.8Kbps

.2 Configuration shall be through RS-232 connection.

.3 BACnet Conformance

.1 MS/TP module shall be approved by the BTL (BACnet Testing Laboratory) as meeting the BACnet Building Controller requirements. MS/TP module shall as a minimum support MS/TP BACnet LAN type. It shall communicate directly using this BACnet LAN as a native BACnet device and shall support simultaneous routing functions between all supported LAN types.

.2 Standard BACnet object types supported shall include, as a minimum, Analog Value, Binary Value, Calendar, Device, File, Group, Notification Class, Program, and Schedule object types. All proprietary object types, if used in the system, shall be thoroughly documented and provided as part of the submittal data. All necessary tools shall be supplied for working with proprietary information.

.4 Power Supply Module

.1 Power supply module shall power up to seven building controller modules. Input for power shall accept between 17–30VAC, 47–65Hz.

.2 Power supply module shall include rechargeable battery for orderly shutdown of controller modules including storage of all data in flash memory and for continuous operation of real-time clocks for minimum of 20 days.

2.3 SYSTEM CONTROLLERS - GENERAL

.1 Configurable controllers will not be accepted.

.2 Provide dedicated controllers as required with the following characteristics:

.1 Modular, fully programmable and fully flexible, capable of being integrated into a network and capable of being expanded;

.2 Full “stand alone” operation following programming, including time of day scheduling;

.3 Peer-to-peer communications with all other controllers on the system over a communications bus for data sharing;

.4 Full and independent operation without the need to have the Operator’s terminal running;

.5 Power backup by rechargeable batteries capable of sustaining the program in RAM for a minimum of 60 days. Recharging circuitry shall be built into each panel. Battery status shall be displayed on the face of the controller. Battery failure shall be annunciated as a service alarm;

.6 Key pad and display;

.7 Jack for portable operator's terminal;

.8 Powerline filters to eliminate surges, spikes, and line noise;

.9 Auxiliary 120V receptacle within the enclosure for powering diagnostic equipment.

.3 Controllers shall be capable of the following functions:

.1 Providing digital and/or analog outputs, as required, for controlling equipment;

.2 Communicating with the network;

.3 Operating on a stand-alone basis.

2.4 TERMINAL UNIT CONTROLLERS

.1 Provide one native BACnet application controller for each terminal unit that adequately covers all objects listed in object list for unit. All controllers shall interface to building controller through MS/TP LAN using BACnet protocol. No gateways shall be used. Controllers shall include on board sensors, inputs, outputs and programmable, self-contained logic program as needed for control of units.

.2 BACnet Conformance

.1 Application controllers shall, at a minimum, support MS/TP BACnet LAN types. They shall communicate directly through this BACnet LAN at 9.6, 19.2, 38.4 and 76.8 Kbps, as a native BACnet device. Application controllers shall be approved by the BTL as meeting the BACnet Application Specific Controller requirements.

.2 Standard BACnet object types supported shall include, as a minimum, Analog Input, Analog Output, Analog Value, Binary Input, Binary Output, Binary Value, Device, File, and Program Object Types. All proprietary object types, if used in the system, shall be thoroughly documented and provided as part of the submittal data. All necessary tools shall be supplied for working with proprietary information.

.3 Application controllers shall include universal inputs with 10-bit resolution that can accept 3K and 10K thermistors, 0–5 VDC, and dry contact signals. Inputs on controller may be either analog or digital. Controller shall also include support and modifiable programming for interface to intelligent room sensor with digital display. Controller shall also include binary outputs on board. For applications using variable speed parallel fans, provide a single analog output selectable for 0-10 V or 0-20 mA control signals.

.4 All program sequences shall be stored on board application controller in EEPROM. No batteries shall be needed to retain logic program. All program sequences shall be executed by controller 10 times per second and shall be capable of multiple PID loops for control of multiple devices. Programming of application controller shall be completely modifiable in the field over installed BACnet LANs or remotely using modem interface. Operator shall program logic sequences by graphically moving function blocks on screen and tying blocks together on screen. Application controller shall be programmed using the same programming tool as Building Controller and as described in operator's workstation section. All programming tools shall be provided as part of system.

.5 Application controller shall include support for intelligent room sensor (see Section 2.6.3.) Display on room sensor shall be programmable at application controller and include an operating mode and a field service mode. All button functions and display data shall be programmable to show specific controller data in each mode based on which button is pressed on the sensor. See sequence of operations for specific display requirements for intelligent room sensor.

2.5 PANELS - GENERAL

.1 Provide all pre-wired control panels, except for those furnished as part of equipment under other sections.

.2 Fabricate fully enclosed cabinets using all steel construction with enamel finish:

.1 Use hinged locking door

.2 Common key all locks

.3 Provide either wall mount or freestanding panels as required by the actual installation.

.4 Where heat-generating equipment is to be mounted inside of an enclosure, provide vented cabinets.

.5 Mount all routinely operated, manually adjusted, and indicating devices on the panel door. Enclose all other devices.

.6 Mount plasticized control schematics inside the panels.

2.6 AUXILIARY CONTROL DEVICES & DDC SYSTEM SENSORS

.1 General:

.1 Where specified, shown and/or required, provide system sensors with the following characteristics:

.1 Humidity (polymer capacitive type): range: 0-100% RH, accuracy: 3.0%.

.2 Temperature (bulb type): range: -50 deg. F to 250 deg. F, accuracy: 0.01%.\

.2 Use Combination Temperature/Humidity Space Sensors where both temperature & humidity sensing is required. Provide as shown on the mechanical drawings.

.3 Use Combination Temperature/Humidity/CO_2 Space Sensors where temperature, humidity, & Indoor Air Quality (CO_2) sensing is required. Provide as shown on the mechanical drawings.

.4 Sensors shall be installed in accordance with manufacturer's instructions and shall be located as per the The City of Winnipeg Accessibility Design Standard & the MECB as listed below:

.1 Between 1400mm and 1500mm above the floor,
.2 On interior partitions or walls, or on exterior walls where a minimum effective thermal resistance of 3.5 m^2*ºC/W is provided between the sensor & outdoors,
.3 Away from direct exposure to sunlight and heat-producing sources, and
.4 Away from draughts or dead pockets of air.
.5 If the building has been deemed a Barrier Free Design, mounting heights for all user operable temperature controls shall be mounted as per the City of Winnipeg's Accessibility design standards. If the building has been deemed a Barrier Free Design and there are no accessibility design standards, the user temperature controls shall be mounted between 900mm (35") and 1200mm (47").

.5 Refer to PART 4 – Sequence of Operations for Controls below for further information.

.2 Temperature Sensors:

.1 All temperature sensors to be solid-state electronic, interchangeable with housing appropriate for application. Wall sensors to be installed as indicated on drawings. Duct sensors to be installed such that the sensing element is in the main air stream. Immersion sensors to be installed in wells provided by control contractor, but installed by mechanical contractor. Immersion wells shall be filled with thermal compound before installation of immersion sensors. Outside air sensors shall be installed away from exhaust or relief vents, not in an outside air intake, and in a location that is in the shade most of the day.

.3 BACnet Intelligent Room sensors with LCD Readout:

.1 Sensor shall contain a backlit LCD digital display and user function keys along with temperature sensor. Controller shall function as room control unit and allow occupant to raise and lower setpoint, and activate terminal unit for override use—all within limits as programmed by building operator. Sensor shall also allow service technician access to hidden functions as described in sequence of operation.

.2 The BACnet intelligent room sensor shall simultaneously display room setpoint, room temperature, outside temperature, and fan status (if applicable) at each controller. This unit shall be programmable, allowing site developers the

flexibility to configure the display to match their application. The site developer should be able to program the unit to display time-of-day, room humidity and outdoor humidity. Unit must have the capability to show temperatures in degrees Fahrenheit or Centigrade.

.3 Override time may be set and viewed in half-hour increments. Override time countdown shall be automatic, but may be reset to zero by occupant from the sensor. Time remaining shall be displayed. Display shall show the word "OFF" in unoccupied mode unless a function button is pressed.

.4 See sequence of operation for specific operation of LCD displays and function keys in field service mode and in normal occupant mode. Provide intelligent room thermostats as noted on the mechanical drawings.

.5 Field service mode shall be customizable to fit different applications. If intelligent room thermostat is connected to terminal unit controller, terminal unit shall be balanced and all air flow parameters shall be viewed and set from the intelligent room sensor with no computer or other field service tool needed.

.6 BACnet sensor shall capable of communicating over a BACnet MS/TP communications network to the building automation system (BAS).

.7 BACnet interface between terminal unit controllers and the space mounted BACnet intelligent sensor shall be provided by the controls contractor.

.1 BACnet interface shall have the ability to orchestrate the following unit operations:

.1 Enable heating and cooling to maintain set-point based on a room sensor.
.2 Enable fan and compressor operation.
.3 Monitors all equipment protection controls.
.4 Monitor water temperature.
.5 Relays status of all vital unit functions.

.4 Wall Sensors:

.1 Standard wall sensor shall use solid-state sensor identical to intelligent room sensor and shall be packaged in aesthetically pleasing enclosure. Sensor shall provide override function and warmer/cooler lever for set-point .

.5 Indoor Air Quality (CO_2) System Sensors:

.1 CO_2 sensors basis of design: **SENVA** model CO2RL wall mounted, self-calibrating, Infrared Carbon Dioxide (CO_2) sensor. C/w LCD display option. Gold plated non-dispersive infrared (NDIR), field interchangeable, optical sensor with automatic baseline correction for self- calibration (eliminating the need for

outdoor CO_2 sensor). CO_2 Output scaling: 0-2000 or 0-5000 ppm (selectable). Output Type: 3-wire 0-5/10V (jumper) or 2-wire 4-20mA, selectable. CO_2 Accuracy: ± 2% full scale to 1400ppm (5000ppm f.s.). Power Supply (0-5v or 0-10v operation): 12-30VDC/24VAC, 15mA max. Power Supply (4-20mA operation): 12-30VDC, 30mA max. Digital Setpoint Output: Solid-state, 1A @ 30VAC/DC, N.O. Operating Conditions: 32 to 122F, 0 to 95% RH. 7-year warranty on electronics.

.2 Provide combination temperature, humidity, & IAQ (CO_2) sensors where possible as outlined & as shown on the mechanical drawings.

2.7 AIR SYSTEM CONTROL DAMPERS AND DAMPER OPERATORS/ACTUATORS

.1 Control dampers shall be all metal construction as follows:

.1 Blades maximum 6" wide and 48" long.
.2 Modules to be maximum of 48" wide and 48" long.
.3 Multiple sections to have stiffening mullions and jack shafts.
.4 Sealed bearings.
.5 Linear flow vs. position characteristics.
.6 Low leakage design with edge seals and blade seals.

.2 Mixing dampers shall be of parallel blade or opposed blade design to eliminate stratification of air streams.

.3 Damper operators shall be spring return, fail safe models. Power return operators will not be accepted.

.4 Damper operators shall be sized to provide adequate power for opening, closing and modulating the dampers as required. They may be 24V or 120V at the Contractor's option.

.5 Outdoor dampers/operators shall be suitable for proper operation down to -50 deg. F and be weatherproof.

.6 Provide operators for the air handling unit mixing dampers supplied by the equipment manufacturer as part of the air handling units.

.7 Provide each operator with a bracket for attaching to ductwork, building structure or equipment. Do not install operators in ducts or fresh air intakes.

2.8 HYDRONIC CONTROL VALVES AND VALVE OPERATORS

.1 Automatic control valves shall be properly sized and selected by the Manufacturer in accordance with the load requirements and characteristics of the system to which they are applied.

.2 Valve operators shall be modulating, spring return, fail safe models. Power return operators will not be accepted.

.3 Valve operators shall be sized to provide adequate power for opening, closing and modulating the valves as required. They may be 24V or 120V at the Contractor's option.

.4 Maximum water pressure drop through control valves shall be 2.5 p.s.i.

.5 All valves shall have integral seats ground into the body. Disc assemblies shall be replaceable and selected for the fluid to be controlled.

.6 All valves shall be of a suitable physical size to fit the intended location. Take particular note of the radiation cabinet/enclosures.

2.9 DIRTY FILTER PRESSURE SWITCH/GAUGES

.1 For all air filters in ERV-1 provide adjustable pressure switch/gauges to permit local readout and remote monitoring of air filter conditions, unless factory supplied pressure swithes/gauges have been supplied integral with units. Coordinate final requirements with equipment supplier/manufacuter as pressure switches/gauges may be factory supplied.

.2 Provide static pressure probes (SPP) and mount the gauges where they can be easily read. Provide lamacoid labels to identify the filter bank and the changeout pressure.

.3 Differential pressure switch/gauges for local indication and remote monitoring of filter pressure drops shall be equal to:

.1 Dwyer Series 3000 Photohelic pressure switch/gauge c/w adjustable signal flag, zeroing valves, mounting kit, aluminum connecting tubing, and static pressure probes with compression fittings.

.4 Differential pressure range shall be suitable for 0 to 1".

2.10 INDOOR/OUTDOOR PRESSURE DIFFERENTIAL TRANSMITTERS & TRANSDUCERS

.1 Provide pressure differential Transmitters/ Transducers to permit remote monitoring & control of indoor/outdoor pressure differential.

.1 Provide building static pressure monitoring and sensors/transmitters for spaces/zones as noted below:

.1 Main Open Library Area.
.2 Living Room Area.
.3 MPR Room.
.4 Library Services & Service Desk Main Entry Lobby Areas.

.2 Building static pressure set-points shall be initially set to +12Pa (0.048" w.c.) (adj.). Final operating set-points during cooling & heating systems operation shall be optimized during commissioning of the building.

.3 Provide slow response or timed average sensor reading for controlling the building pressure to avoid unnecessary ramping of the supply & exhaust fans when an exterior door is opened/closed or an event occurs that affects the building pressure reading for a short period of time.

.4 Differential Pressure Transmitter/ Transducer shall be for air service. The device shall output a 4-20 milli-amp or 0-10 VDC signal, which is linear in relation to the sensed pressure. Accuracy shall be $\pm$ .01% of full scale. The power shall be from the controller and shall be in the range of 22-26 volts DC. The unit shall have temperature compensation so that thermal effects are no more than $\pm$ .05% of the full scale from 32-100 DEG F. The Transmitter/ Transducer shall be suitable for the media and pressure measured.

.5 Standard of acceptance based on: Dwyer.

2.11 AIR FLOW SWITCHES

.1 Where required for airflow indication, provide duct pressure sensors operating on the velocity pressure principal, sensing actual air velocity using an appropriate pitot tube tip as a velocity pressure probe (VPP).

.1 Differential pressure sensors piped across fans will not be accepted.

.2 Current sensing switches are an acceptable substitute. Switches must have both high and low adjustable trippoints.

2.12 WATER FLOW SWITCHES

.1 Where required for water flow indication, provide paddle type flow switch with digital output for DDC system readout.

.1 Current sensing switches on pumps are an acceptable substitute. Switches must have both high and low adjustable trippoints.

2.13 IDENTIFICATION OF EQUIPMENT - NAMEPLATES, LABELS AND TAGS

.1 Use engraved black and white laminated plastic, 25mm x 62mm (1") x (2-1/2"), at all thermostats, thermometers, panels, etc., supplied so as to clearly indicate service of particular device. Manual switches, unless they come with standard nameplates, and thermostats, thermometers, switches, etc., installed on local panels to be similarly labelled.

.2 Excluding room thermostats and damper assemblies, provide lamacoid identification plates fastened with rivets or self-tapping screws at all equipment supplied by Section 23 09 00 so as to clearly indicate service of particular device. All manual switches, unless they come with standard nameplates, shall be similarly labelled.

.3 Equipment installed on surfaces of local panels shall be similarly labelled. Equipment mounted inside local panels must have permanent plate labels with self-tapping screws. Tape labels are not acceptable.

.4 Identification plates, by Section 23 09 00, to be white background with minimum 5mm high black letters, unless specified otherwise. Electrical systems identification to be as per Division 26 00 00.

.5 Provide tags at all valves and equipment not suited for attaching nameplates. Tags shall be engraved, all metal, attached with metal key chains.

.6 Nameplates, labels and tags shall include function, setpoint and equipment names and ID numbers.

.7 Information on lamacoid identification plates to be consistent with "as-built" control drawings.

.8 Prior to lamacoid fabrication, submit copies of control drawings and complete list of proposed wording for each lamacoid, for approval by Consultant and City of Winnipeg. Include a copy of the approved lamacoid list in each Maintenance/Operating Manual.

2.14 VANDAL PROOF COVERS

.1 Provide vandal proof covers (guards) on all wall mounted thermostats, temperature sensors, humidistats, humidity sensors, etc…located in public areas & clinic/exam rooms.

2.15 PIPING/TUBING – POWER, INTERLOCKING, & CONTROL WIRING - ACCESSORIES

.1 Control wiring and conduit shall meet or exceed the requirements of C.S.A., U.L.C., the current edition of the Canadian Electrical Code, and all local Code requirements as well as the requirements as specified in Division 26 00 00.

.2 Control wiring shall be connected from specific breakers in power panels. Refer to Electrical Drawings.

.3 The Controls Contractor shall provide piping/tubing and power and control wiring required by the control systems.

.4 The Controls Contractor shall provide power transformers required by the controls systems.

.5 The Controls Contractor shall provide all interlock piping/tubing and wiring required by the control systems, including but not limited to electric switches, piping/tubing and wiring between control system components such as low limit protection, thermostats, alarms, motor starters and motor interlocks, etc., as required to achieve the control function specified in the schematic drawings and sequences of operation.

.6 All control wiring, regardless of voltage, shall be installed in a continuous, dedicated system of rigid metal tubing (EMT). Maximum lengths of 7 feet of flexible metal conduit will be accepted for final connections to devices and equipment.

2.16 WEB BASED OPERATION & INTERFACE

.1 The DDC control systems shall allow for remote connection & full control via the internet.

.1 Provide a dedicated internet connection and secure remote access to the DDC system through the internet. Coordinate all requirements with electrical divisions.

.2 The DDC system shall be complete with web server capability, where the system shall be capable of being accessed by authorized users via internet browser software. The system shall have the ability to allow authorized users to adjust and control set points of the mechanical controls and to monitor mechanical equipment.

.3 Provide all necessary software.

.2 Provide all documentation relating to the system upgrades and software.

.3 Provide accessories to enable the user to connect to the communications bus at any DDC panel.

.4 Provide system setup programming to permit the operator to easily accomplish the functions of monitoring the systems, controlling the systems, and printing reports and logs.

.5 The system interface shall be able to modify the setpoints of the systems and zones.

.7 System shall allow each authorized operator to execute the following functions as a minimum:

.1 Log in and log out. System shall require user name and password to log in to operator interface.

.2 Point-and-click navigation. Operator interface shall be graphically based and shall allow operators to access graphics for equipment and geographic areas using point-and-click navigation.

.3 View and adjust equipment properties. Operators shall be able to view controlled equipment status and to adjust operating parameters such as set-points, PID gains, on and off controls, and sensor calibration.

.4 View and adjust operating schedules. Operators shall be able to view scheduled operating hours of each schedulable piece of equipment on a weekly or monthly calendar-based graphical schedule display, to select and adjust each schedule and time period, and to simultaneously schedule related equipment. System shall clearly show exception schedules and holidays on the schedule display.

.5 View and respond to alarms. Operators shall be able to view a list of currently active system alarms, to acknowledge each alarm, and to clear (delete) un-needed alarms.

.6 View and configure trends. Operators shall be able to view a trend graph of each trended point and to edit graph configuration to display a specific time period or data range. Operator shall be able to create custom trend graphs to display on the same page data from multiple trended points.

.7 View and configure reports. Operators shall be able to run preconfigured reports, to view report results, and to customize report configuration to show data of interest.

.8 Manage control system hardware. Operators shall be able to view controller status, to restart (reboot) each controller, and to download new control software to each controller.

.9 Manage operator access. Typically, only a few operators are authorized to manage operator access. Authorized operators shall be able to view a list of operators with system access and of functions they can perform

while logged in. Operators shall be able to add operators, to delete operators, and to edit operator function authorization. Operator shall be able to authorize each operator function separately.

.8 Provide programming for graphic screens for the following systems:

.1 Central Dedicated Outdoor Air System (ERV-1) & heating/cooling coil circulation pumps (CP-2A & CP-2B), including:

.1 Cooling/heating coil section (H/CC-1).
.2 DX energy Recovery Heat Pipe coils (RHP-1 & RHP-2)
.3 Heat Reclaim sections.
.4 Associated Motorized intake/exhaust Dampers
.5 Associated Air Filter monitoring.
.6 Associated Fresh Air Supply & Exhaust air fans c/w respective VFDs.

.2 Crawlspace transfer fan (TF-1).

.3 Hydronic System Heating/Cooling system 3-way changeover control valve.

.2 Hydronic System Terminal Units Loop Temperature Heating/Cooling system 3-way mixing control valve and circulation pumps CP-3A & CP-3B

.3 In-Floor Heating & Cooling System manifold 3-way valves.

.4 Terminal units: Active Chilled Beams (ACB), Fan Coil Units (FC), Re-heat Coils (RHC), & Unit Heater (UH) control including 2-way valves.

.6 Hydronic central plant loop systems including: Air Cooled Chiller (ACH-1 & ACHE-1), Central Boilers (B-1, & B-2) c/w packaged internal circulation pumps, & Circulation Pumps (CP-1A & CP-1B) c/w VFDs.

.7 Electric domestic Hot Water Heater DWH-1 and domestic hot water Recirculation Pump RCP-1.

.8 Entrance Electric Force Flow Heaters (EFFH).

.9 Monitoring of miscellaneous points including but not limited to: temperature, humidity, condensate sensors, Current Sensing/Current Transformers (CT), & building pressure as shown on the mechanical drawings and described throughout Section 23 09 00.

.1 Provide building static pressure monitoring and sensors/transmitters for spaces/zones as noted below:

.1 Main Open Library Area.

.2 Living Room Area.
.3 MPR Room.
.4 Library Services & Service Desk Main Entry Lobby Areas.

.2 Provide radiant floor slab temperature & condensate monitoring and sensors/transmitters for spaces/zones as noted on the drawings & schematics.

.3 Provide condensate monitoring and sensors/transmitters for each ACB and radiant device as noted on the drawings & schematics.

.4 Provide monitoring/alarm of exterior doors in the following areas by means of door contacts:

.1 Open Library 1:18
.2 Living Room 1:19
.3 MPR Room 1:20 (both doors).

.5 Provide monitoring/alarm of exterior doors in the following areas by means of door contacts:

.1 Vestibule A - 1:01
.2 Vestibule B - 1:14

.6 Provide monitoring/alarm of exterior operable windows in the following areas by means of window contacts:

.1 Staff Room 1:08
.2 Library Services Workroom 1:04
.3 Branch Head Office 1:22

.10 Weeping Tile Sump Pits & Pumps (WSP-1,2).

.11 Miscellaneous monitoring & control points as noted.

2.17 GENERAL SOFTWARE REQUIREMENTS

.1 Provide all necessary software to incorporate points & control operation listed in input/output schedules/sequences for DDC system. This shall include, but not be limited to, following:
.1 All software and or software revisions for DDC panels, controllers, network engines, etc.

.2 Communication shall be password protected with 3 levels:

.1 Level 1 (operator level) shall allow interface to the system for password access, alarm handling, point addressing, manual commands and display of statistical data.

.2 Level 2 (program level) shall allow operation for command control and definition of energy management parameters.

.3 Level 3 (configuration level) shall allow database entry and modification.

.4 System shall require a user name and password to view, edit, add, or delete data.

.1 Operator Access.

.1 Each user name and password combination shall define accessible viewing, editing, adding, and deleting functions in each system application, editor, and object.

.2 Automatic Log Out.

.1 Automatically log out each operator if no keyboard or mouse activity is detected. Operators shall be able to adjust automatic log out delay.

.3 Encrypted Security Data.

.1 Store system security data including operator passwords in an encrypted format. System shall not display operator passwords.

.3 Point functions and alarm messages shall have English language descriptions.

.4 Each of the controlled systems shall operate independently (i.e.: calls for heat/cool/fan for one system will not affect another system)

.5 O/A temperature, humidity, & presssure monitoring.

.6 Provide software for start/stop optimization.

.7 Provide auto restart after power failures.

.8 Provide system viewing and programmable trending analysis as follows:

.1 The status of all setpoints and the readout of all sensors shall be polled every 5 seconds (adjustable) in order to provide a snap-shot view or a trend log of the systems. Status will be monitored without the need to have the Operator's terminal running;

.2 Automatic printout will be available for each snap-shot or trend log on an adjustable time schedule;

.3 Snap-shot views shall be available for each system, providing complete information regarding setpoints and readouts.

.4 Trend logs shall be set up for each controlled point, indicating setpoint and readout.

.9 System Graphics;

.1 Operator interface shall be graphically based and shall include at least one graphic per piece of equipment or occupied zone, graphics for each system, and graphics that summarize conditions on each floor of the building included in this contract.

.1 Functionality. Graphics shall allow operator to monitor system status, to view a summary of the most important data for each controlled zone or piece of equipment, to use point-and-click navigation between zones or equipment, and to edit set-points and other specified parameters.

.2 Animation. Graphics shall be able to animate by displaying different image files for changed object status.

.3 Alarm indication. Indicate areas or equipment in an alarm condition using color or other visual indicator.

.4 Format. Graphics shall be saved in an industry-standard format such as bmp, jpeg, png, or gif. Web-based system graphics shall be viewable on browsers compatible with World Wide Web consortium browser standards. Web graphic format shall require no plug-in (such as html and JavaScript) or shall only require widely available no-cost plug-ins (such as active-x and adobe flash).

.10 Provide run time accumulators as follows:

.1 For measurement/verification, energy monitoring, & preventative maintenance purposes, the run time shall be monitored and displayed for the following systems and equipment:

.1 Central Dedicated Outdoor Air System (ERV-1) fresh air supply & exhaust fans c/w Variable Frequency Drives (VFDs) and heating/cooling coil circulation pumps (CP-2A & CP-2B).

.2 Crawlspace transfer fan (TF-1).

.3 Central Boiler Systems (B-1, & B-2) & packaged internal circulation pumps; Circulation pumps CP-1A & CP-1B c/w Variable Frequency Drives (VFDs).

.4 Hydronic System Terminal Units Loop Temperature Heating/Cooling system circulation pumps CP-3A & CP-3B.

.5 Air Cooled Chiller (ACH-1 & ACHE-1).

.6 Electric domestic Hot Water Heater DWH-1 and domestic hot water Recirculation Pump RCP-1.

.7 Entrance Electric Force Flow Heaters (EFFH).

.8 Crawlspace electric Unit Heaters (UH).

.9 Domestic hot water Re-circulation pump RCP-1.

.10 Weeping Tile Sump Pumps (WSP-1,2).

.2 Accumulators shall have a range of 0-65,000 hours and shall provide an alarm indication on the operator's terminal at an adjustable trip point selected by the operator.

.3 Accumulators shall be capable of operation without the operator's terminal being turned on.

.4 Provide a separate alarm for each accumulator.

.11 Alarm Monitoring:

.1 In general, provide alarm monitoring and annunciation as follows. Refer to specific requirement in Part 4 – Sequences of Operations for Controls section below for further information.

.2 Alarm functions shall be capable of operation without the operator's terminal being turned on. These alarm conditions shall be immediately annunciated on the local operator terminal and associated alarm printer, or when the terminal is first turned on, if it has been turned off.

.3 Alarm conditions shall be capable of being deemed 'maintenance' or 'critical' by the Operator. Alarm lists shall be capable of being revised by the Operator.

.4 Alarm conditions which indicate a serious malfunction of the mechanical systems, which require immediate attention, shall be designated as "Critical Alarms".

.5 In addition to being annunciated on the local operator terminal, 'critical' alarms shall also initiate the autodial alarm.

.6 Monitor and annunciate alarms for systems, conditions and equipment as follows:

.1 Equipment (Fans, Pumps, Fan Coils, Air Cooled Chiller, Boilers, etc.) failure (critical);

.1 Equipment failure: commanded on, but the status is off.
.2 Equipment in hand: commanded off, but the status is on.
.3 Equipment runtime exceeded: status runtime exceeds a user definable limit (adj.).

.2 All alarms related to the Boiler operation including but not limited to low water, high/low temperature, pressure, failure, etc. (critical);

.3 All alarms related to the Air Cooled Chiller operation including but not limited to low water, high/low temperature, pressure, fan failure, etc. (critical);

.4 Fresh & Exhaust Air motorized dampers (ERV-1) are open/closed out of normal outdoor air temperature operating range.

.5 ERV-1 low supply discharge air temp in heating mode (critical);

.6 ERV-1 high supply discharge air temp in cooling mode (critical);

.7 High primary hot water supply temp (adj.) (warning).

.8 Low primary hot water supply temp (adj.) (warning).

.9 High primary cooled water/fluid supply temp (adj.) (warning);

.10 Low primary cooled water/fluid supply temp (adj.) (warning);

.11 High floor slab surface temp (adj.) (warning);

.12 Low floor slab surface temp (adj.) (critical);

.13 Condensate sensor activated in floor slab (critical);

.14 Heating mode out of nominal range (critical);

.15 Cooling mode out of nominal range (critical);

.16 Low space temperature (critical);

.17 High space temperature (critical);

.18 Indoor space humidity & dew point temperature out of range (warning) & (critical);

.19 Condensate sensor activated at radiant cooling device (ACB, FC, Manifold, etc…);

.20 Exterior door & operable window contact activated (warning) & (critical);

.21 Run time accumulator reached (maintenance);

.22 Air Filter Pressure Drop (maintenance);

.1 Filter change required: filter differential pressure exceeds a user definable limit (adj.).

.7 Provide adjustable time delay software as required to ensure that false alarms are prevented on initial heating call for Air Handling Systems.

.8 When the central air systems are running, supply air temperatures above 90 deg. F (adjustable) will provide an alarm.

.9 When the air systems are running, supply air temperatures below 55 deg. F (adjustable) on a call for heat will provide an alarm. Provide adjustable time delay software as required to ensure that false alarms are prevented on initial heating call.

.10 When the air systems are running, supply air temperatures below 47 deg. F (adj.) will shut the system down and provide an alarm.

.11 At any time, when any space/zone temperature sensor senses temperature below 55 deg. F (adj.) or above 90 deg. F (adj.) the DDC system shall signal an alarm. Each sensor shall provide a separate alarm.

.12 When a run time accumulator has reached it's setpoint, an alarm shall be signalled. Each accumulator shall provide a separate alarm.

.13 When a pump is scheduled to be operational, a lack of signal from a current sensing or flow switch will provide an alarm. Provide adjustable

time delay software as required to ensure that false alarms are prevented on initial start-up. Each sensor shall provide a separate alarm.

2.18 VARIABLE FREQUENCY DRIVES (VFD)/ VARIABLE SPEED DRIVES (VSD)

.1 Materials

.1 Compliance to:

.1 NEMA MG1, No. 30.
.2 NEMA MG1, No. 31.
.3 IEEE-519-1992.
.4 CSA 22.2-1998.
.5 UL508C.

.2 General Design Requirements

.1 Design Characteristics as follows:

.1 The VFD/ VSD shall be of the Pulse Width Modulated (PWM).
.2 The VFD/ VSD shall be rated for variable torque applications, with an overload rating of 120% for 60 seconds.
.3 The VFD/ VSD shall be factory UL/cUL listed.
.4 The VFD/ VSD shall have the capability of operating multiple motors. The minimum VFD/ VSD continuous current rating shall be the sum of the full load current ratings of the connected motors.
.5 The VFD/ VSD shall have a minimum displacement power factor of 0.96 or higher at all output frequencies.
.6 The VFD/ VSD shall include line reactors and load dv/dt filters (RLC component filter).
.7 The VFD/ VSD and all options (e.g. line and load reactors, filters, bypass etc) must be supplied within a wall or floor mount metal, NEMA 1 enclosure with hinged metal door.
.8 The VFD/ VSD manufacturer shall have a minimum of ten years experience in the Canadian Market.
.9 Warranty of the VFD/ VSD system shall be for 12 months from the date of start-up or 18 months from date of delivery, whichever is sooner. The warranty shall include all parts and repair labor.

.2 Standards VSD Design Features, Accessories and Associated Control Components:

.1 Keypad Display: A digital display keypad shall be provided for input of parameter setting and operating commands. The digital display shall indicate output frequency, motor RPM, output current, as well as fault history information.

.2 Digital Inputs: The VFD/ VSD shall include a minimum of five programmable digital inputs.
.3 Analog Inputs: The VFD/ VSD shall accept an analog speed reference input signal of 0-10VDC and/or 4-20mA. If both inputs are active, the 0-10VDC or 4-20mA signals shall be selectable by a digital input.
.4 Relay Outputs: the VFD/ VSD shall include two programmable relay outputs as well as an alarm relay output.
.5 Analog Output: the VFD/ VSD shall provide a programmable analog signal (0-10VDC and/ or 4-20mA) proportional to the output frequency or output current.
.6 Auto Restart: the VFD/ VSD shall have the capability to automatically restart the motor after an interruption in input power.
.7 Start Into a Spinning Motor: the VFD/ VSD shall be capable of staring into motor spinning in either the forward or reverse direction without fault.
.8 Soft PWM Control: the carrier frequency shall be continuously modulated to eliminate metallic motor noise without requirement to de-rate the VFD/ VSD.
.9 Energy Savings: the VFD/ VSD shall include Optimum Excitation Control to further reduce energy consumption by optimizing the motor flux continuously and automatically at all speed and load points.
.10 Fault Log: a fault log will record the details of the last 8 faults including mode, frequency, current, voltage and run time.
.11 Safety Interlocks: Terminals to be provided for connection of safety interlocks such as Fire-stat and Freeze-stat. These interlocks shall shutdown operation in either the Drive or Bypass operating modes.
.12 Single phase, dry type, control transformer with primary voltage, as indicated and 120V secondary, complete with secondary fuse, installed within VFD/ VSD enclosure. Size control transformer for control circuit load plus 20% spare capacity.

.3 Input Power

.1 Voltage: 3 phase + ground 208-240VAC +/- 10%
480VAC +/- 10%
575VAC +/- 10%

.2 Frequency: 48-62 HZ.

.4 Output Ratings

.1 The VFD/ VSD shall operate within the following rated values:

.1 Output Frequency Range: 0.1 to 400 Hz.
.2 Overload Rating: Variable Torque – 120% for 60 seconds

.5 Equipment Identification

.1 Provide equipment identification in accordance with Section 26 05 01 & 21 05 05.

.2 Identify VFD/ VSD panel with Size 2 nameplates, indicating motor number, description, horsepower, and voltage.

.6 Manufacturers

.1 MITSUBISHI or approved equal.

PART 3 Installation And Execution

3.1 EXAMINATION

.1 Prior to starting work, carefully inspect installed work of other trades and verify that such work is complete to the point where work of this Section may properly commence.

.2 Notify the Contract Administrator in writing of conditions detrimental to the proper and timely completion of the work.

.3 Do not begin work until all unsatisfactory conditions are resolved.

3.2 INSTALLATION (GENERAL)

.1 Install in accordance with manufacturer's instructions.

.2 Provide all miscellaneous devices, hardware, software, interconnections, installation, and programming required to ensure a complete operating system in accordance with the sequences of operation and point schedules.

3.3 COMPONENTS - GENERAL

.1 Mount all controllers and relays within control panel cubicles.

.2 Mount exposed components for easy access and protect from damage.

.3 Locate all local control panels as shown on the drawings or as directed by the City of Winnipeg or Consultant.

.4 Damper operators: do not install in ducts or fresh air intakes.

.5 Sensor elements for remote thermometers: where installed to sense a common temperature condition with a controller, strap both elements together.

.6 Provide brass wells of sizes to suit sensor bulbs, c/w unions and dielectric elements as required.

.7 Mount gauges and thermometers for easy readability.

.8 Freeze protection sensors: Mount elements across a coil face approximately 500 mm (18") downstream of the coil, in rows at 400 mm (16") o.c.

3.4 LOCATION AND INSTALLATION OF COMPONENTS

.1 Locate and install components for easy accessibility; in general, mount 48 inches above floor with minimum 3 feet of clear access space in front of units. Obtain approval on locations from Contract Administrator prior to installation.

.2 All instruments, switches, transmitters, etc., shall be suitably wired and mounted to protect them from vibration, moisture, and high or low temperatures.

.3 Identify all equipment and panels. Provide permanently mounted tags for all panels.

.4 Provide stainless steel or brass thermowells suitable for respective application and for installation under other sections, and sized to suit pipe diameter without restricting flow.

3.5 PIPING/TUBING – POWER, INTERLOCKING, & CONTROL WIRING - ACCESSORIES

.1 Provide all interlock and control wiring. All wiring shall be installed neatly and professionally, in accordance with Specification Division 26 00 00 and all national, provincial and local electrical codes.

.2 Provide wiring as required by functions as specified and as recommended by equipment manufacturers, to serve specified control functions. Provide shielded low capacitance wire for all communications trunks.

.3 Control wiring shall not be installed in power circuit raceways. Magnetic starters and disconnect switches shall not be used as junction boxes. Provide auxiliary junction boxes as required. Coordinate location and arrangement of all control equipment with the Contract Administrator prior to rough-in.

.4 Provide auxiliary pilot duty relays on motor starters as required for control function.

.5 Provide power for all control components from nearest electrical control panel or as indicated on the electrical drawings; coordinate with electrical contractor.

.6 All control wiring in the mechanical, electrical, telephone and boiler rooms to be installed in raceways. All other wiring to be installed neatly and inconspicuously per local code requirements & as per Section 2.15.6 noted above.

.7 For equipment connected to emergency power, the controls shall also be connected to emergency power.

.8 Run piping, tubing and conduit neatly clipped to walls or structural members, parallel to and at right angle to, building lines.

3.6 FIELD SERVICES

.1 Prepare and start logic control system under provisions of this section.

.2 Start up and commission systems. Allow sufficient time for startup and commissioning prior to placing control systems in permanent operation.

.3 Provide the capability for off-site monitoring at control contractor's local or main office. At a minimum, off-site facility shall be capable of system diagnostics and software download. City of Winnipeg shall provide phone line for this service for one year or as specified.

.4 Provide Contract Administrator with spare parts list. Identify equipment critical to maintaining the integrity of the operating system.

3.7 TRAINING

.1 Provide application Consultant to instruct City of Winnipeg in operation of systems and equipment.

.2 Provide system operator’s training to include (but not be limited to) such items as the following: modification of data displays, alarm and status descriptors, requesting data, execution of commands and request of logs. Provide this training to a minimum of three persons.

.3 Provide tuition for at least one individual to attend for a one-week factory training class. If applicable, costs for travel, lodging and meals will be the responsibility of the City of Winnipeg.

3.8 PROJECT COMPLETION

.1 Prior to the Occupancy Stage of each Construction Phase:

.1 Start-up and Commission the Controls Equipment and Systems.

.2 Assist the Mechanical Contractor in the Start-up and Commissioning of the Mechanical systems. Refer to Specification Section 23 08 05.

.3 Calibrate all thermostats, valves, damper motors, relays, etc, provided under this contract.

.4 Verify and optimize the system.

.5 Provide three complete instruction manuals, complete with "as constructed" schematics, for insertion into the Operation and Maintenance Manuals.

.6 Provide instructions to City of Winnipeg as required. Refer to Specification Section 21 05 01.

3.9 CALIBRATION AND ADJUSTMENT OF CONTROLS SYSTEMS

.1 All components shall be calibrated before the areas are occupied in order to minimize the disruption to the occupants following the takeover the building.

.2 Upon completion of the installation phase of the project, calibrate and adjust all controls systems and components installed under this contract to provide acceptable space conditions and proper functioning of the systems. Keep a written log of the calibration data for each device, including the instrumentation against which the equipment is calibrated. Include this log in the Operation and Maintenance manuals.

.3 If requested, the Contractor shall be prepared to provide written documentation of recent calibration checks for all instrumentation and sensors.

3.10 VERIFICATION AND OPTIMIZATION OF THE OPERATION OF THE MECHANICAL SYSTEMS

.1 The installation shall be completely tested, demonstrating that the equipment and systems installed are performing in the manner intended.

.2 Provide equipment, personnel and materials necessary to produce written records for verification of the operation of all control systems and all equipment.

.3 Provide equipment, personnel and materials necessary to adjust the controls systems as part of the overall optimization of the mechanical systems.

.4 Adjust control setpoints and tune control algorithm performance to optimize the operation of the systems.

.5 Provide records consisting of computer generated trending logs, snap shot readings of setpoints and settings of variables, and any other method capable of demonstrating to the Consultant that the systems are operating optimally.

.6 At the time of completion, provide trend logs for each and every system to demonstrate the satisfactory operation of each system and each component.

.7 The Contractor shall provide analysis of the trend log data and shall make any and all changes to the controls systems as required to correct deficiencies or to optimize the operation of the systems.

.8 Trend logs shall be printed on 8-1/2" x 11" paper, clearly labeled for time, date, system and variables tracked. Trend log data shall be stored in a file format capable of being imported into a spreadsheet program for graphing.

.9 The Contractor shall be aware that additional trend logs may be required to be submitted during the warranty period to troubleshoot system deficiencies. Prepare and submit this data as required.

3.11 VARIABLE FREQUENCY DRIVES (VFD)/ VARIABLE SPEED DRIVES (VSD)

.1 Installation

.1 Install VFD controller, connect power and control as indicated.

.2 Install correct fuses.

.2 Tests

.1 Perform tests in accordance with Section 26 05 01 and manufacturer's instructions.

.2 Operate switches and contactors to verify correct functioning.

.3 Perform starting and stopping sequences of motors and controls

.4 Check that sequence controls, interlocking with other separate related equipment, control devices, operate as indicated

.5 Ensure that motor rotation corresponds with the direction required by the driven equipment.

PART 4 Sequences of Operations for Controls

4.1 OUTSIDE AIR TEMPERATURE & HUMIDITY SENSOR (TYPICAL OF 2):

.1 Mount in a permanently shaded area, or on the north exterior of the building.

.2 Outside Air Conditions:

.1 The controller shall monitor the outside air temperature and humidity and calculate the outside air enthalpy & dew point on a continual basis. These values shall be made available to the system at all times.

.2 Alarm shall be generated as follows:

.1 Sensor failure: sensor reading indicates shorted or disconnected sensor. In the event of a sensor failure, an alternate outside air conditions sensor shall be made available to the system without interruption in sensor readings.

.3 Outside air temperature & humidity history:

.1 The controller shall monitor and record the high and low temperature & humidity readings for the outside air. These readings shall be recorded on a daily, month-to-date, and year-to-date basis.

4.2 DEDICATED OUTDOOR & EXHAUST AIR SYSTEMS ENERGY RECOVERY VENTILATOR (ERV-1), HEATING/COOLING COIL (H/CC-1), DX ENERGY RECOVERY HEAT PIPES (RHP-1 & RHP-2), & CIRCULATION PUMPS (CP-2A & CP-2B):

.1 General:

.1 A controller shall be provided by the controls contractor to control the operation of the ERV. The controller shall be used in conjunction with the DDC control system to operate the ERV. All final requirements shall be coordinated with the ERV supplier.

.2 Provide temperature & humidity sensors located in the ERV fresh air supply/discharge immediately after the heat recovery cores and prior to the heating/cooling coil (H/CC-1) section, in the ERV discharge plenum downstream of the re-heat recovery heat pipe (RHP-1) section, in the exhaust air inlet plenum to the ERV, & in the outdoor air intake plenums. Refer to mechanical heating schematic for further information. The outdoor air temperature & humidity shall be monitored as noted in paragraph 4.1 above. The temperature and humidity sensors shall be supplied & installed by controls contractor; the ERV manufacturer supplied internal thermostats/sensors may be used if possible. All final requirements shall be coordinated with the ERV supplier/manufacturer.

.3 Supply & Exhaust fans are factory supplied by ERV manufacturer with packaged variable frequency drives (VFD).

.4 ERV unit shall be supplied c/w external, duct mounted, fresh air inlet & exhaust air outlet motorized damper sections to isolate outdoor air from building when unit is not operating. Motorized dampers shall revert to the closed position during loss of power and/or fail safe operation. Refer also to the mechanical drawings.

.5 When the unit is energized, the control system shall open and operate the fresh & exhaust air dampers and modulate the supply & exhaust fans as required.

.6 Provide freeze protection and alarm if heating system fails to raise the supply air temperature. Provide a freeze stat in the supply air duct, which will be hard-wired to de-energize the supply/exhaust fans on sensing discharge air temperatures below 5°C (41°F). The freeze stat will be complete with automatic reset. In order to prevent nuisance tripping, provide a time delay relay on the low limit circuit, which will time-out before the fan is de-energized. The freeze stat will also be wired as a digital input on the DDC controller to provide for freeze alarm at the operator's terminal.

.7 Provide sensors as shown on the drawings and noted throughout Section 23 09 00 – Direct Digital Controls (DDC) Systems, for carbon dioxide (CO_2) monitoring & demand controlled ventilation.

.8 Provide run-time accumulation for ERV supply & exhaust fans.

.9 Air flow sensor shall provide shut-down alarm for F/A fan in ERV.

.10 Provide Air Filter Monitoring.

.11 Control contractor to use the contacts integral to the ERV as required to achieve the control sequences noted within this section.

.12 Provide transformers, relays and power and control wiring as required.

.2 Scheduled Run Conditions:

.1 Provide start/stop function of ERV based on a time-clock function.

.2 The unit shall run based upon an operator adjustable schedule provided by the City of Winnipeg/tenant.

.3 The ERV fresh air & exhaust air fans shall modulate as required to satisfy ventilation requirements as noted throughout this section and as noted in the ERV equipment schedule and the ASHRAE 62.1 ventilation summary noted on the drawings.

.1 When required, the fresh air & exhaust fans shall ramp up and down according to the air quality (CO_2) and occupant use within the building.

.2 When required, the fresh air & exhaust fans shall ramp up during cooling operation when dehumidification is necessary to maintain dew point temperature within the building and/or to satisfy zone/space cooling requirements. During cooling operation, when the radiant systems are operational, the building shall be maintained at a positive pressure to prevent outdoor humid air from infiltrating into the building.

.1 Building static pressure set-points shall be initially set to +12Pa (0.048" w.c.) (adj.). Final operating set-points during cooling & heating systems operation shall be optimized during commissioning of the building.

.4 The ERV shall be capable of set-back operation during times when the building is unoccupied. Refer to paragraphs 4.2.3 - Minimum Outside Air Ventilation & Exhaust and 4.2.11 - Unoccupied Mode below for further information.

.5 ERV Optimal Start:

.1 ERV shall start prior to scheduled occupancy based on the time necessary for the zones to reach their occupied set-points. The start time shall automatically adjust based on changes in outside air temperature and zone temperatures.

.3 Minimum Outside Air Ventilation & Exhaust:

.1 During occupied mode, ERV Fresh air & Exhaust air fans shall be initially set as per the ventilation requirements noted in the ERV equipment schedule and the ASHRAE 62.1 ventilation summary noted on the drawings. The ERV fresh air & exhaust air fans shall modulate as required to satisfy ventilation requirements.

.2 The fresh air & exhaust air motorized dampers shall be in the open position during building occupied hours and shall be closed during unoccupied hours unless instructed to remain open to control humidity levels within the building.

.3 When required, the fresh air & exhaust fans shall ramp up during cooling operation when dehumidification is necessary to maintain dew point temperature within the building and/or to satisfy zone/space cooling requirements. Refer to paragraph 4.2.6 - Cooling Mode below for further information. ERV shall operate independently to maintain space humidity levels & cooling requirements in conjunction with the radiant cooling systems if directed to do so by the DDC system.

.4 Fresh/outdoor air shall also be controlled by a CO_2 based Demand Controlled Ventilation (DCV) & monitoring system.

.1 When required, the fresh air & exhaust fans shall ramp up and down according to the air quality (CO_2) and occupant use within the building.

.2 Provide suitable VAV terminal box controllers as required to perform the functions noted. Refer to the mechanical drawings for minimum/maximum airflow settings & further information.

.3 Refer to the supply air static pressure reset routine noted in paragraph 4.2.4 - Fresh Air Supply Fan & Exhaust Fan Speed Control above. Reset routine to be used in conjunction with the zone mounted motorized dampers/valves & the zone mounted CO_2 sensors to provide a fully operational demand control fresh air ventilation system.

.4 Space mounted CO_2 sensors shall monitor the zone CO_2 concentration and shall be used to control the zone VAV terminal box settings to optimize the amount of outdoor air entering the zones served by the ERV. The outdoor air shall be reduced via modulation of the zone VAV terminal box, if the CO_2 levels allow, to maintain a maximum of 800 ppm of CO_2 within the monitored spaces.

.5 Zone VAV terminal boxes shall be initially set to the minimum airflow settings as noted on the mechanical HVAC drawings.

.6 If any of the space mounted air quality sensors senses a CO_2 level greater than 800 ppm, the respective zone motorized damper/valve shall modulate open to its maximum setting & the outdoor air shall be increased to the ERV by modulating the fresh/outdoor air as required. If any of the space mounted air quality sensors senses a CO_2 level greater than 1000ppm for more than 15 minutes, an alarm shall be generated via the building automation system to the building operator/operator terminal. This alarm shall be an indication that CO_2 levels are out of normal range of operation.

.5 Supply & install Indoor Air Quality (IAQ) CO_2 sensors as shown on the mechanical drawings for carbon dioxide (CO_2) monitoring & control.

.4 Fresh Air Supply Fan & Exhaust Fan Speed Control:

.1 The fans shall initially run with their associated VFD set to the frequency established during balancing according to the ASHRAE 62.1 ventilation summary. The fans shall run anytime the unit is commanded to run, unless shutdown on safeties. To prevent short cycling, the fans shall have a user definable (adj.) minimum runtime.

.2 When required, the fresh air & exhaust fans shall ramp up during cooling operation when dehumidification is necessary to maintain dew point temperature within the building and/or to satisfy zone/space cooling requirements. When the radiant cooling systems are operational, the building shall be maintained at a positive pressure to prevent outdoor humid air from infiltrating into the building. ERV shall operate independently as required to maintain space humidity levels & cooling requirements in conjunction with the radiant cooling systems if directed to do so by the DDC system. Variable speed/frequency fans shall be controlled to maintain space static pressure at set point.

.1 Provide pressure differential Transmitters/ Transducers to permit remote monitoring & control of indoor/outdoor pressure differential. Refer to section 2.10 – Indoor/Outdoor Pressure Differential Transmitters & Transducers for further information.

.1 Provide building static pressure monitoring and sensors/transmitters for spaces/zones as noted below:

.1 Main Open Library Area.
.2 Living Room Area.
.3 MPR Room.
.4 Library Services & Service Desk Main Entry Lobby Areas.

.2 Building static pressure set-points shall be initially set to +12Pa (0.048" w.c.) (adj.). Final operating set-points during cooling & heating systems operation shall be optimized during commissioning of the building.

.3 Provide slow response or timed average sensor reading for controlling the building pressure to avoid unnecessary ramping of the supply & exhaust fans when an exterior door is opened/closed or an event occurs that affects the building pressure reading for a short period of time.

.3 Fresh air & exhaust fans shall operate continuously during occupied mode. The supply fan speed shall be modulated as required to maintain a minimum supply air duct static pressure and the exhaust fan speed shall be controlled to maintain a positive relief plenum pressure. Variable speed/frequency fans shall be controlled to maintain space static pressure at set point.

.1 The minimum exhaust fan airflow volume to be maintained during variable fan speed operation shall be approximately 1810cfm (853 L/s) as noted in the ERV-1 Schedule on mechanical drawing M5.1. This airflow is required to maintain adequate washroom exhaust as per ASHRAE 62.1 requirements. The controls & mechanical contractor

shall work closely with the air balancer to ensure that the minimum associated exhaust fan speed is noted & documented by the balancer during system balancing. The minimum exhaust fan fan speed associated with the minimum exhaust airflow shall be held as a hard limit during fan modulation for static pressure control.

.4 Provide a supply air static pressure reset routine, based upon zone/space VAV box damper output/position, which can be adjusted by the building operator.

.1 Static pressure set-point shall be reset using Trim & Respond logic within an initial range of 0.15 in. w.g. to 1.3 in. w.g. (35 Pa to 325 Pa.) All final static pressure set-points shall be operator adjustable & determined on site. When the fan is off, the set-point shall be 0.5 in. w.g. (125 Pa) (adj.). While the fan is proven on, every two minutes, trim the set-point by 0.04 in. w.g. (10 Pa) (adj.) if there are two or fewer zone pressure requests. If there are more than two zone pressure requests, respond by increasing the set-point by 0.06 in. w.g. (15 Pa) (adj.).

.2 A zone pressure request shall be generated when any VAV box damper is greater than 95% open until it drops to 80% open, or, when any VAV box damper is set to its maximum open position as set during air balancing.

.3 Include operator manual override settings & provide flexibility within the control systems to allow for alternate static pressure control/reset routines to be utilized.

.4 The exhaust & supply fan speed/frequency shall be controlled to maintain positive zone static pressures as necessary.

.5 Measure the supply air duct static pressure near the farthest point on the main distribution duct from the ERV.

.5 The exhaust fan speed/frequency shall be modulated as required to maintain exhaust air flow at set point. (Exhaust_Flow = Supply_Flow – Misc_Exhaust_Flow – Offset).

.5 Heating Mode:

.1 When the HVAC systems operate in heating mode, both the fresh air supply fan and exhaust fan for the ERV shall run according to the run schedule. ERV Fresh air & Exhaust air fans shall be initially set as per the ventilation requirements noted in the ERV equipment schedule and the ASHRAE 62.1 ventilation summary noted on the drawings. The ERV fresh air & exhaust air fans shall modulate as required to satisfy ventilation requirements. The internal motorized changeover damper(s) within the ERV shall cycle to recover heat as noted in paragraph 4.2.8 - Changeover Damper Operation below.

.2 The fresh air supplied to the building shall be tempered with heating coil (H/CC-1).

.3 The heating coil (H/CC-1) shall be fed from circulation pumps (CP-2A & CP-2B) which shall be allowed to fully modulate as required and as controlled by the supply/discharge air temperature sensor(s) & ERV controller.

.4 During typical heating operation, the fresh air supply discharge temperature feeding the building shall be fully adjustable with an initial setting of 20˚C (68˚F).

.5 The ERV controller shall be capable of resetting the heating supply air temperature set-point using a Trim and Respond algorithm based on zone heating requirements, by polling each zone mounted DDC temperature sensor. If there is a demand for heating then the supply air temperature set-point shall be reset to a higher value (adj.). If the demand for heating decreases then the supply air temperature set-point shall reset to a lower value (adj.). Once the zones are satisfied then the set-point shall gradually moderate over time to reduce heating energy use.

.1 The supply air temperature set-point shall be reset based on zone heating requirements as follows:

.1 The initial supply air temperature set-point shall be 20°C (68°F) (adj.).

.2 If there are more than two (adj.) heating requests (heating demand increases), the set-point shall incrementally reset up to a maximum of 22.2°C (72°F) (adj.).

.3 If there are two (adj.) or fewer zone heating requests (heating demand decreases), the supply air set-point shall incrementally reset down to a minimum of 12.8°C (55°F) (adj.).

.6 In event that the fresh air discharge temperature drops below 32˚F (0˚C) prior to the heating/cooling coil (H/CC-1) section, the ERV supply & exhaust fans shall shut-off and the fresh air intake & exhaust air discharge motorized dampers shall fully close as a preventative measure.

.7 Refer also to changeover damper operation section below.

.6 Cooling Mode:

.1 When the HVAC systems operate in cooling mode, both the supply fan and exhaust fan on the ERV shall run according to the run schedule. ERV Fresh air & Exhaust air fans shall be initially set as per the ventilation requirements noted

in the ERV equipment schedule and the ASHRAE 62.1 ventilation summary noted on the drawings. The ERV fresh air & exhaust air fans shall modulate as required to satisfy ventilation requirements. The internal motorized changeover damper(s) within the ERV shall cycle to recover heat as noted in paragraph 4.2.8 - Changeover Damper Operation below.

.2 The fresh air supplied to the building shall be conditioned with cooling coil (H/CC-1) and/or re-heat recovery heat pipe (RHP-1) as required.

.3 The cooling coil (H/CC-1) shall be fed from circulation pumps (CP-2A & CP-2B) which shall be allowed to fully modulate as required and as controlled by the supply/discharge air temperature sensor(s) & ERV controller. CP-2A & CP-2B shall energize & modulate as required to cool the fresh air supplied to the building based on the cooling design space conditions, the discharge air temperature, & the required humidity/ dew point temperature levels within the building.

.4 When required, the fresh air & exhaust fans shall ramp up during cooling operation when dehumidification is necessary to maintain dew point temperature within the building and/or to satisfy zone/space cooling requirements. When the radiant cooling systems are operational, the building shall be maintained at a positive pressure to prevent outdoor humid air from infiltrating into the building. ERV shall operate independently as required to maintain space humidity levels & cooling requirements in conjunction with the radiant cooling systems if directed to do so by the DDC system. Refer to paragraph 4.2.4 - Fresh Air Supply Fan & Exhaust Fan Speed Control for further information.

.5 The cooling supply air temperature set-point shall be reset using a Trim and Respond algorithm, based on zone cooling & dew point temperature requirements, by polling each zone mounted DDC temperature & humidity sensor. If there is a demand for cooling, or the dew point temperature is too high, then the supply air temperature set-point shall be reset to a lower value (adj.). If the demand for cooling decreases and the dew point temperature is within acceptable range, then the supply air temperature set-point shall reset to a higher value (adj.). Once the zones are satisfied the set-point shall gradually moderate over time to reduce cooling energy, maintain building dew point temperature, and maintain indoor humidity levels.

.1 Zone/space dew point temperatures shall be maintained at 1.1 to 1.7°C (2 to 3°F) below the hydronic cooling system water supply temperature to the radiant systems (active chilled beams, in-floor radiant cooled slab, & fan coil units). Interior zone/space humidity shall be initially controlled to 25.5°C (78°F) & 45%RH as to maintain a dew point temperature set-point initially of 12.8°C (55°F) when the radiant system water supply temperature is set to 13.9°C (57°F). Cooling water supply temperature feeding any radiant cooling system shall be reset upwards as required to

ensure cold water supply temperature is always 1.1 to 1.7°C (2 to 3°F) higher than any space/zone dew point temperature.

.2 The supply air temperature set-point shall be reset as follows:

.1 During typical cooling operation, the fresh air supply discharge temperature feeding the building shall be fully adjustable with an initial setting of 8.9°C (48°F) DB (adj.). & 8.9°C (48°F) WB (adj.) downstream of cooling coil (H/CC-1).

.2 If there are two (adj.) or fewer zone cooling requests (cooling demand decreases), the supply air set-point shall incrementally reset up to a maximum of 18.3°C (65°F) (adj.) if allowed by the zone/space dew point temperature. Supply temperatures this high are only expected to occur during shoulder seasons when the radiant cooling systems are not fully functional and free cooling may be used.

.3 If there are more than two (adj.) cooling requests (cooling demand increases), the set-point shall incrementally reset down to a minimum of 8.9°C (48°F) (adj.).

.3 The supply air temperature set-point shall be overridden to its minimum set point of 8.9°C (48°F) (adj.) whenever any of the zone/space dew point temperatures and/or humidity levels are too high.

.4 Section 4.2.7 below shall be read in conjunction with this section, see below for further information.

.7 DX Energy Recovery Heat Pipes (RHP-1 & RHP-2) Heat Reclaim/Recovery mode:

.1 Operation of the heat pipe recovery sections shall be by DDC/BAS system.

.1 Operation shall be to effectively modulate the heat pipe circuit sections to achieve accurate supply air temperature control during cooling operation without overcooling the building spaces.

.2 The heat pipe recovery sections shall initially be used only during cooling operation. Re-heat operation shall only typically be required during times when high outdoor/indoor humidity levels are experienced and when dehumidification is necessary to keep the building's dew point temperature within acceptable limits. The dehumidification requirements shall dictate the operation/modulation of H/CC-1 and subsequent operation/modulation of RHP-1 & RHP-2 as required.

.2 RHP-1 & RHP-2 shall be factory supplied c/w optional modulating control valves option.

.1 All of the Heat Pipe circuits shall be equipped with modulating control valves to control the operation of the Heat Pipe circuits. Each circuit shall have one modulating step motorized valve in the lower liquid line in an accessible location. Each valve will connect to a control printed circuit board in a NEMA 12 enclosure that contains the number of control boards to control all valves in the system and the appropriate power conversion. The power to the control panel power supply transformer shall be: 120 V/1 phase/ 60 Hz and by division 26 00 00; coordinate all requirements with the electrical divisions. The NEMA box shall be located on the nearby wall of the mechanical room.

.2 RHP-1 & RHP-2 shall utilize the ERV fresh & exhaust air duct mounted sensors for determination of heat pipe modulation operation; refer to mechanical heating/cooling schematic for further information. The DDC/BAS system shall be programmed to send the operating control signals to the modulating valves' control boards as required for correct system operation. The control signal shall go through a DDC/BAS interface installed near the heat pipe NEMA box. The DDC/BAS control signal provided shall be 0 to 10 volt DC or 4-20 mA.

.3 With all control valves open, the energy recovery heat pipe assembly will operate at full capacity. Modulating one valve closed restricts the liquid return flow and reduces the heat transferred by the heat pipe until closing the valve shuts off that circuit. Frost control, if needed, is accomplished by closing or shutting off one or more circuits. Economizer operation is also accomplished by shutting off circuits to achieve desired heat transfer.

.4 The final cooling supply air discharge DB temperature set-point downstream of RHP-1 shall be reset using a Trim and Respond algorithm, based on zone cooling requirements, by polling each zone mounted DDC temperature sensor. If there is a demand for cooling then the supply air temperature set-point shall be reset to a lower value (adj.). If the demand for cooling decreases then the supply air temperature set-point shall reset to a higher value (adj.). Once the zones are satisfied the set-point shall gradually moderate over time to reduce cooling energy use.

.1 The supply air temperature set-point shall be reset based on zone cooling requirements as follows:

.1 The initial supply air temperature set-point shall be 13.9°C (57°F) (adj.).

.2 If there are more than two (adj.) cooling requests (cooling demand increases), the set-point can be

incrementally reset down to a minimum of 8.9°C (48°F) (adj.) during times when the inside dew point temperature allows, the surface temperature of the in-floor radiant slab allows, and when the chilled beams are inoperable.

.3 If there are two (adj.) or fewer zone cooling requests (cooling demand decreases), the supply air set-point shall incrementally reset up to a maximum of 20°C (68°F) (adj.).

.8 Economizer (Free) Cooling Mode:

.1 When the HVAC systems operate in economizer cooling mode, the exhaust fan & supply fan shall run according to the run schedule. The motorized changeover damper(s) within the ERV shall not cycle; refer to paragraph 4.2.9 - Changeover Damper Operation below.

.2 During part load shoulder season conditions (spring & fall), when the central hydronic systems are in heating mode and cooling is required: free cooling shall be allowed and the discharge air temperature shall be capable of being reset to lower temperatures.

.3 During part load shoulder season conditions (spring & fall), when the central hydronic systems are in cooling mode and free cooling is provided: the discharge air temperature shall be capable of being reset to lower temperatures only if the in-floor radiant slab surface temperatures are within suitable range & the chilled beams are not operational.

.1 The DDC/BMS system/controller shall confirm status of the in-floor radiant cooled slab & active chilled beams prior to activating free cooling via ERV-1. All free cooling operation shall be commanded from the DDC/BMS system and not via the ERV-1 packaged controls.

.9 Changeover Damper Operation:

.1 Using the ERV DDC system/controller, send a signal to the "On/Off Customer Enable" contact to turn the unit on.

.2 The supply & exhaust fans will engage. Refer to paragraphs 4.2.3 - Minimum Outside Air Ventilation & Exhaust and 4.2.11 - Unoccupied Mode below for further information regarding fan speed settings.

.3 The changeover damper(s) are controlled by the temperature & humidity sensors for the ERV fresh air supply/discharge, ERV exhaust air, and outdoor air. All set-points noted below shall be fully adjustable by the building user/City of Winnipeg.

.4 In all cases ensure that damper section is first on and last off, (after supply and exhaust blower section) to prevent damage to internal damper section.

.5 Setting 1 - Full Energy Recovery (Cooling) Mode:

.1 The DDC/BMS system/controller shall first confirm status of the in-floor radiant cooled slab & active chilled beams prior to activating free cooling via ERV-1. If the in-floor radiant slab surface temperatures are within suitable range & the chilled beams are not operational, then free cooling shall be allowed to be provided. All free cooling operation shall be commanded from the DDC/BMS system and not via the ERV-1 packaged controls.

.2 If outdoor air goes above 82°F (28°C) (adj.), or, if outdoor air enthalpy to ERV > exhaust air enthalpy to ERV, the unit will go into full energy recovery:

.1 Changeover damper shall cycle every 60 seconds, or as required to provide full energy reclaim capability.

.6 Setting 2 - No Energy Recovery (Cooling) Mode:

.1 If outdoor air enthalpy to ERV < exhaust air enthalpy to ERV, and, outdoor air dry bulb temperature to ERV > (or near) conditioned air set-point temperature:

.1 Unit to operate in free cooling & changeover damper shall cycle every 3 hours, or as required to prevent dirt/dust build-up.

.7 Setting 3 - Partial Recovery (Heating) Mode:

.1 If outdoor air enthalpy to ERV < exhaust air enthalpy to ERV, and, outdoor air dry bulb temperature to ERV < conditioned air set-point temperature:

.1 Changeover damper shall cycle every 60 seconds, or as required to provide heat reclaim.

.2 If outdoor air enthalpy to ERV > exhaust air enthalpy to ERV, and, outdoor air dry bulb temperature to ERV < conditioned air set-point temperature:

.1 Changeover damper shall cycle every 60 seconds to every few minutes, or as required to minimize interior space relative humidity levels. Confirm with equipment supplier/manufacturer.

Changeover damper shall cycle less often up to 3 hours (or as required to reduce humidity levels within interior space(s)).

.8 Setting 4 - Full Energy Recovery (Heating) Mode:

.1 If exhaust air from ERV < 68°F (20°C) = energy recovery, or,
.2 If outdoor air dry bulb temperature to ERV < conditioned air set-point temperature = energy recovery:

.1 Changeover damper shall cycle every 60 seconds, or as required to provide heat reclaim.

.10 Supply, Exhaust, & Outdoor Temperatures and Humidity:

.1 The controller shall monitor the supply, exhaust, & outdoor air temperatures and humidity.

.11 Unoccupied Mode:

.1 In the unoccupied mode, ERV supply & exhaust fans shall be normally off.

.2 External duct mounted motorized intake & exhaust dampers shall be fully closed.

.3 ERV shall operate according to an occupied schedule supplied by the City of Winnipeg to maintain air quality within the space.

.4 During unoccupied mode, ERV shall initially operate in recirculation mode to maintain temperature & humidity set points for heating/cooling operation if required.

.5 The ERV shall also operate independently to maintain space humidity levels & cooling requirements in conjunction with the radiant cooling systems if directed to do so by the DDC system.

.6 If CO_2 levels rise above 700 ppm during unoccupied mode, the ERV shall revert to occupied mode to supply fresh air to the building according to the occupied mode temperature & humidity set-points. The ERV shall operate at design airflow until CO_2 levels indicate no occupants are present; at that time, a time delay shall be used to shut-down the ERV which can be adjusted through the DDC system.

.7 At start-up after an unoccupied period during cooling season operation, the ERV primary air system shall be operated while the secondary hydronic systems remain off. The ERV primary air system shall be used to dry out the building and lower humidity levels. Once the building's humidity has been reduced to acceptable levels, the secondary hydronic systems can then be started. This ensures that the dehumidified primary air flushes the moisture out of the building

before the hydronic systems are started. This dry-out cycle may take approximately 30 minutes (adj.).

.8 The ERV shall be capable operating at a reduced low airflow setting via the Variable Speed Drives on the supply & exhaust fans supplied by the manufacturer with the unit.

.12 Alarms Shall Be Provided As Follows:

.1 Supply fan failure: commanded on, but the status is off.

.2 Exhaust fan failure: commanded on, but the status is off.

.3 Supply fan in hand: commanded off, but the status is on.

.4 Exhaust fan in hand: commanded off, but the status is on.

.5 Supply & exhaust fan runtime exceeded: status runtime exceeds a user definable limit (adj.).

.6 Heat pipes (RHP-1 & RHP-2) & associated control valves failure.

.1 Provide alarm if the Heat pipe(s) fail to raise the ERV discharge supply air temperature to set-point.

.2 Control valve failure: commanded on/open, but the status is off/closed.

.3 Control valve in hand: commanded off/closed, but the status is on/open.

.7 Filter Differential Pressure Monitor:

.1 The controller shall monitor the differential pressure across the filter.

.2 Filter change required: filter differential pressure exceeds a user definable limit (adj.).

.8 ERV low supply air discharge temperature in heating mode (adj.).

.9 ERV high supply air discharge temperature in heating mode (adj.).

.10 ERV high supply air discharge temperature in cooling mode (adj.).

.11 ERV low supply air discharge temperature in cooling mode (adj.).

.12 High space/zone dew point temperature (humidity) (adj.).

.13 High supply duct static pressure (adj.).

.14 Low supply duct static pressure (adj.).

.15 High space/zone CO_2 level (adj.).

.16 Provide adjustable time delay as required to ensure that false alarms are prevented on initial heating call.

.17 When the air systems are running, supply air temperatures below 7.2°C (45°F) (adj.) will shut the system down and provide an alarm.

4.3 HYDRONIC CENTRAL PLANT LOOP HEATING/COOLING SYSTEMS INCLUDING: AIR COOLED CHILLER (ACH-1 & ACHE-1), CENTRAL BOILERS (B-1, & B-2) C/W PACKAGED INTERNAL CIRCULATION PUMPS, & CIRCULATION PUMPS (CP-1A/ CP-1B), (CP-2A/ CP-2B), & (CP-3A/ CP-3B).

.1 General:

.1 The boilers & air cooled chiller suppliers shall furnish equipment with interfaces for control and monitoring of the points specified. These specified points shall be the minimum acceptable interface to the equipment. The connection to these points shall be by BACnet MS/TP network connection. Controls contractor shall coordinate with the equipment suppliers to confirm all final requirements are being satisfied. Interfaces shall be furnished (if required) for control and monitoring of points specified.

.2 Variable Speed Drives (VSD/VFD) for circulation pumps (CP-1A/CP-1B), (CP-2A/CP-2B), & (CP-3A/CP-3B) pump motors shall be factory supplied & mounted by the pump manufacturer; refer to Circulation Pump Schedule for further information. Coordinate all electrical requirements with division 26 00 00.

.1 Circulation pumps (CP-1A/CP-1B) speed shall be controlled based on heating & cooling modes of operation. In heating operation, the pumps shall run based on the differential temperature in the loop supply & return lines to ensure minimum/maximum loop temperatures and flows. In cooling operation, the pumps shall run at constant speed to maintain the flow rate noted in the Circulation Pump schedules.

.2 Circulation pumps (CP-2A/CP-2B) speed & associated loop 3-way valve shall be controlled by ERV-1 fresh air supply system discharge air temperature set-point.

.3 Circulation pumps (CP-3A/CP-3B) speed shall be controlled by the downstream differential pressure between the supply & return hydronic loop lines.

.3 Provide Hydronic Loop Supply and Return Temperature Sensors as required & as per the mechanical drawings. Refer to heating schematic drawing for further information.

.4 Provide water flow switch for each boiler (total of 2).

.5 Provide six (6) water flow switches (one for each circulation pump (CP-1A/CP-1B), (CP-2A/CP-2B), & (CP-3A/CP-3B) for sensing pump/flow failure.

.6 Provide transformers, relays and power and control wiring as required.

.2 Primary Hydronic Loop Circulation Pumps (CP-1A/CP-1B):

.1 The main Circulation Pumps (CP-1A/CP-1B) shall run anytime the boilers or air cooled chiller are called to run and shall have a user definable delay (adj.) on stop.

.2 Each Circulation Pump (CP-1A/CP-1B) flow switch will be monitored to indicate a pump failure. When a pump is scheduled to operate, and the flow switch indicates no flow, an alarm shall be triggered and the back-up pump shall start.

.3 The DDC system shall monitor the Loop supply and return water temperatures & the O/A temperature. The DDC system shall sequence and modulate the associated circulation pumps (CP-1A/CP-1B) to ensure minimum/maximum loop supply temperature based on heating or cooling operating mode.

.1 Circulation pumps (CP-1A/CP-1B) speed shall be controlled based on heating & cooling modes of operation.

.1 In heating operation, the pumps shall run based on the differential temperature in the loop supply & return lines to ensure minimum/maximum loop temperatures and flows.

.2 In cooling operation, the pumps shall run at constant speed to maintain the flow rate noted in the Circulation Pump schedules.

.4 Hydronic loop pumps (CP-1A/CP-1B) shall operate on a lead/lag sequenced and staged basis as dictated by the DDC controller. Pumps are each sized for 100% flow. Only one pump is required to run at a time, with the other used for 100% back-up. The lead pump shall operate continuously. When lead pump fails to run, the lag pump shall start and the local panel mounted alarm light shall be lit and an alarm is indicated at the DDC.

.5 Provide run time accumulation and an alternating stop/start schedule for the Circulation Pumps (CP-1A/CP-1B).

.1 The circulation pumps are to be initially set to run on a lead lag schedule, switching pumps every 168 hours (7days). This shall have the capability to be modified as necessary.

.2 The Circulation Pumps are provided with Variable Speed/Frequency Drives (VSD/VFD) factory supplied & mounted by the pump supplier as outlined within this specification. Provisions shall be made for the VSD/VFD to provide accurate run-time & energy consumption data to the DDC system for energy monitoring. If the VSD/VFD cannot accomplish this, a Current Transformer (CT), or current sensor/donut shall be provided to accomplish energy monitoring for each pump.

.6 Circulation Pumps (CP-1A/CP-1B) are provided with packaged variable speed drives supplied integral to the pump unit c/w AUTOADAPT function & integrated frequency converter. These pumps are capable of being controlled locally via the packaged pump controllers. The pumps shall modulate to maintain set point (adj.) as dictated by the heating or cooling modes of operation and also according to the 4.3.5 - Heating Mode & 4.3.6 - Cooling Mode sections noted further below. The specified pumps are provided with the following built in packaged control mode options:

.1 AUTO*ADPT*
.2 FLOW*ADAPT*
.3 Proportional Pressure Mode
.4 Constant Pressure Mode
.5 Constant Temperature Mode
.6 Constant Curve Mode

.7 Alarms shall be provided as follows:

.1 Circ .pump failure: commanded on, but the status is off.
.2 Circ. pump running in hand: commanded off, but the status is on.
.3 Circ. pump runtime exceeded: status runtime exceeds a user definable limit.

.3 Secondary Hydronic Loop DOAS (ERV-1) Circulation Pumps (CP-2A/CP-2B) & Modulating 3-way Mixing Valve:

.1 Provide modulating, 3-way, control valve. Control valve to be mounted by another Division 23 00 00 sub-contractor.

.2 The secondary Circulation Pumps (CP-2A/CP-2B) shall run anytime ERV-1 discharge air requires heating or cooling via associated heating/cooling coil (H/CC-1). (CP-2A/CP-2B) shall have a user definable delay (adj.) on stop.

.3 Each Circulation Pump (CP-2A/CP-2B) flow switch will be monitored to indicate a pump failure. When a pump is scheduled to operate, and the flow switch indicates no flow, an alarm shall be triggered and the back-up pump shall start.

.4 The DDC system shall monitor the (H/CC-1) loop supply and return water temperatures & the O/A temperature.

.1 The DDC system shall sequence and modulate the associated circulation pumps (CP-2A/CP-2B) to ensure heating/cooling discharge air temperatures are met.

.2 The DDC system shall modulate the 3-way Mixing Valve to ensure heating/cooling loop supply & return temperatures are met.

.5 Hydronic loop pumps (CP-2A/CP-2B) shall operate on a lead/lag sequenced and staged basis as dictated by the DDC controller. Pumps are each sized for 100% flow. Only one pump is required to run at a time, with the other used for 100% back-up. The lead pump shall operate continuously. When lead pump fails to run, the lag pump shall start and the local panel mounted alarm light shall be lit and an alarm is indicated at the DDC.

.6 Provide run time accumulation and an alternating stop/start schedule for the Circulation Pumps (CP-2A/CP-2B).

.1 The circulation pumps are to be initially set to run on a lead lag schedule, switching pumps every 168 hours (7days). This shall have the capability to be modified as necessary.

.2 The Circulation Pumps are provided with Variable Speed/Frequency Drives (VSD/VFD) factory supplied & mounted by the pump supplier as outlined within this specification. Provisions shall be made for the VSD/VFD to provide accurate run-time & energy consumption data to the DDC system for energy monitoring. If the VSD/VFD cannot accomplish this, a Current Transformer (CT), or current sensor/donut shall be provided to accomplish energy monitoring for each pump.

.7 Circulation Pumps (CP-2A/CP-2B) are provided with packaged variable speed drives supplied integral to the pump unit c/w AUTOADAPT function & integrated frequency converter. These pumps are capable of being controlled locally via the packaged pump controllers. The pumps

shall modulate to maintain set point (adj.) as dictated in the Heating Mode & Cooling Mode sections noted further below. The specified pumps are provided with the following built in packaged control mode options:

.1 AUTO*ADPT*
.2 FLOW*ADAPT*
.3 Proportional Pressure Mode
.4 Constant Pressure Mode
.5 Constant Temperature Mode
.6 Constant Curve Mode

.8 Alarms shall be provided as follows:

.1 Circ .pump failure: commanded on, but the status is off.
.2 Circ. pump running in hand: commanded off, but the status is on.
.3 Circ. pump runtime exceeded: status runtime exceeds a user definable limit.

.4 Tertiary Hydronic In-floor & Radiant loop Circulation Pumps (CP-3A/CP-3B) & Cooling Chilled Water Return Modulating 3-way Mixing Valve:

.1 Provide modulating, 3-way, control valve. Control valve to be mounted by another Division 23 00 00 sub-contractor.

.2 The tertiary Circulation Pumps (CP-3A/CP-3B) shall run anytime heating or cooling is required via the radiant in-floor systems, chilled beams, heating/cooling coils, or fan coils and shall have a user definable delay (adj.) on stop.

.3 Each Circulation Pump (CP-3A/CP-3B) flow switch will be monitored to indicate a pump failure. When a pump is scheduled to operate, and the flow switch indicates no flow, an alarm shall be triggered and the back-up pump shall start.

.4 The DDC system shall monitor the loop supply and return water temperatures.

.1 The DDC system shall sequence and modulate the associated circulation pumps (CP-3A/CP-3B) to ensure heating/cooling loop temperatures are met.

.2 In Cooling Mode, the DDC system shall modulate the Chilled Water Return (CWR) 3-way Mixing Valve to ensure radiant cooling loop supply & return temperatures are met. Refer to paragraph 4.3.6 - Cooling Mode below for further information.

.5 Hydronic loop pumps (CP-3A/CP-3B) shall operate on a lead/lag sequenced and staged basis as dictated by the DDC controller. Pumps are each sized for 100% flow. Only one pump is required to run at a time, with the other used for 100% back-up. The lead pump shall operate continuously. When lead pump fails to run, the lag pump shall start and the local panel mounted alarm light shall be lit and an alarm is indicated at the DDC.

.6 Provide run time accumulation and an alternating stop/start schedule for the Circulation Pumps (CP-3A/CP-3B).

.1 The circulation pumps are to be initially set to run on a lead lag schedule, switching pumps every 168 hours (7days). This shall have the capability to be modified as necessary.

.2 The Circulation Pumps are provided with Variable Speed/Frequency Drives (VSD/VFD) factory supplied & mounted by the pump supplier as outlined within this specification. Provisions shall be made for the VSD/VFD to provide accurate run-time & energy consumption data to the DDC system for energy monitoring. If the VSD/VFD cannot accomplish this, a Current Transformer (CT), or current sensor/donut shall be provided to accomplish energy monitoring for each pump.

.7 Circulation Pumps (CP-3A/CP-3B) are provided with packaged variable speed drives supplied integral to the pump unit c/w AUTOADAPT function & integrated frequency converter. These pumps are capable of being controlled locally via the packaged pump controllers. The pumps shall modulate to maintain set point (adj.) as dictated in the Heating Mode & Cooling Mode sections noted further below. The specified pumps are provided with the following built in packaged control mode options:

.1 AUTO*ADPT*
.2 FLOW*ADAPT*
.3 Proportional Pressure Mode
.4 Constant Pressure Mode
.5 Constant Temperature Mode
.6 Constant Curve Mode

.8 Alarms shall be provided as follows:

.1 Circ .pump failure: commanded on, but the status is off.
.2 Circ. pump running in hand: commanded off, but the status is on.
.3 Circ. pump runtime exceeded: status runtime exceeds a user definable limit.

.5 Heating Mode:

.1 System Start-up (Heating);

.1 ACH-1 shall not run and shall be locked out.

.2 Heating/cooling changeover 3-way valve shall be modulated to heating setting & ACHE-1 shall be by-passed.

.3 In-floor & radiant loop cooling chilled water return 3-way mixing valve shall be modulated fully open (heating) setting.

.4 B-1 and/or B-2, CP-1A/CP-1B, CP-2A/CP-2B, CP-3A/CP-3B shall run to stabilize the system.

.5 As the system stabilizes, if the return water temperature drops, B-1 and/or B-2 shall modulate as required.

.2 Boilers (B-1 & B-2):

.1 In the heating mode, the DDC boiler controller shall sequence and stage modulating Boilers (B-1 & B-2) and the associated boiler circ. pumps to minimize energy consumption and to maintain the loop heating water supply/return temperatures as noted below and in paragraph 4.3.10 - System Monitoring & Control. Provide flexibility in the control systems to allow both boilers to operate and modulate between low & high fire to reduce energy consumption by increasing turn down of the heating system.

.2 The boilers will operate with their own integral controls.

.3 The boilers shall be enabled when the heating system is commanded on. The boilers shall be enabled after pump status is proven on and shall run subject to its own internal safeties and controls.

.4 The DDC system will monitor the boilers supply and return water temperatures. The DDC system will enable the boilers and their respective pumps to operate and will control them as required to maintain loop temperature & reduce energy consumption.

.5 The boilers shall maintain the hot water heating supply loop temperature to be initially set at 48.9C (120°F) (adj.). System is designed for return loop temperatures between 32.2°C and 37.8°C (90°F and 100°F) from the hydronic heating loop.

.6 The DDC system will monitor each boiler and will annunciate via the central system if a boiler is in alarm.

.7 Monitoring points shall be provided as follows:

.1 Hot water supply temperature.
.2 Hot water return temperature.
.3 Boiler status.

.8 Alarms shall be provided as follows:

.1 Boiler failure: commanded on, but the status is off.
.2 Boiler running in hand: commanded off, but the status is on.
.3 Boiler runtime exceeded: status runtime exceeds a user definable limit.
.4 Make up water flow to system.

.3 Packaged Boiler Circulation Pump(s):

.1 Each circulation pump shall run anytime the respective boiler is called to run and shall have a user definable (adj.) delay on stop.

.2 Alarms shall be provided as follows:

.1 Boiler circ. pump failure: commanded on, but the status is off.
.2 Boiler circ. pump running in hand: commanded off, but the status is on.
.3 Boiler circ. pump runtime exceeded: status runtime exceeds a user definable limit.

.4 Outdoor Air & Hot Water Supply Temperature Set-point Reset:

.1 The design intent is to consistently maintain the heating loop temperatures as indicated in paragraph 4.3.5.2.5 above. The following control capability shall also be provided:

.1 Provide flexibility in the DDC system to allow for outdoor air temperature reset control of the boiler systems by the City of Winnipeg. If required, the DDC system will provide the flexibility to enable the boiler and pumps to operate and will control the heating system hot water supply/return temperature set-points based on an outdoor air temperature reset schedule.

.1 The DDC system will enable the boiler and pumps to operate and will control the heating system hot water supply temperature set-point based on an outdoor air temperature reset schedule.

.2 Heating water supply loop temperature shall be maintained between 32.2°C and 48.9°C (90°F and

120°F) with outside air temperatures between 10°C and –37.2°C (50°F and –35°F) respectively. The minimum supply loop & outdoor air temperature settings shall be fully adjustable.

.3 As outside air temperature rises from -37.2°C (-35°F) (adj.) to 10°C (50°F) (adj.) the hot water supply temperature set-point shall reset downwards by subtracting 1°C (1.8°F) (adj.) from the current boiler set-point.

.6 Cooling Mode:

.1 System Start-up (Cooling):

.1 B-1 & B-2 shall not run and shall be locked out.

.2 Heating/cooling 3-way changeover valve shall be modulated to cooling setting and flow shall be directed to ACHE-1.

.3 In-floor & radiant loop cooling chilled water return 3-way mixing valve shall be modulated to partially open (cooling) setting. Motorized valve shall modulate open/closed as required after cooling requirements & loop temperatures are confirmed.

.4 ACH-1, CP-1A/CP-1B, CP-2A/CP-2B, CP-3A/CP-3B shall run to stabilize the system.

.5 As the system stabilizes, if the return water temperature increases, ACH-1 shall modulate to provide more cooling to the loop as required.

.2 Air Cooled Chiller (ACH-1) & remote mounted Heat Exchanger (ACHE-1):

.1 In the cooling mode, the DDC chiller controller shall sequence and stage (ACH-1) to minimize energy consumption and to maintain the loop cooling water supply/return temperatures as noted below and in paragraph 4.3.10 - System Monitoring & Control.

.2 Provide control transformer(s), relay(s) and power and control wiring as required.

.1 Monitoring points shall be provided as follows:

.1 Chilled water supply temperature.
.2 Chilled water return temperature.
.3 Air Cooled Chiller status.

.2 Alarms shall be provided as follows:

.1 Air Cooled Chiller failure: commanded on, but the status is off.
.2 Air Cooled Chiller running in hand: commanded off, but the status is on.
.3 Air Cooled Chiller runtime exceeded: status runtime exceeds a user definable limit.
.4 Make up water flow to system.

.3 The central cooling systems shall be provided with an indoor dew point temperature reset routine:

.1 The in-floor & radiant cooling loop temperatures shall be initially maintained at 13.9˚C supply and 16.7˚C return (57˚F and 62˚F) (operator adjustable) in order to limit the floor slab surface temperature to 18.9˚C (66˚F) minimum during typical design day conditions. Under typical design day conditions this will result in floor surface temperatures, chilled beam coil temperatures, & chilled water piping that is above the dew point temperature within the building spaces.

.2 During typical non-peak and part cooling load operation conditions, the temperature of the floor slab & resulting space temperature shall be controlled as noted in paragraph 4.3.9 - In-floor Cooling Control further below. The general staging shall be as follows:

.1 The first stage of cooling shall be by the in-floor system;
.2 If further cooling is required within the building, the second stage of cooling shall be by the ERV-1 outdoor air systems & cooling coil H/CC-1.
.3 The floor slab surface temperature shall be kept at a minimum of 1.7˚C (3˚F) above the building's indoor occupied dew point temperature(s) at all times.

.3 Provide EWT sensing at each manifold cabinet supply line to each in-floor cooling zone.

.4 The building's indoor temperature(s), humidity, & dew point temperature(s) shall be monitored at all times; these values shall be used to control the in-floor cooling system supply temperatures & floor slab surface temperatures for the prevention of condensation.

.5 The fluid supply temperature to each in-floor cooling zone shall reset upwards based on the dew point temperature measured within the building's occupied zone(s);

.1 The system supply temperature shall increase as necessary to ensure the respective floor slab surface temperature is always

3˚F (1.7˚C) above the building's occupied indoor dew point temperature.

.2 If high dew point temperatures are detected within the building, the default setting is to shut-off the in-floor cooling systems equipment until the dew point falls back within the typical design parameters. Each in-floor cooling manifold 3-way valve shall modulate closed to stop flow to the in-floor cooling piping & by-pass cooling water back to the main loop.

.4 ERV-1 cooling coil (H/CC-1) circulation pumps (CP-2A/CP-2B) & loop 3-way valve shall modulate as required to maintain discharge fresh air supply temperature; Refer to paragraph 4.2 - 'Dedicated Outdoor & Exhaust Air Systems Energy Recovery Ventilator (ERV-1)' above for further information.

.5 The DDC system shall monitor the building loop supply & return temperature(s) at all times. The DDC system shall also monitor the supply water temperature to each in-floor cooling zone manifold. The temperatures shall be used for controlling the operation of the in-floor & radiant loop cooling chilled water return 3-way mixing valve, each of the manifold 3-way modulating valves, & terminal chilled beam modulating 2-way shut-off valves.

.7 Shoulder Seasons (Spring & Fall):

.1 During shoulder seasons (spring & fall), or periods where heating and cooling is necessary during the same day, the radiant floor shall continue to provide heating as required to the zones/spaces, but the temperatures shall modulate down as per the outdoor air reset. If space cooling is required by a zone/space it shall be provided by the air system (ERV-1), or, where applicable, through operable windows (natural ventilation). Outside temperatures are usually not as high during periods that require heating and cooling during the same day. So the parallel air ventilation system (ERV-1) can be used in economizer mode.

.2 During periods where heating is usually not necessary, the radiant floor shall be used for cooling as the base load (first stage) cooling system. This shall be accommodated by the predictive weather forecasting programming noted in paragraph 4.6, or by using an adjustable delay (typically of at least one day (adj.)) to switch the radiant floor system between heating and cooling mode.

.1 If further cooling is required, the air systems can modulate as required to provide further cooling.

.2 If additional cooling is further required, the zone chilled beams and/or fan coil units (where provided) will be energized to make up the remaining capacity.

.3 Refer also to paragraph 4.7 - In-Floor Heating & Cooling System control including manifold 3-way valves below for additional information regarding shoulder season operation.

.8 Unoccupied Mode & Low Load Conditions:

.1 Refer to 4.2 - 'Dedicated Outdoor & Exhaust Air Systems Energy Recovery Ventilator (ERV-1), sub section 4.2.11 – Unoccupied Mode.

.2 Heating & Cooling shall operate to maintain temperature & humidity levels within the building as required and according to an occupied schedule supplied by the City of Winnipeg.

.3 The Air Cooled Chiller (ACH-1) & circulation pumps shall operate to maintain space humidity levels & cooling requirements in conjunction with the radiant cooling systems if directed to do so by the DDC system.

.4 During cooling season when ERV-1 is shut-down, the Air Cooled Chiller (ACH-1) & circulation pumps shall be disabled to minimize short cycling.

.5 At start-up after an unoccupied period during cooling season operation, ERV-1 primary air system shall be operated while the secondary hydronic systems remain off. ERV-1 primary air system shall be used to dry out the building and lower humidity levels. Once the building's humidity has been reduced to acceptable levels, the secondary hydronic systems can then be started. This ensures that the dehumidified primary air flushes the moisture out of the building before the hydronic systems are started. This dry-out cycle may take approximately 30 minutes (adj.).

.9 In-floor Heating Control:

.1 Provide wall mounted DDC temperature sensors in each zone to modulate a 3-way valve at the respective manifold allowing for water temperature control to each in-floor zone loop.

.1 Each zone/space sensor will be complete with adjustable room set point and temporary occupancy override.

.2 Each zone/space sensor will be c/w set point adjustment and digital temperature readout.

.2 Floor mounted DDC temperature sensors located near the surface of the floor slab shall over-ride the wall thermostat/sensors and control/modulate the flow of water to maintain a maximum floor slab temperature of 33.9˚C (93˚F) for in-floor Zone 1 and 30˚C (86˚F) for all other in-floor Zones. Set-points to be operator adjustable.

.3 The DDC system shall:

.1 Maintain the hot water heating supply temperature to the in-floor manifolds to be initially set at 43.3˚C (110˚F) (adj.) as noted in the in-floor heating manifold design summary schedule. System is designed for a return loop temperature of 36.7˚C (98˚F). Set-points to be operator adjustable.

.4 If additional space heating is required:

.1 ERV-1 shall be capable of providing additional heating via its duct mounted heating coil (H/CC-1), Refer to paragraph 4.2 - 'Dedicated Outdoor & Exhaust Air Systems Energy Recovery Ventilator (ERV-1)' above for further information.

.2 The space/zone mounted chilled beams, heating coils, & fan coil units are capable of providing additional heating as required. Refer to paragraph 4.5 for further information.

.10 In-floor Cooling Control:

.1 Wall mounted DDC temperature & humidity sensors in each zone and supply water temperature sensors for each manifold in-floor cooling zone supply line shall be used to modulate a 3-way valve at the respective manifold allowing for water temperature control to each in-floor zone loop.

.2 Floor mounted DDC temperature sensors located near the surface of the floor slab shall over-ride the wall sensors and control/modulate the flow of water to maintain a minimum floor slab surface temperature 1.7˚C (3˚F) above the measured space dew point temperature. The baseline setting for the minimum floor slab surface temperature shall be initially set to 18.9˚C (66˚F) in all in-floor cooling zones. Set-points to be operator adjustable. Refer also to the mechanical drawings for proposed locations of floor sensors.

.3 Floor mounted DDC humidity/dew point temperature/ condensate sensors shall be installed beneath the carpet tile where required for dew point temperature monitoring & radiant cooling systems control.

.4 The DDC system shall:

.1 Control & limit the in-floor & radiant loop cooling supply temperatures to between 13.9˚C supply and 16.7˚C return (57˚F and 62˚F) as noted in the Radiant heating schedule. Set-points to be operator adjustable.

.2 Monitor the supply water temperature to each in-floor cooling zone manifold. The temperatures shall be used for controlling the operation of the in-floor & radiant loop cooling chilled water return 3-way mixing

valve, each of the manifold 3-way modulating valves, & terminal chilled beam modulating 2-way shut-off valves.

.3 Refer to the Cooling Generation section above. An indoor dew point temperature reset routine shall be provided to prevent any risk of condensation on the floor.

.5 If additional space cooling is required:

.1 ERV-1 shall be capable of providing additional cooling via its duct mounted cooling coil (H/CC-1) & circulation pumps CP-2A/CP-2B, Refer to paragraph 4.2 - 'Dedicated Outdoor & Exhaust Air Systems Energy Recovery Ventilator (ERV-1)' above for further information.

.2 The space/zone mounted chilled beams & fan coil units are capable of providing additional cooling as required. Refer to paragraphs 4.8 - Active Chilled Beams (ACB) Control Including 2-way Valves & 4.11 - Fan Coil Units (FC) Control Including 2-way Valves below for further information.

.6 Refer also to paragraph 4.7 - In-Floor Heating & Cooling System control including manifold 3-way valves below for additional information.

.11 System Monitoring & Control:

.1 Provide a loop water controller, connected to the DDC system, for monitoring/ control of the loop supply and return water temperatures including monitoring/ control of the following:

.1 ACH-1 loop water discharge temp, return temp, average (mean) temp, & status
.2 Boilers (B-1 & B-2) loop water discharge temp, return temp, average (mean) temp, O/A temperature, & statuses.

.12 Primary Water Temperature Monitoring:

.1 The Following Temperatures Shall Be Monitored:

.1 Primary, secondary, & tertiary loop water supply. Refer to Heating Schematic for locations.
.2 Primary, secondary, & tertiary loop water return. Refer to Heating Schematic for locations.
.3 Primary, secondary, & tertiary loop average (mean) temp.
.4 Supply temperature to each in-floor heating/cooling manifold.

.2 Alarms shall be provided as follows:

.1 High loop water supply & return temps in heating mode (adj.).
.2 Low loop water supply & return temps in heating mode (adj.).
.3 High loop water supply & return temps in cooling mode (adj.).
.4 Low loop water supply & return temps in cooling mode (adj.).

4.4 CRAWLSPACE TRANSFER FAN (TF-1).

.1 The transfer fan shall be supplied packaged c/w 24V transformer & variable speed ECM direct drive motor by manufacturer.

.2 Transfer fan shall operate continuously during occupied mode. The fan speed shall be modulated as required via its packaged variable speed ECM direct drive motor to maintain minimum indoor positive static pressure set point within the building. Provide 0-10 VDC to fan for remote operation via the DDC system. Connect 24V power from factory mounted transformer.

.3 The fan shall initially run with its associated variable speed ECM direct drive motor set as established during balancing. The fan shall run anytime the ERV-1 unit is commanded to run in occupied mode, unless shutdown on safeties. To prevent short cycling, the fan shall have a user definable (adj.) minimum runtime.

.4 When required, the transfer fan shall ramp up in conjunction with ERV-1 during cooling operation when dehumidification is necessary to maintain dew point temperature within the building and/or to satisfy zone/space cooling requirements. When the radiant cooling systems are operational, the building shall be maintained at a positive pressure to prevent outdoor humid air from infiltrating into the building.

.5 Refer to paragraphs 2.10 – Indoor/Outdoor Pressure Differential Transmitters & Transducers, 4.2 – Dedicated Outdoor & Exhaust Air Systems Energy Recovery Ventilator (ERV-1), & 4.2.4 - Fresh Air Supply Fan & Exhaust Fan Speed Control for further information regarding indoor static pressure control and ERV-1 operation.

.1 Provide pressure differential Transmitters/ Transducers to permit remote monitoring & control of indoor/outdoor pressure differential.

.2 Final Static Pressure settings shall be determined on site as part of the final commissioning process. The building's pressure set-points shall be tested & confirmed during all seasons (spring, fall, winter, & peak summer) to confirm suitable operation during all conditions. Positive pressure is a necessity during peak summer cooling operation when the building's radiant cooling systems are operational.

.1 Provide building static pressure monitoring and sensors/transmitters for spaces/zones as noted below:

.1 Main Open Library Area.

.2 Living Room Area.
.3 MPR Room.
.4 Library Services & Service Desk Main Entry Lobby Areas.

.2 Provide slow response or timed average sensor reading for controlling the building pressure to avoid unnecessary ramping of transfer fan (TF-1) and ERV-1 supply & exhaust fans when an exterior door is opened/closed or an event occurs that affects the building pressure reading for a short period of time.

4.5 ELECTRICAL ROOM COOLING SYSTEM TRANSFER FAN (TF-2) AND ASSOCIATED COOLING COIL (CC-TF-2).

.1 Provide wall mounted temperature sensor where indicated on the drawings.

.2 Provide two (2), duct mounted, motorized dampers as shown on the mechanical HVAC drawings.

.3 Provide transformers, relays and power and control wiring as required.

.4 Transfer fan shall be supplied packaged c/w 24V transformer & variable speed ECM direct drive motor by manufacturer.

.5 Transfer fan shall operate continuously during occupied mode if required to operate based on the space temperature set-point. The fan speed shall be modulated as required via its packaged variable speed ECM direct drive motor to maintain temperature set point. Provide 0-10 VDC to fan for remote operation via the DDC system. Connect 24V power from factory mounted transformer.

.6 The fan shall initially run with its associated variable speed ECM direct drive motor set as established during balancing. The fan shall run anytime it is commanded to run in occupied mode, unless shutdown on safeties. To prevent short cycling, the fan shall have a user definable (adj.) minimum runtime.

.7 Provide modulating, 2-way, control valve for cooling coil. Control valve to be mounted by another Division 23 00 00 sub-contractor.

.8 Cooling:

.1 Space temperature shall be maintained at maximum 30°C (86°F) (adj.) during cooling operation.

.2 On an initial call for cooling from the space temperature sensor, the fan shall modulate as required up to the maximum airflow as determined during balancing. The cooling coil (CC-TF-2) 2-way valve shall remain fully closed.

.1 Electrical room By-pass motorized damper #1 shall be fully open to direct airflow from transfer fan into ceiling space of adjacent space/room.

.2 Electrical room motorized damper #2 shall be fully closed.

.3 If additional cooling is required, the cooling coil (CC-TF-2) 2-way valve shall modulate open as required to maintain space set point only if the central hydronic systems are in cooling mode of operation and the air cooled chiller is functioning. Otherwise, only the transfer fan shall be used for removing heat from the space.

.1 Electrical room By-pass motorized damper #1 shall be fully closed.

.2 Electrical room motorized damper #2 shall be fully open to recirculate air within electrical room in conjunction with the operation of cooling coil CC-TF-2.

.4 As cooling requirements are decreased within the space, the cooling coil (CC-TF-2) 2-way valve shall modulate closed as necessary to satisfy the space cooling requirements.

.5 If cooling is no longer required, the above stages shall reverse as necessary.

.9 Start-up assistance, on-site programming and system checks to be provided by authorized personnel.

.10 Alarms shall be provided as follows:

.1 High space temperature: if greater than 32.2°C (90°F) (adj.).

.11 Space temperature shall be monitored at all times.

4.6 SOFFIT/OVERHANG TRANSFER FANS (TF-3 & TF-4) AND RESPECTIVE HEATING COILS (HC-TF-3 & HC-TF-4).

.1 Each transfer fan shall start/stop according to the temperature measured within the soffit space compartment. Initial temperature shall be set to 10°C (50°F) (adj.).

.2 Provide D.D.C. temperature sensor installed in soffit/overhang space for control of each transfer fan & heating coil. Approximate location to be as per the mechanical drawings; coordinate final location on site with access panels provided.

.3 Provide transformers, relays and power and control wiring as required.

.4 Provide modulating, 2-way, control valve for each heating coil. Control valves to be mounted by another Division 23 00 00 sub-contractor.

.5 Heating:

.1 On an initial call for heating from the space temperature sensors, the transfer fan shall energize to circulate pre-conditioned building air into the soffit/overhang areas.

.2 If further heating is required to maintain the soffit/overhang space temperature, the respective heating coil 2-way valve shall modulate open as required to maintain the space air temperature set-point.

.3 If heating is no longer required, the above stages shall reverse as necessary.

.6 The transfer fan shall be de-energized and the heating coil 2-way valve shall be fully closed when heating is not required for the soffit/overhang space.

4.7 HYDRONIC CENTRAL PLANT SYSTEMS HEATING/COOLING 3-WAY CHANGEOVER CONTROL VALVE.

.1 The changeover temperature to be used to switch the central system from heating to cooling operation shall be dictated by local predictive weather forecast data. Make provisions to include for local weather forecasts to be obtained from a reliable web-based source for the building's specific location. The web-based forecast system shall be able to predict when the system will need to changeover from heating to cooling, or cooling to heating, and allow for seamless changeover during the unoccupied night schedule to allow proper system operation for the following daytime schedule.

.1 The Canadian weather conditions and forecast weather data shall be brought into the BMS (METASYS). The Canadian Weather Data application retrieves data from the Canada Weather office Data Service via an internet connection. Forecast data is collected for the next seven days, including the current day and night. This data will automatically be implemented into the heating/cooling 3-way changeover control valve & central heating/cooling plant programming to adjust temperature set points for the upcoming days and anticipate when the central plant changeover shall occur from heating to cooling and vice versa.

.2 Programming shall be provided as required to achieve the above requirements. Provide suitable controller and/or routine for the central DDC system as required.

.2 In addition to the above predictive weather forecasting capability, the DDC system shall have the capability to input a user provided outdoor air changeover temperature (adjustable) by which the central plant systems shall switch over from heating to cooling mode of operation and from cooling to heating operation.

4.8 IN-FLOOR HEATING & COOLING SYSTEM CONTROL INCLUDING MANIFOLD 3-WAY VALVES.

.1 Provide modulating, 3-way, control valves for each in-floor heating manifold zone (total of 8). Control valves to be mounted by another Division 23 00 00 sub-contractor.

.2 Provide floor slab mounted DDC temperature sensors (total of 9) located near the surface of the floor for all in-floor heating/cooling zones as required. Refer to drawings for proposed locations.

.3 Provide floor mounted DDC humidity/dew point temperature/ condensate sensors (total of 8) to be installed beneath the carpet tile where required for dew point temperature/ condensate monitoring & radiant cooling systems control. Refer to drawings for proposed locations.

.4 During shoulder seasons (spring & fall), or periods where heating and cooling is necessary during the same day, the radiant floor shall continue to provide heating as required to the zones/spaces, but the temperatures shall modulate down as per the outdoor air reset. If space cooling is required by a zone/space it shall be provided by the air system (ERV-1), or, where applicable, through operable windows (natural ventilation). Outside temperatures are usually not as high during periods that require heating and cooling during the same day. So the parallel air ventilation system (ERV-1) can be used in economizer mode.

.5 During periods where heating is usually not necessary, the radiant floor shall be used for cooling as the base load (first stage) cooling system. This shall be accommodated by the predictive weather forecasting programming noted in paragraph 4.7, or by using an adjustable delay (typically of at least one day (adj.)) to switch the radiant floor system between heating and cooling mode.

.1 If further cooling is required, the air systems can modulate as required to provide further cooling.

.2 If additional cooling is further required, the zone chilled beams and/or fan coil units (where provided) will be energized to make up the remaining capacity.

.6 The in-floor radiant systems shall be controlled by the average water temperature (mean value of supply and return water temperature) according to outside and/or indoor temperatures. This is to coincide with the heat flux into and out of the space. This will result in a faster, more accurate, control of the in-floor systems and will provide better energy performance than controlling the supply water temperature.

.7 The system shall have the capability to control indoor space temperature, comfort conditions, & water temperatures based on an indoor adaptive reset strategy. Provide programming as required. This strategy shall determine the ideal target water temperature by assessing the space conditions (temperature, operative temperature and relative humidity), the water temperature (supply, return, average) and the slab

temperature. The control system shall then continually adjust the target water temperature based on the rate at which the space temperature changes to maximize the effectiveness of the slab while ensuring that the surface temperature never reaches dew point or gets too cold or too hot.

.8 For in-floor radiant slab cooling located in areas where there are operable exterior doors:

.1 Provide door contact to close manifold 3-way valve & divert chilled water flow from in-floor radiant slab if any door is left open (time delay shall be adjustable.). Use door contact(s) supplied as part of security system where provided by others. Refer also to paragraph 4.9 - Active Chilled Beams (ACB) Control Including 2-way Valves.

.9 Refer also to section 4.2 - Hydronic Central Plant Loop Heating/Cooling Systems Including: Air Cooled Chiller (ACH-1 & ACHE-1), Central Boilers (B-1, & B-2) c/w Packaged Internal Circulation Pumps, & Circulation Pumps (CP-1A/ CP-1B), (CP-2A/ CP-2B), & (CP-3A/ CP-3B) above for further information.

4.9 ACTIVE CHILLED BEAMS (ACB) CONTROL INCLUDING 2-WAY VALVES.

.1 ACBs shall be grouped and controlled on a zone basis. Where more than one ACB is located in a control zone, all ACBs shall be controlled together according to the zone temperature & humidity requirements.

.2 Each ACB shall be factory supplied c/w optional modulating 2-way automatic control valve by ACB manufacturer, refer to ACB schedule.

.3 Each ACB shall be factory supplied c/w optional 24V VAV floating point actuated damper.

.4 Provide transformers, relays and power and control wiring as required.

.5 ACB shall be controlled by a D.D.C. controller.

.1 Provide sequencing to ensure that zones also supplied with radiant in-floor heating/cooling have initial heating/cooling provided by the radiant in-floor system. Secondary heating/cooling shall be provided by ERV-1 air systems VAV boxes & ACB actuated dampers. Tertiary heating/cooling shall be provided by the ACB heating/cooling coil & 2-way valve.

.2 Zone/space temperature sensor shall modulate in-floor heating/cooling manifold 3-way valve, zone VAV box and ACB floating point actuated damper, & ACB 2-way valve in sequence to maintain room temperature.

.1 Each zone/space sensor will be complete with adjustable room set point and temporary occupancy override.

.2 Each zone/space sensor will be c/w set point adjustment and digital temperature readout.

.6 Heating:

.1 24V VAV floating point actuated damper supplied by manufacturer with ACB shall revert to minimum airflow positon as set-up during the air balancing for the unit.

.2 Associated zone level VAV box shall revert to minimum airflow position as set-up during the air balancing.

.1 Setting shall be to minimum outdoor/primary air as per ASHRAE 62.1 calculations and the respective CO_2 reading within the space.

.3 Zone/space temperature sensor shall modulate 2-way control valve located on return water line as required to maintain the space temperature set-point.

.4 If heating is no longer required, the above stages shall reverse as necessary.

.7 Cooling:

.1 Initial cooling shall be handled at the central Dedicated Outdoor Air System (ERV-1) based on Trim & Respond discharge temperature control logic (Refer to ERV-1 control sequence for further information.)

.1 24V VAV floating point actuated damper supplied by manufacturer with ACB shall revert to minimum airflow positon as set-up during the air balancing for the unit.

.2 Associated zone level VAV box shall revert to minimum airflow position as set-up during the air balancing.

.1 Setting shall be to minimum outdoor/primary air as per ASHRAE 62.1 calculations and the respective CO_2 reading within the space.

.3 If additional cooling is required in the zone/space the ACB floating point actuated damper shall modulate to maximum cooling airflow position as set-up during the air balancing for the unit. Associated zone level VAV box shall revert to maximum cooling airflow position as set-up during the air balancing. The airflow shall be increased to satisfy the additional latent and/or sensible loads within the space; if the CO_2 level & humidity

increases in the particular space then the primary/fresh air flow will need to be increased to that zone to reduce humidity levels.

.2 If further cooling is required from the space temperature sensor, the floating point actuated damper shall revert to minimum airflow position and the ACB 2-way control valve shall modulate open.

.1 Further cooling can be achieved by modulating the ACB floating point actuated damper to maximum cooling airflow position. Associated zone level VAV box shall also revert to maximum cooling airflow position.

.2 Room temperature sensor shall modulate two-way control valve located on return water line as required to maintain the space temperature set-point.

.3 If cooling is no longer required, the above stages shall reverse as necessary.

.4 Optional condensate sensor shall be provided with ACB from manufacturer for mounting on incoming water line to unit. Controls contractor shall mount condensate sensor. Condensate sensor shall be configured through the D.D.C. system to close its respective ACB 2-way valve if a risk of condensation is detected on the incoming water line to the unit. The ACB 2-way valve shall be allowed to open again once the risk of condensation is no longer present.

.1 Each zone shall also have a temperature/humidity sensor that shall be capable of shutting off the supply of water to its chilled beam via the respective 2-way valve if the zone/room dew point matches the 57°F (adj.) chilled water supply temperature. The primary fresh air unit (ERV-1), however, will continue to provide dehumidified air to the beam, even if a window/door is open and the room's dew point remains high. Chilled-water flow to the beam resumes once the primary fresh air unit (ERV-1) drops the spaces below the specified dew point (a process which can typically take as little as five minutes.)

.2 The chilled beam's water supply shall also be stopped via the 2-way valve if a condensate or temperature/humidity sensor goes out of calibration.

.5 For ACB located in areas where there are operable windows and/or doors:

.1 Provide operable window contact to close 2-way valve associated with ACB within space if window is opened. Use operable window contact(s) supplied as part of security system where provided by others.

.2 Provide door contact to close 2-way valve associated with ACB within space if any exterior door is left open (time delay shall be adjustable.).

Use door contact(s) supplied as part of security system where provided by others.

4.10 ZONE VARIABLE AIR VOLUME TERMINALS (VAV-3 & VAV-9) AND RESPECTIVE HEATING COILS (HC-VAV-3 & HC-VAV-9) ASSOCIATED WITH DEDICATED OUTDOOR AIR UNIT (ERV-1).

.1 Provide CO_2 sensors as shown on the mechanical drawings.

.2 Refer to paragraph 4.2.3.4 regarding CO_2 demand control ventilation system.

.3 For each VAV terminal & corresponding Re-heat coil: utilize the same wall mounted temperature sensor(s) supplied for the in-floor heating/cooling systems where indicated on the drawings. Provide c/w locking guards in areas accessible to the public.

.4 Provide transformers, relays and power and control wiring as required.

.5 Each VAV terminal shall be provided c/w fully programmable DDC zone controller (or a configurable controller c/w dual maximum control logic already installed) to allow for variable (dual maximum) VAV box control logic during heating operation. Each VAV box shall include pressure independent modulating air flow control & damper actuator (via an additional module etc. if required).

.6 Provide modulating, 2-way, control valve for each heating coil. Control valves to be mounted by another Division 23 00 00 sub-contractor.

.7 Heating:

.1 On an initial call for heating from the space temperature sensors, the VAV terminal damper shall modulate to minimum ventilation air flow position (refer to schedules).

.2 The VAV controller will provide a 0-10 VDC signal to the heating coil 2-way valve and the valve will modulate from 0% heat to 100 % heat as required to maintain the space air temperature set-points. The maximum discharge air temperature shall be initially set to 32.2˚C (90˚F) (adj.).

.3 If additional heating is required, and/or the DDC system indicates that the space requires further ventilation due to high CO_2 levels, and/or the occupancy schedules dictate that further ventilation is required; the VAV terminal damper shall modulate open to the maximum heating air flow position (refer to schedules.)

.1 The maximum discharge air temperature shall remain constant and shall be initially set to 32.2˚C (90˚F) (adj.).

.4 If heating is no longer required, the above stages shall reverse as necessary.

.8 Cooling:

.1 On an initial call for cooling from the space temperature sensors, the heating coil 2-way valve shall fully close and the VAV terminal damper shall modulate to minimum ventilation airflow position.

.2 If additional cooling is required, and/or the DDC system indicates that the space requires further ventilation due to high CO_2 levels, and/or the occupancy schedules dictate that further ventilation is required; the VAV terminal damper shall modulate open to the maximum cooling air flow position as required to maintain space set point (refer to schedules.)

.3 As cooling requirements are decreased within the space, the VAV terminal damper shall modulate closed to the minimum ventilation setting as necessary to satisfy the space cooling requirements.

.4 Cooling airflow supply temperature shall be handled at the central Dedicated Outdoor Air System (ERV-1) based on Trim & Respond discharge temperature control logic. Refer to section 4.2 – Dedicated Outdoor & Exhaust Air Systems Energy Recovery Ventilator (ERV-1) for further information.

.5 If cooling is no longer required, the above stages shall reverse as necessary.

.9 Start-up assistance, on-site programming and system checks to be provided by authorized personnel.

4.11 ZONE VARIABLE AIR VOLUME TERMINALS (VAV-1,2,4,5,6,7,8) ASSOCIATED WITH DEDICATED OUTDOOR AIR UNIT (ERV-1)

.1 Provide CO_2 sensors as shown on the mechanical drawings.

.2 Refer to paragraph 4.2.3.4 regarding CO_2 demand control ventilation system.

.3 For each VAV terminal: utilize the same wall mounted temperature sensor(s) supplied for the in-floor heating/cooling systems where indicated on the drawings. Provide c/w locking guards in areas accessible to the public.

.4 Provide transformers, relays and power and control wiring as required.

.5 Each VAV terminal shall be provided c/w fully programmable DDC zone controller (or a configurable controller c/w dual maximum control logic already installed) to allow for variable (dual maximum) VAV box control logic during heating operation. Each VAV box shall include pressure independent modulating air flow control & damper actuator (via an additional module etc. if required).

.6 Heating:

.1 On an initial call for heating from the space temperature sensors, the VAV terminal damper shall modulate to minimum ventilation air flow position (refer to schedules).

.2 If the DDC system indicates that the space requires further ventilation due to high CO_2 levels, and/or the occupancy schedules dictate that further ventilation is required; the VAV terminal damper shall modulate open to the maximum heating air flow position (refer to schedules.)

.3 Heating airflow supply temperature shall be handled at the central Dedicated Outdoor Air System (ERV-1) based on Trim & Respond discharge temperature control logic. Refer to section 4.2 – Dedicated Outdoor & Exhaust Air Systems Energy Recovery Ventilator (ERV-1) for further information.

.4 If further zone/space level heating is required, the zone/space Active Chilled Beam (ACB) shall be used for additional heating as noted in paragraph 4.9 – Active Chilled Beams (ACB) Control Including 2-way Valves.

.5 If heating is no longer required, the above stages shall reverse as necessary.

.7 Cooling:

.1 On an initial call for cooling from the space temperature sensors, the VAV terminal damper shall modulate to minimum ventilation airflow position.

.2 If additional cooling is required, and/or the DDC system indicates that the space requires further ventilation due to high CO_2 levels, and/or the occupancy schedules dictate that further ventilation is required; the VAV terminal damper shall modulate open to the maximum cooling air flow position as required to maintain space set point (refer to schedules.)

.3 Cooling airflow supply temperature shall be handled at the central Dedicated Outdoor Air System (ERV-1) based on Trim & Respond discharge temperature control logic. Refer to section 4.2 – Dedicated Outdoor & Exhaust Air Systems Energy Recovery Ventilator (ERV-1) for further information.

.4 If further zone/space level cooling is required, the zone/space Active Chilled Beam (ACB) shall be used for additional cooling as noted in paragraph 4.9 – Active Chilled Beams (ACB) Control Including 2-way Valves.

.5 As cooling requirements are decreased within the space, the VAV terminal damper shall modulate closed to the minimum ventilation setting as necessary to satisfy the space cooling requirements.

.6 If cooling is no longer required, the above stages shall reverse as necessary.

.8 Start-up assistance, on-site programming and system checks to be provided by authorized personnel.

4.12 FAN COIL UNITS (FC) CONTROL INCLUDING 2-WAY VALVES.

.1 Provide modulating, 2-way, control valve for each FC heating /cooling coil. Control valves to be mounted by another Division 23 00 00 sub-contractor.

.2 For each FC terminal: utilize the same wall mounted temperature sensor(s) supplied for the in-floor heating/cooling systems where indicated on the drawings.

.3 Provide transformers, relays and power and control wiring as required.

.4 FC shall be controlled by a D.D.C. controller.

.1 Provide sequencing to ensure that initial heating/cooling is provided by the radiant in-floor system. Secondary heating/cooling shall be provided by ERV-1 air systems VAV boxes. Tertiary heating/cooling shall be provided by the FC heating/cooling coil & 2-way valve.

.2 Zone/space temperature sensor shall modulate in-floor heating/cooling manifold 3-way valve, zone VAV box, & FC 2-way valve in sequence to maintain room temperature.

.1 Each zone/space sensor will be complete with adjustable room set point and temporary occupancy override.

.2 Each zone/space sensor will be c/w set point adjustment and digital temperature readout.

.5 Heating:

.1 Initial heating shall be handled by the in-floor radiant heating systems & the Dedicated Outdoor Air System (ERV-1) VAV box & re-heat coil for the zone/space. Heating at the central Dedicated Outdoor Air System (ERV-1) shall be controlled based on Trim & Respond discharge temperature control logic. Refer to section 4.2 – Dedicated Outdoor & Exhaust Air Systems Energy Recovery Ventilator (ERV-1) for further information.

.2 If additional heating is required that cannot be handled by the in-floor radiant system or ERV-1 systems:

.1 The FC supply fan shall energize.

.2 The zone/space temperature sensor shall modulate the FC heating coil 2-way control valve located on return water line as required to maintain the space temperature set-point.

.3 If heating is no longer required, the FC 2-way valve shall modulate closed and the supply fan shall de-energize.

.6 Cooling:

.1 Initial cooling shall be handled by the in-floor radiant cooling systems & the Dedicated Outdoor Air System (ERV-1) VAV box for the zone/space. Cooling at the central Dedicated Outdoor Air System (ERV-1) shall be controlled based on Trim & Respond discharge temperature control logic. Refer to section 4.2 – Dedicated Outdoor & Exhaust Air Systems Energy Recovery Ventilator (ERV-1) for further information.

.2 If additional cooling is required that cannot be handled by the in-floor radiant system or ERV-1 systems:

.1 The FC supply fan shall energize.

.2 The zone/space temperature sensor shall modulate the FC cooling coil 2-way control valve located on return water line as required to maintain the space temperature set-point.

.3 If cooling is no longer required, the FC 2-way valve shall modulate closed and the supply fan shall de-energize.

.3 FC units shall be factory supplied c/w drip pans by the manufacturer as shown on the drawings and in the equipment schedules.

.4 Provide condensate sensor for mounting on exposed discharge supply ductwork in respective zone. Controls contractor shall mount condensate sensor. Condensate sensor shall be configured through the D.D.C. system to close its respective FC 2-way valve if a risk of condensation is detected on the discharge supply ductwork from the FC unit. The FC 2-way valve shall be allowed to open again once the risk of condensation is no longer present.

.5 For FC located in areas where there are operable exterior doors:

.1 Provide door contact to close 2-way valve associated with FC within space if any door is left open (time delay shall be adjustable.). Use door contact(s) supplied as part of security system where provided by others. Refer also to paragraph 4.9 - Active Chilled Beams (ACB) Control Including 2-way Valves.

.2 The door contact mentioned above shall also be used to divert chilled water flow from the in-floor radiant slab if any door is left open (time delay shall be adjustable.)

4.13 MECHANICAL ROOM UNIT HEATER (UH-1) CONTROL INCLUDING 2-WAY VALVES.

.1 Unit heater shall be cycled by a D.D.C. temperature sensor located within the room/area to maintain space temp.

.2 Provide wall mounted D.D.C. temperature sensor(s) (with guards) as shown on the mechanical drawings.

.3 Room temperature sensor shall modulate heating 2-way valve fully open then cycle unit fan to maintain room temp.

.4 Provide transformers, relays and power and control wiring as required.

.5 The unit heater system shall be enabled to run whenever the central hydronic system is in heating mode.

.6 Alarms shall be provided as follows:

.1 High space temperature: if greater than 28°C (82°F) (adj.) in heating mode.
.2 Low space temperature: if less than 5°C (41°F) (adj.).
.3 The space temperature shall be monitored at all times.

.7 Provide heavy duty temperature sensor guard.

4.14 ENTRANCE/VESTIBULE ELECTRIC FORCE FLOW HEATERS (EFFH)

.1 Force flow heater shall be cycled by a DDC temperature sensor located within the room/area to maintain space temp.

.2 Provide wall mounted temperature sensor(s) (with guards) as shown on the mechanical drawings.

.3 Provide transformers, relays and power and control wiring as required.

.4 The force flow system shall be enabled to run whenever outside air temperature is less than 10°C (50°F) (adj.).

.5 Heater shall be cycled to maintain the space temperature at its set-point.

.1 The space heating temperature shall be initially set to 15°C (59°F) (adjustable) and the maximum temperature shall never be able to exceed 15°C (59°F).

.6 To prevent short cycling, the force flow heater shall run for and be off for minimum adjustable times (both user definable), unless shutdown on safeties or outside air conditions.

.7 Alarms shall be provided as follows:

.1 High space temperature: if greater than 28°C (82°F) (adj.) in heating mode.
.2 Low space temperature: if less than 5°C (41°F) (adj.).

.8 Force flow monitoring:

.1 The Space temperature shall be monitored at all times.

4.15 CRAWLSPACE ELECTRIC UNIT HEATERS (EUH)

.1 Heater fan shall be cycled by a DDC temperature sensor located within the room/area to maintain space temp. Refer to mechanical hydronic drawings for further information.

.2 Provide wall mounted temperature sensor(s) (with guards) as shown on the mechanical drawings.

.3 Provide transformers, relays and power and control wiring as required.

.4 The heater shall be enabled to run whenever outside air temperature is less than 10°C (50°F) (adj.).

.9 Heater shall be cycled to maintain the space temperature at its set-point.

.1 The space heating temperature shall be initially set to 15°C (59°F) (adjustable).

.5 To prevent short cycling, the heater shall run for and be off for minimum adjustable times (both user definable), unless shutdown on safeties or outside air conditions.

.6 Alarms shall be provided as follows:

.1 High space temperature: if greater than 28°C (82°F) (adj.) in heating mode.
.2 Low space temperature: if less than 5°C (41°F) (adj.).

.7 Heater monitoring:

.1 The Space temperature shall be monitored at all times.

4.16 INDOOR AIR TEMPERATURE AND HUMIDITY MONITORING:

.1 The DDC system shall monitor the inside air temperatures and humidity levels and calculate inside dew point temperatures on a continual basis. These values shall be monitored and made available to the system at all times.

.2 Provide a total of eleven (11) humidity sensing locations approximately as shown on the mechanical drawings. Provide humidity sensing at the same locations as temperature sensors.

.3 Provide flexibility in the controls programming for outdoor air reset control strategies based on both outdoor air temperature & indoor space humidity. Provide indoor air humidity reset during winter operation when the humidifier is operational. Refer also to section 4.17 below.

.4 Alarm shall be generated as follows:

.1 Sensor failure: sensor reading indicates shorted or disconnected sensor.
.2 High space/zone dew point temperature (humidity).

4.17 HUMIDIFIER (H-1) WITH DISPERSION MANIFOLD LOCATED IN ERV-1 FRESH AIR SUPPLY DUCTWORK

.1 The systems consist of packaged Humidifier H-1 mounted in the main mechanical room, c/w dispersion manifold tubes located in their respective ERV-1 fresh air supply discharge duct plenum.

.2 H-1 shall be factory supplied c/w steam dispersion manifold section for mounting in the fresh air supply discharge duct plenum.

.3 ERV-1 shall operate in conjunction with its corresponding Humidifier such that all equipment runs together according to the occupied schedule & sequences for the building.

.4 Provide flexibility in the controls programming for outdoor air reset control strategies based on both outdoor air temperature & indoor space humidity. Provide indoor air humidity reset during winter operation when the humidifier is operational. Refer also to section 4.17 below.

.5 Provide (outdoor air) temperature & humidity sensors as noted in section 4.1 above.

.6 Provide exhaust air return duct humidity sensor. Coordinate final requirements with ERV-1 manufacturer.

.7 Provide Supply Duct High Limit sensor. Coordinate final requirements with ERV-1 manufacturer.

.8 Provide Air Proving Device for ERV-1. Coordinate final requirements with ERV-1 manufacturer.

.9 Provide graphic display at OWS showing humidity sensor locations and humidity readings.

.10 Provide transformers, relays and power and control wiring as required.

.11 During the cooling season, the humidifier shall be locked out.

.12 Controls Contractor shall supply space mounted humidity sensor(s) (for control) as noted on the mechanical drawings.

.13 Provide control & monitoring through the D.D.C. System for System Status.

.14 The unit shall be compatible with the building D.D.C. system and shall be capable of providing SCR control of humidifier outputs, as well as control of all fill and drain functions. The humidifier unit shall be capable of monitoring and controlling the following parameters:

.2 Relative humidity (RH) set-point.
.3 Relative humidity (RH) high limit set-point.
.4 Total system output in lbs/hr.
.5 Real time drain and flush.
.6 End-of-season drain status.
.7 System fault indicator.
.8 High limit and air flow proving circuit condition.
.9 Throttling range adjustment.
.10 "Time until service" message.

.15 Humidifier - Run Conditions:

.1 The humidifier will operate with its own integral controls and shall run subject to its own internal safeties and controls.

.2 The humidifier system shall be enabled to run whenever outside air temperature is less than 5°c (adj.).

.3 The humidifier shall be enabled only after the ERV-1 system is commanded on and ERV-1 fans have proven airflow.

.4 To prevent short cycling, the humidifier shall run for and be off for minimum adjustable times (both user definable), unless shutdown on safeties or outside air conditions.

.5 A call for humidity shall be determined by averaging the readings from the space mounted humidity sensor(s) and comparing with the return humidity sensor reading. The humidifier shall then energize if required, only if allowed by the supply duct high limit sensor, and if ERV-1 is proven to have airflow.

.6 The humidifier output shall modulate as necessary to maintain set-point (adj.). The space humidity set- points shall be adjustable and shall be allowed to be reset by the outdoor air temperature & humidity if required.

.1 A humidity high limit shall be located an adequate distance downstream of the humidifier and shall limit the discharge duct humidity set-point (adj.). The system set-point shall maintain space/zone humidity levels from 20% RH (adj.) minimum to 30% RH (adj.) maximum (within ± 5%).

.2 The indoor humidity shall be reset based on an outdoor air temperature reset control strategy. When OAT = -30°C (-22°F) (or lower) the indoor humidity set-point shall be 20% RH (adj.); when OAT = 0°C (32°F) the indoor humidity set point shall be a maximum of 30% RH (adj.). The indoor temperature humidity set-point shall ramp up or down in % increments between the maximum & minimum values noted above.

.3 When duct humidity rises above the adjustable set-point, or upon exceeding high humidity, the humidifier shall turn off or turndown as necessary. Safety can be reset either manually or automatically depending on type of sensor chosen.

.4 If humidifier fails to operate or receive signal, an alarm shall be annunciated.

.7 The D.D.C. system will monitor the humidifier and will annunciate at the operator workstation if humidifier is in alarm.

.16 Humidifier Safeties:

.1 The following safeties shall be monitored:

.1 Humidifier alarm(s).
.2 Low water level.

.2 Alarms shall be provided as follows:

.1 Humidifier alarm(s).
.2 Low water level alarm.

.17 Humidifier Enable:

.1 The humidifier shall be enabled only after the ERV-1 system is commanded on and ERV-1 has proven airflow. See above.

.2 Alarms shall be provided as follows:

.1 Humidifier failure: commanded on, but the status is off.
.2 Humidifier running in hand: commanded off, but the status is on.
.3 Humidifier runtime exceeded: status runtime exceeds a user definable limit.

.18 Humidity Monitoring:

.1 The following humidity conditions shall be monitored:

.1 Space/zone humidity (as per drawings).
.2 Supply air humidity (one location in main supply air duct).
.3 Return/exhaust air humidity (one location at ERV-1, or in return duct).

.2 Alarms shall be provided as follows:

.1 High space/zone humidity:

.1 During winter conditions when humidifier is enabled: if greater than 35% RH (adj.).

.2 Low space humidity: if less than 10% RH (adj.).
.3 High supply air humidity: if greater than 80% RH (adj.).

4.18 WEEPING TILE SUMP PIT C/W DUPLEX PUMPS (WSP-1, WSP-2)

.1 Sump Pit c/w with duplex pump control (WSP-xx) shall have float switches, and a control panel to be remote mounted.

.2 Division 26 shall connect power wiring. Coordinate all requirements with Division 26.

.3 Float switches shall be mounted by another Division 22 sub-contractor.

.4 Provide control wiring between floats and control panel.

.5 Connect to dry contacts in control panel and wire high water level alarm to DDC system.

.6 Monitor Weeping tile sump pits (WSP-1 & WSP-2) high level alarm.

4.19 CENTRAL DOMESTIC HOT WATER SYSTEMS (DWH-1) & RECIRCULATION PUMP (RCP-1)

.1 Domestic hot water systems (DWH-1):

.1 Stored/discharge domestic hot water temperature shall be set at DWH-1 manually.

.2 Domestic Hot Water Recirculation Pump (RCP-1:

.1 The domestic hot water recirculation pump (RCP-1) shall run according to an adjustable schedule provide by the City of Winnipeg and via the central DDC system timeclock.

.2 The domestic hot water recirculation pump (RCP-1) is provided with packaged variable speed drive supplied integral to the pump unit c/w AUTOADAPT function & integrated frequency converter. The pump is capable of being controlled locally via the packaged pump controller. The pump shall modulate to maintain temperature set point (adj.). The specified pump is provided with the following built in packaged control mode options:

.1 AUTO*ADPT*
.2 FLOW*ADAPT*
.3 Proportional Pressure Mode
.4 Constant Pressure Mode
.5 Constant Temperature Mode
.6 Constant Curve Mode

.3 Run time accumulation for recirculation pump (RCP-1) shall be provided.

.4 Alarms shall be provided as follows:

.1 How water recirc. pump failure: commanded on, but the status is off.
.2 Hot water recirc. pump running in hand: commanded off, but the status is on.
.3 Hot water recirc. pump runtime exceeded: status runtime exceeds a user definable limit.

APPENDIX A: GLOSSARY OF TERMS:

Terms used within the specification text:

- Advanced Application Controller (AAC):
  A fully programmable control module. This control module may be capable of some of the advanced features found in building controllers (storing trends, initiating read and write requests, etc.) but it does not serve as a master controller. Advanced application controllers may reside on either the Ethernet/IP backbone or on a subnet.

- Application Specific Controller (ASC):
  A pre-programmed control module which is intended for use in a specific application. ASCs may be configurable, in that the user can choose between various pre-programmed options, but it does not support full custom programming. ASCs are often used on terminal equipment such as VAV boxes or fan coil units. In many vendors' architectures ASCs do not store trends or schedules but instead rely upon a building controller to provide those functions.

- BACnet/IP:
  An approved bacnet network type which uses an Ethernet carrier and IP addressing.

- BACnet MS/TP:
  An approved bacnet network type which uses a master-slave token passing configuration. MS/TP networks are unique to BACnet and utilize eia485 twisted pair topology running at 9600 to 76,800 bps.

- BACnet over ARCnet:
  An approved bacnet network type which uses an ARCnet (attached resource computer network) carrier. ARCnet is an industry standard that can utilize several speeds and wiring standards. The most common configuration used by BACnet controllers is an eia485 twisted pair topology running at 156,000 bps.

- Building Controller (BC):
  A fully programmable control module which is capable of storing trends and schedules, serving as a router to devices on a subnet, and initiating read and write requests to other controllers. Typically this controller is located on the Ethernet/IP backbone of the bas. In many vendors' architectures a building controller will serve as a master controller, storing schedules and trends for controllers on a subnet underneath the building controller.

- Direct Digital Control (DDC):
  A control system in which a digital computer or microprocessor is directly connected to the valves, dampers, and other actuators which control the system, as opposed to indirectly controlling a system by resetting set-points on an analog pneumatic or electronic controller.

- Pics - Protocol Implementation Conformance Statement:
  A written document, created by the manufacturer of a device, which identifies the particular options specified by BACnet that are implemented in the device.

- Smart Actuator (SA):
  An actuator which is controlled by a network connection rather than a binary or analog signal. (0-10v, 4-20ma, relay, etc.)

- Smart Sensor (SS):
  A sensor which provides information to the BAS via network connection rather than a binary or analog signal. (0-10000 ohm, 4-20ma, dry contact, etc.)

- Web Services:

Web services are a standard method of exchanging data between computer systems using the XML (extensible markup language) and SOAP (simple object access protocol) standards. Web services can be used at any level within a building automation system (BAS), but most commonly they are used to transfer data between BAS using different protocols or between a BAS and a non-BAS system such as a tenant billing system or a utility management system.

Terms used within the sequences of operation:

- Adj.
  Adjustable by the end user, through the supplied user interface.

- AI, AO, etc

  AI = analog input. A physical input to the control module.

  AO = analog output. A physical output from the control module.

  AV = analog value. An intermediate (software) point that may be editable or read-only. Editable AVs are typically used to allow the user to set a fixed control parameter, such as a setpoint. Read only AVs are typically used to display the status of a control operation.

  BI = binary input. A physical input to the control module.

  BO = binary output. A physical output from the control module.

  BV = binary value. An intermediate (software) point that may be editable or read-only. Editable BVs are typically used to allow the user to set a fixed control parameter, such as a setpoint. Read only BVs are typically used to display the status of a control operation.

  Sched = schedule. The control algorithm for this equipment shall include a user editable schedule.

  Trend. The control system shall be configured to collect and display a trend log of this object. The trending interval shall be no less than one sample every 5 minutes. (Change of value trending, where a sample is taken every time the value changes by more than a user-defined minimum, is an acceptable alternative.)

  Alarm. The control system shall be configured to generate an alarm when this object exceeds user definable limits, as described in the sequence of controls.

  Note: If the specifications require use of the BACnet protocol, all of the above shall be provided as BACnet objects.

- kW Demand Limiting:
  An energy management strategy that reduces energy consumption when a system's electric power meter exceeds an operator-defined threshold. When power consumption exceeds defined levels, the system automatically adjust set-points, de-energizes low priority equipment, and takes other

pre-programmed actions to avoid peak demand charges. As the demand drops, the system restores loads in a predetermined manner.

- Occupant Override Switch, or Timed Local Override:
  A control option that allows building occupants to override the programmed HVAC schedule for a limited period of time. When the override time expires, the zone returns to its unoccupied state.

- Occupant Set-point Adjustment:
  A control option that allows building occupants to adjust - within limits set by the HVAC control system - the heating and cooling set-points of selected zones. Typically the user interface for this function is built into the zone sensor.

- Optimal Start-up:
  A control strategy that automatically starts an HVAC system at the latest possible time yet ensures comfort conditions by the time the building becomes occupied.

  In a typical implementation, a controller measures the temperature of the zone and the outside air. Then, using design heating or cooling capacity at the design outside air temperature, the system computes how long a unit must run at maximum capacity to bring the zone temperature to its occupied set-point.

  The optimal start algorithm often includes a self-learning feature to adjust for variations from design capacity.

  A distributed system must use run on request with optimal start. (See below.)

- Requested, or Run on Request:
  A control strategy that optimizes the runtime of a source piece of equipment that supplies one or more receiving units - such as an air handler unit supplying zone terminal units with heating, cooling, ventilation, or similar service. Source equipment runs only when needed, not on a fixed schedule.

  The source equipment runs when one or more receiving units request its services. An operator determines how many requests are required to start the source equipment.

  For example, if all the zones in a building are unoccupied and the zone terminal units do not need heating or cooling, the AHU will shut down. However, if a zone becomes occupied or needs cooling, the terminal unit will send a run request to the AHU to initiate the start-up sequence. If this AHU depends on a central chiller, it can send a run request to the chiller.

  The run on request algorithm also allows an operator to schedule occupancy for individual zones based on the needs of the occupants without having to adjust the schedules of related AHUs and chillers.

- Trim and Respond, or Set-point Optimization:

A control strategy that optimizes the set-point of a source piece of equipment that supplies one or more receiving units - such as an air handler unit supplying zone terminal units with heating, cooling, ventilation, or similar service.

The source unit communicates with receiving units to determine heating, cooling, and other requirements, and then adjusts its set-point.

For example, if all zones are comfortable and do not request cooling, the AHU will gradually increase (trim) its supply air set-point. When a zone requests cooling, the AHU responds by dropping its set-point. The more zones that request cooling, the more it drops the set-point. The AHU repeats this process throughout the day to keep zones cool, but with a supply air set-point that is no cooler than necessary.

END OF SECTION

PART 1 General

1.1 RELATED SECTIONS

.1 Section 21 05 01, Mechanical General Provisions.

.2 Section 21 05 05, Basic Materials and Methods.

.3 Sections 22 06 01 and 23 06 01, Approved Substitute Schedules.

.4 Section 23 30 00, Air Distribution.

.5 Section 23 05 53, Vibration Isolation.

.6 Section 23 25 13, Pipe Cleaning and Chemical Treatment.

.7 Section 23 05 93, Testing and Balancing.

.8 Section 23 09 00, DDC Controls.

.9 Comply with the requirements of the Architectural Specifications.

1.2 REFERENCES

.1 American Society of Heating Refrigeration and Air-Conditioning Engineers (ASHRAE).

.2 Electrical Equipment Manufacturers Advisory Council (EEMAC).

.3 Canadian Standards Association (CSA International).

.1 CAN/CSA-B214-[01], Installation Code for Hydronic Heating Systems.

.4 National Electrical Manufacturers Association (NEMA).

.1 NEMA MG 1-[2003], Motors and Generators.

1.3 WORK PERFORMED UNDER THIS SECTION

.1 Provide a complete installation of the following & as shown on the drawings:

.1 Supply and installation of Heating Water, Cooling Water, and all Hydronic loop systems including all piping & devices.

.2 Supply and installation of all DX refrigeration piping & devices.

.3 Supply and installation of Boilers, Air Cooled Chiller, Pumps, Coils, Heat Recovery Units, Humidifiers, Terminal Heat Transfer Units (Entrance Heaters, Unit Heaters, Radiation), Incremental Heat Pump Units, Fan Coil Units, radiant ceiling panels, active chilled beams, re-heat coils, Circulating Pumps, Expansion Tanks, Fresh Air Units, air relief vents, purgers, valves,etc., for a complete and fully operational system.

.2 Provide Equipment, Personnel and Material necessary to assist with Pipe Cleaning and Chemical Treatment.

.3 Provide Equipment, Personnel and Material necessary to assist with Air and Water Balancing.

.4 Start-up and Commissioning:

.1 Start-up and Commissioning shall be undertaken prior to the Occupancy Stage of each Construction Phase.

.2 Provide the Equipment, Personnel and Material necessary to put the Heating and Cooling Systems into Operation.

.3 Provide the Equipment, Personnel, Material and Information necessary to assist the Mechanical Contractor in completing the Mechanical Commissioning Process.

.4 Provide the Equipment, Personnel, Material and Information necessary to assist the Commissioning Agent in completing the Commissioning Process.

1.4 QUALITY ASSURANCE

.1 Qualifications: execute work of this section only by skilled tradesmen regularly employed in the installation of pressure piping systems and heating and cooling equipment.

.2 The successful contractor shall have his QCM in place and available to the Engineer on request.

1.5 SUBMITTALS

.1 Shop Drawing Submittals:

.1 Submit data for Boilers, Air Cooled Chiller, Pumps, Coils, Heat Recovery Units, Humidifiers, Terminal Heat Transfer Units (Entrance Heaters, Unit Heaters, Radiation), Incremental Heat Pump Units, Fan Coil Units, radiant ceiling panels, active chilled beams, re-heat coils, Circulating Pumps, Expansion Tanks, Fresh Air Units, air relief vents, purgers, valves, etc…

.1 Data for Boilers shall include, but not be limited to:

.1 General arrangement showing terminal points, instrumentation test connections.

.2 Clearances for operation, maintenance, servicing, tube cleaning, tube replacement.

.3 Foundations with loadings, anchor bolt arrangements.

.4 Piping hook-ups.

.5 Equipment electrical drawings.

.6 Burners and controls.

.7 All miscellaneous equipment.

.8 Flame safety control system.

.9 Breeching and stack configuration.

.10 Engineering data including Boiler efficiency at 25%, 50%, 75%, and 100% of design capacity.

.2 Data for Heat Exchangers shall include, but not be limited to:

.1 General arrangement showing terminal points, instrumentation test connections.

.2 Clearances for operation, maintenance, servicing, plate replacement.

.3 Foundations with loadings, anchor bolt arrangements.

.4 Piping hook-ups.

.5 Engineering data including both Quick-heat and Normal Operating mode.

.3 Data for Heat Pump Units, Fan Coil Units, Chilled Beams, Radiant Panels, Terminal Units, shall include, but not be limited to:

.1 General arrangement showing terminal points, instrumentation test connections.

.2 Clearances for operation, maintenance, servicing.

.3 Piping hook-ups.

.4 Electrical Wiring Diagrams including Integral and Field wiring, and unit interconnection wiring.

.2 Closeout Submittals:

.1 Provide maintenance data for incorporation into Operation and Maintenance Manuals.

.2 Provide Spare Parts

.3 Sustainability Submittals

.1 Conform to all of the requirements of the Architectural Specifications, but take special note in relation to Environmentally Friendly Materials, Garbage and Recycling, and Start-up and Commissioning.

.2 Submit WHMIS MSDS - Material Safety Data Sheets for Refrigerants in accordance with Architectural Specifications.

1.6 SPARE PARTS AND MAINTENANCE DATA

.1 Refer to Specification Section 21 05 05 - Basic Materials and Methods for general requirements.

.2 Provide spare parts as follows:

.1 For Boilers:

.1 Special tools for burners, manholes, handholes, etc.

.2 Spare parts for one (1) year of operation.

.3 Spare gaskets.

.2 For Pumps:

.1 One (1) set of pump seals for each pump

.2 One (1) casing joint gasket for each size of pump

.3 For Heat Exchangers:

.1 One (1) head gasket for each Shell and Tube Heat Exchanger.

.4 One (1) glass for each gauge glass.

.5 Two (2) screens for each size of strainer.

.6 One (1) spare rim gasket for each Hydraulic Filter Housing Installed.

.7 One (1) set of belts for each belt-driven piece of equipment

.8 Spare Filters: In addition to the filters to be installed immediately prior to final acceptance, supply one complete set of filters for each filter or filter bank (including cleanable filters).

PART 2 Products And Materials

2.1 HEATING WATER BOILER (FULLY CONDENSING)

.1 Refer to Boiler Schedule.

.2 Refer to Section 2.2 – Boilers – General below for further information.

2.2 BOILERS - GENERAL

.1 Packaged boiler:

.1 Complete with gas burner and all necessary accessories and controls.

.1 Boiler/burner package to bear ULC/CGA label.

.2 Suitable for use with chemically treated ethanol/glycol/water mixed to -40°C (-40°F).

.1 Each boiler bears the National Board Stamp “H”.

.3 Factory tested at rated capacity, and bearing seal or nameplate certifying compliance.

.4 Ready for attachment to piping, electrical power, controls, flue gases exhaust.

.5 Designed and constructed to ANSI/ASME Boiler and Pressure Vessel Code.

.1 Designed and constructed for 1100 kPa (160 psi) working pressure.

.6 With CRN (Canadian Registration Number).

.7 Performance: In accordance with American Boiler Manufacturers Association (ABMA), or ANSI Z21.13/CSA 4.9 (gas burning) testing procedures.

.8 All Electrical components: CSA approved.

.9 Controls: factory wired, enclosed in Electrical and Electronic Manufacturers' Association of Canada (EEMAC) steel cabinet.

.10 Thermal insulation: 50mm (2") thick mineral fibre. Seal insulation at handholes, manholes, mudholes, and piping connections with insulating cement or asphaltic paint. Finish with heat resisting paint.

.11 Jackets: heavy gauge metal, finished with heat resisting paint.

.1 Access panels for easy inspection and servicing of internal components.

.2 Start-up, instruction, and on-site performance tests by Manufacturer's Representative.

.3 Trial usage:

.1 The City of Winnipeg may use boilers for test purposes prior to acceptance and commencement of warranty period.

.2 Supply labour, materials and instruments required for tests.

.4 Temporary use by contractor:

.1 Contractor may use boilers only after written approval from City of Winnipeg.

.2 Monitor and record performance continuously. Keep log of maintenance activities carried out.

.3 Refurbish to as-new condition before final inspection and acceptance.

.5 Accessories:

.1 Provide for each boiler and to meet ANSI/ASME requirements.

.1 Relief valves: ANSI/ASME rated.

.2 Heating Water Pressure gauge: 90 mm (3-1/2") diameter complete with shut-off cock.

.3 Heating Water Thermometer: 115 mm (4-1/2") diameter range 10 to 150 °C.

.4 Low water cut-off with visual and audible alarms.

.5 Auxiliary low water cut-off: with separate cold water connection to boiler.

.6 Flow Switch

.7 High Temperature cut-out with visual and audible alarms

.8 Isolating full port ball valves: on supply and return connections.

.9 Drain valve: boiler connection size.

.10 One set of cleaning tools.

2.3 PUMPS FOR HYDRONIC HEATING OR COOLING

.1 The following are general specifications. Refer to the Individual Pump Specifications in the Pump Schedule for operating characteristics, specific requirements, and any deviations.

.1 Refer also to Section 23 21 23.16.

.2 Vertical in-line configuration

.3 Minimum 860 kPa (125 psi) pressure rating

.4 Volute: cast iron, radially split, with tapped openings for venting, draining and gauge connections, with screwed or flanged suction and discharge connections.

.5 Impeller: corrosion resistant steel.

.6 Shaft: stainless steel with bronze sleeve bearing, integral thrust collar.

.7 Seal assembly: mechanical for service to 135°C (275°F) c/w flushing line.

.8 Motor: resilient mounted, 1800 rpm, drip proof, TEFC, sleeve bearing

.9 Coupling: rigid, self-aligning.

.10 Close coupled design.

.11 Provide suction guides on the inlet of each pump.

.12 Provide on the discharge of each pump angle type combination shut-off, balancing and check valve.

2.4 INCREMENTAL WATER-TO-AIR HEAT PUMPS (HP-xxx)

.1 Refer to the Heat Pump Schedule.

2.5 HEAT EXCHANGERS - PLATE TYPE

.1 General:

.1 Shall be constructed and rated as per all applicable codes and standards.

.2 Shall be factory tested and run-in for performance and leaks.

.3 Shall be capable of operating up to 150 psi (1034 kPa) and a temperature range of 1.7°C (35 °F) to 93.3°C (200°F).

.4 Shall be suitable for the intended fluids.

.5 Shall have a fixed frame of enameled carbon steel, with enough space for a minimum of an additional 25% of the required plates. Frame shall include chrome plated carbon steel guide bars, and zinc plated carbon steel tie bolts.

.6 Shall have individually removable stainless steel channel plates.

.7 Shall have single piece, glueless gaskets.

2.6 HYDRONIC HEATING AND COOLING COILS

.1 The following are general specifications. Refer to the Individual Coil Specifications in the Heating Coil Schedule for operating characteristics, specific requirements, and any deviations.

.1 A.R.I. rated and generally constructed of copper tubes and aluminum fins unless otherwise noted, pressure rated to 860 kPa (125 psi), and sized for an air velocity of +/- 2.54 m/sec (500 fpm).

.2 For hydronic heating coils mounted within packaged equipment, refer to the specifications for that equipment (i.e.: Fan Coil Units, Heat Recovery Units, Make-up Air Units, etc).

.3 For additional information, refer to the schematics and details on the drawings, the heating/re-heat coil schedule, and the Heat Recovery Unit Specifications.

2.7 HYDRONIC ENTRANCE AND UNIT HEATERS

.1 General:

.1 The following are general specifications. Refer to the Individual Entrance and Unit Heater Specifications in the Schedules for operating characteristics, specific requirements, and any deviations.

.1 Provide entrance and unit heaters complete with 18 gauge steel enclosure, copper-aluminum construction coils, P.S.C. motors, permanently lubricated bearings, and speed switch.

.2 Entrance heaters to have replaceable media 25 mm (1") thick filters.

.2 Hydronic Entrance Heaters:

.1 Cabinet: recessed or exposed type as indicated, steel with rounded exposed corners and edges, removable panels, insulation and integral air outlet and inlet.

.2 Finish with factory applied primer coat.

.3 Coils: aluminum fins mechanically bonded to copper tubes. Hydrostatically tested.

.4 Fans: centrifugal double width wheels, statically and dynamically balanced, direct driven, sleeve bearings, resilient mounted.

.5 Motor: multi-speed, tapped wound permanent split capacitor type with sleeve bearings, built-in thermal overload protection and resilient rubber isolation mounting.

.6 Filters: removable 25 mm (1”) thick permanent washable or replaceable type. Provide Spare Filters

.3 Hydronic Unit Heaters:

.1 Casing: cold rolled steel, gloss enamel finish, with threaded connections for hanger rods.

.2 Coils: seamless copper tubing, silver brazed to steel headers with evenly spaced aluminum fins mechanically bonded to tubing. Hydrostatically tested.

.3 Fan: direct drive propeller type, factory balanced, with anti-corrosive finish and fan guard.

.4 Motor: continuous duty, built-in overload protection, and resilient motor supports.

.5 Air outlet: adjustable louvres.

2.8 RADIANT HEATING PANELS

.1 The following are general specifications. Refer to the Individual Radiant Heating Panel Specifications on the drawings for operating characteristics, specific requirements, and any deviations.

.1 Copper tube and aluminum panel type radiant ceiling panels.

.2 Panels shall be installed in drywall ceilings using aluminum frames supplied by the manufacturer.

.3 Panels shall be 1mm (0.04") aluminum sheet with 13mm (0.5") upturn on all four sides.

.4 Panels shall incorporate a 6-pass 16mm (5/8") round serpentine coil secured with pre-sprung metal clips at 300mm (12") spacing to an aluminum heat transfer saddle. The heat transfer saddle shall be fastened to the panel with welded studs. Non-hardening heat transfer paste shall be applied between the aluminum saddle and both the face of the panel and the piping.

.5 Panels shall be painted with standard off-white baked enamel finish.

.6 Sub-contractor shall place 25mm (1") foil faced batt insulation (foil face down) on the panels, after installation, connections and testing have been completed.

.2 Refer to the Radiant Panel Schedule for further information.

2.8 EXPANSION TANK UNITS, AIR PURGERS, AIR VENTS

.1 Expansion tanks shall be pressure rated, hydro-pneumatic, pre-charged, diaphragm type expansion tank:

.1 Refer to Expansion & Glycol Fill Tank Schedule in this specification. Refer also to the Individual Tank Specifications on the drawings for operating characteristics, specific requirements, and any deviations.

.2 Manufacturer/supplier shall be responsible for correct sizing, based on configuration of installed system. Coordinate sizing before tender and after installation.

.3 Units shall be constructed, inspected and tested as required by A.S.M.E. and other applicable codes and standards.

.4 Construct for a maximum working pressure of 517 kPa (75 psi).

.5 Factory pre-charge with air to initial fill pressure of the system.

.6 Use sealed in elastomer EPDM diaphragm suitable for an operating temperature of 116°C (240°F).

.7 Furnish with base mount or saddles as required.

.8 Compatible with propylene glycol/water solution.

2. Air purger shall be constructed of cast iron for a maximum working pressure of 125 psi.

.1 Use threaded connections for sizes through 3" inclusive. Use flanged connections for sizes 4" and larger.

3. Air vents shall be brass automatic float type air vent.

.1 Construction to be suitable for a maximum working pressure of 862 kPa (125 psi) and temperature of 116°C (240°F).

.2 Provide indirect drain line from air vent discharge to nearest approved point of discharge.

.4 Provide expansion tanks, air purgers, and air vents as indicated and required. Refer to Schedules. Basis of Design: Amtrol.

2.9 FLUID STRAINERS

.1 Install where shown on the drawings, Thompson Strainers Model MLS-6 capable of 750 gmp with minimum screen surface area of 4806 cm^2 (745in^2) at 7 kPa (1 psi) pressure drop.

2.10 SYSTEM FLUID

.1 Hydronic system fluid shall be 100% Water.

.2 Refer to Section 23 25 13 - Pipe Cleaning & Chemical Treatment.

.3 Install appropriate inhibitor.

2.11 CALIBRATED BALANCING VALVES

.1 Combined Positive Drip Tight Shutoff, Precision Flow Balancing and Precise Flow Measurement Circuit Balancing Valves.

.2 Valves 15mm – 25mm (1/2" - 2") npt "Y" pattern equal percentage globe style bronze body and stem. Valves to provide four (4) full 360 degree adjustment with micrometer

type indicator and hidden memory feature. 90 degree adjustable valves are not acceptable.

.3 Valves 65mm (2½") and above to be "Y" pattern ductile iron body with grooved ends, bronze valve stem and plug disc. Valve to provide five (5) turns (2½" and 3"), six (6) turns (4" and 6") and 12 turns (8" and 10") of balancing adjustment with micrometer type indicator with hidden memory feature. Valves 65mm (2½") and above shall be field convertible to straight or 90° pattern. Anti-Rotation Flange Adapters shall be supplied for flanged connections.

.4 Each valve shall have two (2) – 8mm (1/4") metering ports with Nordel check valves located on both sides of valve seat. Provide two (2) additional 8mm (1/4") not connections on opposite side for drain connections. Drain and metering ports shall be interchangeable to suit site conditions.

.5 Standard of Acceptance: Armstrong CBV, Tour and Anderson, Bell & Gossett.

.6 Refer to Sections 21 05 01 – Mechanical General Provisions & 23 09 00 - for additional information stated below for clarity:

.1 Circuit Balancing Valves (Circuit Setters) (CBV) (FCV):

.1 General:

.1 Y style globe valve, designed to provide precise flow measurement and control, with valved ports for connection to differential pressure meter.

.2 Accuracy:

.1 Readout to be within plus or minus 2% of actual flow at design flow rate.

.2 1.7MPa (247psi), 121°C (250°F), screwed ends, Teflon disc, screw-in bonnet.

.3 Flow control: at least four (4) full turns of hand wheel, with digital hand wheel and tamperproof concealed mechanical memory.

.4 Drain connection:

.1 DN 20 (NPS ¾) valved and capped, suitable for hose socket.

.2 Incorporated into valve body or provided as separate item.

.5 Maximum water pressure drop through control valves shall be 17 kPa (2.5 psi).

2.12 HEATING SYSTEM PIPING ACCESSORIES

.1 Automatic Air Vent

.1 Standard float vent: brass body and DN 6 (NPS 1/8) connection and rated at 690 kPa working pressure.

.2 Industrial float vent: cast iron body and DN 15 (NPS ½) connection and rated at 860 kPa (125psi) working pressure.

.3 Float: solid material suitable for 115°C (239°F) working temperature.

.2 Air Separator - Boiler Mounted

.1 Complete with dip tube.

.2 Working pressure: 860 kPa (125psi).

.3 Air Separator – In-Line

.1 Working pressure: 860 kPa (125psi).

.2 Size: Full Line Size

.4 Combination Separators/Strainers

.1 Steel, tested and stamped in accordance with ANSI/ASME BPVC, for 860 kPa (125psi) operating pressure, with galvanized steel integral strainer with 5 mm (1/8") perforations, tangential inlet and outlet connections, and internal stainless steel air collector tube.

.5 Combination Low Pressure Relief And Reducing Valve

.1 Adjustable pressure setting: 206 kPa (30psi) relief, 55 to 172 kPa (8 to 25psi) reducing.

.2 Low inlet pressure check valve.

.3 Removable strainer.

.6 Pipe Line Strainer

.1 DN 15 to 50 (NPS 1/2 to 2): bronze body to ASTM B62, solder end or screwed connections, Y pattern.

.2 DN 65 to 300 (NPS 2 1/2 to 12): [cast steel body to ASTM A278M, Class 30,] [cast iron body to ASTM, Class 30].

.3 DN 50 to 300 (NPS 2 to 12): T type with [ductile iron body to ASTM A536] [malleable iron body to ASTM A47M], grooved ends.

.4 Blowdown connection: DN 25 (NPS 1).

.5 Screen: stainless steel or brass with 1.19mm (0.05") perforations.

.6 Working pressure: 860 kPa (125psi).

.7 Suction Diffuser

.1 Body: cast iron with flanged or screwed connections.

.2 Strainer: with built-in, disposable 1.19mm (0.05") mesh, low pressure drop screen and DN 25 (NPS 1) blowdown connection.

.3 Permanent magnet particle trap.

.4 Full length straightening vanes.

.5 Pressure gauge tappings.

.6 Adjustable support leg.

2.13 REFRIGERATION PIPING AND SYSTEMS

.1 Perform all work for a complete refrigeration piping system by a recognized contractor regularly employed in commercial and industrial refrigeration.

.2 Prepare and submit layout drawings and control arrangements for review by the Engineer prior to starting work.

.3 Refrigeration circuits: refer to manufacturer's schematics and recommendations and provide strainers, driers, sight glasses, moisture indicators, shut off valves, thermal expansion valves, solenoid valves, receiver, refrigerant, oil, safety accessories, etc. as required for a complete and working installation.

.4 Piping: Refrigerant grade Type L hard temper copper tubing with bronze alloy (silfos) joints. For sizes 12 mm (1/2") and under, type K soft temper copper tubing with silfos or flared joints may be used.

.5 Valves and Specialties:

.1 Seal cap type valves: brass with teflon seats. acceptable manufacturers: Superior, Mueller, Henry, Frick.

.2 Check valves: type CK-1 as manufactured by Refrigeration Specialties or Frick.

.3 Thermal expansion valves, filter/driers, solenoid valves, moisture indicators, etc: as manufactured bySporlan.

.6 Provide all control wiring and motor control interlocks required by the refrigeration equipment manufacturer and as described on the drawings.

.7 Provide a 100% parts and labour, and loss of refrigerant and oil (by leakage or contamination) warranty during the normal guarantee period.

PART 3 Installation And Execution

3.1 INSTALLATION - GENERAL

.1 Install using Manufacturers Recommended Instructions

.2 Provide accessories such as pressure relief valves, pressure regulating valves, low water cut-offs, back flow devices, barometric dampers and other safety devices, in compliance with Department of Labor standards.

.3 Equipment And Terminal Units

.1 Floor Mounted Equipment: Install level and firmly anchored to supports.

.2 Suspended Equipment: Support independently of adjacent ductwork and piping, with spring isolation and flexible pipe and duct connections.

.3 Ensure vibration free installation.

.4 Locate equipment to provide best possible connection arrangement and accessibility for servicing.

.1 Leave access for servicing.

.2 Motor, bearings and extension tubes shall be easily accessible.

.5 Install terminal heating units such as force flows, unit heaters and radiation with due regard to Architectural considerations, and ensure all items are level and finished in keeping with good workmanship.

.6 Provide chemical treatment connections on heating water & glycol systems as directed by the chemical treatment supplier.

.7 Refer to schematics for piping connections.

3.2 BOILERS

.1 Install in accordance with ANSI/ASME Boiler and Pressure Vessels Code Section IV, regulations of Province having jurisdiction, except where specified otherwise, and manufacturers recommendations.

.2 Make required piping connections to inlets and outlets recommended by boiler manufacturer.

.3 Maintain clearances as indicated or if not indicated, as recommended by manufacturer for operation, servicing and maintenance without disruption of operation of any other equipment/system.

.4 Natural gas fired installations - in accordance with CSA-B149.1.

.5 Safety valves and relief valves:

.1 Run separate discharge from each valve.

.2 Pipe relief valves full size.

.3 Terminate discharge pipe to above floor drain.

.6 Provide a water test spigot.

3.3 INCREMENTAL WATER-TO-AIR HEAT PUMPS

.1 Install thermometer wells with thermometers on inlet and outlet of source and load sides.

.2 Make required piping connections to inlets and outlets recommended by manufacturer.

.3 Maintain clearances as indicated or if not indicated, as recommended by manufacturer for operation, servicing and maintenance without disruption of operation of any other equipment/system.

.4 Terminate discharge from condensate line above as per drawings.

3.4 FAN COIL UNITS

.5 Install thermometer wells with thermometers on inlet and outlet of source and load sides.

.6 Make required piping connections to inlets and outlets recommended by manufacturer.

.7 Maintain clearances as indicated or if not indicated, as recommended by manufacturer for operation, servicing and maintenance without disruption of operation of any other equipment/system.

.8 Terminate discharge from condensate line above as per drawings.

3.5 HEAT EXCHANGERS

.1 Appurtenances

.1 Install with safety relief valve piped to floor.

.2 Install with hose bib drain valve.

.3 Install thermometer wells with thermometers on inlet and outlet of primary and secondary side.

3.6 PUMPS

.1 Do Work in accordance with CAN/CSA-B214.

.2 Install as indicated by flow arrows.

.3 Base mounted type: supply templates for anchor bolt placement. Furnish anchor bolts with sleeves. Place level, shim unit and grout. Align coupling in accordance with manufacturer's recommended tolerance. Check oil level and lubricate. After run-in, tighten glands.

.4 Ensure that pump body does not support piping or equipment. Support at inlet and outlet flanges or unions. Provide stanchions or hangers for this purpose. Refer to manufacturer's installation instructions for details.

.5 Pipe drain tapping to floor/hub drain.

.6 Install volute venting pet cock in accessible location.

.7 Check rotation prior to start-up.

.8 Install pressure gauge test cocks.

.9 Install with bearing lubrication points accessible.

3.7 REFRIGERANT SYSTEM

.1 Install piping, components, equipment, etc., in accordance with schematics, code and standard industry practice.

.2 Pressure tests: Prior to application of insulation and dehydration, test all systems under pressure with nitrogen for 24 hours minimum until no pressure drop occurs. If leaks are detected, repeat test procedure after repairs. Test high side at 2100 kPa (300 psi) and low side at 1050 kPa (150 psi).

.3 Dehydration: Evacuate system, and hold a vacuum of 100 kPa (14.5psi) for 24 hours minimum. Break vacuum with refrigerant operating charge, monitor moisture indicators

and change or replace filter/driers, or filter drier cores until an acceptable level of moisture is achieved.

3.8 FLOW MEASURING DEVICES

.1 To ensure proper balancing of the hydronic systems, provide flow measuring devices across manifolds and across Main Piping Loops.

3.9 ENTRANCE HEATERS

.1 Before acceptance, set discharge patterns and fan speeds to suit requirements.

3.10 EQUIPMENT AND TERMINAL UNITS

.1 Comply with manufacturer's requirements for the installation of all equipment.

.2 Provide accessories such as pressure relief valves, pressure regulating valves, low water cut-offs, back flow devices, barometric dampers and other safety devices, in compliance with Department of Labor standards.

.3 Locate equipment to provide best possible connection arrangement and accessibility for servicing.

.4 Install equipment and terminal heating units with due regard to Architectural considerations, and ensure all items are level and finished in keeping with good workmanship.

.5 Provide chemical treatment connections on heating water & glycol systems as directed by the chemical treatment supplier.

.6 Refer to schematics for piping connections.

3.11 HYDRONIC SYSTEM ACCESSORIES

.1 General

.1 Install using Manufacturer’s Recommended Instructions.

.2 Run drain lines from normally operating outlets to terminate above nearest floor drain. Run drain lines from emergency dump outlets to terminate above a floor, minimum 300mm from a floor drain.

.3 Check shop drawings for conformance of all tappings for ancillaries and for equipment operating weights.

.4 Provide chemical treatment connections on chilled water, condenser water, sprayed coil circuits, heating water, glycol, and steam/condensate systems as directed by the chemical treatment supplier.

.2 Flow Measuring Devices:

.1 To ensure proper balancing of the hydronic systems, provide flow measuring devices across AHU coils, across Heat Exchangers, across Main Piping Loops, and elsewhere as directed by the Water Balancing Contractor.

.3 Air Vents

.1 Install at high points of systems.

.2 Install gate valve on automatic air vent inlet.

.4 Pressure Safety Relief Valves

.1 Run discharge pipe to terminate above floor.

.5 Strainers

.1 Install in horizontal or down flow lines.

.2 Ensure clearance for removal of basket.

.3 Install ahead of each pump, and where indicated on drawings and schematics.

.4 Provide Hose Bibb outlet valve for cleaning.

.6 Suction Diffusers

.1 Install on inlet to pumps having suction size greater than 50 mm.

3.12 TESTING

.1 Test piping in accordance with the procedures outlined in Section 21 05 05 – Basic Materials & Methods.

.2 Test piping systems and prove tight.

.3 Ensure that piping and equipment is tested and inspected prior to being insulated or permanently concealed.

.4 Piping for in-floor heating/cooling systems:

.1 Test piping system in sections as required by the progress of this and other contractors work and provide all required isolating valves.

.2 Test piping hydraulically to a pressure of 690 kPa (100 psi) and prove tight for a period of 8 hours.

.3 Pressure test the in-floor pipe prior to pouring the concrete floor. The pipe cannot be left under pressure while the floor is poured as it will be in an expanded state, and when the pressure is removed and pipes are cooled they may shrink enough to break the bond between pipe and concrete, which would greatly reduce heat transfer rates.

.4 Test all In-Floor Piping on an on-going basis using the Schrader Air Valves.

.1 Specifically test all piping:

.1 At delivery to site

.2 Prior to installation

.3 After installation

.4 Prior to backfilling or concrete pours

.5 After backfilling and concrete pours

.6 Just prior to cutting ends

3.13 START-UP AND COMMISSIONING

.1 General:

.1 Start-up and Commissioning shall be undertaken prior to the Occupancy Stage of each Construction Phase.

.2 Follow the start-up procedures as recommended by the equipment manufacturer unless specified otherwise.

.3 Follow the special start-up procedures specified elsewhere in these Specifications.

.4 Conform to the requirements of Section 21 05 01 – General Mechanical Requirements. Provide instructions to City of Winnipeg. Provide a minimum of 40 hours of operator training.

.5 Start-up and Commission the Equipment and Systems.

.1 Assist with the Balancing of the Systems as required.

.2 Provide equipment, personnel, material and information necessary to assist the Mechanical Contractor in completing the Commissioning Process.

.3 Provide equipment, personnel, material and information necessary to assist the Commissioning Agent in completing the Commissioning Process.

.6 Calibrate and adjust all items provided under this contract.

.7 Provide one (1) year of regular checks and adjustments to the system to insure the entire system is performing at peak efficiency.

.8 Provide instructions to City of Winnipeg as required. Refer to Specification Section 21 05 01 – Mechanical General Provisions.

.2 For Boilers, a Manufacturer's Representative shall:

.1 Start up and commission installation.

.2 Carry out on-site performance verification tests.

.3 Certify installation.

.4 Demonstrate operation and maintenance.

.5 Provide adequate notice prior to inspections, tests, and demonstrations.

.6 Submit written report of inspections and test results.

.3 For Plate Heat Exchangers:

.1 Start-up:

.1 Check heater for cleanliness on primary and secondary sides.

.2 Check water treatment system is complete, operational and correct treatment is being applied.

.3 Check installation, settings, operation of relief valves and safety valves.

.4 Check installation, location, settings and operation of operating, limit and safety controls.

.5 Check supports, seismic restraint systems.

.2 Performance Verification:

.1 Timing: only after TAB of hydronic systems have been successfully completed.

.2 Primary side:

.1 Measure flow rate, pressure drop, and water temperature at heater inlet and outlet.

.2 Control valve: verify proper operation without binding, slack in components.

.3 Secondary side:

.1 Measure flow rate, pressure drop and water temperature at heater inlet and outlet.

.2 Verify installation and operation of air elimination devices.

.4 Calculate heat transfer from primary and secondary sides.

.5 Simulate heating water temperature schedule and repeat above procedures.

.6 Verify settings, operation, safe discharge from safety valves and relief valves.

.7 Verify settings, operation of operating, limit and safety controls and alarms

.4 For Pumps:

.1 Start-Up Procedures:

.1 Prior to startup

.1 Check removability of pumps for servicing without interfering with installation or operation of other equipment.

.2 Check rotation.

.3 Check power supply.

.4 Check starter O/L heater sizes.

.5 Check that over-temperature and other protective devices are installed and operative.

.2 Start pump:

.1 Check impeller rotation.

.2 Check for proper, safe operation.

.3 Check installation, operation of mechanical seals, packing gland type seals. Adjust as necessary.

.4 Check settings, operation of operating, limit, safety controls, over-temperature, audible/visual alarms, other protective devices.

.5 Verify operation of over-temperature and other protective devices under low- and no-flow condition.

.6 Test operation of hand-off-auto switch.

.7 Test operation of alternator.

.8 Eliminate air from scroll casing.

.9 Eliminate causes of cavitation, flashing and air entrainment.

.10 Adjust pump shaft seals, stuffing boxes, glands.

.11 Adjust alignment of piping and conduit to ensure true flexibility at all times.

.12 Measure pressure drop across strainer when clean and with flow rates as finally set.

.3 Verify lubricating oil levels.

.4 Run-in pumps for 12 continuous hours.

.2 Performance Verification

.1 Record point(s) on pump curves of actual performance at maximum and minimum conditions and for single and multiple operation as finally set at completion of commissioning.

.1 Mark points of design and actual performance at design conditions.

.2 Mark pump performance and pump BHP.

.3 Replace seals if pump used to degrease system or if pump used for temporary heat.

.5 For expansion tanks: Adjust expansion tank pressure to suit design criteria.

END OF SECTION

PART 1 General

1.1 RELATED DOCUMENTS

.1 Drawings and general provisions of the Contract, including General and Supplementary Conditions & Division 01,21,22,23,25 Specification Sections, apply to this Section.

.2 Section 21 05 01, Mechanical General Provisions.

.3 Section 21 05 05, Basic Materials and Methods.

.4 Sections 22 06 01 and 23 06 01, Approved Substitute Schedules.

.5 Section 23 30 00, Air Distribution.

.6 Section 23 05 53, Vibration Isolation.

.7 Section 23 05 93, Testing and Balancing.

.8 Section 23 21 05, Liquid Heat Transfer.

.9 Section 23 72 00, Dedicated Outdoor Air System (ERV-1).

.10 Comply with the requirements of the Architectural Specifications.

1.2 SUMMARY

.1 This Section includes Split Passive Energy Recovery Heat Pipes.

1.3 SUBMITTALS

.1 Product Data: For each type of product indicated. Include rated capacities, pressure drop, performance curves with selected points indicated, furnished specialties, and accessories.

.2 Shop Drawings: Complete set of manufacturer's prints of evaporative equipment assemblies, control panels, sections and elevations, and unit isolation. Include the following:

.1 Assembled unit dimensions.

.2 Weight and load distribution.

.3 Required clearances for maintenance and operation.

.4 Sizes and locations of piping and wiring connections.

.5 Wiring Diagrams: For power, signal, and control wiring. Differentiate between manufacturer installed and field installed wiring.

.6 Refer to Section 21 05 01, Mechanical General Provisions, for further requirements.

.3 Operation and Maintenance Data: Each unit to include, operation, and maintenance manual.

.1 Refer to Section 21 05 01, Mechanical General Provisions, for further requirements.

1.4 PRODUCT HANDLING:

.1 Protection: Use all means necessary to protect equipment before, during, and after installation.

.2 Replacement and Repair: All scratched, dented, and otherwise damaged units shall be repaired or replaced as directed by the Architect & Engineer.

1.5 DELIVERY, STORAGE, AND HANDLING:

.1 Deliver materials to the site in such a matter as to protect the materials from shipping and handling damage. Provide materials on factory provided shipping skids and lifting lugs if required for handling. Materials damaged by the elements should be packaged in such a matter that they could withstand short-term exposure to the elements during transportation.

.2 Store materials in clean, dry place and protect from weather and construction traffic. Handle carefully to avoid damage.

.3 Use all means necessary to protect equipment before, during, and after installation.

.4 All scratched, dented, and otherwise damaged units shall be repaired or replaced as directed by the Architect Engineer.

PART 2 Products and Materials

2.1 MANUFACTURERS

.1 The equipment is based on the following manufacturer and model:

.1 Heat Pipe Technology (HPT) Split Passive Energy Recovery Heat Pipes.

2.2 GENERAL

.1 Dedicated Outdoor Air System (DOAS) fresh air supply & exhaust ductwork systems shall be equipped with Energy Recovery Heat Pipes to transfer heat from the exhaust air to the incoming supply air. Supply and Exhaust heat pipe sections are separated horizontally as specified below:

.1 Fixed offset installation whereby supply side is elevated higher than the exhaust side, for optimized re-heating during cooling operation mode with some recovery in the cooling mode.

.2 Energy recovery heat pipes shall be tested and certified to AHRI standard 1060. Performance printouts as well as the product itself to carry AHRI 1060 compliance logo. Documents showing testing in accordance with AHRI 1060, but not certified by AHRI, will not be acceptable. Any deviation from the specifications must be approved by the Consultant. Heat pipes shall be completely manufactured and fully assembled at the manufacturer's facility by factory personnel.

2.3 CONSTRUCTION

.1 Each two rows shall be manifolded together into one liquid line at bottom and one vapor line at top and constitute one circuit. Lines shall be sized according to the performance requirements of the circuit. Each heat pipe section shall be installed level and connected to the other section by two horizontal copper lines, for each circuit, one for liquid and one for vapor. Extended drain pans (by others) to be provided downstream of supply as well as exhaust sections.

2.4 OPTIONAL MODULATING CONTROL VALVE FEATURE

.1 All of the Heat Pipe circuits shall be equipped with modulating control valves to control the operation of the Heat Pipe circuits. Each circuit shall have one modulating step motor valve in the lower liquid line in an accessible location. Each valve will connect to a control printed circuit board in a NEMA 12 enclosure that contains the number of control boards to control all valves in the system and the appropriate power conversion. The customer supplied electrical power to the control panel power supply transformer shall be: 120 V/1 phase/ 60 Hz. The NEMA box shall be located on the nearby wall of the mechanical room.

.2 The Building Automation System (BAS) shall provide the sensors necessary for determination of heat pipe modulation operation and the BAS shall be programmed to send the operating control signals to the modulating valves' control boards as required for correct system operation. The control signal shall go through a BAS interface installed near the heat pipe NEMA box. The BAS control signal provided shall be 0 to 10 volt DC or 4-20 mA.

.3 All additional wiring shall be provided and installed by others. With all control valves open, the energy recovery heat pipe assembly will operate at full capacity. Modulating

one valve closed restricts the liquid return flow and reduces the heat transferred by the heat pipe until closing the valve shuts off that circuit. Frost control, if needed, is accomplished by closing or shutting off one or more circuits. Economizer operation is also accomplished by shutting off circuits to achieve desired heat transfer.

2.5 HEAT PIPES

.1 The Heat Pipe supplier shall have a minimum of 5 years of experience designing, manufacturing, and installing Heat Pipes specifically for split energy recovery applications. Heat pipes must be manufactured and assembled at the heat pipe supplier's own facility by supplier's own staff.

.2 The tubes shall be copper only, of specific design for Heat Pipe application, permanently expanded onto the fin collar to form a firm, rigid, and complete pressure contact at all operating conditions. Aluminum tubes will not be allowed.

.3 The fin surface shall be continuous plate type aluminum fins of specific design to produce maximum heat transfer efficiency for Heat Pipe applications. Airside pressure loss shall be as given on the schedule, or otherwise specified. Fin density and the number of rows of tubes shall be as specified.

.4 The Heat Pipe modules shall have an optional protective coating of E-Coat, similar to Electrofin. Heat pipes shall be dipped and completely submerged to insure full coverage of coating - spray coatings are not acceptable.

.5 Heat transfer fluid shall be classified as Safety Group A1 in ASHRAE Standard 34-2013.

.6 Heat Pipe capacities, entering and leaving dry and wet bulb temperatures, and face velocity shall be as specified.

.7 The Heat Pipes shall be installed as specified.

.8 Frames and mounting structure shall be minimum 16 gauge galvanized steel.

.9 Heat Pipe interconnecting piping and circuitry shall be as specified in design. Each circuit shall be individually processed, charged, hermetically sealed, and tested.

.10 The heat pipe system shall be pressure tested on site under the supervision of the manufacturer's crew. Manufacturer's crew shall vacuum and charge the system. Vacuuming and charging by parties other than the manufacturer's own crew shall not be acceptable.

.11 Scheduled effectiveness or heat recovery shall be met at a minimum and total pressure drop shall not be exceeded. The resulting Recovery Efficiency Ratio, or RER, shall therefore be met at a minimum.

.12 The Heat Pipes shall be ETL listed to UL standard 207 and CSA C22.2.140.3.

.13 The Heat Pipe heat exchanger shall have a five (5) year limited warranty. All components such as valves and dampers shall carry a 12 month warranty.

PART 3 Installation And Execution

3.1 INSTALLATION

.1 Install in accordance with manufacturer's Installation & Maintenance instructions.

3.2 ENVIRONMENTAL REQUIREMENTS

.1 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.

PART 4 Equipment Schedule

4.1 REFER TO MECHANICAL DRAWINGS FOR EQUIPMENT SCHEDULE

END OF SECTION

PART 1 General

1.1 RELATED SECTIONS

.1 Section 21 05 01, Mechanical General Provisions.

.2 Section 21 05 05, Basic Materials and Methods.

.3 Sections 22 06 01 and 23 06 01, Approved Substitute Schedules.

.4 Sections 22 06 01 and 23 06 01, Approved Substitute Schedules.

.5 Section 22 05 05, Plumbing.

.6 Section 23 21 05, Liquid Heat Transfer & Refrigeration.

1.2 WORK PERFORMED UNDER THIS SECTION

.1 Provision of all required equipment, piping, and chemicals, for the flushing, cleaning and degreasing of all piping systems.

.2 Domestic Water Piping:

.1 Thoroughly flush and disinfect all Domestic Water Piping Systems as per Municipal Standards.

.2 Use Chlorine (gas or liquid). Calcium or Sodium Hypochlorite, or other approved disinfectant may also be used.

.3 Heating Water & Glycol Heating Piping Systems:

.1 Provide a water conditioning system to degrease the piping and to control corrosion, scaling, algae, and bacteria in the Heating Water piping system.

.1 Also provide a conditioning program complete with all the required chemicals, etc., for a period of one year commencing with the start-up of the equipment and the systems.

.2 Install appropriate inhibitor.

.4 Provide welding sockets where required or shown on the drawings, and piping from there to the equipment required for water treatment such as pumps, chemical storage tanks, etc. Include all necessary piping, valves, accessories and control wiring.

.5 Use only chemicals and methods that comply with local health codes and do not have a detrimental effect on non-metallic materials such as rubber, neoprene, etc., used in the systems.

.6 Provide pot type feeders on all closed piping systems for the administration of chemical treatment.

.7 Test equipment: Provide all test apparatus which shall include all required chemicals, comparator, titration equipment, test tubes, etc. to provide a complete testing facility for the treated systems, and turn over to the City of Winnipeg.

.8 Provision of all required equipment, piping, and chemicals, for scale, corrosion, algae, and bacteriological control of the closed-loop circulating piping system(s).

.9 Provide equipment, personnel, and material necessary to assist with water balancing.

1.3 START-UP AND COMMISSIONING

.1 Start-up and Commissioning shall be undertaken prior to the Occupancy Stage of each Construction Phase.

.2 Provide equipment, personnel, and material necessary to assist with water balancing.

.3 Provide equipment, personnel and material necessary to put the Hydronic Systems into Operation.

.4 Provide equipment, personnel, material and information necessary to assist the Mechanical Contractor in completing the Commissioning Process.

.5 Provide equipment, personnel, material and information necessary to assist the Commissioning Agent in completing the Commissioning Process.

1.4 QUALITY ASSURANCE

.1 Qualifications: Execute work of this section only by skilled tradesman, technicians, and manufacturers regularly employed in the administration of piping system chemical treatment.

.2 Provide equipment, chemicals, and service by one supplier.

1.5 SPARE PARTS AND MAINTENANCE DATA

.1 Provide all test apparatus which shall include all required chemicals, comparator, titration equipment, test tubes, etc. to provide a complete testing facility for the treated systems, and turn over to the City of Winnipeg's authorized representative.

.2 Provide a conditioning program complete with all the required chemicals, etc., for a period of one year commencing with the start-up of the equipment and the systems.

.1 Provide one (1) years supply.

.3 Spare Parts

.1 Six (6) sets of filter cartridges for each type, size of micron filter.

1.6 SUBMITTALS

.1 Shop Drawing Submittals:

.1 Submit data for all equipment and piping arrangements.

.2 Provide a list of chemicals.

.3 Submit data for procedures.

.2 Closeout Submittals:

.1 Provide a copy of the Preliminary Report

.2 Provide a copy of the Final Report

.3 Provide maintenance data for incorporation into Operation and Maintenance Manuals.

.1 Provide Spare Log Sheets

.4 Provide Spare Parts, Chemicals and Test Equipment.

.3 Sustainability Submittals

.1 Conform to all of the requirements of the Architectural Specifications, but take special note in relation to Environmentally Friendly Materials, Garbage and Recycling, and Start-up and Commissioning.

.2 Submit WHMIS MSDS - Material Safety Data Sheets for all chemicals.

PART 2 Products And Materials

2.1 GENERAL

.1 Comply with the requirements of Section 21 05 05 - Basic Materials and Methods.

.2 Use only chemicals and methods that comply with local health codes and do not have a detrimental effect on non-metallic materials such as rubber, neoprene, etc., used in the systems.

.3 Ensure Fluid in Heating/cooling Water System is compatible with Boiler Controls.

2.2 PRELIMINARY REPORT

.1 Provide detailed report outlining proposed cleaning procedures at least four (4) weeks prior to proposed starting date. Report to include:

.1 Cleaning procedures, flow rates, elapsed time.

.2 Chemicals and concentrations used.

.3 Inhibitors and concentrations.

.4 Specific requirements for completion of work.

.5 Special precautions for protecting piping system materials and components.

.6 Complete analysis of water used to ensure water will not damage systems or equipment.

2.3 FINAL REPORT

.1 When cleaning is completed, submit report, complete with certificate of compliance with specifications of cleaning component supplier.

.1 Provide the test results and information from the pipe cleaning process.

.2 Provide the test results for the treated water in the closed loop systems.

2.4 WATER TREATMENT SERVICES

.1 Provide water treatment monitoring and consulting services for period of one (1) year after system start-up. Service to include:

.1 Initial water analysis and treatment recommendations.

.2 System start-up assistance.

.3 Operating staff training.

.4 Visit plant/system every 90 days during period of operation and as required until system stabilizes, and advise on treatment system performance.

.5 Provide necessary recording charts and log sheets for one year operation.

.6 Provide necessary laboratory and technical assistance.

.7 Instructions and advice to operating staff to be clear, concise and in writing.

2.5 WATER TREATMENT EQUIPMENT FOR HYDRONIC SYSTEMS

.1 Hydronic Water System Pot Feeder.

.2 Micron filter for each pot feeder:

.1 Capacity 2% of pump recirculating rate at operating pressure.

.2 Six (6) sets of filter cartridges for each type, size of micron filter.

2.6 POT FEEDER

.1 Provide pot type feeders on all closed piping systems for the administration of chemical treatment

.2 Welded steel, pressure rating 1000 kPa, Temperature rating to 90°C, 25 L capacity.

2.7 SHIPPING / FEEDING CHEMICAL CONTAINERS

.1 High density moulded polyethylene, with liquid level graduations, cover.

2.8 CHEMICALS

.1 Use only chemicals and methods that comply with local health codes and do not have a detrimental effect on non-metallic materials such as rubber, neoprene, etc., used in the systems.

.2 Disinfection:

.1 Chlorine (gas or liquid).

.2 Calcium or Sodium Hypochlorite.

.3 other approved disinfectant

.3 Cleaning solutions:

.1 Tri-sodium phosphate: 0.40 kg per 100 L water in system.

.2 Sodium carbonate: 0.40 kg per 100 L water in system.

.3 Low-foaming detergent: 0.01 kg per 100 L water in system.

.4 Inhibitors:

.1 As required for scale, corrosion, algae, and bacteriological control

2.9 TEST EQUIPMENT

.1 Provide one set of test equipment for each system to verify performance.

.1 Complete with carrying case, reagents for chemicals, all specialized or supplementary accessories

.2 Complete with all required chemicals, comparator, titration equipment, test tubes, etc. to provide a complete testing facility for the treated systems.

.3 At completion of Pipe Cleaning and chemical treatment, turn test equipment over to the City of Winnipeg's authorized representative.

.2 Conductivity Controller

.1 Fully transistorized, suitable for wall or flush panel mounting, linear over full measuring range of 0-5000 micromhs.

.2 Insensitive to phase angle shifts, capable of operating on 95-130 Volts without affecting accuracy, power, bleedoff status lights.

.3 Conductivity Probes

.1 Dual carbon elements in PVC holder, quick disconnect, self-locking connection.

PART 3 Installation And Execution

3.1 INSTALLATION - GENERAL

.1 Provide welding sockets where required or shown on the drawings, and piping from there to the equipment required for water treatment such as pumps, chemical storage tanks, etc. Include all necessary piping, valves, accessories and control wiring.

.2 Install closed loop water treatment systems in accordance with ASME Boiler Code Section VII, and the requirements and standards of the authorities having jurisdiction, except where specified otherwise

.3 Install using Manufacturer's Recommended Instructions.

.4 Install temporary filters on pumps not equipped with permanent filters.

.5 Install pressure gauges on strainers to detect plugging.

.6 Chemical Feed Piping:

.1 Install crosses at all changes in direction.

.2 Install plugs in unused connections.

.7 Ensure adequate clearances to permit performance of servicing and maintenance of equipment.

.8 Clean and disinfect systems only after all pipes, valves, fittings, fixtures and other components have been installed, tested, and proven ready for operation.

.9 If at any time during the treatment, test results prove unsatisfactory, treatment shall be stopped and redone until results prove satisfactory.

3.2 GENERAL PROCEDURES FOR FLUSHING AND CLEANING

.1 Flush, clean, degrease and add chemicals in the presence of the Contract Administrator.

.2 Add chemicals under direct supervision of chemical treatment supplier.

.3 If at any time during the treatment, test results prove unsatisfactory, treatment shall be stopped and redone until results prove satisfactory.

.4 Flush, clean and disinfect systems only after all pipes, valves, fittings, fixtures and other components have been installed, tested, and proven ready for operation.

.5 Before cleaning is carried out, the systems must be operational, hydrostatically tested and with safety devices functional.

.6 Control valves must be operational, fully open to ensure that terminal units can be cleaned properly.

.1 If dirt accumulates under the seats of automatic control valves, this Sub-Contractor is responsible, during the first year's operation, to remove the collected materials under the valve seats and if the seat is damaged, replace same, at no additional cost to the City of Winnipeg.

.7 When filling systems with water:

.1 Ensure air is vented from system.

.2 Fill expansion tanks and charge system with air.

.3 Use water meter to record volume of water in system to +/- 0.5%.

.8 Systems must be free from construction debris, dirt and other foreign material.

.1 Flush systems after pressure test.

.2 The Flush Velocity in the system mains and branches shall be adequate to ensure removal of all debris. The System pumps may be used for circulating cleaning solution provided that velocities are adequate, and pump seals are replaced prior to City of Winnipeg Acceptance.

.9 Install instrumentation such as flow meters, orifice plates, pitot tubes, and flow metering valves only after cleaning is certified as complete.

.10 Strainers: clean prior to initial fill.

.11 During circulation of cleaning solution, periodically examine and clean filters and screens and monitor changes in pressure drop across equipment.

.12 Disposal of cleaning solutions to be approved by authority having jurisdiction, and to Architect's requirements.

.13 Preparatory to acceptance, clean and refurbish equipment and leave in operating condition, including replacement of filters in piping systems, and replacement of System Pump Seals when System Pumps are used for circulation of fluid.

3.3 PROCEDURE FOR DOMESTIC WATER SYSTEMS

.1 General:

.1 Flush out, disinfect and rinse domestic water systems to requirements of authority having jurisdiction.

.2 Sterilize systems for Legionella control.

.3 Disinfect Domestic Water Systems using approved chemicals.

.2 Remove screens from faucets.

.3 Flush systems with clean potable water to remove dirt and other contaminants.

.4 Replace screens in faucets.

.5 Inject the disinfectant at a service cock and ensure all sections of piping are treated. Circulate fluid as required.

.6 Open each outlet at least twice during injection.

.7 Test chlorine concentration before and after retention. Initial Chlorine concentration shall be not less than 50 ppm, and shall be retained in the system for a minimum of 24 hours. Concentration after retention shall be no less than 5 ppm.

.8 Drain, and flush the system with clean potable water until residual chlorine concentration is no greater than that of the incoming water supply. Test Chlorine concentration.

.9 Submit a written report showing methods, tests and results.

.1 Provide laboratory test reports on water quality for Consultant to review.

3.4 PROCEDURE FOR CLOSED LOOP SYSTEMS

.1 Fill and circulate system, cleaning strainer baskets as often as necessary to ensure that scale, metal particles, etc. have been completely removed.

.1 Establish circulation, raise temperature slowly to maximum design. Circulate for 12 hours, ensuring flow in all circuits. Remove heat, continue to circulate until temperature is below 38°C (100°F). Drain as quickly as possible. Refill with clean water. Circulate for 6 hours at design temperature. Drain and repeat procedures specified above. Flush through low point drains in system. Refill with clean water.

.2 Drain, flush and refill system.

.3 Inject degreasants and circulate the fluid at temperatures, and for time periods, as required to ensure that the system is thoroughly cleaned.

.1 Circulate system cleaner at 60°C (140°F)for at least 36 hours.

.2 Drain, flush and refill system.

.3 Fill with solution of water and non-foaming, phosphate-free detergent 3% solution by weight. Circulate for minimum of 8 hours.

.4 Drain and flush system until alkalinity of rinse water is equal to make-up water.

.1 Refill system with clean water. Circulate for at least 4 hours. Clean out strainer screens/baskets regularly. Then drain.

.2 Refill system with clean water. Circulate for at least 2 hours. Clean out strainer screens/baskets regularly. Then drain.

.3 Drainage to include drain valves, dirt pockets, strainers, every low point in system.

.5 Re-install strainer screens/baskets after obtaining approval.

.6 Refill system with clean water in preparation for administration of chemical treatment (to prevent scale and corrosion during system operation).

.7 Administer chemical treatment and circulate the fluid.

.8 Carefully monitor the condition of the systems from initial fill to the point at which the systems are considered under stable operating conditions.

.9 Provide oral and written instructions to the City of Winnipeg's operating personnel, for the monitoring and maintenance of the water conditioning program.

.10 Submit a written report showing methods, tests and results.

.11 Submit a written report of the system start-up showing water analysis and corrosion check test. Include copies in the O & M manuals.

.12 For the first year of operation, provide service calls once every ninety days, and provide written reports to operating personnel showing details of each service call, with a copy to the Consultant.

3.5 START-UP AND COMMISSIONING

.1 Start-up and Commissioning shall be undertaken prior to the Occupancy Stage of each Construction Phase.

.2 Conform to the requirements of Section 21 05 01 –Mechanical General Provisions.

.3 Assist in the Start-up and Commissioning of the Equipment and Systems.

.1 Assist with the Balancing of the Hydronic Equipment and Systems as required.

.2 Provide equipment, personnel, material and information necessary to assist the Commissioning Agent in completing the Commissioning Process.

.4 Provide instructions to City of Winnipeg as required. Refer to Specification Section 21 05 01 – Mechanical General Provisions.

END OF SECTION

PART 1 General

1.1 RELATED SECTIONS

.1 Section 21 05 01, Mechanical General Provisions.

.2 Section 21 05 05, Basic Materials and Methods.

.3 Sections 22 06 01 and 23 06 01, Approved Substitute Schedules.

.4 Section 23 21 05, Liquid Heat Transfer.

.5 Section 23 05 53, Vibration Isolation.

.6 Section 23 01 30.51, Duct and Equipment Cleaning.

.7 Section 23 05 93, Testing and Balancing.

.8 Section 23 09 00, Direct Digital Controls (DDC)

.9 Comply with the requirements of the Architectural Specifications.

1.2 WORK PERFORMED UNDER THIS SECTION

.1 The mechanical subcontractor shall provide all labour, materials, equipment and services necessary for and reasonably incidental to the supply and installation of the ductwork for the air conditioning systems as shown on the drawings and hereinafter specified.

.2 Provide a complete installation of all ventilation systems including: fresh air systems, exhaust air systems, heat pump & fan coil supply/mixed/return air systems, transfer air systems & elbows, fresh & exhaust air units, heat/energy recovery ventilators, fans, unit heaters, , ductwork, grilles/registers/diffusers, louvres/intakes/vents, balancing dampers, motorized dampers, fire dampers, filters, etc.

.3 In general terms, the scope of work shall include the following:

.1 Provision of new central, high efficiency, dual core, energy recovery ventilation unit (ERV-1) installed in mechanical room as noted on the mechanical drawings/specifications. ERV-1 will exhaust all washrooms, janitor/utility rooms, & provide some general exhaust from the building, recovering energy to pre-heat or pre-cool the outside air. Include for all exhaust ductwork distribution systems; ventilation (fresh air) distribution systems; grilles; dampers; etc… throughout the building.

.1 Ducted fresh air distribution systems for all active chilled beam and VAV box systems shall be provided throughout the building. Provide all ductwork, dampers, grilles, diffusers, registers, etc.

.2 Exhaust systems & ductwork shall be provided for: the washrooms, electrical rooms, & janitor rooms. Provide all ductwork, grilles, dampers, etc.

.3 Provide transfer air fan system (TF-1) & all associated ductwork, grilles, dampers, etc. to ventilate the crawlspace. Conditioned air from the main floor library areas shall be transferred down into the crawlspace for heating/cooling, which will then be exhausted back through the central ERV-1 unit to outdoors.

.2 Supply & installation of Fan Coil units installed at the east end of the library for supplemental heating/cooling of the MPR & Living Room areas. Provision of new supply & return air distribution ductwork for these systems as outlined above & as noted on the drawings.

.3 Ductwork acoustic & thermal insulation as noted on the mechanical drawings/specifications.

.1 The use of fiberglass liner is not allowed. All acoustic duct liner must be constructed of closed-cell, polymer sheet insulation materials. Shop drawings shall be submitted for review & approval by the Consultant & City of Winnipeg for all insulation materials.

.4 Provide complete supply, return, exhaust, and outside air systems including acoustic & thermal insulation as required to satisfy MECB, & ASHRAE requirements.

.5 Supply duct installation shall be carried out in a manner to reduce pressure loss as much as possible. Turning vanes, radius entry/branch fittings, specialty elbows, & transitions shall be installed as required to reduce pressure drop throughout the distribution ductwork.

.6 Provide a complete installation of all ventilation systems including fans, air handling units, make-up air units, heat recovery ventilators, ductwork, heat pump units, fan coils, active chilled beams, unit heaters, entrance heaters, grilles/registers/diffusers, louvres/intakes/vents, balancing dampers, motorized dampers, fire dampers, pitot tube openings, filters, etc.

.7 Provide Equipment, Personnel and Material necessary to assist with Air Balancing.

.8 Provide Equipment, Personnel and Material necessary to assist with Duct & Equipment Cleaning.

.9 Pressure test ductwork for leakage. This is a supplemental test required prior to testing required in Section 23 05 93 – Testing & Balancing. Provide Equipment, Personnel and Material necessary to assist with this.

.10 Indoor Air Quality (IAQ) Management Plan.

.1 During construction meet or exceed the requirements of SMACNA IAQ Guideline for Occupied Buildings under Construction & Renovtion.

.11 Start-up and Commissioning:

.1 Start-up and Commissioning shall be undertaken prior to the Occupancy stage of each Construction Phase.

.2 Provide the Equipment, Personnel and Material necessary to put the Air Distribution Systems into Operation.

.3 Provide the Equipment, Personnel, Material and Information necessary to assist the Mechanical Contractor in completing the Mechanical Commissioning Process.

.4 Provide the Equipment, Personnel, Material and Information necessary to assist the Commissioning Agent in completing the Commissioning Process.

.12 At end of work, leave complete, tested and operating system to Engineer's satisfaction.

1.3 SEPARATE PRICES

.1 Refer to Specification Section 21 05 01 for Separate Pricing.

1.4 ALTERNATE PRICES

.1 Refer to Specification Section 21 05 01 for Alternate Pricing.

1.1 START-UP AND COMMISSIONING

.1 Start-up and Commissioning shall be undertaken prior to the Occupancy stage of each Construction Phase.

.2 Provide the Equipment, Personnel and Material necessary to put the Air Distribution Systems into Operation.

.3 Provide the Equipment, Personnel, Material and Information necessary to assist the Mechanical Contractor in completing the Commissioning Process.

.4 Refer to Specification Section 23 08 05 & complete all required forms.

.5 The Contractor and his sub-contractors must assist the LEED Commissioning Agent to the extent required to complete the LEED CI Commissioning requirements.

1.2 QUALITY ASSURANCE

.1 Execute work of this Section only by skilled tradesmen regularly employed in the manufacture and installation of sheet metal ductwork and air handling equipment.

1.3 SUBMITTALS

.1 Shop Drawing Submittals:

.1 Submit data for Air Handling Units (AHU), Energy Recovery Ventilators (ERV), Heat Pump Units (HP), fans, dampers, motorized dampers (if supplied by this division), grilles/registers/diffusers, louvers/intakes/vents, unit heaters, entrance heaters, terminal Units, filter gauges, and fire dampers.

.2 Closeout Submittals:

.1 Provide maintenance data for incorporation into Operation and Maintenance Manuals.

.2 Provide Record Drawings

.3 Provide Spare Parts

.3 Submit shop drawings on fans, grilles, diffusers, louvres, fire dampers, fire/smoke dampers, filters, and filter gauges.

.4 Conform to all of the requirements of the Architectural Specifications, but take special note in relation to Environmentally Friendly Materials, Garbage and Recycling, and Start-up and Commissioning.

.5 Submit WHIMIS MSDS – Material Safety Data Sheets in accordance with section 01330 Submittal Procedures, with the VOC levels highlighted.

1.2 REQUIREMENTS OF REGULATORY AGENCIES

.1 Electrical equipment shall bear CSA and ULC labels attesting to having met test standards of agencies and having been listed.

.2 Fire dampers shall bear ULC label and shall be approved for use by the I.A.O.

.3 Acoustical linings shall be approved for use by the I.A.O.

1.3 ENVIRONMENTAL REQUIREMENTS

.1 Meet the requirements per Section 01 35 00 – Leadership in Energy and Environmental Design (LEED) – Sustainable Requirements.

.2 All materials listed below that are used in the building interior, (i.e. inside of the exterior air barrier) must not exceed the following requirements:

.1 Adhesives, Sealants and Sealant Primers: South Coast Air Quality Management District (SCAQMD) Rule #1168 requirements in effect on January 1, 2003 and rule amendment dated October 2, 2003.

.2 Aerosol Adhesives: Green Seal Standard GS-36 requirements in effect on October 19, 2000.

.3 Adhesives must contain no urea-formaldehyde.

1.4 FIRE DAMPERS & FITTINGS

.1 In case of discrepancy between architectural and mechanical drawings as to number, type or location of air distribution devices and fire dampers, obtain written ruling during tender call.

.2 Subsequent to close of tender, if a discrepancy is noted between architectural and mechanical drawings as to number, type or location of air distribution device and fire dampers, then the greater number shall be furnished, with the type and location as determined by the Architect and at no additional charge or expense to the City of Winnipeg.

1.5 SPARE PARTS AND MAINTENANCE DATA

.1 Refer to Specification Section 21 05 50 (Basic Materials and Methods) for general requirements.

.2 Provide spare parts as follows:

.1 1 set of belts for each belt-driven piece of equipment

.2 Spare Filters: In addition to the filters to be installed immediately prior to final acceptance, supply one complete set of filters for each filter or filter bank (including cleanable filters).

.3 6 fusible links for fire dampers

PART 2 Products And Materials

2.1 PRODUCTS - GENERAL

.1 Manufacture to SMACNA standards.

2.2 ENERGY RECOVERY UNIT (ERV-1) - (FACTORY FABRICATED)

.1 The following are general specifications. Refer to the Individual ERV Specifications in the ERV Schedule for operating characteristics, specific requirements, and any deviations.

.2 Controls shall include all packaged wiring, contacts, relays, control panels, etc. for connection to external DDC controls system.

.3 Provide in the arrangements and types shown on the drawings.

2.3 FANS

.1 The following are general specifications. Refer to the Individual Fan Specifications on the Drawings for operating characteristics, specific requirements, and any deviations.

.2 General:

.1 Fans: statically and dynamically balanced, constructed in conformity with AMCA 99.

.2 Sound ratings: comply with AMCA 301, tested to AMCA 300. [Unit shall bear AMCA certified sound rating seal] .

.3 Performance ratings: based on tests performed in accordance with ANSI/AMCA 210, and ANSI/ASHRAE 51. Unit shall bear AMCA certified rating seal, except for propeller fans smaller than 300 mm diameter.

.4 Motors:

.1 In accordance with Section 21 05 05 - Basic Materials and Methods and supplemented as specified herein.

.5 Accessories and hardware: matched sets of V-belt drives, adjustable slide rail motor bases, belt guards, coupling guards fan inlet and/or outlet safety screens as indicated.

.6 Factory primed before assembly in colour standard to manufacturer.

.7 Bearing lubrication systems plus extension lubrication tubes where bearings are not easily accessible.

.3 Ceiling Exhaust or Transfer Fans:

.1 Galvanized steel housing
.2 Housing-mounted intake grille
.3 Double strength mounting flanges/brackets
.4 Permanently lubricated, 115V/1 phase, motor
.5 Motor suitable for use with speed controller
.6 Motor directly connected to fan wheel
.7 Motor/fan assembly to be mounted with vibration isolation/rubber grommets
.8 Plug-in power cord
.9 Motor assembly to be removeable through grille without disturbing housing
.10 Integral chatterproof backdraft damper
.11 When specified: roof or wall cap
.12 When specified: time delay, wall-mounted, on-off switch
.13 When specified: 115V/1 phase, variable (infinite) speed controller, suitable for wall mounting
.14 Rated in accordance with CAN/CSA-C260-M and conforming to CSA C22.2

.4 In-line Supply, Exhaust, or Transfer Cabinet Fans:

.1 Galvanized steel housing c/w access panel(s)
.2 Internal acoustic lining
.3 Horizontal in-line configuration
.4 Double strength mounting flanges/brackets
.5 Permanently lubricated, 115V/1 phase, motor
.6 Motor suitable for use with speed controller
.7 Motor directly connected to fan wheel
.8 Motor/fan assembly to be mounted with vibration isolation/rubber grommets
.9 Plug-in power cord
.10 Motor assembly to be removeable through access panel without disturbing housing
.11 Integral chatter-proof backdraft damper
.12 When specified: roof or wall cap
.13 When specified: time delay, wall-mounted, on-off switch
.14 When specified: 115V/1 phase, variable (infinite) speed controller, suitable for wall mounting
.15 Rated in accordance with CAN/CSA-C260-M and conforming to CSA C22.2

.5 Duct Blowers:

.1 Baked enamel, heavy gauge steel cabinet c/w access panel(s)
.2 Internal thermal/acoustic lining
.3 In-line configuration suitable for horizontal or vertical mounting
.4 Reinforced mounting holes for suspended installation

.5 Centrifugal fan with forward curved fan blades

.6 Heavy duty ball bearings suitable for -54^{O} C (-65^{O} F) to 120^{O} C (250^{O} F)
.7 Motor mounted in fan cabinet
.8 Common shaft for twin blower models
.9 Belt driven with adjustable pulleys
.10 Adjustable motor mounting bracket
.11 When specified: filter track section with 50mm (2") medium efficiency filters equal to Farr 30/30
.12 When specified: intake hood with birdscreen

.6 Roof Exhaust Fans – Round

.1 Minimum Requirements: centrifugal non-overloading wheel, belt or direct drive as schedules; spun aluminum housing; up blast discharge, where scheduled. All parts corrosion resistant, vibration isolators, wiring post, head mounted electrical disconnect switch, discharge birdscreen.
.2 Accessories: roof curb or sound curb, backdraft damper or motorized dampers as per schedule.
.3 Baked enamel, heavy gauge steel cabinet c/w access panel(s)
.4 Internal thermal lining
.5 Recessed base suitable for mounting on fabricated roof curb and acting as counterflashing.
.6 Centrifugal fan with forward curved fan blades

.7 Heavy duty ball bearings suitable for -54^{O} C (-65^{O} F) to 120^{O} C (250^{O} F)
.8 Motor mounted in fan cabinet
.9 Belt driven with adjustable pulleys
.10 Shall meet all requirements of NFPA 96, if for removal of grease laden vapours.

.7 Centrifugal Radial Exhaust Fan:

.1 Weatherproof, seamless, heavy gauge, spun aluminum housing, easily removed for service access
.2 General Exhaust:
  .1 Upblast or downflow configuration
  .2 Roof or sidewall mounting
.3 Fume Exhaust:
  .1 Upblast configuration
  .2 Roof or sidewall mounting
.4 For upblast configuration: housing to be self-draining
.5 For roof mounting: Recessed base suitable for mounting on roof curb and acting as counterflashing
.6 For wall mounting: Provide wall mounting plate
.7 Centrifugal, non-overloading, backward inclined, aluminum fan wheel (non-sparking construction)
.8 Heavy duty ball bearings with minimum life of 200,000 hours
.9 Belt driven with adjustable pulleys
.10 Motor to be mounted out of the airstream, with positive cooling ventilation air

.11 Electrical conduit chase to be provided through the unit, with UL safety disconnect switch, and wiring between the switch and the motor
.12 For roof mounting: hinged sub-base and gravity backdraft damper
.13 Aluminum birdscreen
.14 Factory fabricated roof curb or field fabricated roof curb at the Sub-contractor's option

.8 Utility Fans

.1 SISW design for ducted applications
.2 SISW or DIDW for plenum applications
.3 Constructed of heavy gauge steel with enameled finish, and complete with angle iron frame for support
.4 Centrifugal, non-overloading, backward inclined, fan wheel
.5 Aluminum wheel where required for non-sparking construction
.6 Heavy duty ball bearings suitable for -54° C (-65° F) to 120° C (250° F) with minimum life of 200,000 hours
.7 Common shaft for twin blower models
.8 Shaft seal(s) through fan housing(s)
.9 Class 1, welded steel fan housing, able to be rotated in the field to any of 8 positions
.10 Motor to be mounted out of the airstream, on adjustable base
.11 Belt driven with adjustable pulleys
.12 Belt guard
.13 For ducted, exterior applications: vented motor and drive compartment cover with handles
.14 For plenum applications: inlet screen(s)

.9 Axial Fans:

.1 Class 1, welded steel fan housing
.2 Clamshell design or complete with hinged access door(s) for servicing of internal components
.3 Suitable for horizontal or vertical configuration
.4 Mounting feet or lugs for base mount or suspension, as required for individual applications
.5 Air foil blades pitched to suit application
.6 Heavy duty ball bearings
.7 Extended bearing lubricators
.8 Adjustable motor base
.9 Belt driven with adjustable pulleys
.10 Belt guard
.11 For exterior applications: weatherproof motor and drive compartment cover
.12 In plenum applications, provide inlet cone and screen
.13 Optional accessories, when specified: variable inlet vanes, outlet cone, curb cap mounting base, mushroom cap

.10 Sidewall Propeller Fans:

.1 Axial type with steel or aluminum blades and hubs
.2 Permanently lubricated motor and shaft bearings
.3 Belt driven with adjustable pulleys
.4 Drive frame and panel assemblies to be galvanized or painted steel
.5 Optional accessories, when specified: wall collar, gravity backdraft damper, motorized damper, motor-side guard, weatherhood with birdscreen, filter section with 50mm (2") washable filters

.11 Down Draft Ceiling Fans:

.1 Down flow propeller fan
.2 Direct drive
.3 Permanently lubricated, 115V/1 phase, motor
.4 Motor suitable for use with speed controller
.5 Plug-in power cord
.6 115V/1 phase, variable (infinite) speed controller, suitable for wall mounting (note: One speed controller may control more than one fan. Refer to drawings and details for exact circuiting.)
.7 When specified: provide angle iron security frame with wire mesh enclosure and hinged and latched access door.

2.4 SILENCERS

.1 Provide silencers as shown and specified on the drawings. Only silencers with duct-to-reverberant room insertion ratings will be accepted.

.2 Refer to Silencer Schedule Section 23 33 19 for detailed information.

.3 General Construction: 22 ga. galvanized steel outer shell, all welded, prefabricated, with 40 kg/m³ (2½ lb/ft³) density acoustic media packed under 10% compression and protected from air erosion by 22 ga. perforated galvanized steel liner, stream lined inlets and tapered diffuser outlets for maximum insertion loss and minimum pressure drop.

.4 Where internal air velocities exceed 23 m/s (75 ft./s) provide additional fibreglass cloth over perforated steel liner.

.5 Acceptable manufacturers: Vibron, Vibro-Acoustics, Airmaster, Price.

2.5 FILTERS – GENERAL

.1 If air handlers must be used during construction, filtration media with a Minimum Efficiency Reporting Value (MERV) of 8 (duct spot efficiency = 30-35%, arrestance >90%) must be used at each return air grill, as determined by ASHRAE 52.2-1999.

.2 All filter media used during "temporary heating" shall be replaced by new media at regular intervals during equipment use. Contractor shall allow for two (2) complete filter changes after substantial completion, ie. one set installed immediately prior to opening,

and a spare set handed over to City of Winnipeg. The Contractor shall coordinate with City of Winnipeg regarding timing. Install a new set of filter media and hand one spare set of media (for each filter) to the City of Winnipeg at substantial completion. Upon turnover of spare filtration media to City of Winnipeg, the Contractor shall submit request to Consultant for written confirmation from the City of Winnipeg acknowledging the receipt of the spare sets.

.3 Provide shop drawings for all filtration media as outlined in section 21 05 01 - Mechanical General Provisions. Also, provide a schedule listing filtration media installed prior to occupancy, including its MERV value.

.4 Filters shall be listed at least Class II UL flammability.

.5 No filter shall contain asbestos, micro-glass or Urea-formaldehyde.

.6 Regardless of whether the base building HVAC equipment was used during construction or not, the tenant improvement contractor shall allow for two (2) complete filter changes after substantial completion, ie. one set installed immediately prior to opening, and a spare set handed over to City of Winnipeg. The Contractor shall Coordinate with City of Winnipeg regarding timing. Install a new set of filter media and hand one spare set of media (for each filter) to the City of Winnipeg at substantial completion. Upon turnover of spare filtration media to City of Winnipeg, the Contractor shall submit request to Consultant for written confirmation from the City of Winnipeg acknowledging the receipt of the spare sets.

2.6 FILTER GAUGES

.1 Across the filter bank of each air handling unit, and each air-to-air heat exchanger provide magnehelic differential pressure gauges, Dwyer series 2000 range 0 to 2" w.c. (0 to 50 mm w.c.).

2.7 MOTORIZED DAMPERS

.1 Unless noted otherwise, motorized dampers are to be provided on equipment, or supplied by the controls contractor and installed by the sheet metal contractor.

.2 Where motorized dampers are to be provided by the sheet metal contractor, they shall be opposed blade style, with neoprene edge and blade seals, and rated for maximum 5% leakage.

.3 Dampers for Outside Air, Exhaust Air, Relief air and all uses where the indoors are isolated from the outdoors shall be ultra-low leakage, opposed blade style, thermally broken with neoprene edge and blade seals; equal to: TAMCO series 9000 SC, severe cold temperature option, extruded aluminum, opposed blade, extended rear flange type motorized thermally insulated damper. Sizes as shown & tagged on the mechanical drawings. Coordinate structural framing & reinforcing with Architect & Structural Engineer.

2.8 FIRE DAMPERS AND FIRE STOP FLAPS

.1 Provide where shown on the drawings and required to maintain fire separations, type 'B' or 'C', gravity or spring type, U.L.C. labeled and listed, curtain type fire dampers. Use type "A" only where mounted directly behind supply or return grilles.

.2 Do not use asbestos in any form in the construction of fire dampers or fire stop flaps.

.3 Fire Dampers to be dynamic type. Static type to be used only where specifically suited.

.4 Gravity or spring type, U.L.C. labelled and listed, curtain type, meeting requirements of provincial fire authority, ANSI/NFPA 90A, and authorities having jurisdiction.

.5 Fire damper assemblies to be fire tested in accordance with CAN4-S112.

.6 Mild steel, factory fabricated for fire rating requirement to maintain integrity of fire wall and/or fire separation.

.7 Fusible link actuated, weighted to close and lock in closed position when released (for vertical installation with horizontal air flow), or having negator-spring-closing operator (for horizontal position with vertical air flow).

2.9 COMBINATION FIRE/SMOKE DAMPERS

.1 Provide where shown on the drawings, and where required to maintain smoke separations, combination fire/smoke dampers meeting all requirements of ULC, UL, NBC and NFC.

.2 Dampers shall be equipped with fusible linkages for fire operation.

.3 Dampers shall be equipped with 120V (spring close) damper motors mounted outside of the airstream and wired to the fire alarm system. Motors shall be c/w an end switch, suitable for wiring to a test switch and light.

.4 Motors shall be Honeywell Model ML-4115 or Belimo FS-NF-120-S, with no alternates or equals.

2.10 FLEXIBLE CONNECTIONS

.1 General HVAC System:

.1 Provide at fans and at air handling units, and where indicated: neoprene coated glass fabric, factory fabricated, flexible connections, as approved by the Authorities Having Jurisdiction.

.2 Frame: galvanized sheet metal frame with fabric clenched by means of double locked seams.

.3 Material: Fire resistant, self extinguishing, neoprene coated glass fabric, temperature rated at minus 40 degrees C to plus 90 degrees C, density of 1.3 kg/m2.

.4 Except where noted otherwise, connections up to 750 mm (30") in the largest dimension shall be 100 mm (4"). Connections larger than 750 mm to be 150 mm (6").

2.11 TURNING VANES & ELBOWS

.1 Use long radius duct elbows which have a minimum throat radius of 1-1/2 times the diameter.

.2 Where use of above item is precluded by space limitations (or as shown otherwise on the drawings) use duct elbows fabricated with square throats and backs and fitted with "Rovane", single thickness turning vanes with trailing edge.

.3 All round elbows shall be smooth type construction and shall have long radius construction with a minimum throat radius of 1-1/2 times the diameter.

.4 Factory or shop fabricated single or double thickness, to recommendations of SMACNA and as indicated.

2.12 GRILLES, REGISTERS AND DIFFUSERS

.1 The following are general specifications. Refer to the Individual Grille, Register and Diffuser Specifications in the Grille, Register and Diffuser Schedule for types, styles, specific requirements, and any deviations.

.2 Air extractors shall be provided where indicated and/or where supply outlets are directly connected to a trunk duct.

.3 All supply diffusers shall be equipped with manufactured balancing dampers where branch duct dampers are not provided.

2.13 LOUVRES, INTAKES AND VENTS

.1 Fixed Louvres – Aluminum:

.1 Construction: welded with exposed joints ground flush and smooth.\

.2 Material: extruded aluminum alloy [6063-T5].

.3 Blade: stormproof pattern, reinforcing bosses and maximum blade length of 1500 mm.

.4 Frame, head, sill and jamb: 100 or 150 mm deep (to suit installation), one piece extruded aluminum, minimum 3 mm thick.

.5 Mullions: at 1.5 m maximum centres.

.6 Fastenings: stainless steel (Society of Automotive Engineers) SAE-194-8F with SAE-194-SFB nuts and resilient neoprene washers between aluminum and head of bolt, or between nut, ss washer and aluminum body.

.7 Screen: 12 mm exhaust 19 mm intake mesh, 2 mm diam wire aluminum birdscreen on inside face of louvres in formed U-frame.

.8 Finish: prime coated

.9 Louvres shall be 100mm (4") thick, extruded aluminum, c/w birdscreen.

.10 Refer to the Individual Louvre Specifications in the Grille, Register, Diffuser and Louvre Schedule for types, styles, specific requirements, and any deviations.

.2 Gooseneck Hoods:

.1 Thickness: to ASHRAE and SMACNA.

.2 Fabrication: to ASHRAE and SMACNA.

.3 Joints: to ASHRAE and SMACNA.

.4 Supports: as indicated.

.5 Complete with integral birdscreen of 2.7 mm dia. copper or aluminum or ss wire. Use 12 mm mesh on exhaust 19 mm mesh on intake.

.6 Refer to drawing detail.

.3 Louvred Penthouses:

.1 Roof-mounted, factory manufactured, constructed of aluminum.

.2 Square/rectangular configuration with louvers on 4 sides and a solid roof.

.3 With base suitable for mounting on roof curb and acting as counterflashing

.4 Complete with integral birdscreen of 2.7 mm dia copper or aluminum or ss wire. Use 12 mm mesh on exhaust 19 mm mesh on intake.

.5 Finish: prime coated

.6 Equal to Penn Pennhouse

.1 Sizing as noted on floor plans.

2.14 DUCT ACCESS DOORS

.1 Non-Insulated Ducts: sandwich construction of same material as duct, one sheet metal thickness heavier, minimum 0.6 mm thick complete with sheet metal angle frame.

.2 Insulated Ducts: sandwich construction of same material as duct, one sheet metal thickness heavier, minimum 0.6 mm thick complete with sheet metal angle frame and 25 mm thick rigid glass fibre insulation.

.3 Gaskets: neoprene.

.4 Hardware:

.1 Up to 300 x 300 mm: two sash locks complete with safety chain.

.2 301 to 450 mm: four sash locks complete with safety chain.

.3 451 to 1000 mm: piano hinge and minimum two sash locks.

.4 Doors over 1000 mm: piano hinge and two handles operable from both sides.

.1 Hold open devices.

.2 300 x 300 mm glass viewing panel.

2.15 DUCTWORK

.1 Provide all ductwork including all appurtenances, hangers, dampers, turning vanes, etc.

.2 All ductwork shall be constructed of new, prime material free of imperfections, which is guaranteed to bend and flatten without fracture.

.3 Provide Aluminum ductwork for Clothes Drier and Range Hood exhaust.

.4 Provide Aluminum or 316 Stainless Steel ductwork for Acid, Chlorine and Chemical Room Exhaust.

.5 Provide Stainless Steel or Fiberglass Reinforced Plastic (FRP) Supply, Return, Exhaust and Relief ductwork serving wet Areas.

.1 General:

.1 Factory fabricated to CAN/ULC-S110.

.2 Pressure drop coefficients listed below are based on relative sheet metal duct pressure drop coefficient of 1.00.

.3 Flame spread rating not to exceed 25. Smoke developed rating not to exceed 50.

.2 Non-metallic – Insulated

.1 Type 4: non-collapsible, coated type, mechanically bonded to, and helically supported by, external steel wire with factory applied, 37 mm thick flexible mineral fibre thermal insulation with vapour barrier and protective outer jacket, as indicated.

.2 Performance:

.1 Factory tested to 2.5 kPa without leakage.

.2 Maximum relative pressure drop coefficient: 3.

.6 Aluminum Ductwork:

.1 To ASHRAE and SMACNA. Aluminum type: 3003-H-14.

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

.3 Joints: to ASHRAE and SMACNA.

.7 Stainless Steel Ductwork:

.1 To ASTM A480/A480M, Type 304.

.2 Finish: No. 4.

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

.4 Joints: to ASHRAE and SMACNA.

.8 Except as noted above, provide ductwork constructed of galvanized steel sheets as follows:

.1 Lock forming quality: to ASTM A653/A653M, zinc coating.

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

.3 Joints: to ASHRAE and SMACNA.

.4 Round spiral 4 ply seam

.1 Up to 450 mm (18") 26 Ga.

.2 457 to 750 mm (19" to 30") 24 Ga.

.3 Slip joint with 3 @ #8 screws evenly spaced.

.5 Rectangular with Longitudinal seam

.1 Up to 300 mm (12") 26 Ga.
S and Drive cleat

.2 325 to 750 mm (13" to 30") 24 Ga.
S and Drive cleat

.3 775 to 1275 mm (31" to 50") 22 Ga.
25 mm (1") bar slip or standing T @ 1.5 m (60") o.c. (max).

.4 1300 to 1500 mm (51" to 60") 20 Ga.
40 mm (1-1/2") bar slip or standing T @ 1.5 m (60") o.c. (max).

.5 1525 to 2250 mm (61" to 88") 18 Ga.
40 mm (1-1/2") bar slip or standing T @ 1.5 m (60") o.c. (max).
Provide 40 mm x 40 mm x 5 mm (1-1/2" x 1-1/2" x 3/16") angle reinforcement at 750 mm (30") o.c.

.6 Cross break all rectangular ductwork greater than 600 mm (24") wide.

2.16 DUCT FITTINGS

.1 Of same material as straight lengths of duct.

.2 Fabrication: to SMACNA.

.3 Elbows - General

.1 Long radius elbows and/or square elbows with turning vanes are preferred over short radius elbows and/or square elbows without turning vanes. Use the preferred elbows wherever possible.

.4 Radiused elbows.

.1 Rectangular: standard or short radius with single thickness turning vanes.

.2 Round: smooth or sectional. Centreline radius: 1.5 times diameter.

.5 Mitred elbows, rectangular:

.1 To 400 mm: with single thickness turning vanes.

.2 Over 400 mm: with double thickness turning vanes.

.6 Branches:

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

.2 Round main and branch: enter main duct at 45 degrees with conical connection.

.3 Provide volume control damper in branch duct near connection to main duct.

.4 Main duct branches: with splitter damper.

.7 Transitions:

.1 Diverging: 20 degrees maximum included angle.

.2 Converging: 30 degrees maximum included angle.

.8 Offsets:

.1 Full or short radiused elbows as required.

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

.1 Maximum included angles: as for transitions.

2.17 ACOUSTIC INSULATION

.1 Coordinate all requirements with section 21 07 01 – Thermal Insulation.

.2 S/A, R/A, F/A, & E/A ductwork shall be internally lined with acoustic insulation for a minimum of 3.048m (10'-0") back from air handling equipment & heat/energy recovery ventilators unless a larger amount is shown on the drawings.

.3 Provide acoustic lining/insulation in all ductwork 10’-0” (3.048m) from inlet & outlet on all fans (exhaust, transfer, supply, return, etc.), unless a larger amounted is shown on the drawings.

.4 Provide acoustic lining/insulation in all ductwork where indicated on the drawings at a thickness of 25 mm (1”).

.5 The use of fiberglass liner is not allowed. All acoustic duct liner must be constructed of closed-cell, polymer sheet insulation materials.

.6 Product must be cleanable and have a zero perm rating and zero water absorption.

.7 Installation shall not include any tapes, fabrics, cements or other materials which are not cleanable or which offer opportunity for mold growth.

.8 Installation shall be to Manufacturer's standards and shall withstand air velocities of 12.7 m/s (2500 feet per minute).

.9 Duct sizes shown on the drawings are clear inside dimensions. Sheet metal sizes shall increase as required to accommodate the thickness of the internal insulation, to maintain the equivalent free area noted on the drawings.

.10 Shop drawings shall be submitted for review & approval by the Consultant & City of Winnipeg for all insulation materials.

2.18 SEALANT MATERIALS

.1 Do not use caulking that emits strong odours, contains toxic chemicals or is not certified as mould resistant in air handling units.

.2 When low toxicity caulks are not possible, confine usage to areas which offgass to exterior, are contained behind air barriers, or are applied several months before occupancy to maximize offgas time.

2.19 SPLITTER, QUADRANT, & BALANCING DAMPERS

.1 Provide splitter and quadrant dampers where shown on the drawings and as directed by the air balancing contractor.

.2 Construct dampers of not less than 22 gauge material. Where installed in ducts up to 300 mm (12") high, provide single blade dampers. Where installed in ducts greater than 300 mm (12") high, provide multi-blade dampers, each blade being not higher than 228 mm (9").

.3 Splitter Dampers

.1 Of same material as duct but one sheet metal thickness heavier, with appropriate stiffening. Construct dampers of not less than 22 gauge material.

.2 Double thickness construction.

.3 Control rod with locking device and position indicator.

.4 Rod configuration to prevent end from entering duct.

.5 Pivot: piano hinge.

.6 Folded leading edge.

.4 Single Blade Dampers

.1 Of same material as duct, but one sheet metal thickness heavier. V-groove stiffened.

.2 Size and configuration to recommendations of SMACNA.

.3 Locking quadrant with shaft extension to accommodate insulation thickness.

.4 Inside and outside nylon end bearings.

.5 Channel frame of same material as adjacent duct, complete with angle stop.

.5 Multi-blade Dampers

.1 Factory manufactured of material compatible with duct.

.2 Opposed blade: configuration, metal thickness and construction to recommendations of SMACNA

.3 Maximum blade height: 100 mm

.4 Bearings: self-lubricating nylon.

.5 Linkage: shaft extension with locking quadrant.

.6 Channel frame of same material as adjacent duct, complete with angle stop.

2.20 DRIP PANS

.1 Drip pans shall be constructed of nonferrous material. Line inside with two coats of mastic and insulate exterior.

.2 Pans shall have 50 mm (2") high sides and shall be 150 mm (6") larger in both directions than the size of the device or opening requiring the pan.

.3 Provide soldered drain fitting and 25mm (1") drain line to nearest floor drain, or to location noted on the drawings.

2.21 DUCT SEALING

.1 Seal Classification as follows:

Maximum Pressure Pa	SMACNA Seal Class

Maximum Pressure Pa	SMACNA Seal Class
500	A
250	A
125	A

.1 Class A: longitudinal seams, transverse joints, duct wall penetrations and connections made airtight with sealant and tape.

.2 Sealant: oil resistant, water borne, polymer type flame resistant duct sealant. Temperature range of minus 30 degrees C to plus 93 degrees C.

.3 Tape: polyvinyl treated, open weave fiberglass tape, 50 mm wide.

.4 Leakage: In accordance with SMACNA HVAC Air Duct Leakage Test Manual.

.5 Do not use caulking that emits strong odours, contains toxic chemicals or is not certified as mould resistant in air handling units.

.6 When low toxicity caulks are not possible, confine usage to areas which offgass to exterior, are contained behind air barriers, or are applied several months before occupancy to maximize offgas time.

2.22 DUCT HANGERS AND SUPPORTS

.1 Hangers and Supports: in accordance with Section 21 05 05 (Basic Materials and Methods).

.2 Use only 316 Stainless Steel in wet Environments.

.3 Use only Aluminum or 316 Stainless Steel or galvanized in Chemical rooms.

.4 Hangers shall be angle type, except for ducts up to 600mm (24") diameter, strap hangers may be substituted.

.5 Angle type Hangers: Except as noted above, galvanized steel angle with galvanized steel supports rods, locking nuts and washers to the following table.

Duct Size	Angle Size	Rod Size
(mm)	(mm)	(mm)
up to 750	25 x 25 x 3	6
751 to 1050	40 x 40 x 3	6
1051 to 1500	40 x 40 x 3	10
1501 to 2100	50 x 50 x 3	10
2101 to 2400	50 x 50 x 5	10
2401 and over	50 x 50 x 6	10

.1 Upper hanger attachments:

.1 For concrete: manufactured concrete inserts.

.2 For steel joist: manufactured joist clamp

.6 Strap hangers: of same material as duct, but next sheet metal thickness heavier than duct.

.1 Stainless Steel Hangers and Rods may be used for Aluminum ductwork.

.2 For ducts up to 600mm (24") diameter: 25mm (1") x 20 ga straps.

.3 Hanger configuration: to ASHRAE and SMACNA.

2.23 GAS VENTS AND STACKS

.1 General:

.1 Sectional, prefabricated, double wall with air space or mineral wool insulation, with mated fittings and couplings.

.2 Complete with all thimbles, supports, flashings, rain caps, fire stops, base supports, base tee cleanouts, barometric dampers, etc as required to meet all requirements of the Manufacturer's recommendations and the Authorities Having Jurisdiction.

.3 In sizes as shown or as required to meet all requirements of the Authorities Having Jurisdiction.

.2 Gas vents for atmospheric gas fired equipment:

.1 Type B double wall

.2 ULC labelled

.3 Gas vents for forced draft gas-fired equipment:

.1 Pressure vents.

.2 ULC labelled, 760°C (1400°F) rated.

.3 Stainless steel inner wall.

.4 Stainless steel outer wall.

.5 Outer seals between sections: to suit application.

.6 Inner seals between sections: to suit application.

.4 Gas Vents for Condensing Boilers and Water Heaters: As per manufacturer's Recommendations.

.5 Accessories:

.1 Cleanouts: bolted, gasketted type, full size of breeching, as indicated.

.2 Barometric dampers: single or double acting as required, 70% of full size of breeching area.

.3 Rain cap – or – outlet as recommended by equipment supplier. Confirm with consultant.

2.24 BREECHING

.1 Provide galvanized iron breeching with connection to each gas fired device using materials, supports, and connections in accordance with code requirements.

.2 Provide 12 gauge black iron breeching all welded for oil fired equipment with connections and supports to code requirements.

PART 3 Installation And Execution

3.1 INSTALLATION - GENERAL

.1 Install using Manufacturers Recommended Instructions

.2 Install to the recommendations of SMACNA

3.2 AIR BALANCING

.1 Provide personnel and materials to assist and work under the direction of the air balancing firm for air testing and balancing of the systems. This shall include but not be limited to:

.1 The removal and replacement of ceiling tiles; installation of pitot tube test opening enclosures; installation of dampers and baffles; provision of access openings and covers; provision of ladders and scaffolds; removal and replacement of guards; removal and replacement, and provision of, required sheave and belt sizes as directed; and other items as necessary for complete and acceptable air balancing procedures.

.2 Preliminary leak testing.

.1 Provide assistance to the balancing contractor in the performance of a preliminary leak test. Work shall include connection of pressurization fans provided by the balancing contractor, capping of branch ducts, etc. If necessary sections of large ductwork systems may be tested at a time.

.2 Assure that all duct seams are sealed as required prior to test.

.3 After preliminary testing is complete, correct leaks and replace all defective materials. Ductwork shall be free of all audible leaks in a quiet ambient.

.4 Refer to section 23 05 93 – Testing and Balancing for coordination of work.

3.3 AIR TO AIR HEAT EXCHANGERS & HEAT/ENERGY RECOVERY VENTILATORS

.1 Support independently of adjacent ductwork, with spring isolation and flexible duct connections.

.2 Leave access for servicing.

.1 Motor, bearings and extension tubes shall be easily accessible.

.3 The installation of the air to air heat recovery ventilators must be executed with particular care. The following are items of concern:

.1 The drain must be at the warm end on the exhaust side.

.2 The unit must be graded 2% minimum and preferably 4% back to the drain end.

.3 All joints and connections must be made water tight.

.4 The ductwork on the exhaust air leaving side must be water tight.

.5 The insulation must be applied carefully ensuring continuity of the vapour seal.

.6 The condensate drain is to be insulated and vapour sealed.

.7 The trap in the condensate drain shall be 150mm (6”) deep.

.8 Access doors must be double panel insulated type carefully sealed.

.9 Where hangers or support members come in contract with the exchanger they shall be insulated to a point 300mm from the contact point.

.10 Dented or damaged units will not be accepted.

.11 All duct connections shall slope up from the heat exchanger.

.4 Where the manufacturer's installation instructions differ with that stated, such instructions shall be brought to the attention of the Engineer.

3.4 FANS, FAN COILS, & HEAT PUMP UNITS

.1 Comply with manufacturers requirements.

.2 Support independently of adjacent ductwork, with flexible duct connections.

.1 Provide Spring Isolation Hangers for In-line Fans, unless fan has integral isolation.

.3 Ensure vibration free installation.

.4 Leave access for servicing.

.1 Motor, bearings and extension tubes shall be easily accessible.

.5 Install belt guards and weather proof covers as required.

.6 For Sidewall Fans on exterior walls: Caulk, seal and make weather tight.

3.5 VAV TERMINALS

.1 Do not install straight inlet ductwork in lengths less than required by the manufacturer.

.2 Do not provide straight inlet ductwork less than 1.5m (5’-0”) long.

3.6 MOTORIZED DAMPERS

.1 Install automatic dampers free from distortion and binding of linkages.

.2 Thoroughly caulk around damper frame.

3.7 DAMPERS - GENERAL

.1 For supply, return and exhaust systems, locate balancing dampers in each branch duct.

.2 Runouts to registers and diffusers: install single blade damper located as close as possible to main ducts.

.3 All dampers to be vibration free.

.4 Ensure damper operators are observable and accessible.

.5 Seal multiple damper modules with silicon sealant.

.6 Install access door adjacent to each damper - or - ensure dampers are observable and accessible

3.8 SPLITTER , QUADRANT, & BALANCING DAMPERS

.1 Provide splitter and quadrant dampers where shown on the drawings and as directed by the air balancing contractor.

.2 Where installed in ducts up to 300 mm (12") high, provide single blade dampers.

.3 Where installed in ducts greater than 300 mm (12") high, provide multi-blade dampers, each blade being not higher than 228 mm (9").

3.9 FIRE DAMPERS AND FIRE STOP FLAPS

.1 Locate where indicated on the drawings and in all fire assemblies, whether indicated on the Mechanical Drawings or not.

.1 Refer to the Architectural Drawings for Fire Rated Assemblies.

.2 Install in accordance with ANSI/NFPA 90A and in accordance with conditions of ULC listing.

.3 Install to U.L.C. requirements. Refer to detail drawings.

.1 Provide retaining angle iron frame, on full perimeter of fire damper, on both sides of fire separation being pierced.

.2 Install break-away joints of approved design on each side of fire separation.

.3 Seal around fire damper assembly. Coordinate with installer of firestopping.

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

.4 Maintain integrity of fire separation.

.5 Install access door adjacent to each damper.

.6 Ensure access doors/panels, fusible links, damper operators are easily observed and accessible.

.7 After completion, and prior to concealment, obtain approvals of complete installation from authority having jurisdiction.

3.10 FILTER GAUGES

.1 Sensing Points: Locate as directed by the manufacturer and carefully clip tubing to avoid damage and interference with filter removal or servicing.

.2 Mount gauges for convenient observation.

3.11 DUCT INSTALLATION

.1 For Clothes Drier and Range Hood exhaust:

.1 Do not use sheet metal screws for dryer ducts.

.2 Seal all joints with aluminum duct tape.

.2 Install ductwork in accordance with SMACNA duct construction standards.

.3 Ground across flexible connectors with No. 2/0 braided copper strap.

.4 Install balancing dampers at branch ducts.

.5 Seal all ductwork joints with high velocity duct sealer - maximum leakage 5%.

.6 During installation, protect open ends of ducts to prevent debris and dirt from entering.

.7 Where ducts are shown alongside of partitions, place tight to the surface.

.8 Provide baffles, where required to reduce problems of air stratification, as directed by the Engineer.

.9 Provide flashings and counterflashings to suit individual locations.

.10 Do not break continuity of insulation vapor barrier with hangers or rods.

.1 Insulate strap hangers 100 mm beyond insulated duct. Ensure diffuser is fully seated.

.11 Support risers in accordance with ASHRAE and SMACNA and as indicated.

.12 Install breakaway joints in ductwork on both sides of fire separation.

.13 Install proprietary manufactured flanged duct joints in accordance with manufacturer's instructions.

.14 Manufacture duct in lengths and diameter to accommodate installation of acoustic duct lining.

.15 Watertight Ducts:

.1 Provide watertight duct for:

.1 Fresh air intakes.

.2 Pool Dehumidification System Exhaust

.3 HRV Unit exhaust from Unit to Outdoors

.4 As indicated.

.2 Form bottom of horizontal duct without longitudinal seams.

.1 Solder or weld joints of bottom and side sheets.

.2 Seal other joints with duct sealer.

.3 Where water penetration is expected, fit base of duct with 50 mm deep drain sump and 32 mm drain, connected with deep seal trap discharging to drain.

3.12 PLENUMS AND CASINGS

.1 Install hinged doors to swing outward on the suction side of the fan and inward where a positive pressure may exist in the plenum.

.2 Provide gasketting around all doors and seal all seams and joints with high velocity duct sealer.

.3 Construct coil mounting racks to ensure capability of future removal.

.4 Provide two coats of mastic compound on inner surface of drip trays.

.5 Seal all joints in filler pieces to prevent by-pass and install filter banks for easy servicing.

3.13 VIBRATION AND OBJECTIONABLE NOISES

.1 Install ductwork free from pulsation, chatter, vibration or objectionable noises. Should any of these defects appear after the system is in operation, correct same by either removing, replacing or reinforcing the work as directed by the Engineer.

3.14 SEALING AND TAPING

.1 Apply sealant to outside of joint to manufacturer's recommendations.

.2 Bed tape in sealant and recoat with minimum of one coat of sealant to manufacturers recommendations.

3.15 DUCT HANGERS

.1 Install in accordance with SMACNA.

.2 Angle Hanger spacing: in accordance with ASHRAE and SMACNA and as follows:

Duct Size	Angle Size	Rod Size	Spacing
Up to 750mm (30")	25mm x 25mm x 3mm (1" x 1" x 1/8")	6mm (1/4")	3000mm (10'-0")
755mm to 1000mm (31" to 40")	40mm x 40mm x 3mm (1-1/2" x 1-1/2" x 1/8")	6mm (1/4")	3000mm (10'-0")
1005mm to 1500mm (41" to 60")	40mm x 40mm x 3mm (1-1/2" x 1-1/2" x 1/8")	10mm (3/8")	3000mm (10'-0")
1505mm to 2000mm (61" to 80")	50mm x 50mm x 3mm (2" x 2" x 1/8")	10mm (3/8")	2300mm (7'-6")

.3 Strap hangers to be screw fastened at 100mm (4") o.c. along sides and with at least one screw through the bottom of the duct. Space strap hangers at 2400mm (8'-0") o.c.

3.16 FLEXIBLE CONNECTORS

.1 Install in the following locations:

.1 Inlets and outlets to supply air units and fans.

.2 Inlets and outlets of exhaust and return air fans.

.3 As indicated.

.2 Minimum distance between metal parts when system in operation: 75 mm.

.3 Install in accordance with recommendations of SMACNA.

.4 When fan is running:

.1 Ducting on sides of flexible connection to be in alignment.

.2 Ensure slack material in flexible connection.

3.17 DUCT ACCESS DOORS

.1 Constructed and installed so that the door can be operated without twisting or distortion

.2 Size:

.1 900 x 900 mm for person size entry.

.2 600 x 600 mm for servicing entry.

.3 200 x 200 mm for viewing.

.4 Elsewhere as indicated.

.3 Locations:

.1 Fire dampers.

.2 Control dampers.

.3 Devices requiring maintenance.

.4 Both sides of Coils in order to provide complete access for cleaning

.5 Where required by code.

.6 Elsewhere as indicated.

3.18 ACOUSTIC INSULATION

.1 Provide acoustic lining in all ductwork where indicated on the drawings & where noted in the general notes on the drawings.

.2 Provide acoustic lined plenums on the R/A inlets and S/A outlets of all HP's and ERV's, whether shown on the Drawings or not.

.3 Duct sizes shown on the drawings are clear inside dimensions. Sheet metal sizes shall increase as required to accommodate the thickness of the internal insulation, to maintain the equivalent free area noted on the drawings.

.4 Fasten to interior sheet metal surface with 100 % coverage of adhesive to ASTM C916

.1 Exposed leading edges and transverse joints to be factory coated or coated with adhesive during fabrication.

.2 In addition to adhesive, install weld pins not less than 2 rows per surface and not more than 425 mm on centres to compress duct liner sufficiently to hold it firmly in place.

.1 Spacing of mechanical fasteners in accordance with SMAC HVAC DCS and NAIMA AH116.

.5 Joints:

.1 Seal butt joints, exposed edges, weld pin and clip penetrations and damaged areas of liner with joint tape and sealer. Install joint tape in accordance with manufacturer's written recommendations, and as follows:

.1 Bed tape in sealer.

.2 Apply two coats of sealer over tape.

.6 Replace damaged areas of liner

.7 Protect leading and trailing edges of duct sections with sheet metal nosing having 15 mm overlap and fastened to duct.

.8 In systems, where air velocities exceed 20.3 m/sec, install galvanized sheet metal noising to leading edges of duct liner.

3.19 GRILLES, REGISTERS AND DIFFUSERS

.1 Provide duct-mounted balancing damper at branch take-off from main, or grille/diffuser mounted balancing damper supplied with grille/diffuser by grille/diffuser manufacturer.

.2 Set squarely in place parallel to adjacent building lines.

.3 Ensure devices are set rigidly in place and properly secured.

.4 Install with screws in countersunk holes where fastenings are visible.

.5 Floor grilles to be set flush with floor coverings except carpet. Frame to lap over carpet.

3.20 FRESH AIR AND EXHAUST LOUVRES, INTAKES, & VENTS

.1 Caulk all joints at louvre connection and make duct connection water tight.

.2 Reinforce and brace goosenecks as indicated and as required.

.3 Anchor securely into opening. Seal with caulking all around to ensure weather tightness.

.4 Mount all units with bottom of air openings minimum 1200 mm (4'-0") above roof.

.1 Allow for extended roof curbs as required.

.2 Allow for guy wires and bracing as required.

3.21 GAS VENTS AND STACKS

.1 Follow manufacturer's recommendations for prefabricated components.

.2 Comply with the requirements of the Authorities Having Jurisdiction.

.3 Provide a minimum of 3 @ 6 mm (1/4") stainless steel guy cables with turnbuckles on any vent (or stack) higher than 1500 mm (5'-0").

.4 Support chimneys at bottom, roof and intermediate levels as required.

.5 Install thimbles where penetrating roof, floor, or ceiling. Pack annular space with heat resistant caulking.

.6 Install flashings at roof and wall penetrations.

3.22 DUCT AND PLENUM CLEANING

.1 Responsibility: it is the responsibility of the sheet metal sub-trade to ensure that all ductwork installed or modified under this contract is internally and externally clean when handed over to the City of Winnipeg. It includes all ductwork whether lined or not, all plenums and all equipment within duct and plenums.

.2 Installation Procedure: Wipe or brush ducts clean immediately before installation. Close all dampers immediately following installation thus checking the operation and retarding movement of contaminants through the system. Seal all openings at the end of each day and at such other time as site conditions dictate. Floor opening to be capped with sheet metal or floor grilles plus 0.15 mm thick poly. Other openings to be covered with 0.15 mm thick poly sheet taped so as to be air tight. The ducts must remain sealed until the systems area is ready to be started up and must be resealed if subsequent construction creates a risk of dust entering the ductwork.

.3 Cleaning Procedure:

- .1 On completion of the duct and plenum installation and prior to the installation of grilles, registers and diffusers and the use of air systems:
- .2 Vacuum clean all plenums.
- .3 Install air filters of the specified performance.
- .4 Blow-out all supply ducts by operating the supply fan.
- .5 Install grilles, registers and diffusers.
- .6 Prior to balancing the air systems, but not until authorized by the Design Authority.
- .7 Vacuum clean all supply and return air ducts, all plenums and all coils.
- .8 Submit a report that certifies all specified air systems have been cleaned. The Design Authority will inspect for cleanliness of ductwork at Substantial Performance.
- .9 The cleaning shall be to the satisfaction of the Design Authority and City of Winnipeg.

3.23 LEAKAGE TESTS

.1 Refer to Specification Section 23 05 93 – Testing and Balancing.

.2 Provide personnel and materials as required to assist the Testing and Balancing Contractor.

.3 Do leakage tests in sections.

.4 Make trial leakage tests as instructed to demonstrate workmanship.

.5 Do not install additional ductwork until trial test has been passed.

.6 Test section minimum of 30 m long with not less than three branch takeoffs and two 90 degree elbows.

.7 Complete test before insulation or concealment of Work.

3.24 START-UP AND COMMISSIONING

.1 Start-up and Commissioning shall be undertaken prior to the Occupancy Stage of each Construction Phase.

.2 Follow the start-up procedures as recommended by the equipment manufacturer unless specified otherwise.

.3 Follow the special start-up procedures specified elsewhere in these Specifications.

.4 Conform to the requirements of Section 21 05 01 – General Mechanical Requirements.

.5 Start-up and Commission the Air Distribution Equipment and Systems.

.6 Assist with the Balancing of the Systems as required.

.7 Provide equipment, personnel, material and information necessary to assist the Commissioning Agent in completing the Commissioning Process.

.8 Conform to the requirements of the Architectural Specifications

.9 Calibrate and adjust all items provided under this contract.

.10 Provide instructions to City of Winnipeg as required. Refer to Specification Section 21 05 01 – Mechanical General Provisions.

END OF SECTION

PART 1 General

1.1 RELATED DOCUMENTS

.1 Drawings and general provisions of the Contract, including General and Supplementary Conditions & Division 01,21,22,23,25 Specification Sections, apply to this Section.

.2 Section 21 05 01, Mechanical General Provisions.

.3 Section 21 05 05, Basic Materials and Methods.

.4 Sections 22 06 01 and 23 06 01, Approved Substitute Schedules.

.5 Section 23 05 53, Vibration Isolation.

.6 Section 23 05 93, Testing and Balancing.

.7 Section 23 21 05, Liquid Heat Transfer & Refrigeration.

.8 Comply with the requirements of the Architectural Specifications.

1.2 SUMMARY

.1 This Section includes factory assembled and tested, hydronic heating boilers (B-1,2).

1.3 SUBMITTALS

.1 Product Data: For each type of product indicated. Include rated capacities, pressure drop, performance curves with selected points indicated, furnished specialties, and accessories.

.2 Shop Drawings: Complete set of manufacturer's prints of evaporative equipment assemblies, control panels, sections and elevations, and unit isolation. Include the following:

.1 Assembled unit dimensions.

.2 Weight and load distribution.

.3 Required clearances for maintenance and operation.

.4 Sizes and locations of piping and wiring connections.

.5 Wiring Diagrams: For power, signal, and control wiring. Differentiate between manufacturer installed and field installed wiring.

.6 Refer to Section 21 05 01, Mechanical General Provisions, for further requirements.

.3 Operation and Maintenance Data: Each unit to include, operation, and maintenance manual.

.1 Refer to Section 21 05 01, Mechanical General Provisions, for further requirements.

1.4 PRODUCT HANDLING:

.1 Protection: Use all means necessary to protect equipment before, during, and after installation.

.2 Replacement and Repair: All scratched, dented, and otherwise damaged units shall be repaired or replaced as directed by the Architect & Engineer.

1.5 DELIVERY, STORAGE, AND HANDLING:

.1 Deliver materials to the site in such a matter as to protect the materials from shipping and handling damage. Provide materials on factory provided shipping skids and lifting lugs if required for handling. Materials damaged by the elements should be packaged in such a matter that they could withstand short-term exposure to the elements during transportation.

.2 Store materials in clean, dry place and protect from weather and construction traffic. Handle carefully to avoid damage.

.3 Use all means necessary to protect equipment before, during, and after installation.

.4 All scratched, dented, and otherwise damaged units shall be repaired or replaced as directed by the Architect Engineer.

PART 2 Products and Materials

2.1 MANUFACTURERS & SELECTION

.1 Each Boiler shall be equal to: **Camus DynaMax HS model DMNH 0391** natural gas fired, condensing, high efficiency boiler. Full modulation firing down to 20% of rated input with turn down ratio of 5 to 1. Input range= 80-399 Mbh , Output =371 Mbh (93-99% Thermal Efficiency depending on return water temperature). Boiler shall be design certified by CSA and shall meet the requirements of ANSI Z21.13 and CSA 4.9. The boiler shall bear the ASME “H” stamp and shall be national board listed where required.Electrical: FLA = 6 Amps, MOCP = 15 Amps, 120V/60Hz/1ø.

2.2 PERFORMANCE OVERVIEW:

.1 The heating boiler shall be design certified by CSA International and shall meet the requirements of ANSI Z21.13 and CSA 4.9. The boiler shall bear the ASME "H" stamp and shall be national board listed where required.

.2 Boiler shall operate up to 93.0% steady state efficiency.

.3 Heat exchanger shall be a fully condensing counter-flow water tube design with stainless steel construction and all welded design with constant allowable system return temperatures of 40F.

.4 Fine tuned combustion premix providing homogeneous air and gas combustion mix to a radial burner incorporating a knitted stainless steel wrap ensuring stable light off and efficient clean combustion.

.5 5:1 gas input turn down ratio with sustained efficient combustion characteristics throughout entire modulating range.

.6 Factory mounted integral pump, with pre and post purge timing.

.7 Cascade capable integrated control system allowing up to 8 units in lead-lag configuration.

.8 Oxides of Nitrogen (NOx) of 9 ppm corrected to 3% oxygen.

.9 Category II venting models: 0211 to 0801.

.10 The boiler is fully factory fire tested to obtain optimum combustion characteristics and to establish certified gas input rates.

.11 System safety and operating devices and controls are fully configured, calibrated and factory tested.

.12 The boiler shall comply with the energy efficiency requirements of the latest edition of the ASHRAE 90.1 Standard.

.13 Stainless steel outer jacket construction with easily removed outer panels for ease of service.

2.3 COMBUSTION CHAMBER:

.1 The combustion chamber shall be an all welded stainless steel construction which shall be sealed and completely enclosed, independent of the outer jacket assembly. The Stainless Steel combustion chamber shall be designed to drain condensation to the bottom of the heat exchanger assembly. A condensate collection box shall be employed to trap and neutralize flue product condensate. A window view port shall be provided for visual inspection of the boiler combustion during firing.

2.4 **HEAT EXCHANGER:**

.1 The heat exchanger shall be inspected and tested to A.S.M.E. Section IV requirements. The A.S.M.E. Section IV seal of approval will not be provided as standard for jurisdictions not requiring the A.S.M.E Section IV seal of approval. The heat exchanger shall be a counter-flow water tube design with multi-pass stainless steel all welded construction heat exchanger with maximum working pressure of 160 PSI (1100kPa). The heat exchanger design shall be capable of 40oF constant system return temperatures to enablefully condensing operation.

.2 **A pressure relief of valve of 50 psi shall be furnished with the heater. Confirm final requirements on site with final expansion tank size & operating conditions.**

2.5 **INTEGRATED COMBUSTION & OPERATING CONTROLS:**

.1 Standard controls include a SOLA electronic proportional integrated combination ignition limit/operator control accurate to 10F (0.50C) having a pulse width modulation signal output for modulating fan speeds. Controls are lead lag "Cascade" ready for control of up to eight boilers c/w Indoor outdoor reset and lead lag control. Control shall be equipped and ready with 4-20 mA remote set point or modulating control, capable with 0-10 VDC remote set point or modulating control. Control is BMS Modbus RTU protocol ready and capable of other alternate protocol conversions with additional optional gateway protocol converter. Control shall be supplied with a mounted multi-line user configurable display which shall also provide for control system configuration and set up, readouts of boiler target, differential and inlet/outlet temperatures as well as accumulated runtime, enunciator diagnostics, and firing rates. The display shall be accessed through a 5- way touchpad high resolution LCD control with shortcut key access with user and installer protected parameters. The boiler safety control string shall be furnished with controls for optional low gas pressure, optional high gas pressure, blocked flue, high limit, stack limit and flow switch. A current transformer is supplied with all wall hung models to perform flow switch functionality. A paddle style flow switch shall be provided loose on floor mount models. Additional control safeties shall include flame rectification, fan speed,and high limit.

.2 **All alarms including but not limited to low water, high/low temperature, pressure, failure, etc. shall be supplied with the unit.**

.3 **Provide external boiler water low water cut-off piped in accordance with the requirements of the Manitoba Department of Labour.**

.4 **Provide all other appurtenances as required by the Authorities Having Jurisdiction.**

.5 **Provide condensate neutralizer on drain line, indirectly connected to funnel floor drain as per the mechanical drawings & schematics.**

2.6 **BURNER:**

.1 The burner shall be a premix design and constructed of high temperature stainless steel with metal fiber outer covering to provide modulating firing rates. The burner shall provide equal distribution of heat through the entire heat exchanger. A window view port shall be provided for visual inspection of the boiler during firing.

2.7 **VENTING & AIR INTAKE OPTIONS:**

.1 The following venting options shall be utilized:

- Category II Venting –combined vent*
- Category IV Outside Air (Horizontal & Vertical)
- Category IV Through-wall Venting (Horizontal & Vertical)
- Outdoor Venting
- Category IV Direct Venting

* Category II combined vent shall only employ an engineered vent system prepared by a certified vent manufacturer, this can only be used with DynaMax HS floor mount models (DM 211 – 801)

.2 The following category II and IV vent materials shall be utilized:

1. Stainless or AL29-4C for all system applications.
2. Polypropylene (PPE) for all system applications.
3. CPVC for hydronic heating systems.
4. PVC for select low temperature systems only – consult factory.

.3 The boiler shall be vented as a through-wall (vertical or horizontal) Category IV condensing appliance for up to 100 equivalent ft using material approved for use on condensing application under standard ULC S636 or equivalent, or as permitted by the local jurisdiction. The following air intake options shall be utilized:

- Outside air sealed direct (vertical or horizontal);
- Outside air ducted to jacket flange;
- Indoor air.

.4 Vent sizing shall be confirmed by the supplier.

2.8 GAS TRAIN:

.1 The gas train shall consist of a pressure regulating electro-hydraulic proportional air/gas main gas actuator providing a slow opening, fast closing automatic gas valve safety shutoff valve and gas pressure regulator. Optional high and/or low gas pressure switch is available. Models DM 80 – DM 800 operate with a 5:1 turndown ratio.

2.9 EXTERNAL JACKET AND FASTENERS:

.1 The external jacket shall be of 430 stainless steel mirror finish panels and powder coated steel assembled utilizing interference fit locks and minimal non-strip self tap screws for ease of removal and access to the heat exchanger and combustion air / gas control.

END OF SECTION

PART 1 General

1.1 RELATED DOCUMENTS

.1 Drawings and general provisions of the Contract, including General and Supplementary Conditions & Division 01,21,22,23,25 Specification Sections, apply to this Section.

.2 Section 21 05 01, Mechanical General Provisions.

.3 Section 21 05 05, Basic Materials and Methods.

.4 Sections 22 06 01 and 23 06 01, Approved Substitute Schedules.

.5 Section 23 30 00, Air Distribution.

.6 Section 23 05 53, Vibration Isolation.

.7 Section 23 05 93, Testing and Balancing.

.8 Section 23 21 05, Liquid Heat Transfer.

.9 Section 23 72 00, Dedicated Outdoor Air System (ERV-1).

.10 Comply with the requirements of the Architectural Specifications.

1.2 SUMMARY

.1 A. Section includes design, performance criteria, refrigerants, controls, and installation requirements for air-cooled scroll compressor chillers..

1.3 REFERENCES

.1 Comply with applicable Standards/Codes of AHRI 550/590, ANSI/ASHRAE 15, ETL, cETL, NEC, and OSHA as adopted by the State.

1.4 SUBMITTALS

.1 Submit shop drawings and product data in accordance with the specifications.

.2 Submittals shall include the following:

.1 Dimensioned plan and elevation view drawings, required clearances, and location of all field connections.

.2 Summary of all auxiliary utility requirements such as electricity, water, etc. Summary shall indicate quality and quantity of each required utility.

.3 Single line schematic drawing of the field power hookup requirements, indicating all items that are furnished.

.4 Schematic diagram of control system indicating points for field interface/connection.

.5 Diagram shall fully delineate field and factory wiring.

.6 Installation and operating manuals.

.7 Refer to Section 21 05 01, Mechanical General Provisions, for further requirements.

.3 Operation and Maintenance Data: Each unit to include, operation, and maintenance manual.

.1 Refer to Section 21 05 01, Mechanical General Provisions, for further requirements.

1.5 QUALITY ASSURANCE:

.1 Qualifications: Equipment manufacturer must specialize in the manufacture of the products specified and have five years experience with the type of equipment and refrigerant offered.

.2 Regulatory Requirements: Comply with the codes and standards specified.

.3 Chiller manufacturer plant must be ISO Registered.

1.6 DELIVERY, STORAGE, AND HANDLING:

.1 The outdoor unit shall be delivered to the job site with condensing section completely assembled and a holding charge of nitrogen.

.2 Comply with the manufacturer's instructions for rigging and handling equipment.

.3 Deliver materials to the site in such a matter as to protect the materials from shipping and handling damage. Provide materials on factory provided shipping skids and lifting lugs if required for handling. Materials damaged by the elements should be packaged in such a matter that they could withstand short-term exposure to the elements during transportation.

.4 Store materials in clean, dry place and protect from weather and construction traffic. Handle carefully to avoid damage.

.5 Use all means necessary to protect equipment before, during, and after installation.

.6 All scratched, dented, and otherwise damaged units shall be repaired or replaced as directed by the Architect Engineer.

1.7 WARRANTY:

.1 Standard Warranty (Canada): The refrigeration equipment manufacturer's guarantee shall be for a period of one year from date of equipment start-up but not more than 18 months from shipment. The guarantee shall provide for repair or replacement due to failure by material and workmanship that prove defective within the above period, excluding refrigerant.

1.8 MAINTENANCE:

.1 Maintenance of the chillers shall be the responsibility of the City of Winnipeg and performed in accordance with the manufacturer's instructions.

PART 2 Products and Materials

2.1 MANUFACTURERS

.1 The equipment is based on the following manufacturer and model:

.1 Daikin Applied Air Cooled Chiller.

2.2 UNIT DESCRIPTION

.1 Provide and install as shown on the plans factory-assembled, air-cooled scroll compressor chiller with remote evaporator in the quantity specified. Each outdoor section shall consist of hermetic tandem scroll compressor sets (total of 4 compressors), air-cooled condenser section, microprocessor-based control system and all components necessary for controlled unit operation. A multi-circuit, brazed plate insulated evaporator shall be provided for remote location to be installed and piped to the outdoor unit by the installing contractor. Components shall be shipped with a holding charge of nitrogen.

.2 Chiller shall be functionally tested at the factory to ensure trouble free field operation

2.3 DESIGN REQUIREMENTS

.1 Flow Range: The chiller shall have the ability to support variable flow range down to 40% of nominal design (based on AHRI conditions).

.2 Operating Range: The chiller shall have the ability to control leaving chilled fluid temperature from 15F to 65F.

.3 General: Provide a complete scroll compressor chiller system consisting of an outdoor compressor-condenser section and a remote indoor evaporator as specified herein and as shown on the drawings. The unit shall be in accordance with the standards referenced in section 1.02 and any local codes in effect.

.4 Performance: Refer to the schedule of performance on the drawings. The chiller shall be capable of stable operation to a minimum percentage of full load (without hot gas bypass) of 25%. Performance shall be in accordance with AHRI Standard 550/590.

.5 Acoustics: Sound pressure levels for the unit shall not exceed the following specified levels. All manufacturers shall provide the necessary sound treatment (parts and labor) to meet these levels if required. Sound data shall be provided with the quotation. Test shall be in accordance with AHRI Standard 370.

Sound Pressure (at 30 feet)											
63 Hz	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz	**Overall dBA**	75% Load dBA	50% Load dBA	25% Load dBA
Sound Power											
63 Hz	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz	**Overall dBA**	75% Load dBA	50% Load dBA	25% Load dBA

2.4 CHILLER COMPONENTS

.1 Compressor

.1 The compressors shall be sealed hermetic, scroll type with crankcase oil heater and suction strainer. The compressor motor shall be refrigerant gas cooled, high torque, hermetic induction type, two-pole, with inherent thermal protection on all three phases and shall be mounted on RIS vibration isolator pads. The compressors shall be equipped with an internal module providing compressor protection and communication capability.

.2 Evaporator

.1 The evaporator shall be a compact, high efficiency, dual circuit, brazed plate-to-plate type heat exchanger consisting of parallel stainless steel plates.

.2 The evaporator shall be protected with an external, electric resistance heater plate and insulated with 3/4" (19mm) thick closed-cell polyurethane insulation. This combination shall provide freeze protection down to -20°F (-29°C) ambient air temperature.

.3 The water-side maximum design pressure shall be rated at a minimum of 653 psig (4502 kPa). Evaporators shall be designed and constructed according to, and listed by Underwriters Laboratories (UL).

.3 Condenser

.1 Condenser fans shall be propeller type arranged for vertical air discharge and individually driven by direct-drive fan motors. The fans shall be equipped with a heavy-gauge vinyl-coated fan guard. Fan motors shall be TEAO type with permanently lubricated ball bearings, inherent overload protection, three-phase, direct-drive, 1140 rpm. Each fan section shall be partitioned to avoid cross circulation.

.2 Coil shall be microchannel design and shall have a series of flat tubes containing multiple, parallel flow microchannels layered between the refrigerant manifolds. Tubes shall be 9153 aluminum alloy. Tubes made of 3102 alloy or other alloys of lower corrosion resistance shall not be accepted. Coils shall consist of a two-pass arrangement. Each condenser coil shall be factory leak tested with high-pressure air under water. Coils shall withstand 1000+ hour acidified synthetic sea water fog (SWAAT) test (ASTM G85-02) at 120°F (49°C) with 0% fin loss and develop no leaks.

.4 Refrigerant Circuit

.1 Each of the two refrigerant circuits shall include a replaceable-core refrigerant filter-drier, sight glass with moisture indicator, liquid line solenoid valve (no exceptions), expansion valve, and insulated suction line.

.5 Construction

.1 Unit casing and all structural members and rails shall be fabricated of pre-painted or galvanized steel. Painted parts shall be able to meet ASTM B117, 1000-hour salt spray test.

.2 Upper condenser coil section of unit shall have protective, 12 GA, PVC-coated, wire grille guards.

.6 Control System

.1 A centrally located weatherproof control panel shall contain the field power connection points, control interlock terminals, and control system. Box shall be designed in accordance with NEMA 3R rating. Power and starting components shall include factory circuit breaker for fan motors and control circuit, individual contactors for each fan motor, solid-state compressor three-phase motor overload protection, inherent fan motor overload protection and two power blocks (one per circuit) for connection to remote, contractor supplied disconnect switches. Hinged access doors shall be lockable. Barrier panels or separate enclosures are required to protect against accidental contact with line voltage when accessing the control system.

.2 Shall include high short circuit current rating of 65,000 amps (25,000 amps at 575Volt) with single-point disconnect switch.

.7 Unit Controller

.1 An advanced DDC microprocessor unit controller with a 5-line by 22-character liquid crystal display provides the operating and protection functions. The controller shall take preemptive limiting action in case of high discharge pressure or low evaporator pressure. The controller shall contain the following features as a minimum:

.2 The unit shall be protected in two ways: (1) by alarms that shut the unit down and require manual reset to restore unit operation and (2) by limit alarms that reduce unit operation in response to some out-of-limit condition. Shut down alarms shall activate an alarm signal.

.3 Shutdown Alarms

.1 No evaporator water flow (auto-restart)
.2 Sensor failures
.3 Low evaporator pressure
.4 Evaporator freeze protection
.5 High condenser pressure
.6 Outside ambient temperature (auto-restart)
.7 Motor protection system
.8 Phase voltage protection (Optional)

.4 Limit Alarms

.1 Condenser pressure stage down, unloads unit at high discharge pressures.
.2 Low ambient lockout, shuts off unit at low ambient temperatures.
.3 Low evaporator pressure hold, holds stage #1 until pressure rises.
.4 Low evaporator pressure unload, shuts off one compressor.

.5 Unit Enable Section

.1 Enables unit operation from either local keypad, digital input, or BAS

.6 Unit Mode Selection

.1 Selects standard cooling, ice, glycol, or test operation mode

.7 Analog Inputs:

.1 Reset of leaving water temperature, 4-20 mA\
.2 Current Limit

.8 Digital Inputs

.1 Unit off switch
.2 Remote start/stop
.3 Flow switch
.4 Ice mode switch, converts operation and setpoints for ice production
.5 Motor protection

.9 Digital Outputs

.1 Shutdown alarm; field wired, activates on an alarm condition, off when alarm is cleared
.2 Evaporator pump; field wired, starts pump when unit is set to start

.10 Condenser fan control - The unit controller shall provide control of condenser fans based on compressor discharge pressure.

.11 Building Automation System (BAS) Interface

.1 Factory mounted DDC controller(s) shall support operation on a BACnet® network via one of the data link / physical layers listed below as specified by the successful Building Automation System (BAS) supplier.

.2 BACnet MS/TP master (Clause 9).

.3 The information communicated between the BAS and the factory mounted unit controllers shall include the reading and writing of data to allow unit monitoring, control and alarm notification as specified in the unit sequence of operation and the unit points list.

.4 All communication from the chiller unit controller as specified in the points list shall be via standard BACnet objects. Proprietary BACnet objects shall not be allowed. BACnet communications shall conform to the BACnet protocol (ANSI/ASHRAE135-2001). A BACnet Protocol Implementation Conformance Statement (PICS) shall be provided along with the unit submittal.

2.5 OPTIONS AND ACCESSORIES

.1 The following options are to be included:

.1 Hot Gas Bypass: allows unit operation to 10 percent of full load. Includes factory-mounted hot gas bypass valve, solenoid valve, and manual shutoff valve for each circuit.

.2 Low Ambient Control: Provide fan cycling control to allow unit operation down to 32°F.

.3 Single point electrical power connection.

.4 High Short Circuit Current Rating (HSCCR) 65kA @ 208V.

.5 Ground Fault Protection: Factory installed circuit breaker to protect equipment from damage from line-to-ground fault currents less than those required for conductor protection.

.6 Phase loss with under/over voltage protection and with LED indication of the fault type to guard against compressor motor burnout.

.7 BAS interface module to provide interface with the BACnet MSTP protocol.

.8 Evaporator insulation.

.9 Low noise Compressor Sound Reduction - Acoustic reduction blankets shall be factory installed on each compressor.

.10 The following accessories, if selected, are to be included:

- .1 Protective vinyl-coated, welded-wire base guards.
- .2 Rubber-in-shear vibration isolators for field installation.
- .3 Factory-mounted thermal dispersion type flow switch.
- .4 Field-mounted, paddle type, chilled water flow switch field wired to the control panel to prevent evaporator freeze-up at low flow conditions. (For field installation.)
- .5 Factory mounted refrigerant line shut-off valves.
- .6 Wye strainer, to be installed at the evaporator inlet and sized for the design flow rate , with perforation diameter of 0.063" with blowdown valve and Victaulic couplings (factory mounted or field installed).
- .7 115V GFI convenience outlet.

PART 3 Installation And Execution

3.1 INSTALLATION

.1 Install in strict accordance with manufacturer's requirements, shop drawings, and contract documents.

.2 Adjust and level chiller in alignment on supports.

.3 Coordinate electrical installation with electrical contractor.

.4 Coordinate controls with control contractor.

.5 Install a field-supplied or optional manufacturer-supplied strainer in the chilled water return line at the evaporator inlet that meets manufacturer perforation size specifications.

3.2 START-UP

.1 Provide testing and starting of machine, and instruct the City of Winnipeg in its proper operation and maintenance.

PART 4 Equipment Schedule

4.1 REFER TO MECHANICAL DRAWINGS FOR EQUIPMENT SCHEDULE

END OF SECTION

PART 1 General

1.1 RELATED DOCUMENTS

.1 Drawings and general provisions of the Contract, including General and Supplementary Conditions & Division 01,21,22,23,25 Specification Sections, apply to this Section.

.2 Section 21 05 01, Mechanical General Provisions.

.3 Section 21 05 05, Basic Materials and Methods.

.4 Sections 22 06 01 and 23 06 01, Approved Substitute Schedules.

.5 Section 23 05 53, Vibration Isolation.

.6 Section 23 05 93, Testing and Balancing.

.7 Section 23 21 05, Liquid Heat Transfer & Refrigeration.

.8 Section 23 23 13, Split Passive Energy Recovery Heat Pipes (RHP-1,2)

.9 Section 23 30 00, Air Distribution.

.10 Comply with the requirements of the Architectural Specifications.

1.2 SUMMARY

.1 This Section includes factory assembled and tested, high efficiency, Dual Core energy recovery ventilator (ERV-1).

1.3 SUBMITTALS

.1 Product Data: For each type of product indicated. Include rated capacities, pressure drop, performance curves with selected points indicated, furnished specialties, and accessories.

.2 Shop Drawings: Complete set of manufacturer's prints of evaporative equipment assemblies, control panels, sections and elevations, and unit isolation. Include the following:

.1 Assembled unit dimensions.

.2 Weight and load distribution.

.3 Required clearances for maintenance and operation.

.4 Sizes and locations of piping and wiring connections.

.5 Wiring Diagrams: For power, signal, and control wiring. Differentiate between manufacturer installed and field installed wiring.

.6 Refer to Section 21 05 01, Mechanical General Provisions, for further requirements.

.3 Operation and Maintenance Data: Each unit to include, operation, and maintenance manual.

.1 Refer to Section 21 05 01, Mechanical General Provisions, for further requirements.

1.4 PRODUCT HANDLING:

.1 Protection: Use all means necessary to protect equipment before, during, and after installation.

.2 Replacement and Repair: All scratched, dented, and otherwise damaged units shall be repaired or replaced as directed by the Architect & Engineer.

1.5 DELIVERY, STORAGE, AND HANDLING:

.1 Deliver materials to the site in such a matter as to protect the materials from shipping and handling damage. Provide materials on factory provided shipping skids and lifting lugs if required for handling. Materials damaged by the elements should be packaged in such a matter that they could withstand short-term exposure to the elements during transportation.

.2 Store materials in clean, dry place and protect from weather and construction traffic. Handle carefully to avoid damage.

.3 Use all means necessary to protect equipment before, during, and after installation.

.4 All scratched, dented, and otherwise damaged units shall be repaired or replaced as directed by the Architect Engineer.

PART 2 Products and Materials

2.1 MANUFACTURERS

.1 The equipment is based on the following manufacturer and model.

.1 Tempeff, high efficiency, Dual Core energy recovery ventilator (ERV) as basis of design.

2.2 GENERAL DESCRIPTION

.1 Configuration: Fabricate as detailed on drawings.

2.3 UNIT CONSTRUCTION

.1 Fabricate unit with extruded aluminum channel posts and galvanized panels secured with mechanical fasteners. All access doors shall be sealed with permanently applied bulb-type gasket.

.1 Panels and access doors shall be constructed as a 2-inch (50-mm) nominal thick; 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. Module to module assembly shall be accomplished with self-adhering foam gaskets. Manufacturer shall supply test data demonstrating less than 0.2" deflection for an unsupported 48x48 panel under 30" W.C pressure. Units that cannot demonstrate this deflection are unacceptable.

.2 Access Doors shall be flush mounted to cabinetry, with minimum of two hinges, locking latch and full size handle assembly.

2.4 SUPPLY / RETURN FANS

.1 Provide direct-drive airfoil plenum supply & return fans. 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 Bearings shall be self-aligning, grease lubricated, ball or roller bearings with extended copper lubrication lines to access side of unit. Grease fittings shall be attached to the fan base assembly near access door. If not supplied at the factory, contractor shall mount copper lube lines in the field.

.3 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 2" deflection spring vibration type isolators inside cabinetry.

2.5 BEARINGS AND DRIVES

.1 Bearings: Basic load rating computed in accordance with AFBMA - ANSI Standards, [L-50 life at 200,000 hours – all DWDI fans] [L-50 life at 500,000 hours – DWDI fans on unit sizes 003 - 035], [L-50 life at 400,000 hours all belt-drive airfoil plenum fans and DWDI fans on unit sizes greater than 035] [L-50 life 1,000,000 hours – DWDI fans on unit sizes 003 – 035] [L-50 life at 600,000 hours – all inline fans], heavy duty pillow block type, self-aligning, grease-lubricated ball bearings.

.2 Shafts shall be solid, hot rolled steel, ground and polished, keyed to shaft, and protectively coated with lubricating oil. Hollow shafts are not acceptable.

2.6 ELECTRICAL

.1 The air handler(s) shall bear an ETL listing label for the entire assembly. Units with only components bearing third party safety listing are unacceptable.

.2 On RGP sizes 1000 through 18000 all controls shall be located on the side of the unit for ease of servicing. Alternate manufacturers who supply units with controls on roof must supply a permanently installed ladder to access controls, and appropriate safety rails on roof of unit, meeting all applicable OSHA standards.

.3 Controls must include Self diagnostics with fault and PLC error Code. On board fault detection and diagnostics that senses and alerts when the damper is not operating correctly.

.4 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.

.5 Fan motors shall be 1800 rpm, open drip-proof (ODP)]type. Motors shall be premium efficiency and inverter duty rated. Electrical characteristics shall be as shown in schedule.

.6 Supplier shall provide and mount ABB variable speed drives with electrical characteristics as shown on project schedule.

.7 Air handler manufacturer shall provide and mount a damper hand-off-auto (HOA) switch.

2.7 PARTICULATE FILTERS

.1 Filter section with filter racks and guides with hinged and latching access doors for side loading and removal of filter.

.2 Filter media shall be UL 900 listed, Class I or Class II.

.3 Provide c/w MERV 13 fresh air intake filter.

2.8 ENERGY RECOVERY

.1 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. 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.

.2 Energy Cores shall be Generation 3, comprised of precisely corrugated 0.7mm (0.0276") thick 1100 Series aluminum. Thinner aluminum is unacceptable to prevent deformation should cleaning be required to maintain indoor air quality. Spacing between plates shall be minimum 9 mm (0.35") to assure that frost growth will not restrict airflow or reduce performance. Heat exchangers shall be a minimum or 995 mm (39") long to assure minimum 60 second dwell time. Time between switchovers shall be minimum 60 seconds. Technologies employing shorter heat exchangers are not acceptable due to high cross leakage, and excessive cycling. Maximum allowable face velocity across heat exchangers shall be 490 fpm. Heat exchanger face velocities exceeding 490 fpm are not acceptable.

.3 Heat exchangers shall be sectioned for a maximum section weight of 40 kg (88 lbs) so that the heat exchangers can be easily removed for cleaning to maintain indoor air quality. Sections weighing more are not acceptable. Heat exchanger that require special equipment to remove for cleaning (cranes, hoist etc.) are not acceptable. Heat exchangers shall be durable enough to handle high pressure power washing without deformation.

.4 Unit Cross-leakage shall be maximum 1-3% as defined and tested in accordance with ASHRAE 84 Test Methods. Cross leakage exceed this amount is unacceptable. Manufacturer shall produce testing data reflecting this performance in accordance with ASHRAE 84 test method. . Testing must use the tracer gas method prescribed by ASHRAE 84.

.5 Switchover damper section shall be comprised of multi section low leakage dampers operated by fast acting electric actuators. Pneumatic actuators are not acceptable. 800 CFM-7,000 CFM shall have damper switching times of 0.75 seconds. 7000 CFM-75,000 CFM shall have damper switching times of 1.25 seconds. Dampers that do not switch within the specified times without objectionable noise are not acceptable. This switch over must limit any internal cross leakage below 3%. Test report must be provided showing that the damper configuration meets this requirement. Testing must use the tracer gas method prescribed by ASHRAE 84.

.1 Single blade damper sections are not acceptable. Each damper shall control one of the 4 airways, upper-horizontal, lower-horizontal, forward-vertical and rear-vertical. Dampers shall be capable of orienting to close off outside air to the building without needing external shut off dampers.

.2 Dampers shall also be capable of orienting to allow 100% recirculation of air without using heat recovery device for off peak or unoccupied heating modes. Units incapable of these operations without extra

ductwork are not acceptable. Re-circ design must be capable of pre-warming both heat exchangers simultaneously for morning warm-up cycle. Strategies that only warm one heat exchanger is unacceptable.

.3 Damper seals shall be ½" heavy thickness EPDM bulb seal. Single blade seals are unacceptable due to high leakage and poor sealing.

.4 Damper bearings shall be heavy duty greasable pillow block flange bearings. Bronze or plastic bearings are not acceptable due to high cycle requirements. Bearings shall have a minimum diameter:

.1 800-7000 CFM: ¾" Bearings, maximum of 4 shafts per unit
.2 7,000 – 21,000 CFM: 1" Bearings, maximum of 4 shafts per unit
.3 21,000 CFM and larger – 1" Bearings, maximum of 6 shafts per unit

.5 Damper shafts shall be large diameter shafts meeting:

.1 800-7,000 CFM ¾" Chromium Shafts, maximum of 4 shafts per unit
.2 7,000 – 21,000 CFM - 1" Chromium Shafts, maximum of 4 shafts per unit
.3 21,000 CFM and larger – 2' Diameter Steel shafts, maximum of 6 shafts per unit
.4 Technologies employing smaller diameter shafts, or more shafts per unit are unacceptable as that would be considered light duty, and insufficient to withstand the demanding nature of the application.

.6 Damper manufacturer must provide written documentation that the dampers are capable of a minimum duty cycle of 500,000 cycles annually. Damper Manufacturer shall provide a written warranty on damper manufactures letterhead confirming the warranty.

.6 Recovery cycles shall be controlled by either internal programmed thermostats, or sensors provided by controls contractor, measuring both supply and exhaust air and optimizing performance of both heat recovery and free cooling modes.

PART 3 Installation And Execution

3.1 INSTALLATION

.1 Install in accordance with manufacturer's Installation & Maintenance instructions.

3.2 ENVIRONMENTAL REQUIREMENTS

.1 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.

PART 4 Equipment Schedule

4.1 REFER TO MECHANICAL DRAWINGS FOR EQUIPMENT SCHEDULE

4.2 NOTES/ REMARKS:

1. ERV-1 to be controlled by the central BAS/DDC system. Provide unit factory supplied c/w Variable Speed Drives (VSD) for the exhaust & fresh air fans. Provide factory mounted control panel suitable for DDC controls capability. Dry contacts shall be provided by manufacturer to allow stage/damper control via the DDC System. Coordinate final installation with controls contractor & refer to controls specifications for further requirements.
2. ULC listed, CSA certified.
3. Provide c/w MERV 13 fresh air filter (plus one spare set).
4. Equipment orientation as per the mechanical drawings.
5. 24 Ga galvanized exterior panels & 24 Ga. galvanized liner.
6. 2" insulation.
7. All sections shall come w/ hinged access doors & locking latches on control section.
8. Multi-damper switchover section c/w actuators.
9. Direct Drive plenum fans.
10. Galvanized heat exchanger frames.
11. S/S drain pans under heat exchangers w/ 1" NPT connections.
12. Galvanized damper blades, damper rods, & axles.

END OF SECTION

PART 1 General

1.1 RELATED SECTIONS

.1 Division 01 – General Requirements, Division 03 – Concrete, Division 07 – Thermal and Moisture Protection

.2 Section 01 11 00, Summary of Work

.3 Section 01 23 00, Alternates

.4 Section 01 31 00, Project Management and Co-ordination

.5 Section 03 35 00, Concrete Finishing

.6 Section 03 48 00, Precast Concrete Specialties

.7 Section 07 21 00, Thermal Insulation

.8 Section 07 26 00, Air/Vapour Barrier Membrane

.9 Section 21 05 01, Mechanical General Provisions.

.10 Section 21 05 05, Basic Materials and Methods.

.11 Section 21 07 01, Thermal Insulation.

.12 Sections 22 06 01 and 23 06 01, Approved Substitute Schedules.

.13 Section 23 21 05, Liquid Heat Transfer & Refrigeration.

1.2 SUMMARY

.1 This section outlines the specifications for the implementation of High Density Expanded Polystyrene (EPS) insulation floor panels for radiant in-floor heating & cooling hydronic piping.

1.3 REFERENCES

.1 CAN/ULC S701 Thermal Insulation: Polystyrene Boards & Pipe Coverings

.2 ASTM C578 Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation

.3 ASTM D1622 Apparent Density of Rigid Cellular Plastics

.4 ASTM C165 Measuring Compressive Properties of Thermal Insulations

.5 ASTM C203 Breaking Load & Flexural Properties of Block-Type Thermal Insulation

.6 ASTM C303 Dimensions & Density of Preformed Block & Board-Type Thermal Insulation

.7 ASTM C518 Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus

.8 ASTM D1621 Compressive Properties of Rigid Cellular Properties

.9 ASTM D2842 Water Absorption of Rigid Cellular Plastics

.10 ASTM E96 Water Vapor Transmission of Materials

.11 CCMC Masterformat 07 21 13.06

.12 ASTM E84 Surface Burning Characteristics of Building Materials

.13 CCMC Listing Report 14007-L

1.4 SYSTEM DESCRIPTION

.1 Sheet product shall consist of flame-resistant EPS boards.

.2 The EPS boards shall be manufactured using BASF bead resins.

.3 Sheet panels shall be interlocking.

.4 Hydronic tubing shall be tube rated for radiant-heating systems

1.5 ENVIRONMENTAL DATA

.1 Produced without the use of chlorofluorocarbon (CFCs), hydrochloroflurocarbon (HCFs), or formaldehyde. As a result, sheet panel will not produce harmful emissions to the environment.

1.6 SUBMITTALS

.1 Relevant data for submission before, during and after construction shall include the following:

.1 Laboratory tests or data that validate product compliance with performance criteria specified;

.2 Manufacturer's Product/Design Manual;

.3 Relevant code compliance certificates.

.4 Comply with Section 01 33 00 – Submittal Procedures

.5 Refer to Section 21 05 01, Mechanical General Provisions, for further requirements.

.2 Operation and Maintenance Data: Each unit to include, operation, and maintenance manual.

.1 Refer to Section 21 05 01, Mechanical General Provisions, for further requirements.

1.7 DELIVERY, STORAGE & HANDLING

.1 Packing, Shipping, Handling & Unloading

.1 Product shall be delivered on-site in original factory packaging. All delivered products shall show traceability by bearing on the identification label the location of manufacturing plant, product description, batch/lot number and date produced.

.2 Product shall remain in original factory packaging until ready for installation.

.3 Storage location shall be in an area that will minimize damage or soiling to products.

1.8 PROJECT CONDITIONS

.1 Refer to Division 01 – General Requirements, Division 03 – Concrete, & Division 07 – Thermal and Moisture Protection for further information.

1.9 SEQUENCING

.1 Refer to Division 01 – General Requirements, Division 03 – Concrete, & Division 07 – Thermal and Moisture Protection for further information.

.2 Coordinate all requirements with all other disciplines including, but not limited to: Architectural, Structural, Electrical, Mechanical, & all other requirements set out by the City of Winnipeg.

PART 2 Products And Materials

2.1 MANUFACTURERS

.1 The equipment is based on the following manufacturer:

.1 Heat-Sheet High Density Expanded Polystyrene (EPS) Radiant Floor Panels as manufactured by:

.1 Form Solutions, 840 Division St., Cobourg, ON, Canada, K9A 5R9, phone: 905-373-9346

.2 Beaver Plastics Ltd., 7-26318-TWP RD 531A, Acheson, AB, Canada, T7X 5A3, phone: 780-962-4433

.3 AMC Foam Technologies Inc. 35 Headingley St., Headingley, MB, Canada, R4H 0A8, phone: 204-633-8800

.4 Form Systems, Inc., 330 Caine Dr., Haysville, KS, USA, 67060, phone: 316-522-9285

.5 Perma R Products, 106 Perma R Rd., Johnson City, TN, USA, 37604, phone: 1-800-647-6130

2.2 MATERIALS

.1 BASF Expanded Polystyrene (EPS) bead resins

2.3 MANUFACTURED UNITS

.1 EPS sheet panel:

.1 EPS Type 2 complying with CAN/ULC S701

.2 Minimum compressive strength at 10% deformation = 110 kPa (16 psi).

.3 Minimum water vapour permeance (per inch) = 200 ng/Pa-s-m^2

.4 Grid height = 22mm (7/8”)

.5 Panel size = 609.6mm x 1219.2mm (2 ft x 4 ft)

.6 Tube size = 15.9mm (5/8") nominal diameter, 14.8mm (0.584") inside diameter, 19.05mm (0.75") outside diameter; at 75mm (3") on center spacing

.7 Model HS-R6:

.1 Minimum average thermal resistance value = R-6 (RSI-1.057)

.1 R-value based on weighted average R-value of nodule and panel profile in accordance with ASTM C578 and CAN/ULC S701, at 24°C (75°F).

.2 Panel thickness = 25mm (1")

.3 Panels do not interlock

PART 3 Installation And Execution

3.1 EXAMINATION

.1 Verify site conditions are acceptable for installation of Heat-Sheet

.2 Verify subbase/subfloor is level, smooth and compact before placing Heat-Sheet.

.3 Verify vapour barrier is properly installed

.4 Verify work from trades will not interfere with installation or damage sheet panels

.5 Do not proceed with installation until unacceptable conditions are corrected.

3.2 INSTALLATION

.1 Install sheet panels according to manufacturer's installation instructions, and as indicated on the drawings.

.2 Place a vapour barrier, if required, before laying sheet panels.

.3 To secure the thinner R4 and R6 sheet panels, apply foam friendly adhesive, such as PL300 Foamboard Adhesive, between the sheet panels and the subfloor.

.1 Make provisions to include for all required means to support the EPS insulation sheets to the hollow core concrete.

.4 Be sure to maintain the 3" (75mm) grid spacing pattern. The idea is to have a staggered (running bond) layout rather than rows or columns. This helps keep the panels bound together and reduces waste.

.5 Ensure interlocks are snug (where applicable).

.6 Ensure knob spacing is maintained to ensure proper tube spacing.

.7 Install tubing according to manufacturer's installation instructions.

.8 Ensure the tubing is fully seated when turning a corner before you begin the next run.

.1 Make provisions to include for all required means to hold the in-floor radiant heating/cooling piping to the insulation panel during testing prior to application of topping. Plastic staples, or other approved means, shall be used where required on turns/bends to keep the piping in place.

.9 Install tubing as specified in 23 21 05, Liquid Heat Transfer & Refrigeration, and as indicated on the drawings.

.10 Place concrete according to the drawings, and specifications.

.11 Remove debris on top of sheet panels prior to placing concrete.

3.3 **PROTECTION**

.1 Prior to concrete placement, protect installed Heat-Sheet panels from damage during construction.

.2 See Section 1.7 for additional protection requirements.

END OF SECTION

1 ELECTRICAL GENERAL PROVISIONS

1.1 GENERAL REQUIREMENTS

.1 Comply with the requirements set out for the General Contractor.

1.2 APPLICATION

.1 This Section applies to and is part of all Sections of divisions 26, 27 and 28.

1.3 DEFINITIONS

.1 Notwithstanding any definition elsewhere in the contract documents, wherever the term "Contractor" is used in divisions 26, 27 and 28 Specifications, it means the firm having a contract with the "City" to perform supervise and coordinate all work.

.2 Notwithstanding any definition elsewhere in the contract documents, wherever the term "Sub-Contractor" is used in divisions 26, 27 and 28 Specifications, it means the firm having a contract with the "Contractor" to perform supervise and coordinate all work of that particular Division. This Sub-contractor shall be wholly responsible to the "Contractor" for all work of that Division.

.3 Notwithstanding any definition elsewhere in the contract documents, wherever the term "Engineer" is used in divisions 26, 27 and 28 specifications, it shall refer to Tower Engineering Group, 1 - 1140 Waverley Street, Winnipeg, Manitoba, R3T 0P4, Telephone: (204) 925-1150, Fax: (204) 925-1155.

.4 INSPECTION AUTHORITY means agent of any authority having jurisdiction over construction standards associated with any part of electrical work on site.

.5 ELECTRICAL CODE means Local Code in force at Project location.

.6 INDICATED means as shown on contract drawings or noted in Contract Documents.

.7 Notwithstanding any definition elsewhere in the contract documents, wherever the term "Provide" is used in relationship to equipment, piping etc., in this Division, it means "Supply, Install and Connect, test, commission and put into work order".

.8 Whenever "Drawings and Specifications" are referred to in these documents, it means "the Contract Drawings and Specifications" (including all addenda and post contract revisions) of all Disciplines (Architectural, Structural, Mechanical and Electrical).

1.4 TRADE DEFINITIONS

.1 All work called for in the Contract Documents shall be considered to be within the scope of the Contract, and shall be the responsibility of the Contractor.

.2 The arrangement of the Drawings and Specifications into Divisions, Sections, and Trades is purely arbitrary, with the sole intention of clarifying the scope and content of the work

required to complete the project. The actual division of the work amongst the sub-contractors shall be the responsibility of the Contractor, and the actual division of the work between the sub-sub-contractors shall be the responsibility of the sub-contractors.

.3 The Contractor, at his option and as per his contracts with the Sub-Contractors, may delegate responsibility to the Sub-contractors for the division of the work.

.4 The Sub-contractors, at their option and as per their contracts with the sub-sub-contractors, may delegate responsibility to the sub-sub-contractors for the division of the work.

.5 Sections of the Electrical specifications, and specific but arbitrary responsibility divisions noted in the Electrical Specifications, are not intended to delegate functions nor to delegate work to any specific trade, but may be useful to the Contractor or Sub-contractor when dividing the work amongst the Trades and Sub-trades.

.6 In the event of a dispute regarding the responsibilities of the various trades and sub-trades, the Contractor and Sub-contractors may request information or a recommendation from the Engineers and/or Architect. However, the Contractor and Sub-contractor shall be responsible for determining the final division of work.

1.5 GENERAL SCOPE OF WORK

.1 The Electrical work shall include all labour, materials, equipment, and tools required to install, test and place into operation a complete and fully operational Electrical System consisting of the various sub-systems as described in, but not necessarily limited to, the items in the following Specification Sections and Drawings:

.1	Section 01 90 00	Commissioning
.2	Section 26 00 05	Electrical General Provisions
.3	Section 26 05 01	Basic Electrical Materials and Methods
.4	Section 26 05 04	Miscellaneous Apparatus and Appliances
.5	Section 26 05 21	Wire and Cables
.6	Section 26 05 22	Connectors and Terminations
.7	Section 26 05 28	Grounding
.8	Section 26 05 29	Fastenings and Supports
.9	Section 26 05 31	Cabinets, Splitters, Junction and Pull Boxes
.10	Section 26 05 32	Outlet Boxes and Fittings
.11	Section 26 05 34	Conduit
.12	Section 26 05 36	Cable Tray
.13	Section 26 05 37	Wireways
.14	Section 26 05 43	Underground Conduits & Cables
.15	Section 26 05 80	Mechanical Equipment Connections
.16	Section 26 05 94	Electric Heating and Cooling Controls
.17	Section 26 08 00	Electrical Commissioning
.18	Section 26 09 24	Lighting Control Equipment
.19	Section 26 24 13	Main Distribution Switchboard
.20	Section 26 24 13.10	Load Balance Test Report
.21	Section 26 24 17	Panelboards

.22	Section 26 27 26	Wiring Devices
.23	Section 26 28 14	Fuses
.24	Section 26 28 21	Circuit Breakers
.25	Section 26 28 23	Disconnect Switches – Fused and Non-fused
.26	Section 26 29 01	Contactor
.27	Section 26 43 13	Transient Voltage Surge Suppression
.28	Section 26 50 00	Lighting
.29	Section 26 52 01	Unit Equipment for Emergency Lighting
.30	Section 26 52 01.10	Emergency Lighting Verification
.31	Section 27 05 13	Voice Data Communication System
.32	Section 27 05 14	Communications System Raceways
.33	Section 27 05 17	Copper CAT 6 Data
.34	Section 27 05 18	Fibre Optic WAN Riser System
.35	Section 27 51 16	Public Address System
.36	Section 28 16 00	Security and Intrusion Alarm System
.37	Section 28 23 00	Closed Circuit Television System
.38	Section 28 31 01	Fire Alarm System
.39	Section 28 31 01.10	Fire Alarm Verification
.40	Drawing E1.1	Electrical Site Plan
.41	Drawing E2.0	Electrical Lighting Layout Crawlspace
.42	Drawing E2.1	Electrical Lighting Layout Main Floor
.43	Drawing E3.0	Electrical Power and Systems Layout Crawlspace
.44	Drawing E3.1	Electrical Power and Systems Layout Main Floor
.45	Drawing E4.0	Electrical Life Safety Layout Crawlspace
.46	Drawing E4.1	Electrical Life Safety Layout Main Floor
.47	Drawing E5.1	Electrical Schedules
.48	Drawing E6.1	Electrical SLD, Riser Diagram and Details

1.6 DETAILED SCOPE OF WORK

.1 The detailed Scope of Work includes, but is not limited to:

.1 Provision of all labour, new materials, tools, transportation, services and facilities for a complete electrical installation to the satisfaction of the Electrical Engineer or City.

.2 All other work as described herein or as shown on the drawings.

.3 Arranging for and coordination the utilities work for underground power, data, and telephone service for the proposed building. Provide underground conduits, trenching, back filling as required by Utilities and as shown or indicated on drawings.

.4 Provision of complete power distribution system including main distribution, sub-distributions, feeders and panelboards.

.5 Provision of a complete operational lighting systems including conduits, fixtures, lamps, wire, switches, boxes, termination, associated contactors and interface with control systems.

.6 Provision of all Emergency and Exit lighting system including conduit, wire remote heads, batteries and battery charging system. Systems shall be complete in every respect.

.7 Provision of a complete Fire Alarm System.

.8 Provision of power supply to all mechanical equipment and controls. Provide motor control as indicated.

.9 Provision of a complete receptacle system including conduits, wire, receptacle, boxes and termination.

.10 Provision of a complete, effective grounding and bonding system.

.11 Provision of complete conduit and wiring infrastructure for security systems including wire, conduit, boxes, and pull string for, access control, intrusion and CCTV systems.

.12 Provision complete voice data system including conduit, cables, cable trays.

.13 Electrical Contractor shall be responsible to coordinate, submit and facilitate all items related to Manitoba Power Smart program incentives. All rebates to be forwarded to the City.

1.7 CASH ALLOWANCES

.1 For information regarding Cash Allowances, refer to the Architectural Specifications.

.2 For information regarding Cash Allowances, refer to the Specifications set out for the General Contractor.

.3 Cash Allowances are to be carried by the General Contractor, not by the Electrical Contractor unless specifically noted otherwise.

1.8 SUPPLEMENTARY TENDER FORM

.1 At tender close, submit a copy of the Electrical Supplementary Tender Form showing all requested information.

.2 There will be no substitution of named Subtrades / Manufactures after tender close except as approved by the Engineer.

1.9 SITE EXAMINATION

.1 Visit and inspect the site of the work to verify the location and elevation of existing items and services (such as piping, ductwork, lighting, conduit, ceilings, walls, columns, beams, etc.) which may affect the Tender and work of this Division, before submission of tender and proceeding with the work.

.2 Make allowance to relocate all existing items/services as required, or to provide alternate locations/routings of new items/services as required. Confirm alternate locations/routings with the City/Architect/Engineer prior to submitting Tender Pricing.

.3 Claims for extra payments resulting from conditions which could have reasonably been foreseen during a pre-tender site examination will not be considered.

1.10 ELECTRICAL DRAWINGS

.1 The Drawings for the Electrical work are performance drawings, diagrammatic and approximately to scale, intended to convey the scope of work and indicate the general arrangement and approximate location of devices, fixtures, panelboards and conduit / cable runs. These Drawings do not intend to show Architectural and Structural details.

.2 Do not scale the Drawings. Obtain information involving accurate dimensions from dimensions shown on the Architectural and Structural drawings, and by site measurement.

.3 Even though some conduit, cables and systems is not completely shown or is shown schematically, and all details are not shown or specified, it is expected that the contractors be familiar enough with their fields of work to complete the project to the standards generally adhered to by the local industry, including good workmanship and common sense. The Engineer reserves the right to furnish any additional detail drawings, which, in the judgement of the Engineer, may be necessary to clarify the work, and such drawings shall form a part of this contract. The work for such Clarifications shall be at no cost to the City.

.4 Make, at no additional cost, any changes or additions to materials, and/or equipment necessary to accommodate structural conditions, pipes, ducts, beams, columns etc, and to provide complete and adequate service clearance.

.5 The exact location of the Electrical components may be changed by the contractors to suit site conditions, provided the changes are reviewed with the Engineer, the changes are duly noted on the 'Record' drawings, and the changes do not affect the operation or code-compliance of the system(s). Any such changes shall be at no cost to the City.

1.11 CHANGES TO THE SCOPE OF WORK

.1 From time to time during construction, changes to the scope of work may be proposed by the City. These Proposed Changes are to be priced by the contractors in a timely manner. Only after the City has reviewed and accepted the pricing, will these Proposed Changes be added to the contract.

.2 Pricing for the Electrical portions of these Proposed Changes shall be submitted by the Sub-contractor to the Contractor complete with price breakdowns as follows:

.1 Sub-sub-contractors' prices c/w labor, material and overhead prices broken out.

.2 Sub-contractor's price c/w labor, material and overhead prices broken out.

.3 Pricing shall be submitted on an item-by-item basis. Each Proposed Change may contain more than one item.

1.12 PHASING

.1 This project involves sequential construction in phases. Refer to the Architectural Drawings and Specifications for exact requirements.

.2 During all phases of the work, certain portions of the facility must be kept fully functional. Re-route existing services and/or provide temporary service connections as required to meet this objective.

.3 Coordinate with the City and other contractors as required for shut-down of services.

.4 Provide start-up, testing, verification and certification of the Electrical Systems at the Occupancy Stage of each construction phase.

.5 Provide for partial fire alarm verification reports as required to accommodate phasing and occupancy requirements.

.6 The contractors shall be responsible for determining the exact requirements for Phasing.

1.13 LIABILITY

.1 Maintain all necessary insurance coverage to save and indemnify the City.

.2 Protect and maintain the work until the project has been completed and turned over to the City. Protect the building and contents from damage during the construction period. Repair all damages without additional cost to the City.

.3 Special care shall be taken to insure that any existing equipment, structures, components and property are not damaged during the construction period. Repair all damages without additional cost to the City.

1.14 WORK SCHEDULE

.1 Unless otherwise noted, the work shall be scheduled for normal hours. The contractors shall be aware that off-hour work may be necessary for certain locations or types of work, and shall include the extra costs in the tender price.

.2 Where the work requires the contractors to be in occupied areas, or where building services may be disrupted, the contractors shall closely coordinate the hours and areas of work with the Citys and occupants.

.3 It shall be the responsibility of the Contractor to schedule the work to meet the City's completion date. The Contractor shall coordinate the sub-trades and adjust the workforce as required to meet the schedule.

1.15 SUPERVISION

.1 Maintain at this job site qualified personnel and supporting staff with proven experience in supervising, installing and commissioning projects of comparable nature and complexity.

.2 Supervision personnel and their qualifications are subject to the approval of the Engineer.

1.16 ENGINEERING SITE REVIEW

.1 The Sub-Contractor's work will be reviewed periodically by the City, the Engineer, or their representatives, solely for the purpose of determining the general quality of the work. Guidance will be offered to the contractors in regard to interpretation of plans and specifications, to assist them in carrying out the work. Inspections, and directives given to the contractors, do not relieve the Contractor, and his agents, servants and employees, of his responsibility to provide the work in all of its parts, in a safe and workmanlike manner, and in accordance with the plans and specifications, nor impose upon the City, and/or Engineer or their representatives, any responsibility to supervise or oversee the erection or installation of any work.

.2 The Engineer will issue inspection reports and deficiency lists from time to time. All deficiencies shall be cleared up to the satisfaction of the Engineer within a reasonably short time.

1.17 PATENTS

.1 Pay all royalties and license fees, and defend all suits or claims, for infringement of any patent rights, and save the City and Engineer harmless of loss or annoyance on account of suit, or claims of any kind for violation or infringement of any letters patent or patent rights, by this Contractor or anyone directly or indirectly employed by him, or by reason of the use by him or them of any part, machine, manufacture or composition of matter on the work, in violation or infringement on such letters patent or rights.

1.18 CONSTRUCTION DRAWINGS

.1 Where requested, prepare drawings in conjunction with all trades concerned, showing sleeves and openings for passage through structures, and all inserts, equipment bases, sumps and pits, supports, etc.

1.19 UTILITY SERVICES

.1 Coordinate, arrange, and pay for all utility relocations, terminations and connections as required and shown on the drawings, complete with all required metering.

.2 Install all metering equipment in accordance with utility requirements.

.3 Test all services and provide report(s) as required by the Authorities Having Jurisdiction.

1.20 CODES, PERMITS, FEES AND INSPECTIONS

.1 Comply with the most stringent requirements of the latest editions of the applicable C.S.A. standards; and the requirements of the Authorities Having Jurisdiction; Federal, Provincial and Municipal Codes; and the applicable standards of the Underwriters' Association. These codes and regulations constitute an integral part of these specifications.

.2 In case of conflict, the codes take precedence over the Contract Documents. In no instance reduce the standard or scope of work or intent established by the drawings and specifications by applying any of the codes referred to herein.

.3 Before starting any work, submit the required number of copies of Drawings and Specifications to the Authorities for their approval and comments. Comply with any changes requested as part of the contract, but notify the Engineer immediately of such changes, for proper processing of these requirements. Prepare and furnish any additional drawings, details or information as may be required. Information such as load calculations and other data that may be required can be obtained from the Engineer. Should the authorities require the information on specific forms fill in these forms by transcribing the information provided by the Engineer.

.4 Apply for, obtain, and pay for all required permits, licenses, inspections, examinations, and fees.

.5 Arrange for the inspection of all the work by the Authorities Having Jurisdiction over the work. On completion of the work, present to the Engineer the final unconditional certificate of approval of the inspecting authorities. When the Authorities Having Jurisdiction do not normally issue certificates, provide a declaration confirming that the Authorities have inspected and accepted the work.

1.21 SHOP DRAWINGS

.1 Present a schedule of shop drawings within 2 weeks after the award of the contract, indicating the shop drawing submission and equipment delivery dates.

.2 Shop Drawings submitted by the Contractor shall contain:

.1 Project Information such as Name and Address

.2 Contractor Information such as Name, Address, Phone Numbers

.3 Supplier Information such as Name, Address, Phone Numbers

.4 Equipment Identification using the same System Name and Identification Number as the Contract Documents.

.5 All Equipment Information required for the Engineer to assess the suitability such as:

.1 Make, Model, Size

.1 including schedules where numerous similar items are provided
.2 Physical Data such as:
.1 Dimensions
.2 Materials
.3 Weights
.4 Installation Requirements
.5 Installation Clearances
.3 Performance Data such as:
.1 Volume
.2 Pressure
.3 Capacity
.4 Performance Curves (with specified performance clearly marked)
.4 Motor Data such as:
.1 Horse Power
.2 Voltage/Phases
.3 Efficiency
.5 Wiring and Control Diagrams

.3 Equipment Information may contain standard manufacturer's brochures, catalogue sheets, schematics, diagrams performance charts, illustrations, etc., but must have:

.1 Information which is not applicable crossed off
.2 Available listed options which are being provided clearly marked

.4 Shop Drawing Review:

.1 In addition to project identification, date, etc., the form of stamp used in shop drawing review shall contain the following format:

.1 Drawing:
.1 Reviewed
.2 Reviewed As Noted
.3 Revise and Re-Submit
.4 Not Reviewed

.2 This review by the Engineer is for the sole purpose of ascertaining conformance with the general design concept.

.3 This review shall not mean that the Engineer approved the detail design inherent in the shop drawings, the responsibility for which shall remain with the Sub-contractor submitting same, and such review shall not relieve the Sub-contractor of his responsibility for errors or omissions in the shop drawings, or of his responsibility for meeting all the requirements of the contract documents. The contractors are responsible for confirming and correlating dimensions at the job site, for information that pertains solely to fabrication processes or to techniques of construction and installation, and for coordination of the work of all sub-trades, as well as compliance with codes and inspection authorities such as C.S.A., etc.

.5 Bind one complete set of final shop drawings in each operating and maintenance instruction manual.

.6 Refer to the Architectural General Specifications for additional information.

1.22 COORDINATION

.1 The Contractor shall be responsible for the complete coordination amongst all trades, including timing, completion, deliveries, interference of building components and sequencing of the trades.

.2 The Contractor shall coordinate the Mechanical and Electrical sub-contractors to ensure compatibility of the system components.

.3 The Contractor shall coordinate the Mechanical and Electrical sub-contractors to ensure access to control panels on mechanical equipment for the purpose of completing fire alarm panel connections.

.4 The Contractor shall coordinate all trades to ensure that access doors and panels are of the same manufacturer and of a style appropriate for the intended use.

1.23 EXPEDITING

.1 Continuously check and expedite delivery of equipment and materials. If necessary, inspect at the source of manufacture.

.2 Continuously check and expedite the flow of necessary information to and from all parties involved.

.3 Immediately inform the General Contractor if information is required from him.

1.24 RECORD DRAWINGS

.1 Obtain two sets of white prints and, as the job progresses; mark these prints to accurately indicate the installed work. Have the white prints available for inspection at the site at all times, and present for scrutiny at each job meeting.

.2 At the completion of the work, submit these sets of "Record" drawings to the Engineer for review. Make changes as requested by the Engineer and resubmit. This process will continue until the "Record" drawings are deemed complete by the Engineer.

.3 Arrange and pay for three copies of the final 'Record' Drawings to be produced and labeled 'As Constructed'.

.4 Submit the "Record" and "As-constructed" drawings to the City.

.5 For Additional Information, refer to the Architectural General Specifications.

.6 For Additional Information, refer to the Specifications set out for the General Contractor.

1.25 CUTTING AND PATCHING

.1 The cutting of openings not requiring lintels or other structural support will be the responsibility of the trade requiring the opening. The opening size shall be the minimum required. 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.

.2 Where openings require lintels or other structural support, or roofing work, such openings will be specified under other divisions of this specification.

.3 Cutting, patching, and repairs to existing surfaces required as a result of the removal and/or relocation of existing equipment, piping and/or installation of new equipment in existing buildings is to be included in the tender price.

1.26 WORK IN EXISTING AREAS

.1 Do the work in existing areas to best suit the available space and not interfere with or obstruct the use of the existing facilities.

.2 Cut, cap-off, modify, or extend as necessary or as directed by the Engineer, existing material or equipment to be removed, reused or relocated to suit the work under this contract.

.3 Where disruptions of existing Electrical services are required, coordinate the shut down with the City and do the work at a time and in a manner mutually acceptable. Carefully schedule disruptions to keep "Down Time" to a minimum. Submit a concise written schedule of each disruption at least 72 hours in advance and obtain the City's written consent prior to implementation.

1.27 TEMPORARY SERVICES

.1 Do not use any of the permanent Electrical systems during construction unless specific written approval is obtained from the Engineer.

.2 The use of permanent facilities for temporary construction service shall not affect, in any way, the commencement date of the warranty period.

.3 If the permanent Electrical systems are used during construction, the equipment and systems shall be cleaned and refurbished as required to bring them back to a new/unused condition.

1.28 TEMPORARY AND TRIAL USAGE

.1 The City has the privilege of trial usage of Electrical systems, or parts thereof, for the purpose of testing and learning the operational procedures.

.2 Assist in the trial usage over a length of time, as deemed reasonable by the Engineer, at no extra cost, and do not waive any responsibility because of trial usage.

.3 Trial usage shall not be construed as acceptance by the City.

.4 Provide and pay for all testing required on the system components where, in the opinion of the Engineer, Manufacturer's ratings or specified performance is not being achieved.

1.29 CLEANING

.1 General Clean-up:

.1 The worksite shall be maintained in a condition of general cleanliness and tidiness.

.2 Provide, erect, maintain and remove temporary protective barriers and shelters. Use drop sheets, temporary walls or other means necessary to limit the spread of construction dirt and debris. Barriers shall be used to minimize the spread of dust, smoke, fumes and noise to other portions of the building.

.3 For renovation work, and for phased work where part of the building is occupied, coordinate and cooperate with the occupants throughout the duration of the project to maintain the site in a usable condition.

.4 For renovation work, and for phased work where part of the building is occupied, clean the site to the satisfaction of the occupants at the end of each work day, so as to neither inconvenience the occupants nor hinder the use of the facility.

.5 For renovation work, at the end of the project, provide cleaning services to leave the site in as clean a condition as existed before the commencement of the work.

.2 Electrical Systems Clean-up:

.1 At the completion of the project, leave all systems in full operation, the exterior of all new and renovated systems clean, and the work areas cleaned to the satisfaction of the Engineer, City and Occupants.

.2 Clean exposed surfaces of new and renovated electrical equipment, light fixtures, panelboards, control panels, etc.

.3 The level of cleaning shall be consistent with the intended use of the building and the electrical systems.

.4 The City reserves the right to inspect the Electrical Systems to determine the effectiveness of the cleaning. Where cleaning is deemed to be unacceptable, the cleaning shall be re-done at no extra charge to the City.

1.30 INSTRUCTIONS TO ONWERS

.1 Prepare a Suitable List/Sign-off Sheet to indicate the Instructions and Materials provided.

.1 List shall include all Systems.

.2 List shall include all Materials.

.3 List shall include spaces for Sign-off Names and Dates for the Contract Administrator.

.2 Instruct the City in all aspects of the operation of the systems and equipment.

.3 Arrange and pay for the services of Manufacturers' representatives required for the instruction on specialized portions of the installation.

.4 Assemble three Operation and Maintenance Manuals in three ring binders with index tabs, each containing:

.1 this Sub-contractor's and suppliers names and telephone numbers,
.2 a complete set of reviewed shop drawings,
.3 brochures,
.4 data sheets,
.5 operating, maintenance, and lubricating instructions,
.6 wiring diagrams,
.7 controls ‘As-Built’ shop drawings,
.8 commissioning information,
.9 warrantee certificates.

.5 Present all copies of the Operation and Maintenance Manuals to the Engineer for review. The Engineer will review the manuals and return them with comments. The Sub-contractor shall make all requested changes. This process shall continue until the Manuals are deemed complete by the Engineer. The Sub-contractor shall turn over the completed manuals to the City.

.6 Present all copies of the Final Record Drawings to the City.

1.31 SPECIAL TOOLS AND SPARE PARTS

.1 Prepare a Suitable List/Sign-off Sheet to indicate the Materials provided.

.1 List shall include all Materials.

.2 List shall include spaces for Sign-off Names and Dates for the City’s Contract Administrator.

.2 Provide spare parts as follows:

.1 Circuit breakers and fuse as indicated in panelboard schedules and single line drawings.
.2 Motor starters as indicated

.3 10 % spare lamps of each type and rating or a minimum of two
.4 Other systems as indicated

.3 Identify spare parts containers as to contents and replacement parts number.

.4 Provide one set of all specialized tools required to service equipment as recommended by the Manufacturers.

1.32 WARRANTIES

.1 No certificate issued, payment made, or partial or entire use of the system(s) by the City, shall be construed as acceptance of defective work or material.

.2 Include copies of all warranty and guaranty certificates and declarations in the Operating and Maintenance Manuals, in the appropriate sections.

.3 Provide a certificate or declaration indicating the warranty and conditions.

.4 Warranty satisfactory operation of all work and equipment installed under this contract. Repair or replace at no charge to the City, all items which fail or prove to be defective within the Warranty period, provided that the failure is not due to improper usage by the City. Make good all damages incurred as a result of the failure and of the repair of the system(s).

.5 The warranty shall be for all parts and labour. Do not expect any participation from the City's personnel in the correction of warranty related work.

.6 For systems, equipment and components which are used continuously throughout the year, the normal warranty period shall be one calendar year from the date of Substantial Completion. For seasonal equipment, components and systems which are not normally used continuously throughout the year, the warranty period shall include at least one full season of satisfactory operation.

.7 When equipment or systems are put into use subsequent to the acceptance of the building, or a portion of the building, the warranty period for seasonally used equipment and systems shall be deemed to commence from the date of satisfactory operation, not from the date of final acceptance by the City.

.8 The City retains the right to demand, and to receive, an extension of the original construction warranty for any equipment, component or system which consistently fails to perform, or which requires repeated repair or adjustment.

.9 Wherever manufacturer's warranties in excess of the Contractor's warranty are provided, furnish the City with copies of the Certificates, dated and acknowledged, and inserted in the O and M Manuals. The Contractors Warranty shall include a list of the Manufacturer's extended warranties.

.10 Warranty work shall be carried out within a reasonable time period following the reporting of the problem. Should the repair time for any failed component be

unreasonably long, as determined by the City, make alternate arrangements to have a temporary replacement component made available until such time that the original component is repaired and re-installed. There shall be no additional cost to the City for any temporary replacement component or for any labour required to implement the work.

1.33 DOCUMENTATION AND SYSTEM(S) ACCEPTANCE

.1 The Contractor shall prepare a suitable document to be signed by the City or his Contract Administrator, confirming:

.1 The City has received satisfactory instruction in the operation and maintenance of all equipment and systems.

.2 The Operation and maintenance manuals have been received and reviewed by the City.

.3 The "Record" and "As-constructed" drawings have been received and reviewed by the City.

.4 Specified spare parts, components, keys, removable handles, tools and the like, have been accepted by the City.

1.34 COMPLETION

.1 The Contractor shall be aware that it is the Engineer's intention to withhold recommendations for payment of progress claims totalling more than 92.5% of the electrical contract until the project is declared Substantially Complete.

.2 The close-out procedure may entail a take-over and occupancy of the building in more than one stage, depending on the specified phasing and the City's timetable.

.3 SUBSTANTIAL COMPLETION

.1 The project will be ready for a Substantial Completion inspection only when it is ready for the City to occupy and utilize the building for its intended purpose.

.2 At Substantial Completion, the City will realise that some deficiencies may still exist.

.3 In preparation for the inspection to determine Substantial Completion for all or a portion of the project, the Contractor shall ensure and declare in writing that:

.1 Except for seasonal deficiencies, the Start-up and Verification of the Commissioning Process has been completed, and all systems are fully functional.

.2 All systems and equipment have been cleaned.

.3 All systems and equipment have been identified and labelled.

.4 The preliminary Record drawings have been submitted for review.

.5 One set of preliminary O and M Manuals have been submitted for review.

.6 Instructions to the City have been given.

.7 Maintenance Materials and Spare Parts have been provided.

.4 When the Contractor is satisfied that the entire project is completed, and after making his own inspection, he shall apply, in writing, to the City and/or Engineer, for an inspection to determine if the project can be deemed to be Substantially Complete.

.5 In the letter of request, a date shall be specified upon which the project can be delivered and be Substantially Complete.

.6 During the inspection, a deficiency list will be compiled and a report will be issued. These deficiencies shall be corrected or completed in a satisfactory and timely manner.

.7 Based on the inspection report, the City will retain a sum of money, sufficient in his estimation to cover the cost of completing the deficiencies.

.4 TOTAL COMPLETION

.1 When the Contractor has determined that the deficiencies noted during the Substantial Completion inspection have been completed or corrected, he shall apply, in writing, to the City and/or Engineer, for a final inspection to determine if the project can be deemed to Totally Complete.

.2 In the letter of request, a date shall be specified upon which the project can be delivered and be Totally Complete.

.3 In preparation for the inspection to determine Total Completion for all or a portion of the project, the Contractor shall ensure and declare in writing that:

.1 All aspects of the Commissioning Process have been completed.

.2 The final Record and As-Constructed drawings have been submitted, reviewed and accepted.

.3 The final O and M Manuals have been submitted, reviewed and accepted.

.4 The deficiencies noted during the Substantial Completion inspection have been corrected or completed.

.4 During the inspection, a deficiency list will be compiled and a report will be issued. These deficiencies shall be corrected or completed in a satisfactory and timely manner.

.5 Based on the inspection report, the City will retain a sum of money, sufficient in his estimation to cover the cost of completing the deficiencies.

.6 Final Payment will only be made after the project has been determined to be Totally Complete, with all deficiencies satisfactorily corrected.

END OF SECTION

1 GENERAL

1.1 RELATED WORK

.1 Bidding & Contract Requirements Division 0

.2 General Requirements Division 1

.3 All Electrical Drawings and Division 26, 27 and 28 specification sections.

.4 All Mechanical Drawings and Mechanical specification sections.

1.2 QUALITY ASSURANCE

.1 Do complete installations in accordance with local standard.

.2 While not identified and specified by number in this Division, comply with CSA Electrical Bulletins in force at time of tender submission. Comply with the requirements of all Provincial and local laws, rules, ordinances and codes.

.3 Electrical installation shall be in accordance with the current edition of the Electrical Code, Provincial and other codes, rules and regulations. Supply material and labour required to meet the requirements of these codes, rules and regulations even though the work is not shown on the drawings or mentioned in the specifications. Where the electrical installation calls for better quality materials or construction than the minimum requirements of these codes, rules and regulations, the electrical installation shall be as shown on the drawings and as specified.

1.3 PERMITS, FEES

.1 Submit to Electrical Inspection Department and Supply Authority necessary number of drawings and specifications for examination and approval prior to commencement of work. Additional drawings for approval will be provided by the consultant.

.2 Obtain all necessary permits required for the electrical installation.

.3 Pay all fees for permits and inspections as required for the electrical installation.

1.4 SUBMITTALS

.1 Submit shop drawings and product data for review by the Consultant. All drawings must be in English with Imperial dimensions or in metric where indicated. Manufacture of equipment must not commence until shop drawings have been reviewed.

.2 Indicate details of construction, dimensions, capacities, weights and electrical performance characteristics of equipment or material.

.3 Where applicable, include wiring, single line and schematic diagrams.

.4 Include wiring drawings or diagrams showing interconnection with work of other Sections.

.5 Submit samples in accordance with General Conditions. Samples shall be forwarded to the Consultant's office. Pay all transportation costs to ship samples to Consultant's office and return. Approved samples will be retained until after tender closing, then all samples will be returned except for the sample submitted by the manufacturer who has been listed by the successful Contractor in the Tender Documents. This sample will be used for comparison with the actual production run of successful manufacturer.

.6 Required shop drawing section:

.1	26 05 04	Miscellaneous Apparatus and Appliances
.2	26 05 31	Cabinets, Splitters, J.B.'s
.1	26 05 36	Cable Tray
.3	26 05 94	Electric Heating Equipment
.4	26 09 01	Contactors
.5	26 09 24	Lighting Control Equipment
.6	26 24 13	Main Distribution
.7	26 24 17	Panelboards
.8	26 27 26	Wiring Devices
.9	26 28 14	Fuses
.10	26 28 21	Breaker
.11	26 28 23	Disconnect Switches
.12	26 29 10	Starters
.13	26 50 00	Lighting
.14	26 52 01	Unit Equipment for Emergency Lighting
.15	28 31 01	Fire Alarm System

1.5 OPERATIONS AND MAINTENANCE DATA

.1 Provide operation and maintenance data for incorporation into Maintenance Manuals.

.2 Include details of design elements, construction features, component function and maintenance requirements and schedules to permit effective start-up, operation, maintenance, repair, modification, extension and expansion of any portion or feature of installation.

.3 Include technical data, product data, supplemented by bulletins, component illustrations, exploded views, technical descriptions of items, and parts lists. Advertising or sales literature not acceptable.

.4 Include wiring and schematic diagrams and performance curves.

.5 Include names and addresses of local suppliers for items included in Maintenance Manuals.

.6 Submit Maintenance Manuals to the Consultant for review. Manuals that are incomplete shall be returned to the Electrical Subcontractor for completion. Completed manuals must be submitted, to the satisfaction of the Consultant, before final payment may be considered to be due.

1.6 MAINTENANCE MANUALS

.1 Provide maintenance materials and information as specified.

.2 Turn materials over to City in an orderly fashion upon completion of installation.

.3 Maintenance manuals shall contain a copy of the final verification report and certificate, as well as a copy of the electrical inspection certificate.

1.7 EXAMINATION OF SITE AND CONSTRUCTION DOCUMENTS

.1 Attend pre-tender site meeting as scheduled and request further information or clarifications at that time.

.2 Prior to submitting a tender, examine the site and local conditions which will affect the work. Claims for extra payments, resulting from conditions which could reasonably be foreseen during an examination of the documents and site, will not be recognized.

1.8 PRICING OF CHANGES AFTER TENDER

.1 The consultant reserves the right to review costing using accepted Contractor's Pricing Standards.

1.9 OTHER TRADES

.1 Include in cost all work by subtrades, such as painting, coring, plastering, access doors etc. to restore all finished areas to original finish.

.2 Schedule execution of electrical work with associated work specified in other Divisions.

.3 Coordinate electrical work to avoid conflicts with pipes, air ducts or other equipment.

1.10 DELIVERY, STORAGE AND HANDLING

.1 Deliver all materials to site in an orderly fashion and in accordance with schedule.

.2 Provide additional protection such as tarps, padding, wood skids, etc., where such is required to ensure protection of equipment and as directed by the Consultant.

1.11 PROJECT RECORD DOCUMENTS

.1 The Electrical Contractor shall maintain one set of white prints on site to record all changes to the Contract Drawings, which affect electrical layouts of equipment. Record

drawings shall indicate all circuit wiring and all conduit runs, circuit numbers and devices. All relocations of equipment shall be shown. At project completion, the Contractor shall transfer the record information to a clean set of white prints, using recognized drafting standards, and stamp drawings As-Built, including the company name, date and signature of site Supervisor.

2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT

.1 Provide labour, materials, transportation, equipment and facilities, etc., required for the complete electrical installation as indicated or implied on the drawings and specifications.

.2 Electrical equipment shall be new and of type and quality specified.

.3 Equipment and material to be CSA certified, and manufactured to standards described. Where there is no alternative to supplying equipment which is not CSA certified, obtain special approval from the appropriate Inspection Departments.

.4 All motors (including motors used for mechanical equipment) shall comply with the relevant appliance or equipment efficiency act or CAN/CSA-C390, article 4-10.

2.2 VOLTAGE RATINGS

.1 Operating voltages: to CAN3-C235.

.2 Motors, electric heating, control and distribution devices and equipment to operate satisfactorily at 60 Hz within normal operating limits established by above standard. Equipment to operate in extreme operating conditions established in above standard without damage to equipment.

3 EXECUTION

3.1 INSPECTION

.1 Furnish a Certificate of Acceptance from the Inspection Authorities on completion of work. Copies of Certificate to be included in Maintenance Manuals.

.2 Certificate of Inspection and Approval must be submitted before final payment may be considered to be due.

.3 During the course of the project construction, the Consultant will carry out periodic inspections and prepare a deficiency list for remedial action by the Electrical Subcontractor. When requested, the Electrical Contractor shall respond in writing to the Consultant, stating corrective action and completion date for each item listed as deficient. This response shall be in the hands of the Consultant within three working days of receipt

of the Site Observation Report.

3.2 CARE, OPERATION AND START-UP

.1 Instruct the Building Manager's personnel in the operation, care and maintenance of equipment. Arrangement of such instructional sessions to be done at a time convenient to the City.

.2 Arrange and pay for services of manufacturer's factory service engineer to supervise start-up of installation, check, adjust, balance and calibrate components.

.3 Provide these services for such a period, and for as many visits as necessary to put equipment into operation, and ensure that operating personnel are conversant with all aspects of its care and operation.

3.3 FINISHES

.1 Clean and touch up surfaces of shop-painted equipment, scratched or marred during shipment or installation, to match original paint.

.2 Clean, prime and paint exposed hangers, racks, fastenings to prevent rusting.

3.4 EQUIPMENT IDENTIFICATION

.1 Identify electrical equipment with lamacoid nameplates.

.2 Provide lamacoid nameplates, 1/8" (3 mm) thick plastic engraving sheet, white face, black core, mechanically attached (screwed or rivetted) unless specified otherwise. Sizes as follows:

Size 0	3/8" x 1 ½"	(10 x 38 mm)	1 line 1/8" (3 mm) high letters
Size 1	3/8" x 4"	(10 x 100 mm)	1 line 1/8" (3 mm) high letters
Size 2	½" x 3"	(13 x 75 mm)	1 line 3/16"(5 mm) high letters
Size 3	½" x 3"	(13 x 75 mm)	2 lines 1/8" (3 mm) high letters
Size 4	3/4" x 3"	(19 x 75 mm)	1 line 3/8" (10 mm) high letters
Size 5	3/4" x 4"	(19 x 100 mm)	2 lines 3/16"(5 mm) high letters
Size 6	1" x 4"	(25 x 100 mm)	1 line ½" (13 mm) high letters
Size 7	1" x 4"	(25 x 100 mm)	2 lines 1/4" (6 mm) high letters

.3 Wording on nameplates to be approved prior to manufacture. Submit schedule of nameplates and wording to City (where existing systems are modified or added to) and to the Consultant for new construction.

.4 Allow for average of twenty-five (25) letters per nameplate.

.5 Identification to be English and French on separate nameplates.

.6 Nameplates for terminal cabinets and junction boxes to indicate system, circuit, loop

numbers.

.7 Use red nameplates with white lettering for fire alarm equipment. Use blue nameplates with white lettering for UPS power circuits.

.8 Use heat shrink type markers or CAB-3 cable marking system (Pass & Seymour) for all conductors and cables. Mark cables at both ends, see detail 1/E2. Mark fire alarm, card access and LAN cables. Confirm labels with consultant.

3.5 LOCATION OF OUTLETS

.1 Change location of outlets at no extra cost or credit, providing distance does not exceed 10'-0" (3 m) and information is provided before installation.

3.6 MOUNTING

.1 Mounting height of equipment is from finished floor to centerline of equipment unless specified or indicated otherwise.

.2 Refer to Architectural elevations and details for mounting heights.

.3 If mounting height of equipment is not indicated, verify with Engineer and Architect before proceeding with installation.

.4 Install electrical equipment at the following heights unless indicated or directed otherwise (to bottom of outlet).

.1 Outlets above counters: 6" (150 mm); splashbacks: 4" (100 mm).

.2 General receptacles, telephone and television outlets: 16" (400 mm).

.3 Receptacles in mechanical and shop areas: 40" (1 m).

.4 Switches, dimmers, push buttons, Luxo bracket: 47" (1.2 m) above the finished floor level measured from the centre of the device box.

.5 Fire alarm pullstations, intercoms, thermostats: 47" (1.2m) above the finished floor level measured from the centre of the device box.

.6 End of line resistors: 64" (1.6 m).

.7 Fire alarm horns: 88" (2.2 m).

.8 Panelboards, annunciators, etc.: 78" (2.0 m) to top.

.9 Clock outlets: 84" (2.15 m).

.10 Power door operator for person using wheel chair to be located and operated with

two heights: one with its centre located 35 1/2" (900mm) from the finished floor level; and the other with its centre located 9" (225mm) from the finished floor level.

.11 As per Architectural elevations.

.12 Heights as above or at bottom of nearest block or brick course.

.13 Wall mounted telephone: 60" (1525mm).

.5 All floor-mounted electrical equipment shall be mounted on 4" (100 mm) concrete housekeeping pads. The Electrical Contractor shall be responsible for provision of these pads. Where ceiling heights will not allow housekeeping pads to be installed below distributions, and where pre-approved by the Consultant, 1 ½" (38 mm) galvanized cantruss shall be provided in place of the pad.

3.7 CONDUIT SLEEVES AND HOLES

.1 Make necessary arrangements for cutting of chases, coring of holes and other structural work required to install electrical conduits, cables, pullboxes and outlet boxes.

.2 Install cables, conduits, and fittings to be embedded or plastered over, neatly and close to building structure so furring can be kept to minimum.

.3 The contractor shall satisfy himself by X-Ray or other acceptable means that coring through the floor slab will not disturb existing conduit or cables. The contractor will be responsible for resulting disruptions and required refurbishments.

3.8 FIREFPROOFING

.1 Where cables or conduits pass through floors, block or concrete walls and fire rated walls, provide fire stop to maintain rating.

.2 Refer to Architectural drawings and specifications, and conform with all requirements therein.

.3 Acceptable manufacturers (where Architects specifications do not provide details) are Dow Corning Firestop, A/D Fire Barrier Silicone Sealant, Ener Stop - Ancron Corporation. Install fire stop with strict attention to manufacturers directions. Include directions in maintenance manuals.

.4 Fireproofing of electrical cables, conduits, trays, etc., passing through fire barriers shall conform to local codes and inspection authorities.

3.9 TESTS

.1 Conduct and pay for tests including, but not limited to, the following systems:

.1 Systems: new electrical distribution system, fire alarm system(s), card access system, low voltage lighting control, parking lot demand controls, mechanical system controls, voice/data infrastructure, emergency lighting system.

.2 Furnish Manufacturer's Certificate or letter confirming that entire installation, as it pertains to each system, has been installed to manufacturer's instructions. Include letters in maintenance manuals.

.3 Carry out tests in presence of Consultant where directed.

.4 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project.

.5 Submit test results in Maintenance Manuals.

3.10 CLEANING

.1 Do final cleaning in accordance with Section 01100.

3.11 CUTTING AND PATCHING

.1 Include the costs of all cutting and patching required for the installation of electrical work.

.2 Obtain the approval of the Consultant, Building Manager and City before arranging for any cutting. Patching shall restore the affected area to the original condition; materials and methods used for patching shall match existing.

3.12 WORKMANSHIP

.1 Install equipment, conduit and cables in a workmanlike manner to present a neat appearance to the satisfaction of the Consultant. Install conduit and cable runs parallel and perpendicular to building lines in chases, behind furring or above ceilings, where such concealment is possible. In areas where systems are to be exposed, install neatly and group in a tidy appearance.

.2 Install equipment and apparatus requiring maintenance, adjustment or eventual replacement, with adequate clearances and accessibility for same.

.3 Include, in the work, all requirements shown on the shop drawings or manufacturer's installation instructions.

.4 Replace work unsatisfactory to the Consultant without extra cost.

3.13 ACCESS DOORS

.1 Access doors to be a minimum #12 gauge prime coat painted bonderized steel. Each to be complete with a heavy flush frame and anchor, concealed hinges, positive locking

screwdriver lock, and mounting and finishing provisions to suit the finish material for which they are supplied. Access doors in fire rated ceilings, walls, partitions, structures, etc. shall be U.L.C. listed and labelled and of a rating to maintain the fire separation integrity.

.2 Refer to Architectural drawings and specifications for requirements and conform there to.

.3 Where access doors are located in surfaces where special finishes are required, they shall be of a recessed door type capable of accepting the finish in which they are to be installed so as to maintain the final building surface appearance throughout.

.4 Supply access doors in inaccessible construction to give access to all concealed junction boxes, pullboxes, conductor joints and other similar electrical work which may need maintenance or repair.

END OF SECTION

1 GENERAL

1.1 RELATED WORK

.1	Basic Electrical Materials and Methods	Section 26 05 01
.2	Wire and Cables	Section 26 05 21
.3	Outlet Boxes and Fittings	Section 26 05 32
.4	Conduit	Section 26 05 34
.5	Wiring Devices	Section 26 27 26

1.2 SYSTEM DESCRIPTION

.1 Make all required electrical connections to devices, equipment, appliances, etc., furnished by other trades or City, as indicated or implied on the drawings or in the specifications.

.2 Provide and install miscellaneous electrical components where required.

1.3 COORDINATION

.1 Verify electrical supply characteristics of all equipment prior to rough-in. Report any discrepancies immediately. Revise wire sizing, device type, connection type, breaker size, etc., as required to accommodate the electrical supply characteristics of the equipment supplied by other trades.

2 PRODUCTS

2.1 GENERAL

.1 Provide all required electrical devices, components, conduits, fittings, wiring, disconnects, and miscellaneous equipment to make all connections to equipment.

.2 Be familiar with the apparatus being supplied and carefully coordinate and cooperate with the supplier/installer to ensure a proper and complete installation.

2.2 RECEPTACLES

.1 Where equipment has line cord and plug, ensure cap is compatible with receptacle. Provide cordsets to equipment where required.

3 EXECUTION

3.1 EQUIPMENT SUPPLIED BY OTHER TRADES OR CITY

.1 Wire and connect all equipment requiring an electrical connection. Install disconnect switches where required.

.2 Provide a direct connection or receptacle and cord set to suit hook-up requirements of each piece of equipment. Confirm connection method with City or General Contractor.

END OF SECTION

1 GENERAL

1.1 RELATED WORK

.1	Conduits, Conduit Fastenings	Section 26 05 34
.2	Connectors and Terminations	Section 26 05 22
.3	Communication Systems	Section 27 05 13
.4	Data Cable Raceway System	Section 27 05 14

2 PRODUCTS

2.1 BUILDING WIRES

.1 Copper conductors: size as indicated, with 300V or 600V insulation of chemically cross-linked thermosetting polyethylene material rated RW90.

.2 All wiring in conduit.

.3 Minimum wire size #12 AWG, copper.

.4 Use #10 for runs longer than 45m (15A branch circuits).

2.2 TECK CABLE

.1 Cable: to CAN/CSA-C22.2 No. 131

.2 Conductors:

.1 Grounding conductor: copper

.2 Circuit conductors: copper, size as indicated

.3 Insulation

.1 Type: ethylene propylene rubber

.2 Chemically cross-linked thermosetting polyethylene rated type RW90, 1000V.

.4 Inner Jacket: polyvinyl chloride material

.5 Armour: interlocking aluminum

.6 Overall covering: polyvinyl chloride material minimum FT4 rated. If installed in plenum, minimum FT6 rated.

.7 Fastening:

.1 One hole steel straps to secure cables 50mm and smaller. Two hole steel straps for cables larger than 50mm.

.2 Channel type supports for two or more cables at 1.0m centers.

.3 Threaded rods: 10mm diameter to support suspended channels.

.8 Connectors:

.1 Watertight, explosion-proof approved for TECK cable.

2.3 ARMOURED CABLES

.1 Conductors: insulated, copper, size as indicated

.2 Type: AC90

.3 Armour: interlocking type fabricated from aluminum strip

.4 Type ACWU – PVC flame retardant jacket, minimum FT4 rated. If installed in plenum, minimum FT6 rated.

.5 Connectors: as per manufacturers recommendations.

2.4 ALUMINUM SHEATHED CABLE

.1 Conductors: copper, size as indicated.

.2 Insulation: type RA90 rated 600V.

.3 Sheath: aluminum applied to form continuous corrugated sheath.

.4 Outer jacket of pvc applied over sheath. Jacket to have LFS/LGE rating minimum FT-4, FT-6 in plenums.

.5 Fastenings for aluminum sheathed cable:

.1 One hole aluminum straps to secure surface cables 25 mm and smaller. Two hole aluminum straps for cables larger than 25 mm. Use aluminum strap only with single conductor cable.

.2 Channel type supports for two or more cables at 1.5 mm centers.

.3 Nine mm diam threaded rods to support suspended channels.

3 EXECUTION

3.1 INSTALLATION OF BUILDING WIRES

.1 Install wiring as follows:

.1 In conduit systems in accordance with Section 26 05 34.

.2 Only cables/wires in totally enclosed noncombustible raceways are permitted to penetrate a fire rated/fire-resistance assembly.

3.2 INSTALLATION OF TECK CABLES 0-1000V

.1 Group cables wherever possible.

.2 Lay cables in trenches in accordance with Section 26.

.3 Lay cables in cabletrays in accordance with Section 26.

.4 Terminate cables in accordance with Section 26 05 20 – Wire and Box Connectors 0-1000V.

3.3 INSTALLATION OF ARMOURED CABLES

.1 Group cables wherever possible.

.2 Lay cables in cabletrays in accordance with Section 26.

.3 Terminate cables in accordance with Section 26 05 20 – Wire and Box Connectors 0-1000V.

3.4 INSTALLATION OF ALUMINUM SHEATHED CABLE

.1 Group cables wherever possible on channels.

.2 Terminate cables in accordance with Section 26 05 22 - Connectors & Terminations.

END OF SECTION

1 GENERAL

1.1 RELATED WORK

.1	Wires and Cables	Section 26 05 21
.2	Grounding	Section 26 05 28

1.2 SHOP DRAWING AND DATA

.1 Submit product data in accordance with section 26 05 01.

1.3 INSPECTION CERTIFICATE

.1 Obtain Inspection Certificate of Compliance covering high voltage connections from inspection authority and include in Maintenance manuals.

2 PRODUCTS

2.1 CONNECTORS AND TERMINATIONS

.1 Copper long barrel compression connectors as required, sized for conductors.

.2 Heat shrink termination kits for connectors.

3 EXECUTION

3.1 INSTALLATION

.1 Install terminations in accordance with manufacturer's instructions.

.2 Bond and ground as required

END OF SECTION

1 GENERAL

1.1 RELATED WORK

.1	Basic Electrical Materials and Methods	Section 26 05 01
.2	Wire and Cable	Section 26 05 21
.3	Conduit	Section 26 05 34
.4	Main Distribution	Section 26 24 13
.5	Panelboards	Section 26 24 17

1.2 REFERENCES

.1 Ground equipment to: CSA C22.2 No.41.

.2 Copper grounding conductors to: CSA G7.1.

2 PRODUCTS

2.1 EQUIPMENT

.1 Grounding conductors system, circuit and equipment, grounding to be bare standard copper, sized in accordance with the Canadian Electrical Code.

.2 Non-corroding accessories necessary for grounding system, type, size, material as indicated, including but not necessarily limited to;
- .1 grounding and bonding bushings
- .2 protective type clamps
- .3 bolted type conductor connectors
- .4 thermit welded type conductor connectors
- .5 boding jumpers, straps
- .6 pressure wire connectors.

3 EXECUTION

3.1 INSTALLATION GENERAL

.1 Install complete permanent, continuous, system and circuit, grounding systems including electrodes, conductors, connectors and accessories to conform to requirements of local authority having jurisdiction over installation.

.2 Install connectors to manufacturer’s instructions.

.3 Protect exposed grounding conductors from mechanical injury.

.4 Make buried connections using copper welding by thermit process.

.5 Use mechanical connectors for grounding connections to equipment provided with lugs. Soldered joints not permitted.

.6 An artificial groundling electrode shall be provided to suit the requirements of the local inspection authorities.

.7 Install bonding wire for flexible conduit, connected to both ends to grounding bushing, solderless lug, clamp or cup washer and screw. Neatly cleat bonding wire to exterior of flexible conduit.

.8 Install separate ground conductor, to exterior pole mounted luminaries.

.9 Make grounding connections in radial configuration only, with connections terminating at single grounding point. Avoid loop connections.

.10 Bond single conductor, metallic armored cables to cabinet at supply end, and provide non-metallic entry plate at load end and run separate ground conductor.

.11 Provide separate ground conductors in PVC conduit, plastic or fibreglass raceways, Metal conduit and EMT.

3.2 SYSTEM AND CIRCUIT GROUNDING

.1 Install system and circuit grounding connections to neutral points of 600V and 208V systems.

.2 Connect isolated ground buses as indicated to “Y” point of transformer immediately upstream of panel. Connection shall be via insulated green ground wire in conduit. Minimum Size #2/0.

3.3 EQUIPMENT GROUNDING

.1 Install grounding connections to typical equipment included in, but not necessarily limited to: service equipment, transformers, frame of motors, motor control centers, starters, control panels, building steel work, generators, elevators distribution panels, outdoor lighting.

3.4 COMMUNICATION SYSTEM

.1 Install grounding connections for telephone, sound, fire alarm, intercommunication systems as follows:
- .1 provide telephone grounding system in accordance with the utilities requirements
- .2 sound, fire alarm, intercommunication systems, as indicated.

3.5 TESTS

.1 Perform tests in accordance with Section 26 05 01.

.2 Perform ground continuity and resistance tests using method appropriate to site conditions and to approval of the local inspection authority. A report shall be submitted to the consultant from the testing agency.

.3 Perform tests before energizing electrical system.

.4 Disconnect ground fault indicator, if provided, during tests.

.5 A ground electrode with an unsatisfactory resistance test result shall be altered as necessary until the required resistance reading is achieved.

END OF SECTION

1 GENERAL

1.1 RELATED WORK

.1	Wires & Cables	Section 26 05 21
.2	Conduits	Section 26 05 34

2 PRODUCTS

2.1 SUPPORT CHANNELS

.1 U shape, size 41 x 41 mm, 2.5 mm thick, surface mounted or suspended as indicated.

3 EXECUTION

3.1 INSTALLATION

.1 Secure equipment to masonry with lead anchors.

.2 Secure equipment to poured concrete with expandable inserts.

.3 Support equipment, conduit or cables using clips, spring loaded bolts, cable clamps designed as accessories to basic channel members.

.4 Fasten exposed conduit or cables to building construction or support system using straps.

.1 One-hole steel straps to secure surface conduits and cables 50 mm and smaller.

.2 Two-hole steel straps for conduits and cables larger than 50 mm.

.3 Beam clamps to secure conduit to exposed steel work.

.5 Support 2 or more cables or conduits on channels supported by 9 mm dia. threaded rod hangers at 1.5m OC where direct fastening to building construction is impractical.

.6 Group conduits on support channels in all corridor ceilings.

.7 Provide metal brackets, frames, hangers, clamps and related types of support structures where indicated or as required to support conduit and cable runs.

.8 Ensure adequate support for raceways and cables dropped vertically to equipment where there is no wall support.

.9 Do not use wire lashing or perforated strap to support or secure raceways or cables.

.10 Do not use supports or equipment installed for other trades for conduit or cable support except with permission of other trade and approval of Engineer.

.11 Install fastenings and supports as required for each type of equipment cables and conduits, and in accordance with manufacturer's installation recommendations.

END OF SECTION

1 GENERAL

1.1 RELATED WORK

.1	Basic Electrical Materials and Methods	Section 26 05 01
.2	Conduits	Section 26 05 34
.3	Fastenings and Supports	Section 26 05 29

2 PRODUCTS

2.1 LOCATION

.1 Locate splitters, junction and pullboxes as indicated or as needed for each system.

2.2 SPLITTERS

.1 Sheet metal enclosure and hinged cover, suitable for locking in closed position.

.2 Main and branch lugs, to match required size and number of incoming and outgoing conductors, as indicated.

.3 Provide minimum three spare terminals on each set of lugs in splitters.

2.3 JUNCTION AND PULLBOXES

.1 Sheet steel construction with screw-on flat covers for surface or recessed mounting.

.2 Covers with 1" (25 mm) minimum extension all around, for flush-mounted pull and junction boxes.

.3 Cast-type with gasketted covers where exposed to weather.

2.4 CABINETS

.1 Type E: sheet steel, hinged door and return flange overlapping sides, handle, lock and catch, for surface-mounting.

.2 Type T: sheet steel cabinet, with hinged door, latch, lock, 2 keys, containing 3/4" (19 mm) GIS fir plywood backboard. Cabinets to be flush or surface-mounted as indicated.

.3 Provide other systems' cabinets as specified in Divisions 26, 27 and 28 and located on the electrical drawings.

3 EXECUTION

3.1 SPLITTER INSTALLATION

.1 Install splitters as indicated and mount plumb, true and square to the building lines.

.2 Extend splitters full length of equipment arrangement except where indicated otherwise.

.3 Use splitters only where indicated on the drawings.

3.2 JUNCTION PULLBOXES AND CABINETS

.1 Install pullboxes in inconspicuous but accessible locations.

.2 Mount cabinets with top not higher than 74" (1.9 m) above finish floor.

.3 Install terminal blocks, as indicated.

.4 Provide pullboxes in conduit runs as described in Section 26 05 34.

.5 Boxes and cabinets to be installed plumb and square with building lines.

.6 Install junction and pullboxes clear of all mechanical ductwork and piping.

3.3 IDENTIFICATION

.1 Identify splitters with Size 5 nameplates.

.2 Identify junction and pullboxes with Size 1 nameplates.

.3 Identify cabinet with Size 5 nameplates.

END OF SECTION

1 GENERAL

1.1 RELATED WORK

.1 Basic Electrical Materials and Methods Section 26 05 01

.2 Wiring Devices Section 26 27 26

1.2 REFERENCE STANDARDS

.1 CSA C22.1-18 Canadian Electrical Code, Part 1.

2 PRODUCTS

2.1 OUTLET AND CONDUIT BOXES GENERAL

.1 Size boxes in accordance with CSA C22.1.

.2 102 mm square or larger outlet boxes as required for special devices.

.3 Gang boxes where wiring devices are grouped.

.4 Blank cover plates for boxes without wiring devices.

2.2 CONDUIT BOXES

.1 Cast FS or FD feraloy boxes with factory-threaded hubs and mounting feet for surface wiring of switches and receptacle.

2.3 FITTINGS GENERAL

.1 Bushing and connectors with nylon insulated throats.

.2 Knock-out fillers to prevent entry of debris.

.3 Conduit outlet bodies for conduit up to 32 mm and pullboxes for larger conduits.

.4 Double locknuts and insulated bushings on sheet metal boxes.

3 EXECUTION

3.1 INSTALLATION

.1 Support boxes independently of connecting conduits.

.2 Fill boxes with paper, sponges or foam or similar approved material to prevent entry of debris during construction. Remove upon completion of work.

.3 Provide correct size of openings in boxes for conduit and aluminum sheathed cable

connections. Reducing washers are not allowed.

END OF SECTION

1 GENERAL

1.1 RELATED WORK

.1 Basic Electrical Materials and Methods Section 26 05 01

.2 Fastenings and Supports Section 26 05 29

1.2 LOCATION OF CONDUIT

.1 Drawings do not show all conduits. Those shown are in diagrammatic form only.

.2 Electrical Subcontractor to produce layout sketches of conduit runs through mechanical and electrical service areas in order to pre-avoid any conflict with other construction elements and to determine the most efficient route to run conduit.

.3 Electrical Subcontractor to confirm layout of conduits in Open Library area with consultant in order to minimize surface runs.

2 PRODUCTS

2.1 CONDUITS

.1 Electrical metallic tubing (EMT), with couplings: size as indicated. Minimum size 3/4" (21mm).

.2 Liquid-tight flexible metal conduit: size as indicated, for equipment with vibrational aspects only.

2.2 CONDUIT FASTENINGS

.1 One hole steel straps to secure surface conduits 1 1/4" (35 mm) and smaller. Two hole steel straps for conduits larger than 1 1/4" (35 mm).

.2 Beam clamps to secure conduits to exposed steel work.

.3 U-channel type supports for two or more conduits at 60" (1.52 m) intervals (surface-mounted or suspended). 4 1/4" (6 mm) diameter threaded rods to support suspended channels. One rod shall be non-ferrous.

2.3 CONDUIT FITTINGS

.1 Fittings manufactured for use with conduit specified.

.2 Manufacturer elbows where 90E bends are required for 2 2" (64 mm) and larger conduits.

.3 Die cast set screw connectors and couplings. Insulated throat liners on connectors.

.4 Raintight connector fittings, complete with O-rings, for use on weatherproof or

sprinklerproof enclosures. Raintight couplings to be used for surface conduit installations exposed to moisture or sprinkler heads. Raintight connectors shall be used for all top entries to panels, contactors and motor control centres.

3 EXECUTION

3.1 INSTALLATION

.1 Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass.

.2 Conceal conduits except in mechanical and electrical service rooms.

.3 Use electrical metallic tubing (EMT) except where noted otherwise.

.4 Wiring home runs to panels and main branch wiring runs in ceiling spaces to be run in conduit. Wiring drops from conduit systems into boxes for wiring devices in steel stud partitions may be wired with AC-90. AC-90 drops to light fixtures shall not run horizontally more than 5' (1.5 m) from conduit system junction boxes in ceiling space. AC-90 drops from conduit system in the ceiling space to feed outlets in steel stud partitions shall not run more than 5' (1.5 m) horizontally from the ceiling outlet box to the point where the AC-90 drops vertically into the partition. Where the total length of AC-90 is greater than 3m in the ceiling, provide conduit to a junction box closer to drop location.

.5 Use liquid-tight flexible metal conduit for connection to motors, transformers and equipment subject to movement or vibration. Provide a separate insulated grounding conductor within flexible conduit.

.6 Motor connections (use liquid-tight flexible metal conduit only) shall not exceed 6’ (1.83m) except where expressly allowed by the Consultant.

.7 Bend conduit cold. Replace conduit if kinked or flattened more than 1/10th of its original diameter.

.8 Install polypropylene fish cord in empty conduits.

.9 Install two 1" (27 mm) spare conduits to ceiling space from each panelboard, cabinet, annunciator, etc. Terminate these conduits in 6" x 6" x 4" (150 x 150 x 100 mm) junction boxes in ceiling space or in case of an exposed concrete slab, terminate each conduit in a flush concrete-type box with extension ring.

.10 Where conduits become blocked, remove and replace blocked section.

.11 The length of any conduit run shall not exceed 150' (45 m) and no conduit run shall have more than four 90^{o} bends (or equivalent) before a pullbox is installed. Pullboxes shall be installed in accessible ceiling spaces. Conduits shall be supported within 12" (300 mm) of entering any junction box, pullbox, cabinet, or panelboard.

.12 Conduit to be sized as per Canadian Electrical Code or as shown on drawings. Note that the sizes of branch circuit conductors scheduled and/or specified on the drawings are minimum sizes and must be increased as required to suit length of run and voltage drop in accordance with Canadian Electrical Code. Where conductor sizes are increased to suit voltage drop requirements, increase the conduit size to suit at no extra cost.

.13 Provide separate bonding conductor for EMTs if installed/located in concrete or masony slabs in contact with the earth or in any location where material having a deteriorating effect may come in contact with the EMT.

3.2 SURFACE CONDUITS

.1 Run parallel or perpendicular to building lines.

.2 Do not locate conduits within 78" (2 m) of infrared or gas-fired heaters.

.3 Group conduits wherever possible on suspended or surface channels.

.4 Do not pass conduits through structural members, except as indicated.

.5 Do not locate conduits less than 6" (150 mm) to steam or hot water lines.

3.3 CONCEALED CONDUITS

.1 Do not install conduit home runs horizontally in masonry walls.

.2 Do not install conduits in terrazzo or concrete toppings, unless otherwise indicated.

3.4 CONDUIT IDENTIFICATION

.1 Color code coverplates of junction boxes in conduit systems shall match City/facility standard or if none exists as per the color code list below.

.2 Color code by spray painting the coverplate on each junction box in the conduit run.

.3 In addition to color coding coverplates on junction boxes with power wiring, the circuits being run in the box shall be identified on the inside coverplate with permanent felt marker.

.4

120/250V Normal Power	yellow
347/600V Normal Power	orange
Fire Alarm	red
Data/Voice	blue
Security	white
Controls	brown

Provide 50mm wide colour coded tape on all conduits at 3.5m centres.

END OF SECTION

1 GENERAL

1.1 RELATED WORK

.1	Basic Electrical Materials and Methods	Section 26 05 01
.2	Wire and Cable	Section 26 05 21
.3	Fastenings and Supports	Section 26 05 29

1.2 SHOP DRAWINGS AND DATA

.1 Submit shop drawings and product data in accordance with Section 26 05 01.

.2 Show actual cable tray installation details and suspension system.

2 PRODUCTS

2.1 CABLE TRAY

.1 Aluminum centre hung cable tray or basket style cable tray.

.2 18" x 4" x 6" (rung spacing), 450 x 100 x 150 mm, or as specified on the drawings.

2.2 SUPPORTS

.1 In ceiling spaces: cable tray to be suspended above ceiling using tray manufacturer's approved system, fastened to steel floor deck above sub-ceiling.

.2 Provide 45° risers over or under mechanical equipment.

.3 Provide Stiffener bars.

.4 Not all transitions (vertical or horizontal) are indicated on drawings - only general routing. Provide connectors and transitions as required.

3 EXECUTION

3.1 INSTALLATION

.1 Install complete cable tray system above finished ceilings. Cable tray shall not be used in exposed ceilings unless specifically noted.

.2 Remove sharp burrs or projections to prevent damage to cables or injury to personnel.

.3 Coordinate with all trades and provide additional offsets, bends, etc. as required to adjust cable tray routing and height to avoid conflict with ducts, pipes, beams, etc. Confirm requirements on site and include costs in tender price.

3.2 CABLES IN CABLE TRAY

.1 Install cables individually.

.2 Lay cables into cable tray.

.3 Secure cables in cable tray at 6' (1.83 m) centres, with category 5 approved clips.

.4 Identify cables in accordance with Section 26 05 13.

.5 Install voice cables on one side of tray and data cables on other.

3.3 FIRE BARRIERS

.1 Arrange for opening in fire rated walls, and floors for width and depth of cable tray to pass through.

.2 Provide fire rating of floors or walls after cables have been installed in accordance with Section 26 05 01.

3.4 GROUNDING

.1 Provide ground wire in cable tray.

.2 Provide a #6 bare copper ground wire and bond to tray on 3m intervals using approved clips.

.3 Include jumpers and compression connections between tray sections and at all transitions.

.4 Test ground system throughout for continuity.

END OF SECTION

1 GENERAL

1.1 RELATED WORK

.1 Basic Electrical Materials and Methods Section 26 05 01

1.2 SUBMITTALS

.1 Submit product data in accordance with Section 26 05 01.

2 PRODUCTS

2.1 WIREWAYS (TELEPHONE DISTRIBUTION)

.1 Sheet steel with hinged cover to give uninterrupted access.

.2 Cross-section dimensions: 2 1/2" x 2 1/2" (64 x 64 mm) or 4" x 4" (100 x 100 mm) or or 6" x 6" (150 x 150 mm) as indicated.

.3 Finish: baked grey enamel.

.4 Elbows, tees, couplings and hanger fittings manufactured as accessories to wireway supplied.

.5 Acceptable manufacturers: Pursley, Square D, and Pilgrim.

2.2 WIREWAYS (POWER AND COMMUNICATION)

.1 Formed steel with snap-on cover to give uninterrupted access.

.2 Cross-section dimensions: 1 3/4" x 4 1/4" (45 x 107 mm).

.3 Finish: standard grey.

.4 Inside elbows, tees, couplings, clips, device plates and fittings manufactured as accessories to wireway supplied.

.5 Barriered, as indicated, for power wiring and communication wiring. Non-barriered, as indicated, for power only or communications only.

.6 Telephone outlets in wireways to have a 1/2" (13 mm) I.D. grommet hole.

.7 Receptacle outlets in wireways to be one piece with mounting straps taped for standard devices.

3 EXECUTION

3.1 INSTALLATION

.1 Install wireways in lengths and configurations as indicated.

.2 Install power and telephone feed-in connections as indicated.

.3 Install supports, elbows, tees, connectors, fittings.

.4 Install barriers in the full length of wireways, where required.

.5 Install devices, wire and make connections.

.6 Install device plates and snap-on cover.

.7 Provide wire markers on individual wires in power wireways indicating circuit number. Markers to be installed every 40" (1 m).

.8 Provide Lamacoid nameplates on all system Wireways.

END OF SECTION

1 GENERAL

1.1 RELATED WORK

.1	Basic Electrical Materials and Methods	Section 26 05 01
.2	Wire and Cable	Section 26 05 21
.3	Conduits	Section 26 05 36

1.2 SUBMITTALS

.1 Submit shop drawings in accordance with Section 26 05 01.

2 PRODUCTS

2.1 CONDUIT

.1 Heavy wall rigid PVC conduits, size as indicated.

.2 FRE duct, size, as indicated.

.3 Provide pull boxes as required. Install underground pull box minimum every 200 feet unless otherwise approved. Coordinate location of pull boxes before rough-in.

2.2 FITTINGS

.1 Rigid PVC opaque solvent welded type watertight couplings, bell end fittings, plugs, caps adaptors, as required to make complete installation.

.2 Expansion joints as required.

.3 FRE duct couplings, bends, adapters, caps, etc., as required.

2.3 GROUNDING

.1 Provide a separate insulated ground wire in each PVC or FRE conduit run.

2.4 DIRECT BURIED SINGLE AND MULTI-CONDUCTOR CABLES

.1 Single conductor and multi-conductor direct buried cables to Section 26 05 21.

2.5 WIRE

.1 Wire in conduit to Section 26 05 21.

3 EXECUTION

3.1 INSTALLATION OF DIRECT BURIED CABLES AND CONDUITS

.1 Conduits and multi-conductor cables to be laid out and spaced appropriately.

.2 Single conductor cables to be spaced 6" (150 mm) apart.

.3 Install sand 6" (150 mm) below and 6" (150 mm) above cables and conduits.

.4 Install conduit with watertight couplings. Make transitions, offsets and changes in direction using 5° bend sections. Do not exceed a total of 20° with conduit offset. Clean conduits before laying. Cap ends of conduits during construction and after installation to prevent entrance of foreign materials. Install pull cords in empty conduits.

.5 Install continuous overlapping cuprinol-treated planking 6" (150 mm) above cables and conduits before backfilling. Install continuous yellow marker tapes 6" (150 mm) above treated planking.

3.2 INSPECTIONS

.1 Advise Consultant that he may inspect cable and conduit installation prior to backfilling.

3.3 AS-CONSTRUCTED DRAWINGS

.1 Include on As-constructed Drawings, exact dimensioned position and routing of all underground cable feeders, pullboxes, etc.

3.4 COORDINATION

.1 Coordinate underground installations with Utilities (including underground work of other trades) before commencing any work.

.2 Coordinate underground installations with other trades before commencing any work.

END OF SECTION

1 GENERAL

1.1 RELATED WORK

.1 Mechanical Specifications

.2	Basic Electrical Materials and Methods	Section 26 05 01
.3	Wire and Cable	Section 26 05 21
.4	Outlet Boxes and Fittings	Section 26 05 32
.5	Conduits	Section 26 05 34

1.2 SYSTEM DESCRIPTION

.1 Provide complete electrical power and control connections for mechanical equipment, except as noted herein, or as noted on the drawings.

2 PRODUCTS

2.1 MATERIALS

.1 Include motor starters, disconnects, conduit, wire, fittings, interlocks, outlet boxes, junction boxes, and all associated equipment required to provide power wiring for mechanical and controls equipment, unless otherwise indicated.

.2 Include pushbutton stations, motor protective switches, interlocks, conduit, wire, devices, and fittings required to provide control wiring for mechanical and controls equipment.

.3 Unless otherwise noted, motors and control devices shall be supplied by Mechanical Division/Contractor. Motor horsepower ratings shall be as shown in the Mechanical Division specifications. Motor voltage and phase ratings shall be as shown on the Electrical Division drawings.

.4 Provide the Mechanical Contractor with a copy of the Motor Schedule and ensure conformance with voltage shown. Additional prints of Motor Schedule will be made available by the General Contractor.

3 EXECUTION

3.1 POWER WIRING

.1 Install branch circuit wiring for mechanical system control panels, time clocks, and control transformers.

.2 Install main power feeders to starter/control panels, DDC control panels, etc. furnished by mechanical Divisions. Install branch wiring from starter/control panels to controlled

equipment such as motors, electric coils, etc.

.3 Flexible connections to motors shall not exceed 6 feet (1.83 m), unless approved by Consultant.

3.2 CONTROLS

.1 Install all electrical controls in accordance with Motor Schedule Equipment list.

.2 Wire and connect float switches, pressure switches, alternators, alarms, etc. for sump pumps, sewage pumps, domestic hot water, recirculating pumps, booster pumps, jockey pumps and compressors.

.3 Wire and connect line voltage remote thermostats and P/E switches for furnaces, condensing units, force flows, gas-fired unit heaters, electric heaters and rooftop units.

.4 Install conduit, wire, devices and fittings required to wire and connect low voltage controls which are an integral part of the trade supplying the packaged unit, unless otherwise indicated. Control wiring shall be installed in conduit.

.5 In general: conduit, wire, devices and fittings required to wire and connect low voltage temperature control systems, shall be supplied and installed by the trade supplying the temperature control system. Control wiring shall be installed in conduit.

3.3 COORDINATION

.1 Refer to Mechanical Drawings for the exact location of motor control devices, and mechanical equipment requiring an electrical connection.

.2 Obtain full information from Mechanical Divisions, regarding wiring controls, overload heaters, equipment ratings and over-current protection. Notify the Mechanical Subcontractor, at once, if any information provided is incorrect or unsatisfactory.

.3 Coordinate control wiring requirements with Mechanical Divisions and provide all control wiring and connections as required to make the control systems operate as specified.

.4 Refer to Mechanical Division specifications for any further electrical requirements.

.5 Review both electrical and mechanical drawings and specifications and coordinate all controls with Mechanical Subtrades through General Contractor. Report all discrepancies to both Mechanical and Electrical Consultants before close of tender. No additional money will be justified for assumptions made on any duplication of information.

.6 Submit to General Contractor, as part of the tender submission, a list of controls and wiring to be provided in the Electrical Contract.

END OF SECTION

1 GENERAL

1.1 SCOPE OF WORK

.1 All equipment specified in Section 26 05 94 to be provided, wired and installed by Electrical Contractor, unless otherwise noted.

1.2 PRODUCT DATA

.1 Submit shop drawings and product data in accordance with Section 26 05 01.

.2 Product data to include:

.1 Element replacement data.

.2 Mounting methods.

.3 Auxiliary controls.

.4 Finish.

.5 kW rating, voltage, phase.

.6 Cabinet material thicknesses.

.7 Controls.

2 PRODUCTS

2.1 MINIMUM REQUIREMENTS FOR SPACE HEATERS (UNIT AND FORCE FLOW HEATERS)

.1 Built-in overheat protection.

.2 18 gauge steel construction. (16 gauge front cover).

.3 Heater assembly to be easily removable.

.4 Finish to be coordinated with architect.

.5 Wall mounted. (Approx. 7" above finished floor).

.6 Front inlet and outlet. (Sloped outlet for Dura convector).

.7 Architectural style, rounded corners.

.8 Elements: stainless steel, free floating.

.9 Voltage as noted on drawings.

.10 Capacity as indicated on drawings.

.11 Relays for control by DDC system

2.2 BASEBOARD HEATERS

.1 Standard watt density.

.2 Voltage as noted on drawings.

.3 Relays for control by DDC system

.4 Refer to drawings for quantity and wattage of each unit.

2.3 WARRANTY

.1 Replace any heater, relay or thermostat which malfunctions within one year from project acceptance by City.

3 EXECUTION

3.1 INSTALLATION

.1 Mount electric heaters on wall as indicated. Provide additional supports or braces as required to suit application.

.2 Provide power connection.

.3 Commission, test and demonstrate operation.

END OF SECTION

1 GENERAL

1.1 SUMMARY

.1 Section Includes:

.1 General requirements for commissioning of electrical equipment systems.

.2 Related Sections:

.1 Section 019113 General Commissioning
.2 Section 220800 Commissioning of Plumbing
.3 Section 238000 Commissioning of HVAC
.4 Section 258000 Commissioning of Integrated Automation

1.2 INTENT

.1 Provide commissioning of electrical equipment and systems in accordance with this, Section 019113 and related sections.

1.3 MANUFACTURER'S SERVICE ON SITE

.1 Arrange and pay for qualified Manufacturer's representatives to supervise starting and testing of following electrical equipment and systems:

.1 Telephone Equipment System
.2 Fire Alarm System and associated devices
.3 Lighting Control system

.2 Use manufacturers factory trained personnel where required to maintain manufacturer's warranty.

.3 Maintain documentation of all equipment start-up and commissioning and provide to Commissioning Agent.

1.4 REFERENCE DOCUMENTS

.1 Perform tests in accordance with:

.1 These Contract Documents.
.2 Requirements of authorities having jurisdiction.
.3 Manufacturer's published instructions.
.4 Applicable CSA, IEEE, IPCEA, EEMAC, NEMA and ASTM standards.

1.5 CONTRACTOR AND MANUFACTURER REPORTS

.1 Arrange for Manufacturer to submit copies of all production test records for production tests required by EEMAC and CSA standards for manufactured electrical equipment to the Consultant prior to shipping.

1.6 TESTING QUALIFICATIONS

.1 Arrange and pay for services of testing agent(s) to perform tests and verifications specified in this Section that are not within the capabilities of the Contractor.

.2 Required Testing Qualifications:

.1 Minimum of five years experience in the maintenance and testing of electrical equipment and systems at all voltage levels up to and including 25 kV class.

.2 Personnel involved in power system testing shall have proven experience in the use of the following test equipment:

.1 Insulation Resistance Testers (Meggers) at 250 V, 1000 V and 2500 V.

.2 DC hipot test equipment up to 100 kV DC.

.3 Capacitance bridges.

.4 Transformer ratio test equipment.

.5 Contact resistance testers (ductor). Protective relay test equipment of current injection type for testing and calibration of induction disc and solid state protective devices.

.3 The Contractor will be responsible for appointing a verification agent to direct verification of fire alarm system in accordance with:

.1 CAN/ULC-S537-M86, "Standard for Verification of Fire Alarm System Installations"

.2 Requirements of authority having jurisdiction in the province of Manitoba.

2 PRODUCTS

.1 None

3 EXECUTION

3.1 GENERAL

.1 Commission all equipment and systems installed as part of this contract. Typical required information or actions are listed below for each equipment or system.

.2 Provide check sheets for equipment not listed in this section.

.3 Document the commissioning process by completing the Component Verification Forms, System Tests and Integrated System Tests.

3.2 MAIN DISTRIBUTION SWITCHGEAR

.1 Enclosure:

.1 Visually inspect.

.2 Torque all bus connections to Manufacturers requirements and seal with red lacquer.

.3 Megger test main bus at 1000 V.

.4 Check phasing and continuity of horizontal and vertical bus. This includes phasing and phase rotation of two incoming services or supplies.

.2 Wiring Checks:

.1 Check all control, relaying and instrumentation wiring against vendor wiring schematics, three line diagrams, and project specifications.

.2 Test each circuit for continuity using a buzzer or similar device.

.3 All current circuits shall be injected, all voltage circuits shall be powered at 120 Volts, all devices functioned and checked against control schematic diagram.

.4 Check polarity and verify phase relationships on all three phase metering circuits.

.5 Where errors are discovered and changes are required, mark up and note required corrective action on vendor prints.

.3 Fused Disconnect Switches:

.1 Visually inspect and clean.

.2 Ductor test across switch blade contact surfaces.

.3 Megger test.

.4 Mechanical function test.

3.3 DISTRIBUTION PANELS

.1 Enclosure:

.1 Visually inspect.

.2 Torque all bus connections.

.2 .2 Breakers:

.1 Visually inspect.

.2 Ductor test.

.3 Megger test.

.4 Mechanical function test.

.5 Set all units with adjustable magnetic trip units.

.6 Where solid state protection is provided with large breakers, test units as follows:

.1 Inspect and test in accordance with Manufacturer's most recent installation and maintenance brochure.

.2 Perform tests using Manufacturer's relay test unit as applicable, with corresponding test instruction.

.3 If Manufacturer's tester is not available, use an approved relay tester unit with the proper test data and test accessories.

.4 Proof test each relay in its control circuit by simulated trip tests to ensure total and proper operation of breaker and relay trip circuit by injection of relay circuit to test trip operation.

.5 Check C/T and P/T ratios.

3.4 ELECTRICAL START-UP AND TESTING

.1 Energizing Main Electrical System:

.1 Prior to energizing main electrical system:

.1 Verify supply authority voltage and phase rotation.

.2 Megger test all feeders and record results on approved test report forms.

.2 Testing of Wiring and Wiring Devices:

.1 Test conductors at distribution centres and panelboards for insulation resistance to ground (megger test).

.2 Test service grounding conductors for ground resistance.

.3 Test all wiring devices for correct operation and circuitry.

.3 Ground Resistance Testing:

.1 Measure ground resistance of ground grids with earth test megger to verify compliance with CSA C22.2 No. 0.4-1982 and Canadian Electrical Code.

.4 Load Balance Testing:

.1 Perform load tests with as many building loads on as possible prior to Interim Acceptance.

.2 Test load balance on all feeders at distribution centres, motor control centres and lighting panelboards.

.3 If load unbalance exceeds 15%, reconnect circuits to balance loads. Revise panelboard directories and wiring identification accordingly.

.5 Power Factor Testing:

.1 Record power factor readings at 15 minute intervals for full 72 hour period during a normal work week, once during summer with A/C operating and once during winter.

.2 Take readings at the following locations on power distribution system:

.1 Main Breaker.

.2 All motor control centres.

.3 Feeder breakers which control large motor loads (e.g. Air Handling Units).

.6 Voltage Testing and Adjusting:

.1 Test voltage at service entry point. Record voltages at Interim Acceptance for a period of ten hours (07:00 to 17:00) during a normal work day.

.2 Coordinate with utility to adjust transformer tap settings to compensate for under-voltage or over-voltage conditions, if directed to do so by the City.

.7 Starting Motors:

.1 Prior to starting motors:

.1 Confirm motor nameplate data with motor starter heater overloads, setting of MCPs and sizing of fuses.

.2 Verify rotation.

.3 Ensure disconnects are installed.

.4 Confirm labelling of motors, disconnects and starters.

.2 Measure and record operating load amp readings for all three phase motors.

3.5 HARMONIC DISTORTION TESTING

.1 Perform harmonic distortion testing at following locations:

.1 Main incoming service.

.2 All 208 volt distribution centres.

.2 Harmonic tests to include phase and neutral currents and voltages for each order of harmonic up to 50th order.

.3 Allow for four hours of sampling at each location.

.4 Ensure all sources of harmonic distortion such as variable speed drives, uninterruptible power supplies, computer and microelectronics equipment are energized before performing tests.

.5 Perform tests prior to interim acceptance.

.6 Certified test results sealed by professional engineer are to include harmonic distortion of each harmonic from 1 to 50 in graphic or tabular form. Results for main incoming service shall include harmonics coming in from utility and outgoing harmonics generated on facility power system.

.7 Recommended limits of distortion are to be based on ANSI/IEEE 519-1981 IEEE Guide for Harmonic Control and Reactive Compensation of Static Power Converters.

3.6 LIGHTING

.1 Function test all light switches, luminaries, dimmers and lighting control equipment.

.2 Record all photocell and time-clock settings.

.3 Prior to energizing dimming system, ensure Manufacturer has checked all equipment and wiring for proper installation and termination. Manufacturer to check that all pre-set levels are set and operate as specified.

.4 Check operation of all emergency lighting units, exit lights and connection of exit lights to emergency power as specified.

.5 Verify that correct lamps and ballasts have been used.

.6 Record lighting levels for typical rooms and specialized areas.

.7 Confirm operation of battery operated emergency lighting units including battery size and operating time.

.8 Check all terminations and label all lighting circuits.

3.7 LIGHTING CONTROL SYSTEM

.1 Inspect system to ensure that the low voltage lighting system is correctly installed, connected and fully operational in accordance with requirements of the Contract Documents and Manufacturers recommendations.

.2 Demonstrate the operation of each timed, occupancy control or daylight control function to the City.

.3 Ensure the program interface provides an easy means for the building operator to make changes to the sequences.

3.8 WIRING AND WIRING DEVICES

.1 Test all receptacles for proper polarity.

.2 Verify panelboard directories and branch circuit designations as indicated on record drawings, directories and lamacoid labelling.

3.9 SURGE SUPPRESSION

.1 Test and verify operation in accordance with Manufacturers recommendations.

.1 Terminated prior to testing.

3.10 VOICE AND DATA CABLE TESTING

.1 Test all runs upon completion of permanent terminations, using instrumentation acceptable to the City. Before commencing testing, submit sample test data sheet(s) and information with respect to test instrumentation to be used.

.2 Copper Media:

.1 Test for the following:

.1 Continuity.

.2 Pair placement and polarity.

.3 DC resistance.

.4 Characteristics at highest contemplated frequency Hz:

.1 Attenuation - data cable.

.2 Mutual Capacitance - data cable.

.3 Near-end crosstalk (NEXT) - data cable.

.4 Run length.

.2 Before recording results, compare readings to predicted values based on cable specification and run length, using connector and patch cord losses as part of the predicted value. Retest runs with:

.1 Resistance and capacitance readings more than [10% above [or below] predicted values.

.2 NEXT values [5 dB] higher than predicted values.

.3 Attenuation values [2 dB] higher than predicted values.

.3 Reconnect or re-install and retest as necessary to correct excessive variations.

.4 Check installation of all equipment.

.5 Ensure all cables are properly identified at each end and correctly terminated prior to testing.

3.11 FIRE SAFETY SYSTEMS

.1 Prior to requesting verification of Fire Alarm system by Contractor, Verification Agent, and Fire Safety system Manufacturer's technical staff shall:

.1 Inspect system in conjunction with the Manufacturer to ensure that Fire Alarm system is correctly installed, connected and fully operational in accordance with requirements of the Contract Documents and Manufacturers recommendations. This includes all auxiliary equipment connected to fire alarm system such as elevators, central station tie-in, fan shut-down, sprinklers, door hold-open devices, etc.

.2 Ensure that any subsequent work remaining to be performed on the above noted items will not invalidate examinations and test performed during verification procedure.

.3 Ensure that operation and maintenance data has been submitted.

.4 Ensure that spare parts and maintenance materials have been delivered.

.2 Certify to the City in writing that above prerequisites have been fulfilled and specifying known exceptions in the form of a list of items to be completed or corrected, prior to proceeding with verification.

.3 The City will proceed with verification, or advise Contractor that prerequisites are not adequately fulfilled.

.4 Fire Alarm Verification:

.1 Assist and co-operate with the City in verification procedure.

.1 Provide following equipment:

.1 Velometer.

.2 Artificial Smoke.

.3 Rate of Rise Heat Detector Tester.

.2 Do not proceed with verification unless the following parties are present at all times during verification procedure:

.1 Electrical Contractor.
.2 Fire Alarm System Manufacturer's Representative.
.3 City's verification representative.

.3 Disassemble and reassemble system components.

.4 Disconnect and reconnect wiring.

.5 Perform required field adjustments.

.6 Repair defective work and replace defective components.

.7 Perform all other work on system required by verification procedure.

3.12 SECURITY AND ACCESS SYSTEM

.1 Prior to function testing of system, perform following in conjunction with Manufacturer:

.1 Ensure all equipment is properly installed and all terminations completed.

.2 Verify wiring of all card readers.

.3 Ensure all programming is complete and software is performing correctly.

.4 Confirm operation of each door. Check proper latching of electric strikes, card operation and request to exit sensors.

.2 Manufacturer shall function test system in presence of the City as follows:

.1 Card Access System:

.1 Check installation of all equipment.

.2 Confirm operation of each card reader.

.2 Check all interconnections with other systems.

.3 Record results on approved test report forms.

3.13 ELECTRICAL EQUIPMENT AND SYSTEMS DEMONSTRATION AND INSTRUCTION

.1 Provide operation and maintenance instruction and demonstrations in accordance with Section 019113.

END OF SECTION

1 GENERAL

1.1 RELATED WORK

.1 Contactors Section 26 29 01

1.2 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with Section 26 05 01.

2 PRODUCTS

2.1 LIGHTING CONTACTOR PANEL

.1 Enclosure constructed with minimum 14 gauge cold rolled steel, pad-lockable, flush mounted, finished with ASA 61 Grey baked enamel inside and outside.

.2 Inner panel, 12 gauge, baked enamel, white.

.3 Terminal blocks:

.1 Design base: Wiedmueller, SAK series.

.4 Lighting Contactor:

.1 20 amp, 4 pole, 600 volt rated (multiple 4 pole as required).

.2 Control transformer coil: 120 volt and fuse.

.3 Mount on inner panel.

.4 Design base: Cutler Hammer CN35 Series.

.5 Selector switch mounted inside: HAND-OFF-AUTO:

.1 Heavy duty Cam type.

2.2 LINE VOLTAGE OCCUPANCY SENSORS

.1 Dual technology (IR and ultrasonic)

.2 Wall or ceiling mounted as indicated.

.3 Finish: White

2.3 DAYLIGHT SENSORS

.1 Wall or ceiling mounted as indicated.

.2 0-10V dimming

.3 Finish: White

3 EXECUTION

3.1 INSTALLATION

.1 Terminate all conductors to terminal blocks.

.2 Mount contactor near breaker panelboard for control of building lights.

.3 Provision for additional supports as required.

END SECTION

Part 1 General

1.1 RELATED WORK

.1	Basic Electrical Materials and Methods	Section 26 05 01
.2	Wire and Cable	Section 26 05 21
.3	Grounding	Section 26 05 28
.4	Conduit	Section 26 05 34
.5	Circuit Breakers	Section 26 28 21

1.2 DESCRIPTION OF EQUIPMENT

.1 Main distribution board incorporates service entrance cable connection section, main breaker complete with built-in sub-feeder distribution section and customer metering section, factory assembled in one enclosure.

1.3 SUBMITTALS

.1 Submit shop drawings and product data in accordance with Section 26 05 01.

.2 Indicate:

.1 Floor anchoring method and foundation template.

.2 Dimensioned cable entry and exit locations.

.3 Dimensioned position and size of bus.

.4 Overall length, height and depth.

.5 Dimensioned layout of internal and front panel mounted components.

.6 Shipping sections and weights.

1.3 MAINTENANCE DATA

.1 Provide data for incorporation into Maintenance Manual specified in Section 26 05 01.

1.5 MAINTENANCE MATERIALS

.1 One set spare parts as recommended by manufacturer.

.2 Fuses:

.1 3 fuses for each type above 600A.

.2 6 fuses for each type up to and including 600A.

1.6 SOURCE QUALITY CONTROL

.1 Refer to Section 26 05 01.

Part 2 Products

2.1 MATERIALS

.1 Service entrance board: to CSA C22.2 No.31.

.2 Molded case circuit breakers: to CSA C22.2 No.5.

.3 Fuse holder assemblies: to CSA C22.2 No.39.

.4 HRC Fuses: to CSA C22.2 No.106.

.5 Meters: to CSA C17.

.6 Meter mounting devices: to CSA C22.2 No.115.

.7 Analogue instruments: to ANSI C39.1.

.8 Instrument transformers: to CSA C13.

.9 Basis of Design: Schneider Canada

2.2 POWER SUPPLY

.1 Power supply: 3 phase, 4 wire, grounded neutral, 60 Hz, short circuit current rating and voltage as indicated on the drawings.

2.3 SERVICE ENTRANCE SWITCHBOARD

.1 Ampere rating: as indicated on the drawings.

.2 Enclosure:

.1 Free-standing, totally enclosed sheet steel, 'sprinklerproof' enclosure with steel frame.

.2 Sheet steel barriers to separate adjoining sections.

.3 Customer metering instruments, transformers and selector switches.

.4 Distribution section or sections - see single line include spaces and spares as indicated.

.5 Hinged access panels with captive knurled thumb screws.

.6 High conductivity aluminium bus.

.7 Bus from load terminals of main breaker via metering section to main lugs of distribution section.

.8 Identify phases with color coding.

2.4 MAIN BREAKER SECTION

.1 The main circuit breaker shall be a manually operable, fixed mounted molded case circuit breaker. Breaker shall be equipped with solid state o/c relay to provide the following time/current curve shaping adjustments: (1) long time pick-up setting; (2) long time delay; (3) short time pick-up; (4) short time delay. All LSI functions shall be fully adjustable. Frame size ampere rating to be as indicated on the drawings.

.2 The relay shall be provided with three light emitting diodes (L.E.D.'s) to indicate tripping occurred from long time overload or instantaneous. The relay shall be provided with contacts for remote indication. The breaker shall be equipped with in-built current sensors on each phase and neutral. Current sensors ampere tap setting shall be rated to match the frame size of the main breaker. Shunt trip shall be direct acting solenoid-type powered by the sensor/relay energy.

2.5 GROUNDING

.1 Copper ground bus extending full width of cubicles and located at bottom.

.2 Lugs at each end sized for grounding cable.

.3 Bond non-current carrying metal parts to ground bus.

.4 Connect to station ground and building ground bus.

2.6 HYDRO UTILITY METERING SECTION

.1 Separate compartment for exclusive use of utility company metering transformers.

.2 Provide mounting and wiring for the following:

.1 Potential Transformers (PT)
.2 Current Transformers (CT)

.3 Hydro utility metering transformer to be supplied by the Hydro utility and factory installed by the switchboard manufacturer.

2.7 CUSTOMER METERING SECTION

.1 Digital metering

.1 Standards: ANSI-C6241, IEEE-587.

.2 Phase selectable current and voltage (L-L and L-N).

.3 Capable of displaying kW, kVA, MWHR, kilowatt demand, current demand, kVA demand, frequency, power factor.

.4 LCD or LED display.

.5 Resettable minimum and maximum for current, voltage and p.f.

.2 Potential transformers: if required.

.3 Potential transformers fused with separate fuse block, equipped with fuse holder and fuses. Fuses to Section 26 28 14.

.4 Current transformers: as indicated dry type for indoor use with the following characteristics:

.1 nominal voltage class as indicated

.2 rated frequency: 60 Hz

.3 primary circuit rated to match ampere rating of main breaker trip. Secondary current rated at 5 amp.

2.8 SECONDARY DISTRIBUTION

.1 The distribution section shall contain thermal/magnetic molded case circuit breakers. Each breaker shall be manually operated, field adjustable trip for breakers 150A and larger. Fixed trip to 125A ratings as shown on the drawings.

.2 Breakers shall have a minimum interrupting capacity as indicated on single line diagram.

.3 Breaker with 250A rating or greater shall be fully adjustable LSI type.

.4 The distribution section to be provided with sufficient spaces for breakers and spare spaces as indicated on drawings.

2.9 FINISHES

.1 Apply finishes in accordance with Section 26 05 01:

.1 Service entrance switchboard finish to be exterior gray

.2 Supply 2 spray cans of touch-up enamel

.3 Treated to inhibit rusting.

2.10 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 01.

.2 Nameplates:

.1 white plate, black letters, size 7, to indicate voltage, amp rating and designation

.2 complete switchboard: labelled as above main disconnect: labelled "Main Breaker"

.3 sub-breakers: labelled to indicate panel or equipment fed.

2.11 SHOP FABRICATION

.1 Assemble and wire complete service entrance board.

.2 Energize switchboard.

.3 Check meters and phase selector switches.

.4 Prepare switchboard for shipment to site.

2.12 MANUFACTURERS

.1 Basis of Designs: Schneider Canada

Part 3 EXECUTION

3.1 INSTALLATION

.1 Locate service entrance switchboard as indicated.

.2 Connect main secondary service entrance cables to line terminals of switchboard.

.3 Connect load terminals of distribution breakers to outgoing feeders, as indicated.

.4 Check factory-made connections for mechanical security and electrical continuity.

.5 Run one #2/0, bare copper, grounding conductor in 1" (25 mm) conduit from ground bus to the main building ground.

.6 Adjust relay settings to those indicated in shop drawings to ensure proper working and protection of components.

.7 Manufacturer to provide test equipment and field test overload, magnetic and ground fault tripping. Include test report in Maintenance Manuals.

.8 Perform 3 phase load testing under normal building load after project is deemed substantially complete. Measure voltage, current and power factor for 4 hours, sampling every 5 minutes and recording peak load. Customer metering device may be used for sampling. Recording instrument to be supplied by distribution manufacturer or third party - cost to be included.

.9 Arrange for main distribution switchboard to be mounted on 4" (100 mm) housekeeping pad.

.10 Provide breaker setting as per Coordination study report.

END OF SECTION

LOAD BALANCE TEST REPORT

The following report shall be dated and signed by E.C. and upon final completion of all work outlined in electrical specifications.

This **Load Balance test Report** document must be included in electrical O&M manuals.

	VOLTS						AMPS			
	A-B	**B-C**	**A-C**	**A-N**	**B-N**	**C-N**	**A**	**B**	**C**	**N**

	VOLTS						AMPS			
	A-B	**B-C**	**A-C**	**A-N**	**B-N**	**C-N**	**A**	**B**	**C**	**N**

END OF SECTION

1 GENERAL

1.1 RELATED WORK

.1 Panelboards shall be provided as indicated and required for the systems served and supplied under electrical Divisions.

.2 Circuit breakers, switches and accessories shall be provided as indicated and required for a complete installation.

1.2 SUBMITTALS

.1 Shop drawings shall be submitted for approval for all panelboards.

.2 Voltage and amperage test results shall be submitted to the engineer, prior to the final site observation.

2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

.1 Basis of design is Schneider Canada.

.2 Panelboards and all of the related components shall be supplied by only one manufacturers. Partial or split packages of equipment are not acceptable.

2.2 GENERAL

.1 Panel ratings, sizes, mounting, and components shall be as indicated on the drawings.

.2 Multiple circuit breakers shall be common trip type.

.3 All bussing shall be full height at the panelboard rated capacity.

.4 Provide lockable covers for all CDP's and panels.

.5 Covers shall be hinged, locking type with concealed trim clamps.

.6 Main circuit breakers and disconnect switches shall not be branch-mounted unless explicitly indicated.

.7 Branch circuit breakers shall have a minimum interrupting capacity as indicated on single line diagram.

.8 Provide CDP type panels where indicated.

.9 All CDP's shall be sprinkler proof and CSA enclosure Type 3. Panels shall be sprinkler proof.

.10 Provide breakers for each panelboard and each CDP as indicated.

.11 Provide GFCI and AFCI breakers as indicated.

.12 Provide integral TVSS in each panelboard as specified in section 26 43 13.

3 EXECUTION

3.1 INSTALLATION

.1 Wall mounted panels shall be mounted with tops at 6'-0" and mounted to 3/4" plywood equipment mounting panels which are painted with a gray fire-retardant.

.2 Floor mounted panels shall be provided with a 4" concrete housekeeping pad.

.3 Typed circuit directories shall be provided for all circuit breaker panelboards. Include supply disconnect location and size of feeder.

.4 Laminated (white/black) plastic nameplates with 3/16" letters shall be provided for each panelboard and for each device in the distribution panelboard(s).

.5 Loads shall be evenly balanced on all phases.

3.2 TESTING

.1 Voltage and amperage readings shall be taken on the incoming line side of each panelboard with the maximum possible number of systems operating to simulate peak operating conditions.

END OF SECTION

1 GENERAL

1.1 RELATED WORK

.1 Basic Electrical Materials and Methods Section 26 05 01

.2 Outlet Boxes and Fittings Section 26 05 32

1.2 SUBMITTALS

.1 Submit shop drawings and product data in accordance with Section 26 05 01.

2 PRODUCTS

2.1 SWITCHES

.1 Decora style general purpose AC switches 15A and 20A, 120V AC, single pole, double pole, three-way and four-way switches as indicated, with the following features:

.1 Terminal holes approved for No. 10 AWG wire.

.2 Silver alloy contacts.

.3 Urea molding.

.4 Suitable for back and side wiring.

.5 White finish or as directed by Architect.

.6 Fully rated for LED and fluorescent luminaires.

.2 Switches of one manufacturer throughout project.

.3 Switches to be premium specification grade.

2.2 RECEPTACLES

.1 Duplex receptacles, Decora style, NEMA No. 5-15R, 5-20R, 125V AC, 15A, U-ground, with the following features:

.1 Nylon face color to be determined by Architect.

.2 Suitable for No. 10 AWG for back and side wiring.

.3 Break-off links for use as split receptacles.

.4 Double wipe contacts and riveted grounding contacts.

.2 Single receptacles NEMA No. 5-15R, 5-20R, 125V AC, 15A, U-ground, with the following features:

.1 Nylon face, color as indicated above.

.2 Suitable for No. 10 AWG for back and side wiring.

.3 Receptacles to be of one manufacturer throughout project.

.4 Receptacles to be premium specification grade.

2.3 SPECIAL WIRING DEVICES

.1 Special wiring devices: as indicated on drawings.

.2 Pushbutton stations to be flush or surface-mounted as required. Units to be complete with up/down or start/stop buttons, as required, and green pilot light.

.3 Range outlets to be NEMA #14-50, 125/250V, 50A, black, complete with cord set.

.4 Dryer outlets to be NEMA #14-30, 125/250V, 30A, black, complete with cord set.

.5 Floor mounted, flush-type receptacles to be equivalent to Legrand Evolution Series complete with faceplates for duplex receptacle, data outlet, etc. as indicated on drawings. Coordinate finish with architect.

2.4 LIGHTING DIMMER CONTROLS

.1 Dimmer control devices to have a calibrated linear slide control lever from 1% to 100%. A separate ON/OFF switch to turn off current flow to lamps.

.2 Dimmers shall be compatible with specified LED luminaires.

.3 Color of dimmer snap-on cover to be as selected by the Architect, or as indicated on the drawings.

.4 Provide a separate neutral wire for each dimmer circuit.

2.5 TRANSIENT VOLTAGE SURGE PROTECTION RECEPTACLES

.1 Transient voltage surge protection (TVSS) receptacles, NEMA No. S-15R, 125V AC, 15A, U-ground with the following features:

.1 Thermo-plastic face, duplex, white, hospital grade construction.

.2 Back and side wiring.

.3 80 joules of energy absorption in each of the three modes: line-to-neutral; line-to-ground; neutral-to-ground.

.4 6000 volts protection in each of the three modes.

.5 Two filtering capacitors for 7:1 RFI and EMI noise reduction.

.6 Varistor clamping voltage 150V RMS.

.7 Response time of less than 1 nanosecond.

.8 Built-in LED for surge protection indication.

.9 Electronic components potted for electrical, mechanical and thermal stability.

.2 TVSS receptacles to be orange face, isolated ground-type. Provide a separate insulated ground wire for each isolated ground circuit.

.3 Basis of Design: Pass & Seymour 6262-SP Series.

2.6 COVERPLATES

.1 Coverplates from one manufacturer throughout project.

.2 White coverplates for wiring devices mounted in flush-mounted outlet boxes. Confirm with shop drawings.

.3 Sheet steel utility box cover for wiring devices installed in surface mounted utility boxes.

.4 Cast gasketted coverplates for wiring devices mounted in surface mounted FS or FD.

.5 Weatherproof double lift spring-loaded cast aluminum coverplates, complete with gaskets for duplex receptacles as indicated.

.6 Weatherproof coverplates, complete with gaskets for single receptacles or switches as indicated.

3 EXECUTION

3.1 INSTALLATION - SWITCHES

.1 Install single throw switches with toggle in “UP” position when switch closed.

.2 Install switches in gang-type outlet box when more than one switch is required in one location.

.3 Mount toggle switches at height specified in Section 26 05 01 or as indicated.

3.2 INSTALLATION - RECEPTACLES

.1 Install receptacles in gang-type outlet box when more than one receptacle is required in one location.

.2 Mount receptacles horizontally at height specified in Section 26 05 01, or as indicated.

3.3 INSTALLATION - COVERPLATES

.1 Install suitable common coverplates where wiring devices are ganged.

.2 Do not use coverplates intended for flush outlet boxes on surface mounted boxes.

.3 Provide a coverplate on each outlet. Stainless steel, unless otherwise directed.

3.4 IDENTIFICATION

.1 Identify receptacles with size ~~0~~ nameplate indicating panel and circuit number. Nameplates to be pre-glued with peel-off paper backing.

END OF SECTION

1 GENERAL

1.1 RELATED WORK

.1 Basic Electrical Materials and Methods Section 26 05 01

.2 Disconnect Switches Section 26 28 23

1.2 SUBMITTALS

.1 Submit shop drawings and product data in accordance with Section 26 05 01.

.2 Submit fuse melting and clearing time-current characteristics for each fuse type and size above 400A.

1.3 MAINTENANCE MANUALS

.1 Provide maintenance materials in accordance with Section 26 05 01.

.2 Three spare fuses of each type and size.

1.4 DELIVERY AND STORAGE

.1 Ship fuses in original containers.

.2 Do not ship fuses installed in switchboards or disconnects.

.3 Store spare fuses in storage cabinet.

2 PRODUCTS

2.1 FUSES - GENERAL

.1 Plug and cartridge fuses: to CSA C22.2 No.59.

.2 HRC fuses: to CSA C22.2 No.106 (R1967) to have interrupting capability of 200,000 amps symmetrical.

.3 Fuses: product of one manufacturer.

2.2 FUSE TYPES

.1 Form I, HRC fuses, Class L:

.1 Type L1, time delay, capable of carrying 500% rated current for 4s minimum.

.2 Type L2, fast-acting.

.2 Form I, HRC fuses, Class J:

.1 Type J1, time delay, capable of carrying 500% rated current for 10s minimum.

.2 Type J2, fast-acting.

.3 Form I, HRC fuses, Class R:

.1 Type R1, time delay, capable of carrying 500% rated maximum let-through limits.

.2 Type R2, time delay, capable of carrying 500% rated current for 10s minimum, to meet UL Class K5 maximum let-through limits.

.3 Type R3, fast-acting Class R, to meet UL Class K1 maximum let-through limits.

.4 Form II, HRC fuses, Class C:

.1 Type C, current limiting.

2.3 MANUFACTURERS

.1 Basis of Design: FuseTek.

3 EXECUTION

3.1 Installation

.1 Install fuses in mounting devices immediately before energizing circuit.

.2 Ensure correct fuses fitted to physically matched mounting devices.

.3 Ensure correct fuses fitted to assigned electrical circuit.

END OF SECTION

1 GENERAL

1.1 RELATED WORK

.1	Basic Electrical Materials and Methods	Section 26 05 01
.2	Panelboards	Section 26 24 17

1.2 SUBMITTALS

.1 Submit product data in accordance with Section 26 05 01.

.2 Include with requests for equal time-current characteristic curves for breakers with ampacity of 800A and over, or with interrupting capacity of 25,000A symmetrical RMS and over at system voltage.

2 PRODUCTS

2.1 BREAKERS - GENERAL

.1 Bolt-on molded case circuit breaker, quick-make, quick-break type, for manual and automatic operation with temperature compensation for 40°C (104°F) ambient.

.2 Common-trip breakers with single handle for multi-pole applications.

.3 Magnetic instantaneous trip elements in circuit breakers, to operate only when the value of current reaches setting. Trip settings on breakers with adjustable trips to range from 3-10 times current rating.

.4 Circuit breakers with interchangeable trips as indicated.

2.2 STATIC TRIP (LSI) BREAKERS

.1 All upstream breakers to protect transformers shall be equipped with LSI fully adjustable type breaker. Instantaneous setting of the breakers shall be greater than transformer inrush current (12x primary rated current).

.2 All LSI breakers as indicated in the drawings shall be fully adjustable. Fixed setting is not accepted.

2.3 THERMAL MAGNETIC BREAKERS

.1 Molded case circuit breaker to operate automatically by means of thermal and magnetic tripping devices to provide inverse time current tripping under overload conditions and instantaneous magnetic tripping for short circuit protection.

2.4 GROUND FAULT CIRCUIT INTERRUPTERS

.1 Molded case circuit breakers as above with integral Class A Group 1 ground fault

interrupter.

2.5 ARC FAULT CIRCUIT INTERRUPTERS

.1 Molded case circuit breakers as above with integral Arc Fault Circuit Interrupter to CSA-C22.2 No. 5.1.

.2 Series, parallel and ground protection.

2.5 MANUFACTURERS

.1 Basis of Design: Schneider Canada.

3 EXECUTION

3.1 INSTALLATION

.1 Install circuit breakers as indicated.

END OF SECTION

1 GENERAL

1.1 RELATED WORK

.1	Basic Electrical Materials and Methods	Section 26 05 01
.2	Fastenings and Supports	Section 26 05 29
.3	Mechanical Equipment Connections	Section 26 05 80

1.2 SUBMITTALS

.1 Submit shop drawings and product data in accordance with Section 26 05 01.

2 PRODUCTS

2.1 DISCONNECT SWITCHES

.1 Fusible and non-fusible disconnect switches in EEMAC Type 3R, size as indicated.

.2 Provision for padlocking in "ON-OFF" position with 3 padlocks. Mechanically interlocked door to prevent opening when handle in "ON" position.

.3 Mechanically interlocked door to prevent opening when handle in “ON” position.

.4 Fuse holders: suitable without adaptors, for type and size of fuse indicated.

.5 Quick-make, quick-break action.

.6 "ON-OFF" switch position indication on switch enclosure cover.

.7 Fuses as indicated in accordance with Section 26 28 14.

.8 Single-phase motor disconnect switches shall be one or two-pole toggle-type, 20 amp, 120/227V AC, brown handle with side and back wiring complete with pilot light.

.9 Three-phase motor disconnect switches shall be 600V non-fusible safety switches, sized as required. Switch shall be non-teasing, quick-make, quick-break type with visible blades, line terminal shield and enclosure, as indicated, with cover interlock and lockable handle.

.10 Fusible and non-fusible disconnect switches in sprinkler proof enclosure for interior applications, and EEMAC Type 3R enclosure for exterior applications, unless otherwise indicated.

3 EXECUTION

3.1 INSTALLATION

.1 Install motor disconnect switches (complete with fuses) where indicated.

.2 Install fused circuit disconnect switches where indicated or where required by the inspection authorities and/or for equipment supplied by other trades.

3.2 IDENTIFICATION

.1 Indicate name of load controlled on Size 4 nameplate to Section 26 05 01.

3.3 MANUFACTURERS

.1 Basis of Design: Schneider Canada.

END OF SECTION

1 GENERAL

1.1 RELATED WORK

.1	Basic Electrical Materials and Methods	Section 26 05 01
.2	Lighting Contactor Panel	Section 26 09 25

2 PRODUCTS

2.1 CONTACTORS

.1 Contactors to EEMAC No. ICS-1970.

.2 Mechanically held controlled by pilot devices as indicated and rated for type of load controlled. Half size contactors not accepted.

.3 Fused switch combination contactor as indicated.

.4 Complete with two normally open and two normally closed auxiliary contacts unless indicated otherwise.

.5 Mount in CSA enclosure Type 3, or specific control panel, unless indicated otherwise.

.6 Include the following options in cover:

.1 Red indicating lamp.

.2 Hand-Off-Auto selector switch.

2.2 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 01 - Electrical General Requirements.

.2 Size 4 nameplate indicating name of load controlled as indicated.

2.3 MANUFACTURER

.1 Basis of Design: Schneider Canada

3 EXECUTION

3.1 INSTALLATION

.1 Install contactors and connect auxiliary control devices.

END OF SECTION

1 GENERAL

1.1 SCOPE

.1 The Contractor shall furnish and install the low voltage motor starters as specified herein and as shown on the contract drawings.

1.2 RELATED SECTIONS

.1	Mechanical Equipment Connections	Section 26 05 80
.2	Circuit Breakers	Section 26 28 21

1.3 REFERENCES

.1 The motor starters shall be designed, manufactured and tested in accordance with the latest applicable standards of NEMA, ANSI, UL and CSA.

1.4 SUBMITTALS – FOR REVIEW/APPROVAL

.1 The following information shall be submitted to the Engineer:

1. Master drawing index
2. Dimensioned outline drawings
3. Conduit entry/exit locations
4. Cable terminal sizes
5. Wiring diagrams
6. Nameplate schedule
7. Ratings including:
   a. Voltage
   b. Horsepower and/or continuous current
8. Product data sheets

1.5 SUBMITTALS – FOR CONSTRUCTION

.1 The following information shall be submitted for record purposes:

1. Final as-built drawings and information for items listed in Paragraph 1.04, and shall incorporate all changes made during the manufacturing process.
2. Wiring diagrams
3. Seismic certification as specified

1.6 QUALIFICATIONS

.1 The manufacturer of the assembly shall be the manufacturer of the major components within the assembly.

.2 For the equipment specified herein, the manufacturer shall be ISO 9001 or 9002 certified.

.3 The manufacturer of this equipment shall have produced similar electrical equipment for a minimum period of five (5) years. When requested by the Engineer, an acceptable list

of installations with similar equipment shall be provided demonstrating compliance with this requirement.

1.7 REGULATORY REQUIREMENTS

1.8 DELIVERY, STORAGE AND HANDLING

.1 Equipment shall be handled and stored in accordance with manufacturer's instructions. One (1) copy of these instructions shall be included with the equipment at time of shipment.

2 PRODUCTS

2.1 MANUFACTURERS

.1 Basis of Design: Eaton Canada

The listing of specific manufacturers above does not imply acceptance of their products that do not meet the specified ratings, features and functions. Manufacturers listed above are not relieved from meeting these specifications in their entirety. Products in compliance with the specification and manufactured by others not named will be considered only if pre-approved by the Engineer ten (10) days prior to bid date.

2.2 MANUAL MOTOR CONTROL

.1 Single-Phase Manual Starters

1. Manual single-phase starters 1 hp or smaller shall be Cutler-Hammer type MS starters or approved equal. The starter shall have a quick-make/quick-break toggle mechanism. The overload shall have a field adjustment allowing up to +/- 10% variance in ratings of the nominal heater value
2. Manual single-phase starters above 1 hp shall be Cutler-Hammer type B100 or approved equal. The starter shall have quick-make/quick-break mechanism. The closure of the contacts shall be blocked while the line terminals are exposed. The operating handle or button shall clearly indicate whether the unit is ON, OFF or TRIPPED
3. The enclosure shall be general purpose NEMA 1 or general purpose NEMA 1B – flush mounted as indicated on the contact drawings

.2 Three-Phase Manual Starters

1. The starter shall have quick-make/quick-break operating mechanism
2. The operating handle or button shall clearly indicate whether the unit is ON, OFF or TRIPPED
3. The closure of the contacts shall be blocked while the line terminals are exposed
4. The enclosure shall be general purpose NEMA 1, as indicated on the contract drawings]
5. Manual three-phase motor starters shall be Cutler-Hammer type B100 or equal

2.3 ELECTROMECHANICAL MOTOR CONTROL

.1 Non-Reversing Starters

1. Magnetic starters through NEMA Size 9 shall be equipped with double-break silver alloy contacts. The starter must have straight-through wiring. Each starter shall have one (1) NO auxiliary contact
2. Coils shall be permanently marked with voltage, frequency and part number
3. Overload relays shall be an ambient compensated bimetallic-type with interchangeable heaters, calibrated for 1.0 and 1.15 service factor motors. Electrically isolated NO and NC contacts shall be provided on the relay. Visual trip indication shall be standard. A test trip feature shall be provided for ease of troubleshooting and shall be conveniently operable without removing components or the motor starter. Overload to have (+/-) 24% adjustability, single-phase sensitivity, and isolated alarm contact, and manual or automatic reset
4. NEMA Size 1 through 2 starters shall be suitable for the addition of at least six (6) external auxiliary contacts of any arrangement normally open or normally closed. Size 3 through 8 starters shall be suitable for the addition of up to eight (8) external auxiliary contacts of any arrangement normally open or normally closed
5. Motor starters shall be Cutler-Hammer Freedom Series or approved equal

.2 Reversing Starters

1. Reversing starters shall consist of two (2) contactors and a single overload relay assembled together. The contactors shall be mechanically and electrically interlocked to prevent line shorts and the energizing of both contactors simultaneously
2. Magnetic starters through NEMA Size 8 shall be equipped with double-break silver alloy contacts. The starter must have straight-through wiring
3. Coils shall be permanently marked with voltage, frequency and part number
4. Overload relays shall be an ambient compensated bimetallic-type with interchangeable heaters, calibrated for 1.0 and 1.15 service factor motors. Electrically isolated NO and NC contacts shall be provided on the relay. Visual trip indication shall be standard. A test trip feature shall be provided for ease of troubleshooting and shall be conveniently operable without removing components or the motor starter. Overload to have +/- 24% adjustability, single-phase sensitivity, and isolated alarm contact and manual or automatic reset

.3 Two-Speed Starters

1. Magnetic starters through NEMA Size 6 shall be equipped with double-break silver alloy contacts. The starter must have straight-through wiring
2. Coils shall be permanently marked with voltage, frequency and part number
3. Overload relays shall be an ambient compensated bimetallic-type with interchangeable heaters, calibrated for 1.0 and 1.15 service factor motors. Electrically isolated NO and NC contacts shall be provided on the relay. Visual trip indication shall be standard. A test trip feature shall be provided for ease of troubleshooting and shall be conveniently operable without removing

components or the motor starter. Overload to have +/- 24% adjustability, single-phase sensitivity, and isolated alarm contact and manual or automatic reset

4. NEMA Size 1 through 2 starters shall be suitable for the addition of at least six (6) external auxiliary contacts of any combination of normally open or normally closed contacts. Sizes 3 through 6 starters shall be suitable for the addition of up to eight (8) external auxiliary contacts of any combination of normally open or normally closed contacts
5. Two-speed magnetic starters for motors up to 400 hp, 600 volts shall be Cutler-Hammer Freedom Series type AN700 or approved equal

2.4 SOLID-STATE REDUCED-VOLTAGE MOTOR CONTROL

.1 Reduced Voltage Motor Starter Type S801

1. Controller shall be Cutler-Hammer type S801
2. The solid-state reduced-voltage starter shall be UL and CSA listed. The solid-state reduced-voltage starter shall be an integrated unit with power SCRs, logic board, paralleling bypass contactor, and electronic overload relay enclosed in a single molded housing
3. The SCR-based power section shall consist of six (6) back-to-back SCRs and shall be rated for a minimum peak inverse voltage rating of 1500 volts PIV
4. Units using triacs or SCR/diode combinations shall not be acceptable
5. Resistor/capacitor snubber networks shall be used to prevent false firing of SCRs due to dV/dT effects
6. The logic board shall be mounted for ease of testing, service and replacement. It shall have quick disconnect plug-in connectors for current transformer inputs, line and load voltage inputs and SCR gate firing output circuits
7. The logic board shall be identical for all ampere ratings and voltage classes and shall be conformally coated to protect environmental concerns
8. The paralleling run bypass contactor shall energize when the motor reaches 90 of full speed and close/open under one (1) times motor current
9. The paralleling run bypass contactor shall utilize an intelligent coil controller to limit contact bounce and optimize coil voltage during varying system conditions
10. Starter shall be provided with electronic overload protection as standard and shall be based on inverse time-current algorithm. Overload protection shall be capable of being disabled during ramp start for long acceleration loads via a DIP switch setting on the device keypad
11. Overload protection shall be adjusted via the device keypad and shall have a motor full load ampere adjustment from 30 to 100% of the maximum continuous ampere rating of the starter
12. Starter shall have selectable overload class setting of 5, 10, 20 or 30 via a DIP switch setting on the device keypad
13. Starter shall be capable of either an electronic or mechanical reset after a fault
14. Units using bimetal overload relays are not acceptable
15. Over temperature protection (on heat sink) shall be standard

16. Starters shall provide protection against improper line-side phase rotation as standard. Starter will shut down if a line-side phase rotation other than A-B-C exists. This feature can be disabled via a DIP switch on the device keypad
17. Starters shall provide protection against a phase loss or unbalance condition as standard. Starter will shut down if a 50% current differential between any two phases is encountered. This feature can be disabled via a DIP switch on the device keypad
18. Start shall provide protection against a motor stall condition as standard. This feature can be disabled via a DIP switch on the device keypad
19. Starter shall provide protection against a motor jam condition as standard. This feature can be disabled via a DIP switch on the device keypad
20. Starter shall be provided with a Form C normally open (NO), normally closed (NC) contact that shall change state when a fault condition exists. Contacts shall be rated 60 VA (resistive load) and 20 VA (inductive load). In addition, an LED display on the device keypad shall indicate type of fault (Overtemperature, Phase Loss, Jam, Stall, Phase Reversal and Overload)
21. The following control function adjustments on the device keypad are required:
    1. Selectable Torque Ramp Start or Current Limit Start
    2. Adjustable Kick Start Time: 0–2 seconds
    3. Adjustable Kick Start Torque: 0–85%
    4. Adjustable Ramp Start Time: 0.5–180 seconds
    5. Adjustable Initial Starting Ramp Torque: 0–85%
    6. Adjustable Smooth Stop Ramp Time: 0–60 seconds.
22. Units enclosed in motor control centers shall be of the same manufacturer as that of the circuit breaker and motor control center for coordination and design issues
23. Maximum continuous operation shall be at 115% of continuous ampere rating

2.5 ENCLOSURES

.1 The enclosure shall be as indicated on the contract drawings.

.2 Starters shall have an adjustable instantaneous motor circuit protector (HMCP) type disconnect device.

2.6 OPTIONS

.1 Each starter shall be equipped with a fused control power transformer (100 va minimum)] HOA selector switch, red “run” pilot light, green “stop” pilot light, 2 no/2 NC auxiliary contacts and or as indicated on the contract drawings.

.2 Pilot Lights shall be LED type

3 EXECUTION

3.1 FACTORY TESTING

.1 Standard factory tests shall be performed on the equipment provided under this section. All tests shall be in accordance with the latest version of CSA, UL and NEMA standards.

.2 The manufacturer shall provide three (3) certified copies of factory test reports.

3.2 FIELD QUALITY CONTROL

1. Provide a detailed motor list indicating the size and type of overloads installed for each motor.

2. Include motor overload list in operation and maintenance manuals.

3.3 SPARE PARTS

.1 Provide three spare overloads of each size installed.

END OF SECTION

1 GENERAL

1.1 SCOPE

.1 The Contractor shall furnish and install the Transient Voltage Surge Suppression (TVSS) equipment having the electrical characteristics, ratings and modifications as specified herein and as shown on the contract drawings. To maximize performance and reliability, the AC surge protection shall be integrated into electrical distribution equipment such as switchgear, switchboards, panelboards, busway and/or motor control centers. Refer to related sections for surge requirements in:

1.2 RELATED SECTIONS

.1 Panelboards Section 26 24 17

1.3 REFERENCES

.1 TVSS units and all components shall be designed, manufactured and tested in accordance with the latest applicable UL Listed standards (UL 1449, 2nd Edition), UL 1283 and CSA certified per CSA 22.2

1.4 SUBMITTALS – FOR REVIEW/APPROVAL

.1 The following information shall be submitted to the Engineer:

.1 Provide verification that the TVSS device complies with the required UL 1449 2nd Edition and CSA approvals.

.2 Provide actual let through voltage test data in the form of oscillograph results for the ANSI/IEEE C62.41Category C3 & C1 (combination wave) and B3 (ringwave) tested in accordance with ANSI/IEEE C62.45.

.3 Provide spectrum analysis of each unit based on MIL-STD-220A test procedures between 50 kHz and 200 kHz verifying the devices noise attenuation equal or exceeds 50 dB at 100 kHz.

.4 For retrofit mounting applications, electrical/mechanical drawings showing unit dimensions, weights, installation instruction details, and wiring configuration.

.5 Provide test report in compliance with NEMA LS1 from a recognized independent testing laboratory verifying the suppressor components can survive published surge current rating on both a per mode and per phase basis using the IEEE C62.41, 8 x 20 microsecond current wave. Note that test data on individual module is not accepted.

.2 Where applicable the following additional information shall be submitted to the engineer:

.1 Descriptive bulletins

.2 Product sheets.

1.5 SUBMITTALS – FOR CONSTRUCTION

.1 The following information shall be submitted for record purposes:

.1 Final as-built drawings and information for items listed in section 1.04.

1.6 QUALIFICATIONS

.1 For the specified herein, the manufacturer shall be ISO 9000 certified.

.2 The manufacturer must have a 24-hour response capability with nationwide field engineering personnel. The field service organization must have fully accredited, power system Engineers located across the North America who are capable of performing complete grounding, Power Quality analysis, and coordination studies. Factory trained TVSS sales personnel do not qualify as Power System Engineers.

.3 The manufacturer of the transient voltage surge suppression equipment shall be the same manufacturer as the manufacturer of the low voltage distribution equipment in which the TVSS units are installed.

1.7 DELIVERY, STORAGE AND HANDLING

.1 Equipment shall be handled and stored in accordance with manufacturer's instructions. One (1) copy of manufacturer's instructions shall be included with the equipment at time of shipment.

1.8 OPERATION AND MAINTENANCE MANUALS

.1 Equipment operation and maintenance manuals shall be provided with each assembly shipped, and shall include instruction leaflets and instruction bulletins for the complete assembly and each major component.

2 PRODUCTS

2.1 MANUFACTURERS

.1 Basis of Design Eaton/Cutler-Hammer: Visor Series

.1 The listing of specific manufacturers above does not imply acceptance of their products that do not meet the specified ratings, features and functions. Manufacturers listed above are not relieved from meeting these specifications in

their entirety. Products in compliance with the specification and manufactured by others not named will be considered only if pre-approved by the Engineer ten (10) days prior to bid date.

2.2 VOLTAGE SURGE SUPPRESSION – GENERAL

.1 Electrical Requirements

.1 Unit Operating Voltage – Refer to drawings for operating voltage and unit configuration.

.2 Maximum Continuous Operating Voltage (MCOV) – The MCOV shall be greater than 115% of the nominal system operating voltage.

.3 The suppression system shall incorporate a hybrid designed Metal-Oxide Varistors (MOV) surge suppressor for the service entrance and other distribution level. The system shall not utilize silicon avalanche diodes, selenium cell, air gaps or other components that may crowbar the system voltage leading to system upset or create any environmental hazards.

.4 Protection Modes – For a wye configured system, the device must have directly connected suppression elements between line-neutral (L-N), line-ground (L-G), and neutral-ground (N-G). For a delta-configured system, the device must have suppression elements between line to line (L-L) and line to ground (L-G).

.5 UL 1449 2nd Edition Suppressed Voltage Rating (SVR) – The maximum UL 1449 2nd Edition SVR for the device must not exceed the following:

Modes	208Y/120	480Y/277	600Y/347
L-N; L-G; N-G	400V	800V	1200V
L-L	800V	1800V	1800V

.6 ANSI/IEEE Cat. C3 Let Through Voltage – The let through voltage based on IEEE C62.41 and C62.45 recommended procedures for Category C3 surges (20 kV, 10 kA) shall be less than:

Mode	208Y/120	480Y/277	600Y/347
L-N	560V	960V	1840V

.7 ANSI/IEEE Cat. B3 Let Through Voltage – Let through voltage based on IEEE C62.41 and C62.45 recommended procedures for the ANSI/IEEE Cat. B3 ringwave (6 kV, 500 amps) shall be less than:

Mode	208Y/120	480Y/277	600Y/347
L-N	160V	165V	168V

.2 TVSS Design

.1 Balanced Suppression Platform – The surge current shall be equally distributed to all MOV components to ensure equal stressing and maximum performance. The surge suppression platform must provide equal impedance paths to each matched MOV. Designs incorporating TVSS modules shall not be acceptable.

.2 Electrical Noise Filter – Each unit shall include a high-performance EMI/RFI noise rejection filter. Noise attenuation for electric line noise shall be 50 dB at 100 kHz using the MIL-STD-220A insertion loss test method. Products not able to demonstrate noise attenuation of 50 dB @ 100 kHz shall be rejected.

.3 Extended Range Filter –The Surge Protective Device shall have a High Frequency Extended Range Tracking filter in each Line to Neutral mode with compliance to UL 1283 and NEMA LS1. The filter shall have published high frequency attenuation rating in the attenuation frequencies.

Attenuation Frequency	50kHz	100kHz	500kHz	1MHz	10MHz	100MHz
Insertion Loss (ratio)	40	316	316	89	200	79
Insertion Loss (dB)	32	50	50	39	46	38

.4 Internal Connections – No plug-in component modules or printed circuit boards shall be used as surge current conductors. All internal components shall be hardwired with connections utilizing low impedance conductors and compression fittings.

.5 Standard Monitoring Diagnostics – Each TVSS shall provide integral monitoring options:

.1 Each unit shall provide a green / red solid state indicator light shall be provided on each phase. The absence of a green light and the presence of a red light, shall indicate which phase(s) have been damaged.

.2 Remote Status Monitor – The TVSS device must include form C dry contacts (one NO and one NC) for remote annunciation of unit status. The remote alarm shall change state if any of the three phases detect a fault condition.

.3 Audible Alarm – The TVSS shall provide an audible alarm with a reset pushbutton that will be activated under any fault condition.

.4 Event Counter – The TVSS shall be equipped with an LCD display system designed to indicate to the user how many surges, sags, swells and outages have occurred at the location. The event counter triggers each time under each respective categories after significant event occurs. A reset pushbutton shall also be standard allowing all counters to be zeroed.

.5 Push to Test – The TVSS shall be equipped with push-to-test feature is designed to provide users with real time testing of the suppressor's monitoring and diagnostic system. By depressing the test button, the diagnostic system initiates a self test procedure. If the system is fully operational, the self test will activate all indicator lights.

.6 Voltage Monitoring – The TVSS shall display true Root Mean Square (RMS) on three L-N voltage protection mode on Wye configuration and three L-L voltage on delta configuration.

.6 Optional Monitoring Diagnostics:

.1 Non Volatile Memory – The TVSS shall at least be able to save the last 1000 events.

.2 Network Communication – The TVSS shall have the ability to communicate via Ethernet 10BaseT port or Modbus to provide information to the network master drive.

.3 Security – The TVSS monitoring diagnostics shall be password protected.

.4 Protection Remaining – The TVSS shall indicate the level of protection remaining.

.5 Total Harmonic Distortion (%THD) – The TVSS shall display Total Harmonic Distortion.

.7 Overcurrent Protection Fusing: In order to isolate the TVSS under any fault condition, the manufacturer shall provide:

.1 Individual Fusing: MOV's shall be individually fused via Copper Fuse Trace. The Copper Fuse shall allow protection during high surge (kA) events.

.2 Thermal Protection: MOV's shall be equipped with Thermal Fuse Spring (TFS) Technology which allows disconnection of the suppression component at the overheated stage common during temporary over voltage condition. For small fault currents between 100mA to 30Amp, or if the occurrence is over a longer period of time, the TFS will disconnect first. Manufacturers that utilize fuse trace only shall not be approved since there is no fault current protection between 100mA to 30A.

.3 All overcurrent protection components shall be tested in compliance with UL 1449-Limited Current Test and AIC rating test.

.3 Minimum Repetitive Surge Current Capability as per ANSI/IEEE C62.41 and ANSI/IEEE C62.45 – 1992

.1 The suppression filter system shall be repetitive surge tested in every mode utilizing a 1.2 x 50µsec, 20kV open circuit voltage. 8 x 20µsec, 10kA short circuit current Category C3 bi-wave at one minute intervals without suffering either performance degradation or more than 10% deviation of clamping voltage

at a specified surge current. The minimum repetitive surge current capability as per ANSI/IEEE C62.41 and ANSI/IEEE C62.45 – 1992 shall be:

.1 Service Entrance: 12000 impulse per mode.
.2 Distribution Panelboard: 10000 impulse per mode.
.3 Branch Location Panelboard: 9000 impulse per mode.

2.3 SYSTEM APPLICATION

.1 The TVSS applications covered under this section include distribution and branch panel locations, bus plugs, motor control centers (MCC), switchgear, and switchboard assemblies. The branch panel located TVSS shall be tested and demonstrate to be suitable for ANSI/IEEE C62.41 Category C1 environments.

.2 Surge Current Capacity -- The minimum total surge current 8 x 20 microsecond waveform that the device is capable of withstanding shall be as shown in the following table:

Minimum total surge current and withstand Capability with compliance to ANSI/IEEE C62.41 AND NEMA LS1			
Application	Per Phase	Per Mode	Surge Withstand Capabilities ANSI/IEEE C3 Wave (10 kA)
Service Entrance Locations (Switchboards, Switchgear, MCC Main Entrance)	250kA	125kA	12000
High Exposure Roof Top Locations (Distribution Panelboards)	160kA	80kA	10000
Branch Locations (Panelboards, MCCs, Busway)	120kA	60kA	9000

.3 Lighting and Distribution Panelboard Requirements

.1 The TVSS application covered under this section includes lighting and distribution panelboards. The TVSS units shall be tested to demonstrate suitability for ANSI/IEEE C62.41 Category C1 environments.

.2 The TVSS shall not limit the use of Through-feed lugs, Sub-feed lugs and Sub-feed breaker options.

.3 The TVSS shall be immediately installed on the load side of the main breaker.

.4 The panelboard shall be capable of re-energizing upon removal of the TVSS.

.5 A direct bus bar connection shall be used to mount the TVSS component to the panelboard bus bar to reduce the impedance of the shunt path.

.6 The TVSS panelboard shall be constructed using a direct bus bar connection (cable connection between bus bar and TVSS device is not acceptable). TVSS units that use a cable connection do not meet the intent of this specification.

.7 The TVSS shall be included and mounted within the panelboard by the manufacturer of the panelboard.

.8 The TVSS shall be of the same manufacturer as the panelboard.

.9 The complete panelboard including the TVSS shall be UL67 listed.

.4 Retrofit Installation (externally mounted suppressor). Maximum conductor lead length between breaker and suppressor shall not exceed 14 inches. Comply with the manufacturer's recommended installation and wiring practices.

.5 Switchgear, Switchboard, MCC and Busway/ Bus Plug Requirements

.1 The TVSS application covered under this section is for switchgear, switchboard, MCC and Bus Plug locations. Service entrance located TVSS shall be tested and suitable for ANSI/IEEE C62.41 Category C3 environments.

.2 The TVSS shall be of the same manufacturer as the switchgear, switchboard, MCC and Bus Plug.

.3 The TVSS shall be factory installed inside the switchgear, switchboard, MCC and Bus Plug at the assembly point by the original equipment manufacturer.

.4 Locate suppressor on load side of main disconnect device, as close as possible to the phase conductors and ground/neutral bar.

.5 Provide a 30-amp disconnect. The disconnect shall be directly integrated to the suppressor and assembly bus using bolted bus bar connections.

.6 The TVSS shall be integral to switchgear, switchboard, MCC and Bus Plug as factory standardized design.

.7 All monitoring diagnostics features shall be visible from the front of the equipment.

2.4 ENCLOSURES

.1 All enclosed equipment shall have NEMA 1/ 3R general purpose enclosures, unless otherwise noted. Provide enclosures suitable for locations as indicated on the drawings and as described below:

.1 NEMA 1/3R rainproof enclosures intended for outdoor use primarily to provide protection against rain, sleet and damage from external ice formation.

.2 NEMA 12 dust-tight enclosures intended for indoor use primarily to provide protection against circulating dust, falling dirt and dripping non-corrosive liquids. (Panelboards Only)

.3 NEMA 4 watertight stainless steel intended for indoor or outdoor use primarily to provide protection against windblown dust and rain, splashing rain, hose-directed water, and damage from external ice formation. (Side Mounted Units Only)

3 EXECUTION

3.1 EXAMINATION

3.2 FACTORY TESTING

.1 Standard factory tests shall be performed on the equipment under this section. All tests shall be in accordance with the latest version of NEMA and UL standards.

3.3 INSTALLATION

.1 The Contractors shall install all equipment per the manufacturer's recommendations and the contract drawings.

3.4 WARRANTY

.1 The manufacturer shall provide a full ten (10) year warranty from the date of shipment against any TVSS part failure when installed in compliance with manufacturer's written instructions and any applicable national or local code.

END OF SECTION

1 GENERAL

1.1 RELATED WORK

.1	Commissioning	Section 01 90 00
.2	Basic Electrical Materials and Methods	Section 26 05 01
.3	Fastenings and Supports	Section 26 05 29
.4	Outlet boxes	Section 26 05 32

1.2 SUBMITTALS

.1 Submit shop drawings and product data in accordance with Section 26 05 01.

.2 Submit complete photometric data prepared by independent testing laboratory for luminaires where specified for approval by Consultant.

.3 Submit list of replacement lamp data for each luminaire. Include lamp type, voltage, wattage, base type and order code. Include list in maintenance manual.

1.3 GUARANTEE

.1 Replace:

.1 LED’s burning out within 12 months of takeover.

.2 Drivers that fail or exceed their labelled noise level rating or THD within 12 months of takeover.

1.4 COORDINATION

.1 Coordinate luminaire locations with work of other trades.

.2 Coordinate luminaire types with ceiling finishes to ensure compatibility.

2 PRODUCTS

2.1 GENERAL

.1 Luminaires shall carry the CSA label.

.2 Provide supporting devices, plaster frames, junction boxes and outlet boxes where required.

.3 Provide lenses or diffusers of glass or acrylic material as indicated. Acrylic lenses shall be a minimum of .125" (3 mm) thick, and shall be mounted in a hinged frame.

.4 Include finishes to Section 26 05 01 and as indicated.

.5 Where soffits or ceilings have thermal insulation, provide fixtures which are CSA approved for such use.

2.2 LAMPS

.1 Provide lamps as indicated.

.2 LED "PL" lamps shall be 9W (or as indicated on drawings) and match colour temperature of other luminaires

2.3 DRIVERS AND ACCESSORIES

.1 Provide drivers and accessories as indicated.

2.4 EXIT LIGHTS

.1 Provide exit lights as indicated, complete with directional arrows, as shown on the drawings.

.2 Units to be provided with full panel LED's, meeting CSA-C860-01.

.3 Arrange exit lights as required, to allow exits to be visible from access to egress locations.

3 EXECUTION

3.1 INSTALLATION (LUMINAIRES)

.1 Install luminaires at locations indicated, complete with all wiring, connections, fittings, hangers, aligners, box covers and accessories, as required.

.2 Install luminaires and lens materials in architectural details, as indicated.

.3 Install luminaires parallel with building lines. Wall-mounted luminaires to be installed plumb.

.4 Review all ceiling types, construction details and mounting arrangements before placing luminaire orders and ensure that all mounting assemblies, frames, rings and similar features are included for and match the required installation.

.5 All luminaires and assemblies shall be properly secured and supported. Support luminaires independent of the ceiling construction, complete with all fasteners, framing and hangers, as may be required. Do not secure luminaires to mechanical ductwork or other vibration producing apparatus.

.6 Where a luminaire is suspended from the ceiling using a self-aligning box cover, an

additional ground wire from the outlet box to the luminaire shall be provided.

.7 Coordinate the installation of luminaires with the work of other trades, ensuring that the necessary depths and mounting spaces are provided. Luminaires which cannot be installed due to a conflict with structural members, pipes or ductwork shall be relocated to a more suitable location, as directed by the Consultant and/or Architect.

.8 Do not handle specular lenses with bare hands. Use plastic gloves as recommended by supplier.

3.2 WIRING

.1 Connect luminaires to lighting circuits as indicated.

.2 Circuit breakers for exit light circuits shall be provided with lock-on devices.

.3 Wiring for exit and night light circuits shall be installed in a separate conduit system.

.4 Connect luminaires to contactor controlled circuits where indicated. In general corridor, alternating fixtures on separate contactors.

3.3 TESTS

.1 Perform tests in accordance with Section 01 71 00 and Section 26 05 01.

.2 Check luminaires and replace defective lamps, ballasts, drivers, lenses and accessories.

3.4 CLEANING

.1 Prior to take-over of the project, clean the lenses and reflectors of all luminaires with a damp cloth to remove dust, smudges and fingerprints.

.2 Do not handle specular lenses with bare hands. Use plastic gloves as recommended by supplier.

END OF SECTION

1 GENERAL

1.1 RELATED WORK

.1	Commissioning	Section 01 90 00
.2	Basic Electrical Materials and Methods	Section 26 05 01
.3	Wire and Cable	Section 26 05 21
.4	Outlet Boxes and Fittings	Section 26 05 32
.5	Conduit	Section 26 05 34

1.2 SUBMITTALS

.1 Submit shop drawings in accordance with Section 26 05 01.

.2 Data to indicate system components, mounting method, source of power and special attachments.

.3 Battery bank sizing criteria.

1.3 OPERATION AND MAINTENANCE DATA

.1 Provide data for incorporation into Maintenance Manual specified in Section 26 05 01.

.2 Operation and Maintenance Manual to include:

.1 Operation and maintenance instructions for complete battery system to permit effective operation and maintenance.

.2 Technical data - illustrated parts lists with parts catalogue numbers.

.3 Copy of approved shop drawings.

1.4 MAINTENANCE MANUALS

.1 Provide maintenance manuals in accordance with Section 26 05 01.

1.5 WARRANTY

.1 Provide a written guarantee, stating that the battery for emergency lighting is guaranteed against defects in material and workmanship for a period of ten years, with a no-charge replacement during the first five years and a pro-rate charge on the second five years from the date of the Final Acceptance from the City.

1.6 SYSTEM DESCRIPTION

.1 The system to include battery unit(s) remote heads, wire and conduit, etc., to provide backup emergency lighting in the event of a loss of AC power to the normal lighting system.

.2 Unit equipment certified to CSA Standard C22.2 No. 141.

2 PRODUCTS

2.1 BATTERY BANK

.1 Supply voltage: 120 or 347 volt as indicated.

.2 Output voltage: 12VDC.

.3 Battery: long life sealed lead, maintenance-free.

.4 Charger: solid state, multi-rate, voltage/current regulated, inverse temperature compensated, short circuit protected, modular constructed.

.5 Solid state transfer.

.6 Low voltage disconnect: solid state, modular, operates at 80% battery output voltage.

.7 Signal lights: solid state, life expectancy 100,000 h minimum, for “AC Power ON” and “High Charge”.

.8 Lamp heads: integral on unit and remote as indicated. Adjustable mounting, swivel type, complete with LED lamp. Minimum twin heads required per location.

.9 Cabinet: suitable for shelf mounting to wall and complete with knockouts for conduit.

.10 Auxiliary equipment:

.1 test switch

.2 battery disconnect device

.3 AC input and DC output terminal blocks inside cabinet

.4 shelf

.5 cord and plug connection for AC

.6 RFI suppressors

2.2 REMOTE HEADS

.1 Double or triple adjustable heads, as indicated.

2.3 MANUFACTURERS

.1 Basis of Design: Lumacell

3 EXECUTION

3.1 INSTALLATION

.1 Install unit equipment for emergency lighting in accordance with CSA C22.1.

.2 Install conduit and wiring as indicated.

.3 Install unit equipment and remote mounted fixtures as indicated.

.4 Cut and re-cap cord to remove surplus.

.5 Direct heads as indicated.

.6 Mount double remote heads on outlet box such that two heads will be horizontal with the building lines.

.7 Provide "dark test" at the end of the project to direct heads as indicated and required to provide adequate egress lighting. Confirm test complete before requesting substantial performance and/or final on-site review by consultant.

.8 Charge the batteries and test the system for proper operation (minimum of 30 minutes discharge time).

END OF SECTION

EMERGENCY LIGHTING VERIFICATION

The following document shall be dated and signed by E.C. and G.C. upon final completion, witnessing and verification of installed, fully operational emergency lighting systems (including installation and testing of all exit lights and emergency lights) as outlined in drawings and electrical specifications.

This **Emergency Lighting Verification** document must be submitted to Tower Engineering **PRIOR** to submitting request for 'Substantial Completion'.

Company Name: _____ Date: _____
(Electrical Contractor)

Printed Name: _____ Signature: _____

I hereby verify that all emergency lighting systems as noted above are complete and have been commissioned on above noted date.

Company Name: _____ Date: _____
(General Contractor)

Printed Name: _____ Signature: _____

I hereby verify that all emergency lighting systems as noted above are complete and have been commissioned on above noted date.

Witness (circle one):

Engineer - Tower representative Date: _____

Printed Name: _____ Signature: _____

I hereby verify that all emergency lighting systems as noted above are complete and have been commissioned on above noted date.

The above does not constitute a waiver of any of the contract document requirements.

1 GENERAL

1.1 RELATED WORK

.1	Basic Electrical Materials and Methods	Section 26 05 01
.2	Conduit	Section 26 05 34
.3	Cable Tray	Section 26 05 36
.4	Communication System Raceways	Section 27 05 14
.5	Copper CAT 6 Data	Section 27 05 17

1.2 CODES & STANDARDS

.1 EIA/TIA TSB 40 Additional Transmission specifications for Unshielded Twisted Pair Connecting Hardware.

.2 EIA/TIA - 56B Commercial Building Telecommunications Wiring Standards.

.3 CAN/CSA T529 - M-91 High Performance specifications for horizontal UTP.

.4 CAN/CSA - T530-M-90 Building Facilities, Design Guidelines for Telecommunications.

1.3 USE OF A CSV

.1 Data Communications work as specified shall be the responsibility of Certified System Vendor (CSV). The CSV is required to:

.1 Provide proof of Certification with Tender Submission;

.2 Design a Category 6 wiring system based on contract documents;

.3 Comply with Leviton, Nordx IBDN, AMP, Systemax, Panduit design guide and installation principles;

.4 Perform and supervise the cable pull;

.5 ONLY qualified technicians directly employed by the CSV shall terminate cables (at either ends), test and perform cross-connects;

.6 Upon completion, provide standard and enhanced testing on all cable runs, and documentation of test results.

.7 Provide and install equipment as specified herein;

.8 Provide documentation of the installation;

.9 Provide CSV Letter of Certification within two weeks of completion of Job which will include performance level, the identification of the installation by the location and installation date.

1.4 GENERAL COMMENTS

.1 Each work station and office, conference rooms shall be provided with one (or more) CAT 6 data outlet c/w RJ 45 jack (refer to drawings for quantities). Staff and public areas to have RJ 45 CAT 6 outlets where shown.

.2 Work to be done under this section to include finishing of labour materials, and equipment required for a Category 6 Data wiring system Installation.

.3 The Contractor will be responsible for supplying all parts, labour warranties, as well as testing documentation for the wiring system. All parts, components, connectors and physical connections must confirm to a level 6 category wiring plan. Certification of 350 MHz speeds end to end is required.

.4 Contractor is responsible for all cross connects at distribution panel as well as equipment/patch cable (2m) at floor site and equipment rooms.

.5 All bidders must demonstrate that they can meet the installation standards required and submit detailed proposals with specification documents of material components with their bid.

.6 An autocad drawing (on disk) of the cabling structure for each floor is to be supplied indicating runs and identification numbers on project completion by the contractor.

.7 The contractor is responsible for all facets of the project, including but not limited to, backboards in the LAN room, system cabinets, wiring and wall outlets.

.8 Fibre Optic cable should have enough slack to provide 2 metres out using STC connectors on both ends in the LAN and/or hub room.

.9 Provide one 12 strand multi mode fiber optic cable from telephone backboard to data rack in the LAN room.

.10 Provide one 50 pair Cat 3 cables from telephone backboard to data rack LAN room and terminated on patch panels in data racks.

.11 Two post data rack to be City supplied.

.12 Provide patch cables at work station and in LAN room.

.13 Provide conduit pathways from outlets to cable tray.

.14 Provide basket type cable trays for main runs in concealed ceilings and in crawlspace. Provide main runs in conduit for exposed ceilings.

.15 Provide one 2/0 insulated ground cable riser from main ground to LAN room and provide one insulated ground bus per room. Provide one #6 insulated ground from ground bus to equipment racks and trays.

2 PRODUCTS

2.1 STATION OUTLETS

.1 For each outlet provide:

.1 2 Category 6, Data Outlets, complete with icon type numbered labels: DXX-YYYA, where XX=floor level (08, 09, 10) of Work Station, YYY is work station number (001, to 100 etc.) and A is wire to outlet. Outlets as manufactured by Thomas & Betts or approved equal.

.2 Termination of cables on Bix Block at applicable cabinet.

.3 Cable and termination of same on Bix Block to back of cross connect outlet on rack

.4 One cross connect jumper.

.2 Basis of design: Nordx Category 6 BIX RJ45 jacks for all cabinet/racks.

2.2 UTP CABLE

.1 Horizontal cable shall be Category 6 cable 22 AWG unshielded twisted pair. All cables shall be installed as per CSA C22.1. Part 1, Section 50 and Section 60.

.2 In the Wiring/Equipment (LAN) room, provide cables to each equipment cabinet/rack.

.3 All cables in the Wiring/Equipment room are to be placed in a neat and professional manner and routed as per specifications and drawings provided. All cables must be combed and/or routed in such a manner to ensure all bundled cabling is neat and parallel to all other cables in the bundles. All exposed cable bundles are to be Velcro bound at a maximum of 200 mm apart.

.4 Each 4-pair cable shall be terminated in an eight position modular (RJ45) jack (typically QCBIX46DI). Data pin/pair assignment must meet ISDN standard. Standard 4-pair colour codes, Tip (T) and Ring (R) and Pin assignments are illustrated below:

Standard	4-Pair	Wiring Colour Codes	RJ45
Pair 1	T	White/Blue	Pin 5
	R	Blue/White	Pin 4
Pair 2	T	White/Orange	Pin 3
	R	Orange/White	Pin 6
Pair 3	T	White/Green	Pin 1
	R	Green/ White	Pin 2
Pair 4	T	White/Brown	Pin 7
	R	Brown/White	Pin 8

.5 Data communications cables shall be routed in conduit and terminated in a connection location as specified.

.6 Cable runs shall be completed without splices.

2.3 FIBRE SPECIFICATION FOR DUAL WINDOW MULTIMODE FIBRE USING THE 1300 WAVELENGTH PER THE FOLLOWING:

.1	Core Diameter	50um plus or minus 3um
.2	Cladding Diameter	125um plus or minus 4um
.3	Buffer Diameter	90um
.4	Numerical Aperture	0.275 plus or minus 0.015
.5	CoreCladding offset	3um maximum
.6	Core non-circulatory	6% maximum
.7	Cladding non-circulatory	2% maximum
.8	Maximum attenuation:	
	850 nm	3.75 db/km
	133	1.5 db/km
.9	Minimum Band width:	
	850 nm	160 MHz/km
	1300 nm	500 MHz/km

2.4 DISTRIBUTION/EQUIPMENT TERMINATION

.1 Supply and Install QMBIX10A mounts, QCBIX1A4 distribution connectors, designation strips and labels, distribution rings according to horizontal runs and in compliance with approved IBDN IDC (Installation Displacement Connection) design.

.2 Supply and Install QMBIX10C mounts and QCBIX46DI connectors for cabinet/rack located in the Wiring/Equipment Room.

.3 Terminate all horizontal cables on the “Distribution” block and the equipment cables on the “Equipment” block in the Wiring/Equipment room on raised plywood backboard, supplied by the General Contractor.

.4 All cables in the Wiring/Equipment room are to be installed to the equipment; cables are to be dressed neatly into the equipment using Velcro.

.5 To ensure proper Jumper wire routing, replace the vertical distribution rings in the “Equipment” portion of the plywood backboard with “Wire Distribution Spools” with captive screw (#10 wood screw), Anixter part #061688 as shown on the “typical backboard” layouts provided.

2.5 SERVER ROOM RACK

.1 Data rack is City supplied.

.2 UPS is City supplied.

2.6 PATCH PANELS

.1 Basis of Design: Belden IBDN System 2400

3 EXECUTION

3.1 INSTALLATION

.1 Install drops into wall mounted outlets with appropriate connectors as required.

.2 Path must be straight through, as per specifications on pin outs, pairs and wire colours attached.

.3 The installation is to be a certified level 6 installation.

.4 Cables to be identified at both ends of cable with 5 cm from termination. Port on cross connected to be identified as well.

.5 All cables shall be terminated on the cross connect panel and DVO with no more that 1.27 cm of untwisted cable before termination.

.6 Provision of cross connect cables in various lengths; stranded level 6 cable meeting main cable specifications which are to be determined and identified as price per piece (include 200 1.5m cables in base bid).

END OF SECTION

1 GENERAL

1.1 RELATED WORK

.1	Basic Electrical Materials and Methods	Section 26 05 01
.2	Cabinets, Splitters, Junction, and Pullboxes	Section 26 05 31
.3	Outlet Boxes and Fittings	Section 26 05 32
.4	Conduit	Section 26 05 34
.5	Voice Data Communication system	Section 27 05 13

1.2 SYSTEM DESCRIPTION

.1 Complete empty telephone raceway system consists of outlet boxes, coverplates, cabletroughs, pullboxes, sleeves, fish wires, plywood backboards, and grounding conductors.

1.3 COORDINATION WITH UTILITY

.1 Coordinate complete installation with telephone utility.

2 PRODUCTS

2.1 MATERIALS

.1 Conduits: EMT, as per Section 26 05 34.

.2 Junction boxes and T-cabinets: as per Section 26 05 31.

.3 Outlet boxes and fittings: to Section 26 05 32.

.4 Pull cord: polypropylene type.

2.2 DVO OUTLETS - GENERAL

.1 Flush wall mounted telephone outlet to consist of a 2-gang backbox with a single gang extension ring. Provide a 3/4" (21 mm) conduit from each outlet stubbed into the ceiling space.

.2 Refer to Communications Infrastructure for cable and jack details.

3 EXECUTION

3.1 INSTALLATION

.1 Install empty raceway system, fish wires, terminal cabinets, outlet boxes, floor boxes, pullboxes, coverplates, conduit, sleeves and caps, and miscellaneous material to constitute a complete system.

.2 Conduit bends to be 10 times the interior diameter of conduit.

.3 Ground raceways in accordance with the requirements of the telephone utility.

.4 Install pullboxes such that no conduit run is longer than 50' (15 m) or contains more than two 90° bends along its length. Conduit fittings are not acceptable as pullboxes.

.5 Conform to all requirements of the telephone utility for the installation of the raceway system.

.6 Install pull cord in all conduits.

.7 Identify raceway system components as per Section 26 05 01.

.8 Provide a #6 insulation ground in conduit and a duplex receptacle at each backboard for MTS use.

END OF SECTION

1. GENERAL

1.1 INTEGRATED SYSTEM

.1 Provide a complete integrated Voice-Data system .

1.2 RELATED WORK

.1	Electrical General Requirements	Section 26 05 01
.2	Communication Cabling Raceways	Section 27 05 14

1.3 CODES & STANDARDS

.1 CAN/CSA-T529 (Electrical Installations).

.2 CAN/CSA-T528 (Wiring Systems Administration)

.3 CAN/CSA-T530 (Telecommunication Pathways and Spaces)

.4 IEEE Std. 1100 (Powering and Grounding Sensitive Electronic Equipment.

.5 EIA/TIA, IEEE, FCC Standards (Data System Performance Standards).

.6 Manitoba Building Codes (Fire Ratings, Wall Penetration, etc.)

.7 CAN/CSA C22.1 Section 60, latest edition.

1.4 CONTRACTOR

.1 Only experienced data installation Contractors, shall be considered for the work. Contractors shall be able to provide evidence of having performed work on a similar type as specified.

.2 Contractor shall be trained and authorized by the manufacturers they represent. All bidders shall submit evidence of their certification and references upon request. Contractor shall own and maintain tools necessary for the complete installation of the Cat.6 Communications System and all personnel shall be trained in the use of such equipment.

.3 Any and all Sub-Contractors used to assist in the completion of this work shall be identified on the Tendered Equipment List.

1.5 GBPS STANDARD

.1 All wiring, components and installation procedures shall be approved, for and capable of exceeding the requirements of IEEE Ethernet 802.3 – 1Gbps Base-T.

2. PRODUCTS

2.1 MATERIAL CABLING

.1 Cabling: Unshielded Twisted Pairs. Generally, the U.T.P. Media specifications contained in this section reflect the physical characteristics consistent with the UTP media, commonly known as Category 6. The industry standard I.E.E.E. 802.3 1000 BaseT will apply. Cable shall be Category 6 AMP blue jacket.

.2 Construction: Eight single, solid conductors, 23 gauge (AWG), 100% fluorinated ethylene propylene (FEP) insulated, formed into 4 individually twisted pairs and enclosed by an overall plenum-rated jacket (FT6). Cable construction to be determined by the manufacturer to ensure compliance with the cross-talk requirements of the above standard.

.3 Polarization: Generally arranged in compliance with Standard CSA-T529A. Each of eight (8) conductors, when used in conjunction with RJ45 modular plugs, or their corresponding jacks, shall be arranged in accordance with the following table: Conductor ID Pin ID Colour Code Pair 1 5 White/Blue (T) Pair 1 4 Blue/White (T) Pair 2 3 White/Orange (T) Pair 2 6 Orange/White (T) Pair 3 1 White/Green (T) Pair 3 2 Green/White (T) Pair 4 7 White/Brown (T) Pair 4 8 Brown/White (T)
(T) denotes coloured tracer for identification.

2.2 PERFORMANCE DATA

.1 Category 6 cable performance is intended for high-speed LAN applications (>=1Gbps). Category 6 Commercial Building Standard Specification for horizontal UTP cables. This specification places limits on the horizontal distances to assure minimum boundaries of performance. The cable run from the communication closet to the work area outlet is limited to 90 meters. An additional 3 meters is allowed from the outlet to the terminal and up to 7 meters allowance for patching on the cabinet patch panel to switching equipment.

.2 Testing shall be to CAT6 standards and will be according to LINK test specifications only. LINK is defined as the installed CAT6 cable between the V/D Room Patch Panel and the office Communication Outlet (max length = 90 meters) and includes the test equipment patch cords (maximum of 4 meters total) at each end.

.3 For reference only, note that testing will NOT be according to CHANNEL test specifications. CHANNEL is defined as the installed CAT6 cable between the VDR Patch Panel and the office Communication Outlet (max length = 90 meters) and includes the test equipment patch cords and the user equipment cords (maximum of 10 meters total).

2.3 MATERIALS - CORDS & CONNECTORS

.1 Unless otherwise specified by the project, the contractor shall provide all materials according to the details specified below.

.2 Data Patch Cords: For data use (in voice-data room) shall be provided for each cable drop unless otherwise specified in project details. Four twisted pair Category 6 type stranded cable configuration indicated under ‘Polarization’ previously shown. Cords are

required to be equipped with strain relief sleeves over the jacks. All cords shall be labelled as to their manufacture, category level, and length. Engineer shall request batch testing information if doubt exists as to cable quality.
Cord color as follows: Grey for Voice and Data cords; Blue for Printers; Black for Wireless Access Points (WAP); Red for Servers; Red for Closed Circuit T.V. cameras; Red for Card Access control Panels; Yellow for Public Address/Clocks; Final cord length and color count shall be determined after Client has assembled the cabinets. Allow seven meters for pricing purposes.

.3 Data Line Cords: As detailed above for data patch cords except to be used in conjunction with workstation (office). Length required - 3 meters.
Cord color as follows: Grey for all line cords.

.4 Contractor shall supply a data patch cord for each keystone port installed regardless of whether the port is initially utilized or not.

.5 Contractor shall supply a data line cord for each keystone port installed regardless of whether the port is initially utilized or not.

2.4 EQUIPMENT RACKING AND CABLE MANAGEMENT

.1 2 post equipment rack, floor mount, supplied by City.

.2 Provide patch panels with cable management support bar in rack as indicated on drawings.

.3 Cable Management Systems (CMS) to be specified. Each horizontal CMS to have 5 finger retaining rings and use as many U spacing as indicating on drawing. Provide for both patch panels and active electronic equipment.

3. EXECUTION

3.1 INSTALLATION

.1 Communications Outlet Assemblies (CO): Outlet assemblies at each workstation shall be as indicated on drawings to accommodate the required jack arrangement. This assembly shall be mounted either as a wall outlet or on a dedicated communications floor pedestal, both complete with the associated face plate.

.2 Each data drop shall contain minimum of 2 CAT6 cables unless otherwise noted.

.3 Install all communication cables and associated termination components as previously specified

.4 Ensure that all cabling is kept clear of all power equipment and lighting fixtures and installed in conduit.

.5 Ensure that all equipment is constructed to the Standards specified above. All like materials shall be by a single manufacturer.

.6 No splicing, tapping or bridging devices will be used between specified connecting hardware and outlet assemblies.

.7 Cabling should be installed along lines parallel to building structures. Penetrations through full-height wall partitions should be made through pre-established horizontal openings or sleeves.

.8 Cabling installed in ceiling plenum spaces shall be installed in conduit. Flextray wire cage tray is acceptable above finished ceilings only. Support by cable ties to existing structures.

.9 All cable installations shall be protected from mechanical damage.

.10 Cable should be free from tension over the entire length of each run.

.11 Cable installation and termination methods shall be completed in a manner that will not degrade the cable specification. All V/D room terminations shall be inserted by the use of the proper tool. Use of the "dust cap" to effect insertion will not be considered adequate. Bundling, supporting, stripping of outer jacket and retention of wiring twist will be subject to the final approval of the Engineer Work not meeting the above criteria will be re-done.

.12 Cables dropped in wall cavity shall have insulated bushings fitted to the top wall plate.

.13 All cables shall be labeled generally as indicated on drawings and shall adhere to EIA/TIA 606 Standards.

.14 All fire separation penetrations shall be fire stopped in compliance with Manitoba Building Code and N.F.P.A. regulations.

.15 All conduit ends, including vertical stubs in wall cavities, shall be fitted with insulated grommets.

.16 Where the use of surface conduit must be used a minimum box size for data/voice termination shall be 4 x 4 x 2 1/4 inches (basis of design: WIREMOLD #VC5744-2 for surface), complete with either a single gang or double gang mud-ring as required by number of drops specified.

.17 Small numbers of cables splitting off the harness to individual room drops shall be supported by either Velcro straps or combined wire wraps/nylon ties.

.18 Where installation is arranged in a hollow wall construction, EMT conduit shall be run up wall to ceiling space.

.19 Orientation of all faceplates shall be vertical for all installations. (mounted at height of adjacent power outlet)

.20 Where numbers warrant, cable tray shall be installed to support major harnessing.

.21 Carefully monitor cable tension during installation. Do not exceed manufacturer’s

recommended pulling tension.

.22 Cable tray drop-off chutes shall be fitted in all instances where cable exits cable tray downward.

.23 During installation data cable coils shall not be suspended from the structure by nylon ties or equivalent. Proper support of coils to prevent damage is essential.

.24 One small loop of cable shall be arranged in the cable before entering the wall cavity. Excessive slack cable should be avoided as this increases run length.

.25 Bundle data cable in transition areas between conduit and tray runs. Utilize data grade velcro ties for bundling only and not to support weight.

.26 Cables shall be bundled in Groups of 12 for keystone installation which equals one-quarter patch panel.

3.2 TESTING

.1 Testing will be to CAT6 standards

.2 Test and record in tabular form the following for each outlet:

.3 1 Wire Map .2 Length .3 Attenuation .4 Near End Crosstalk (NEXT) .5 Return Loss .6 PSNEXT,FEXT(including ELFEXT and PSELFEXT measurements) .7 Propagation Delay .8 Delay Skew Test and record the length of all horizontal data field wiring from the wire management panel to the workstation outlet assembly.

.4 Test results shall be submitted in electronic and shall include the date the tests were recorded, the installer's name and the test equipment used. Format of data file shall be pdf.

.5 An experienced data installer in compliance with Clause 1.4.2 shall perform the above testing.

.6 Specify on tender documents, type of test instrument to be used to complete above test procedures.

3.3 WARRANTY

.1 The installation Contractor shall support the installed system for a period of one year from the date of acceptance by the City.

.2 Contractor shall be responsible for obtaining all documentation necessary to achieve a 20 year warranty

.3 The installation Contractor shall indicate a willingness to enter into a Maintenance Agreement at the termination of the above warranty period as indicated in 3.3.1. The response time required shall be as under warranty above.

END OF SECTION

1 GENERAL

1.1 RELATED WORK

.1 Electrical General Provisions Section 26 05 01

.2 Communication Cabling Raceways Section 27 05 14

1.2 CODES AND STANDARDS

.1 1 CAN/CSA - T529 (Electrical Installations).

.2 CAN/CSA - T528 (Wiring Systems Administration).

.3 CAN/CSA - T530 (Telecommunication Pathways and Spaces).

.4 IEEE Std. 1100 (Powering and Grounding Sensitive Electronic Equipment).

.5 EIA/TIA, IEEE, FCC Standards (Data System, Performance Standards).

.6 Manitoba Building Codes (Fire Ratings, Wall Penetration, etc.).

.7 CAN/CSA C22.1 Section 60.

2 PRODUCTS

2.1 MATERIALS

.1 Basis of design for cable(s) and components are; NORDX.

.1 Multimode
Fiber count identified on drawing Fiber type Core size 50/125 ± 3.0um Cladding size 125 ± 2um Colored coating size 250 ± 15um Buffer size 900 um (for indoor cable) Numerical Aperture of .275 ± 0.015 Bandwidth 850 NM 500 MHz - km Bandwidth 1300 NM 500 MHz - km
Attenuation 850 NM 3.5 dB/km Attenuation 1300 NM 1.0dB/km (For indoor installation) - Fire Code Requirements CSA FT6 and/or UL equivalent

.2 Connectors: Will be SC type connectors, certified by manufacturer for installation on fiber optical cable supplied. The maximum optical attenuation per each mated connector pair will not exceed 1.0db.

.3 Supply the following fibre patch cords with ST to ST connectors:

.1 1 Provide 1 2.0 meter, duplex multimode fibre zip cord for each end of fibre cable.

2.2 FIBRE OPTIC DATA RACK EQUIPMENT

.1 Patch panel assemblies utilizing SC connectors.

.2 The patch panels shall accommodate 36 fibers for SC jacks that match cable specified in 2U of rack space. The panel shall have back and front cable

management systems with easy access to back for cable termination (i.e. slide out drawer).

.3 Fiber termination enclosure: Panduit FRME2 or equivalent.

3 EXECUTION

3.1 INSTALLATION

.1 Provide fibre connection from telephone backboard to LAN room.

.2 Contractor to terminate all fibre cables.

.3 All cables and individual fiber ports will be labeled to indicate the locations of each end. If the specific labeling detail is not shown on the drawing, the contractor will contact ACC for this information and install accordingly. The sequential color code for the individual fibers and binders will be as follows: 1Blue, 2-Orange, 3-Green, 4-Brown, 5-Slate, 6-White, 7-Red, 8-Black, 9-Yellow, 10-Violet, 11-Rose, and 12-Alpha.

.4 The Manufacturer's recommended bend radius for cable during and after installation will be complied with.

.5 Carefully monitor cable tensions during installation. Observe manufacturer recommended maximum pulling tension for each type of cable installed.

.6 Do not run Fiber Optic Cable in same raceway as copper wiring.

.7 Do not pull cables through LB conduit fittings. Where practical, when raceway changes direction install a maximum 12" x 12" x 6" pull box. Conduit shall enter and leave the box in the same direction. No more than two quarter bends are allowed between boxes.

.8 All conduit ends, including vertical studs in wall cavities, shall be fitted with insulated grommets.

.9 Bond all metallic enclosures associated with the cable installation in compliance with C.E.C. Section 10.

.10 Identify all raceways and cable trays every 50' with appropriate warning labels to indicate presence of Fiber Optic Cable. Where cable is visible on tray it will be identified with a caution tag (plastic) secured with nylon tie-wraps every 50'.

.11 Vertical backbone cable will be secured at each floor level.

.12 After the installation is complete; there will not be tensile forces on the cable. The only exception to this is for vertical installations, where the only allowable tensile force on the operating cable is that of its own weight.

.13 During installation, protect the cable from kinks, crimps, sharp edges or any area where the cable may be crushed.

.14 The cable will be independently supported over its entire length by conduit and/or cable tray. Cable raceway installed by Electrical Division. Cable ties/tie-wraps and/or Velcro straps attached to existing structures is subject to approval prior to tender/bid closing.

.15 Reduce pull friction by cleaning and lubricating cables at the conduit point of entry. Use only approved lubricants for this purpose.

.16 The installation of Fiber Optic Cable in the same conduit as copper is not acceptable.

.17 Dust caps will be supplied and installed whenever cables or devices are not immediately connected.

.18 The contractor will clean up all fiber cable debris at each termination site. All jacket, conductor casing and cleaved fiber remnants will be carefully bagged and removed from site. Disposal in garbage containers within the building/site will not be allowed.

.19 The contractor will be courteous and will provide quality workmanship and will clean up during and after construction.

.20 The contractor will co-ordinate with all other trades and/or sub-trades, as necessary to complete the project.

.21 The contractor will conduct a ‘pre-test’, prior to the installation of the cable, to ensure all fibers are intact.

END OF SECTION

1. GENERAL

1.1 SUMMARY

.1 Provide a complete public address system as indicated.

1.2 RELATED WORK

.1	Basis Electrical Materials and Methods	Section 26 05 01
.2	Wire and Cables	Section 26 05 21
.3	Conduit	Section 26 05 34
.4	Outlet Boxes and Fittings	Section 26 05 32
.5	Communication Cabling Raceways	Section 27 05 14

1.3 SUBMITTALS

.1 Submit shop drawings in accordance with Section 26 05 01 including:

.1 Layout of equipment

.2 Complete wiring diagram, including connection to devices

1.4 OPERATION AND MAINTENANCE DATA

.1 Provide data for incorporation into Maintenance Manual Specified in Section 26 05 01.

.2 Operation and Maintenance manual to include:

.1 Operation and maintenance instructions for complete PA System

.2 Technical data – illustrated parts lists with parts catalogue numbers

.3 Copy of reviewed shop drawings and As-Builts

1.5 MAINTENANCE

.1 Provide one year's free maintenance with an 11th month inspection during the first year of service. Replace or repair any defective equipment

1.6 SERVICE

.1 The supplier of the system must employ factory trained technicians and maintain a service organization within Winnipeg.

1.7 WARRANTY

.1 The system shall carry a one year warranty parts and labour from date of acceptance by the City. Main amplifier and control equipment to carry a five years hardware warranty.

1.8 SYSTEM DESCRIPTION

.1 The Electrical Contractor shall furnish and install a complete and operating public address system as specified and as shown on the drawings.

.2 The new system shall be capable of the following functions:

.1 Transmission to all loudspeakers from a microphone as shown on the drawings.

.2 Provide microphone outlets as shown on the drawings.

.3 Location of amplifier to be determined by the City. Relocate amplifier if necessary at no additional cost,

2. PRODUCTS

2.1 MAIN AREA SYSTEM COMPONENTS

.1 Basis of Design: TOA amplifier (A-9120SM2 CU) c/w TOA line input module (D-001R), TOA mic/line input module (D-001T), TOA telephone zone paging module (ZP-001T).

.2 Basis of Design: TOA paging Microphone c/w cable (PM-660U).

.3 Basis of Design: TOA ceiling-mount speakers (PC-580S) c/w back box (Q-BB-580S) and wall mounted projection speakers as shown on drawings. Coordinate back box type (surface/recess mount) with drawings.

.4 Basis of Design: TOA volume control as shown on drawings.

.1 Volume controls shall consist of a stainless steel wall plate with a dial scale to indicate attenuator position and shall mount to a standard electrical backbox.

.5 PA system to be supplied and installed by approved system installer, basis of design: National Industrial Communication Inc.

2.2 MPR AREA SYSTEM COMPONENTS

.1 Basis of Design: TOA mixer/amplifier (BG-21202)

.2 Basis of Design: TOA wireless tuner (WT-5805)

.3 Basis of Design: TOA wireless lapel microphone

.4 Basis of Design: TOA wall-mount speakers (F-2000WT) c/w wall mount brackets as shown on drawings. Coordinate back box type (surface/recess mount) with drawings.

.5 Basis of Design: TOA volume control as shown on drawings.

.1 Volume controls shall consist of a stainless steel wall plate with a dial scale to indicate attenuator position and shall mount to a standard electrical backbox.

.6 Basis of Design: Listen Technologies (LCS-120-01) assisted listening system c/w the following:

.1 One (1) 2 channel (mono) Wi-Fi Server
.2 One (1) 3 channel transmitter (72MHz)
.3 One (1) 2m dual RCA to RCA cable
.4 Two (2) 3 channel receiver (72MHz)
.5 Two (2) ear speakers
.6 Two (2) neck loops

.7 Provide wall mounted rack to contain MPR PA system components

.8 PA system to be supplied and installed by approved system installer, basis of design: National Industrial Communication Inc.

3. EXECUTION

3.1 GENERAL

.1 Locate, install, wire and connect all components and devices in accordance with the requirements of the manufacturer.

3.2 INSTALLATION OF DEVICES

.1 Mount devices at heights as described in Section 26 05 01.

.2 Mount equipment square with building lines. Install devices flush and square with walls.

3.3 WIRE CONNECTION OF ALL DEVICES

.1 Terminate conductors directly to the terminals of each device.

3.4 WIRING AND CONDUIT

.1 Install wiring in an independent conduit system.

.2 Install speaker backboxes to form part of the conduit system. Conduit to be sized to accommodate the wiring being installed.

.3 Use 2/C 18 AWG speaker wire and 3/C 22AWG microphone input wire.

3.5 TESTING

.1 The complete system shall be tested in the presence of the Contract Administrator and

the City on the completion of the work. Tests shall demonstrate that the PA system will function in an acceptable manner. This includes paging functions and all aux input functions.

.2 Conduct intelligibility test. Adjust tap settings on individual speakers to suite volume requirements. Have the City or Contract Administrator sign-off that the sounds quality is acceptable.

END OF SECTION

1 GENERAL

1.1 SUMMARY

.1 Related Section

.1	Wire and Cables	Section 26 05 21
.2	Conduit	Section 26 05 34
.3	Outlet Boxes and Fittings	Section 26 05 32

1.2 SYSTEM DESCRIPTION

.1 The system shall be supplied by City.

.2 Electrical Contractor is responsible to provide pathways and wiring.

.3 Electrical Contractor is responsible to install all City supplied equipment.

.4 Pathways shall be independent of other system pathways.

.5 Provide power as indicated on drawings.

2 PRODUCTS

2.1 N/A

3 EXECUTION

3.1 INSTALLATION

.1 Provide all necessary backboxes, pullboxes, connectors, supports, conduit, cable, and wire. Exact location of all boxes, conduit, and wiring runs shall be presented to the Tenant for approval in advance of any installation.

.2 Conduits shall be provided for concealed or open structure ceiling spaces.

.3 All conduit, cable, and wire shall be installed parallel and square with building lines. Conduit fill shall not exceed forty percent (40%).

.4 Each card access location required Profusion multi-conductor cabling homerun to access control system panel located in electrical room.

.5 Each door contact and motion detector required 4C-#18 control cabling homerun to security system panel located in electrical room.

.6 Provide dedicated 15A, 120V circuits for access control system panel and for security

system panel.

END OF SECTION

1 GENERAL

1.1 RELATED WORK

.1	Basic Electrical Materials and Methods	Section 26 05 01
.2	Wire and Cables	Section 26 05 34
.3	Outlet Boxes and Fittings	Section 26 05 32
.4	Communication Raceway	Section 27 05 14
.5	Copper CAT 6 Data	Section 27 05 17

1.2 DESCRIPTION OF SYSTEM

.1 The system shall be supplied by City.

.2 Electrical Contractor is responsible to provide pathways and wiring.

.3 Electrical Contractor is responsible to install all City supplied equipment.

.4 Pathways shall be independent of other system pathways.

.5 Provide power as indicated on drawings.

2 PRODUCTS

2.1 N/A

3 EXECUTION

3.1 INSTALLATION

.1 Provide all necessary backboxes, pullboxes, connectors, supports, conduit, cable, and wire. Exact location of all boxes, conduit, and wiring runs shall be presented to the Tenant for approval in advance of any installation.

.2 Conduits shall be provided for concealed or open structure ceiling spaces.

.3 All conduit, cable, and wire shall be installed parallel and square with building lines. Conduit fill shall not exceed forty percent (40%).

.4 Each camera location requires CAT6 cable back the data rack located in electrical room.

.5 CAT6 cable shall be tested in accordance with EIA/TIA T568A standard and test results included in O&M manuals.

END SECTION

1 GENERAL

1.1 RELATED WORK

.1 General provisions of Contract, including General and Supplementary Conditions and Division 1 Specifications.

.2 The requirements of this section apply to Fire and Life Safety Systems specified elsewhere in the specification: Coordinate with Mechanical Divisions for interface to mechanical systems.

1.2 REFERENCES

.1 CAN/ULC-S524-14 Installation of Fire Alarm Systems.

.2 ULC-S525-1978 Audible Signal Appliances, Fire Alarm.

.3 CAN/ULC-S527-M87 Control Units, Fire Alarm.

.4 CAN/ULC-S528-M91 Manual Pull Stations, Fire Alarm.

.5 CAN/ULC-S529-M87 Smoke Detectors, Fire Alarm.

.6 CAN/ULC-S530-M91 Heat Actuated Fire Detectors, Fire Alarm.

.7 CAN/ULC-S531-M87 Smoke Alarms.

.8 CAN/ULC-S536-M86 Inspection and Testing of Fire Alarm Systems.

.9 CAN/ULC-S537-M86 Verification of Fire Alarm Systems.

.10 CAN/ULS-S561-003 Installation and Services for Fire Signal Receiving Centres and Systems.

.11 NFPA 720 2009 Standard for installation of Carbon Monoxide (CO) Detection and Warning Equipment

.12 UL Standard 2075 Standard for Gas and Vapor Detector Sensors

.13 NBC- National Building Code of Canada.

.14 Manitoba Building Code

1.3 DESCRIPTION OF SYSTEM

.1 Included in this work:

.1 Microprocessor control panel to carry out fire alarm, CO alarm and protection functions including receiving alarm signals, actuating zone annunciators,

initiating alarm, supervising system continuously, performing fire control functions, and initiating trouble signals.

.2 Periodic 24 hour automatic background test.

.3 Intelligent environmental compensation.

.4 History logging system.

.5 System degrade operation.

.6 Trouble signal devices.

.7 Power supply facilities.

.8 Manual alarm stations.

.9 Automatic alarm initiating devices.

.10 Audible signal devices.

.11 End of line devices.

.12 Visual alarm signal devices.

.13 Standby batteries.

.14 Auxiliary control.

.15 Remote annunciator

.16 Compare program system software verification feature.

1.4 REQUIREMENTS OF REGULATORY AGENCIES

.1 System:

.1 Shall be ULC/CSA listed and subject to approval by local authority having jurisdiction.

1.5 SHOP DRAWINGS

.1 Submittal to include:

.1 Data sheets on all equipment used.

.2 Sequence of operation.

.3 Layout of equipment.

.4 Zoning.

.5 Component wiring diagrams.

.6 One line riser diagram showing all equipment and size, type and number of all required conductors.

1.6 OPERATION AND MAINTENANCE MANUAL

.1 Provide 3 copies of as-built operation and maintenance manual including the following:

.1 System sequence of operation.

.2 Operation instructions.

.3 Approved data sheets of all the equipment components.

.4 As built riser diagram.

.5 Hard copy of final system programming including logic functions.

.6 Verification report on CFAA forms as filled by CFAA certified technician.

1.7 MAINTENANCE

.1 Provide one year's free maintenance with two inspections by the manufacturer's CFAA certified technicians during the year. Inspection tests to conform to CAN/ULC-S536-M86 and NFPA 720-2009, provide reports to City no later than 7 days after inspections.

1.8 WARRANTY

.1 Provide minimum one year warranty on all products and complete installation. Warranty period to commence from date of total performance for the entire project.

1.9 TRAINING

.1 Provide 4 hours of on-site lecture and demonstration by fire alarm manufacturer to train operational personnel in the use and maintenance of the fire alarm system.

1.10 SEQUENCE OF OPERATION

.1 Single Stage Operation: Operation of any alarm initiating device to:

.1 Cause audible signal devices to sound throughout building continuously and visual signalling devices to operate.

.2 Audible signal for CO alarm shall be temporal coded distinctive from fire alarm signals as specified in NFPA-720, clause 5.5.6.5 (Distinctive Signal). It allows

occupant notification to be limited to the notification zone encompassing the area where the CO signal is originated, if the CO alarm signal is transmitted to a constantly attended onsite location or off-premises location.

.3 Transmit signal to fire department or central station.

.4 Cause zone of alarm device to indicate on local LCD display, remote LCD display and logging printer including time, date and device type as well as all resulting automatic events.

.5 Cause air conditioning and ventilating fans to shut down or to function so as to provide required control of smoke movement.

.6 Cause fire doors and smoke control doors, if normally held open to close automatically.

2 PRODUCTS

2.1 MATERIALS

.1 The system and components must be supplied by one manufacturer and be compatible with existing fire alarm system. Manufacturer shall have established reputation and experience and must have produced similar apparatus for a period of at least five (5) years and who must be able to refer to similar installations rendering satisfactory service. All references to model numbers and other pertinent information herein is intended to establish minimum standards of performance, quality and construction.

.2 Any equipment proposed as equal to that specified herein must conform to the standards herein. In addition, the contractor must obtain the architect's or City's approval in writing ten (10) working days prior to bidding other than as specified.

.3 The manufacturer's name, model numbers, and three copies of working drawings and engineering data sheets shall be submitted for approval along with a cross reference listing, item by item, of the specification for compliance.

.4 Approval of other manufacturer's does not relieve the contractor from meeting the specification requirements.

.5 Acceptable manufacturers: Notifier, Simplex

2.2 SYSTEM DESCRIPTION

.1 The control panel shall be modular and network and of expandable design in construction with multi-tasking microprocessor-based technology, distributed processing, and include a watchdog circuit per individual module processor to monitor the proper operation of every system processor. Systems with one watchdog circuit for all the modules are not considered equal. All components must be housed in an approved enclosure, behind a cylinder locked, removable hinge door with a viewing window. Opening of the panel door must not expose live components or wiring. The door must be easily removable

without tools to prevent any obstruction to the operator during fire alarm management procedures or during system maintenance procedures.

.2 All panels and peripheral devices shall be the standard product of a single manufacturer and shall display the manufacturer's name on each component.

.3 The base system board must provide minimum one (1) class A addressable loop and space for two (2) additional class A loops, six (6) signal circuits of 1.5 A each, one alarm relay, one trouble relay, one programmable relay, a communication network port, an alphanumeric LCD annunciator driver port, an auxiliary power limited 24 VDC supply, a communication active LED, a programming port, a digitally controlled battery supervision circuit and charger.

.4 Maximum 105 addressable devices per loop. The loop resistance shall be 100 Ohm resistance per loop

.5 The system must be fully field programmable. Capable of monitoring up to 500 intelligent addressable input devices. Perform any required logical sequence for fan and damper control. Provide 20 software timers accurate to one second for any required timing functions. The timers may be individually programmed from one second to four hours.

.6 The system software must fully integrate all of the system functions including annunciation, alarm management sequence, fan and damper control.

.7 The system must be capable of providing alarm indication in degrade mode by activating the addressable loop alarm led.

.8 The total system one way response to an alarm shall be no more than 2.5 seconds on a system configured to the maximum capacity.

.9 The system addressable loops must be DCLA with loop isolation between fire compartments. The addressable loop must not have more than 75 intelligent addressable devices regardless of system capacity.

.10 The control panel shall have a two line by forty character backlit supertwist (for any required viewing angle) alphanumeric LCD display.

.11 An output circuit for operation of DC audible devices, or city tie, shall be provided by Controllable Signal Module Model. This module shall be capable of operating with either Class "A" or Class "B" wiring, and shall be operable by the control panel. The module shall be supervised by the control unit for open and shorted circuits. Open and short circuits shall report trouble only and respond with circuit identification. The module shall contain two (2) programmable open collector outputs capable of sourcing 250 ma at 40 VDC for relay or LED activation.

.12 For control of air handling units, mag locks and elevators there shall be provided a Controllable Relay Module Model. The module shall be operable by the control unit and shall be located in the main panel. It shall contain four independent relays, fitted with

form "C" contacts, rated at 2 amps 28VDC/120 VAC resistive. All relays shall be supervised for coil open or shorted conditions.

.13 The system shall require no manual input to initialize in the event of a complete power down condition. It shall return to an on line state as an operating system performing all programmed functions upon power restoration. Systems requiring battery backed-up memory devices shall not be acceptable.

.14 Selectable history event logging up to 800 events, shall be stored in flash memory and displayed, printed or downloaded by classification for selective event reports.

.15 The system shall support intelligent analog smoke, heat and CO detection, conventional smoke detection, manual station, water flow, supervisory, security, and status monitoring devices. The system shall also support amplifiers, voice/visual circuits, and a firefighter's telephone system.

.16 The panel must be capable of measuring the sensitivity of connected intelligent analog ionization and photoelectric smoke detectors and intelligent CO detectors.

.1 The measurements shall be discrete voltage readings, accurate to .01 VDC. The readings shall be dynamic, providing a constant display of voltage shifts when in the sensitivity voltage list mode.

.2 The control panel shall provide a display and a printed list of these sensitivity measurements as a permanent record of the required sensitivity testing.

.3 When programmed, any system connected, ionization or light refraction style smoke detector shall be capable of automatic sensitivity drift compensation up or down. This adjustment shall keep the relationship between the sensing chamber voltage and the programmed alarm threshold voltage constant throughout the life of the detector to prevent false indications or failure to alarm in the presence of smoke.

.4 The control panel shall place each detector in the system in an alarm condition, transparent to the system user, every twenty four hours as a dynamic check of the accuracy of the alarm threshold setting. Upon reception of the alarm report, the system detector shall be restored to its pretest state.

.5 The system shall be capable of monitoring the state of detectors and display a message when a detector is approaching the limits of adjustment as a result of contaminants. A second message shall be displayed when the detector reaches the limits of adjustment due to these contaminants.

.6 The system shall be capable of recognizing that a detector has been cleaned, initiating a series of tests to determine if the cleaning was successful and display a detector cleaned message, readjusting that detectors normal sensitivity setting reference.

.17 The system shall recognize initiating of an alarm and indicate the alarm condition in a

degrade mode of operation, in the event of processor failure or the loss of system communications to the circuit interface panels.

.1 Each circuit interface panel shall be capable of operation in its own degrade mode. In this mode, the system shall receive an alarm from any intelligent analog or conventional initiating device. It shall activate local indicating appliances and remote or auxiliary connect circuits.

.2 The system shall indicate a trouble condition during degrade mode operation and shall give a visual indication of an alarm condition.

.3 Detector operation in the degrade mode shall continue at the alarm threshold previously programmed. Systems returning detectors to a common default value in degrade mode shall not be acceptable.

.18 The system shall be capable of reporting alarms from devices whether programmed or not. Alarm reports from these devices shall activate indicating appliance circuits.

.19 The system shall perform time based control functions including automatic changes of specified smoke detector sensitivity settings.

.1 Time based functions shall be controlled by specifying time periods or actual dates. It also shall provide the ability to control these functions on an exception basis using a holiday schedule.

.20 The system shall provide a one person field test of either the complete system or a specified area, maintaining full function of areas not under test.

.1 Field test shall be usable in a silent or audible mode. When in the audible mode, the signals shall audibly annunciate alarms, troubles and device types.

.2 All field test activity shall be logged to the system printer and historical memory.

.21 The system shall be provided with eight levels of password protection with up to forty passwords.

.22 Provide a cost savings software verification Compare program. The program shall instruct the technician as to what software changes have been made from one software revision to another and what points require verification and be ULC approved.

.23 The system must be capable of reading and displaying at the control panel the sensitivity of remote intelligent/analog ionization and photoelectric detection devices. Individual intelligent/analog detection device alarm threshold must be adjustable form the control panel.

.24 The detection system must remain 100% operational and capable of responding to an alarm condition while in either routine operator maintenance mode or during programming by the manufacturer.

.25 Dynamic supervision of system electronics, wiring, detection devices and software must be provided by the control system. Failure of system hardware or wiring must be indicated by type and location on the alphanumeric display.

.26 The control mode must permit the arming and disarming of individual detection or output devices. Status of these devices must be displayed upon command from the control panel

.27 The address, type of device and sensitivity setting of each addressable device must be field settable by a simple programming device and stored in the addressable device in non-volatile memory. Loss of both A/C power and batteries in the control panel will not affect the system device programming.

.28 The system must be programmed in the field only via laptop computer. Burning of EPROMs is not acceptable. System programming must be password protected. The final system program must be available electronically on a USB flash drive and on hard copy and included in the O&M's.

.29 The alphanumeric display must be capable of listing upon request:

.1 Alarms and troubles with time, date and location.

.2 Status of output functions.

.3 Sensitivity of intelligent /analog smoke/heat/CO detectors.

.4 Detection device number, type and location.

.5 Status of remote relays.

.6 Acknowledgement time and date.

.7 Signal silence time and date.

.8 Reset time and date.

.9 Battery voltage, A/C voltage and battery charge current.

.30 The system must be capable of:

.1 Counting the number of intelligent/analog devices within a "zone" which are in alarm.

.2 Counting "zones" which are in alarm.

.3 Counting the number of intelligent/analog detectors which are in alarm on the system.

.4 Differentiating among types of intelligent/analog detectors such as smoke detectors, CO detectors, manual stations, water-flow switches, thermal detectors,

cross zoning, etc.

2.3 POWER SUPPLY

.1 120 VAC, 60 Hz input, 24 VDC output standby power from gel cell batteries sized as per NBC/MBC-2010 requirements.

.2 System to include system power supplies, including necessary transformers rectifiers, regulators, filters and surge protection required for system operation, with the capacity to power the system in a worst case condition with all devices in alarm and all local indicating appliances active without exceeding the listed ratings. The system devices shall display normal and alarm conditions consistently whether operating from normal power or reserve (standby) power.

2.4 DEVICE PROGRAMMER/TESTER

.1 Entire system shall be programmable via built-in keyboard and RS232 portable computer link.

2.5 DEVICES

.1 Manual alarm stations must be pull down lever, semi-flush or surface type, bilingual single stage addressable.

.2 Automatic Detectors - General:

.1 All intelligent and addressable ionization/photoelectronic or combo smoke detectors, thermal detectors and pull stations, remote zone module and programmable remote relays must be capable of being intermixed on the same addressable loop. All intelligent addressable detectors must be individually identifiable from the control panel and must be capable of being selected for environmental compensation via software.

.2 All addressable ionization smoke detectors, photoelectric smoke detectors and rate of compensation thermal detectors must mount in a plug-in, twist-lock base with screw terminals for field wiring. Pig-tails or in-line connectors must not be permitted. A concealed locking mechanism requiring a special unlocking tool must be available to prevent unauthorized removal.

.3 Remote relays located on detector bases or double gang outlets throughout the building must be controlled in the same manner as panel mounted relays and must not require a separate address.

.3 Heat detectors:

.1 Combination fixed temperature / rate of rise, non-restorable.

.2 Provide addressable type combination heat detectors which mount in same bases as smoke detectors. Each to have an alarm indicating light.

.4 Smoke detectors:

.1 The intelligent addressable ionization smoke detector must contain two ionization chambers and solid state alarm indicator alarm lamp. The reference chamber must compensate against sensitivity changes due to changes in environmental temperature, humidity and barometric pressure. Each must contain its own microcomputer capable of storing all of the devices programmed information provide discreet sensitivity and transmitting same in digital format to the control panel.

.2 The intelligent addressable photoelectronic smoke detector must contain optical sensing chamber designed to sense the presence of smoke particles produced by a wide-range of combustion sources. It includes integrated circuit which incorporates signal processing to reduce false alarms.

.3 It must be possible to furnish the intelligent detectors with a relay base whose relay may be made to follow the activation of the detector or may be programmed to follow any system function desired. The use of the relay base must not reduce the number of available addresses on the addressable loop.

.5 Duct Mounted Smoke Detectors:

.1 The air duct detector must operate on a cross-sectional air sampling principle to overcome stratification and the skin effect. The air duct detector must consist of a standard intelligent/analog or non-addressable detector mounted in an air duct sampling assembly and sampling tube that protrudes across the duct of the ventilating system.

.6 Aspirator type Smoke Detector:

.1 System shall be installed throughout areas as noted on the drawings. They system shall consist of a highly sensitive smoke detector, aspirator and filter connected to a network of sampling pipes.

.2 Sampling pipe network to transport air to the detection system, supported by calculations from a computer based design modelling took.

.3 System shall be approved to provide very early warning smoke detection with programmable sensitivities.

.4 System shall report any fault on the unit, monitor for filter contamination and airflow faults.

.5 System supplier shall be authorized and trained by the manufacturer to calculate/design, install, test and maintain the air sampling system and shall be able to produce a certificate stating such on request.

.7 CO Detectors:

.1 The intelligent detector must contain either Metal Oxide Semiconductor or Electrochemical (platinum/Acid combination) sensing technologies. Each must contain its own microcomputer capable of storing all the devices programmed information, provide discrete sensitivity and transmitting same in digital format to the control panel.

.2 It must be possible to furnish the intelligent detector with a relay base whose relay may be made to follow the activation of the detector or may be programmed to follow any system function desired. The use of the relay base must not reduce the number of available addresses on the addressable loop.

.8 Intelligent Interface Modules:

.1 Provide intelligent interface modules incorporating a custom microprocessor based integrated circuit for connection of normally open or normally closed contact type devices such as water flow switches, tamper switches and OS and Y valves. Provide one for "flow" and one for "supervisory" for each sprinkler zone, confirm with sprinkler supplier.

.9 Audible/Visual Signalling:

.1 Horns: polarized 24 VDC, flush or surface mounted, with integrated strobe lights.

.2 Audible/Visual signal devices if located in refrigeration area shall be rated at minus 40 degree Celsius, minimum 110 candelas with adjustable light intensity switch.

.3 Audible signal devices shall be in the range 100-110 decibel (110 dB) type with temporal coded feature and adjustable decibel.

.4 CO audible alarm shall be distinctive from Fire alarm signal sound, and temporal coded as specified in NFPA-720.

.5 Finish: White

.10 Power Pack/Booster/Synchronization module:

.1 The units shall be standalone power supplies intended for powering fire alarm notification appliances via their own Notification Appliance Circuit(s) (NAC). The units shall be UL 864 Listed for power limited operation of their outputs and comply with NFPA 70 (NEC), article760.

.2 The power supplies shall support a full 8A of notification power even if the battery is in a degraded mode and only AC power is connected.

.3 The power supplies shall be activated by a standard Notification Appliance Circuit (NAC) from any Fire Alarm Control Panel (FACP) or a "Dry contact"

closure. The units shall be 8 ampere, 12 or 24 VDC, regulated and filtered, supervised remote power supply/chargers. The power supplies shall provide a full 8 amperes of current and shall not be battery dependent. They shall operate over the voltage range of 8 to 33 VDC or FWR. The primary application of the units shall be to expand fire alarm system capabilities for additional NAC circuits to support ADA requirements and to provide auxiliary power to support system accessories or functions. The power supplies shall provide four Class "B", two Class "A", or two Class "B" and one Class "A" NAC circuit(s).

.4 The units shall also supply up to 200 mA of auxiliary power that is available during both non-alarm and alarm.

.5 The units shall also supply auxiliary power of not less than 3.5A at 24 VDC during non-alarm. The power supplies shall be capable of charging batteries of up to 12 ampere hours per NFPA 72 (1999). Input activation options shall be from not less than two NAC circuits or Dry Contact closures. These inputs shall have the capability of being directed to any combination of the four NAC circuit outputs. Each NAC circuit output shall be rated at 3 amperes for Class "B" applications or 3 amperes each for Class "A". The outputs shall be programmable to generate a steady or Temporal (Code 3) output and or a synchronized strobe or horn output. The power supplies shall provide independent loop supervision for either Class "A" or Class "B" FACP NAC circuits and shall have the capability to "steer" all alarm or trouble conditions to either incoming NAC circuit. The units shall have common output terminals. The power supplies shall be powered from a 120 VAC or 240 VAC source with a current consumption of 5 amperes max. The unit shall incorporate short circuit protection with auto reset.

.6 The power supply shall incorporate a built in battery charger for lead acid or gel type batteries with automatic switchover to battery backup in the event of AC power failure. The charger shall incorporate fused protection for the batteries and have the ability to report low battery and/or no battery condition(s). Standby current for battery backup shall be 100 mA max.

.11 End of Line Devices (EOL):

.1 Provide high impact plastic red end of line plates with screw terminations as required for all conventional circuits. The EOL devices shall be installed in separate boxes/enclosures.

.12 Equipment for Fire Signal Transmitter to The Monitoring Centre:

.1 The fire alarm signal transmitter shall be conforming to CAN/ULC S559-04 – Equipment for Fire Signal Receiving Centres and Systems.

.2 Alarm signal transmitting and receiving shall be conforming to section 10 of CAN/ULC S561-03 and section 5 of CAN/ULC S559-04.

.3 Central station reporting equipment and interconnection with fire alarm system

shall be conforming to CAN/ULC S524 – Amendment 1

3 EXECUTION

3.1 INSTALLATION

.1 Install systems in accordance with CAN/ULC-S524-14, NFPA-720 and according to the manufacturer's requirements.

.2 Coordinate with mechanical division for exact location of the CO detector locations.

.3 Install main control panel(s) and connect to AC power supply.

.4 Locate and install manual alarm stations and connect to alarm circuit wiring.

.5 Locate and install detectors and connect to alarm circuit wiring. Do not mount detectors within 1m radius of air outlets. Maintain at least 600mm radius clear space on ceiling, below and around detectors. Locate duct type detectors in straight portions of ducts.

.6 Connect alarm circuits to main control panel.

.7 Locate and install booster/synchronization modules, signal and/or visual signal devices and connect to signalling circuits. Alternate circuits for adjacent audible devices.

.8 Connect signalling circuits to main control panel.

.9 Install end-of-line devices.

.10 Install remote annunciator panel(s) and connect to annunciator circuit wiring.

.11 Locate and install door releasing devices where applicable.

.12 Locate and install elevator home coming controls.

.13 Locate and install remote relay units to control fan shutdown.

.14 Where applicable, connect sprinkler system alarm and supervisory switches to control panel.

.15 Connect CO detection system to control panel.

.16 Arrange for and make connection for Central Reporting tie-in through. Local Tel lines and/or mobile communication phone lines. The interconnection wiring from the fire alarm control unit/transponder to the fire signal receiving centre shall comply with CAN/ULC-S561-03, CAN/ULC-S524-14 and NFPA-720.

3.2 FIELD QUALITY

.1 The manufacturer or his authorized representative must perform tests in accordance with

CAN/ULC-S537-04 and NFPA-720.

.2 The verifying technician must bear approval of CFAA (Canadian Fire Alarm Association). Where required by local Authorities, the verification of Fire Alarm System and the required documentation of the verification must be completed under the direction of a Professional Engineer (having license in the province and complete with seal), who through training and experience, is familiar with the installation and functional requirements of fire alarm system. The contractor shall arrange and pay for all Engineer Fire Alarm System Verification service charges.

.3 Provide a complete verification report on CFAA forms.

.4 Verification shall also include but not limited to test and report of the operations of the fire alarm interlock ancillary contacts and "downstream" ancillary devices such as mag locks, door opening/releasing devices, cooking appliance under commercial hood shutdown due to fire suppression release, air fan shutdown, etc.

END OF SECTION

FIRE ALARM VERIFICATION

The following document shall be dated, signed and forwarded to Tower Engineering by E.C. and G.C. upon final completion and verification of installed, fully operational Fire Alarm system as outlined in drawings and electrical specifications (including verifications/reports/certificate noted below).

This **Fire Alarm Verification** document must be submitted to Tower Engineering **PRIOR** to submitting request for 'Substantial Completion'.

Company Name: _____ Date: _____
(Electrical Contractor)

Printed Name: _____ Signature: _____
I hereby verify that the fire alarm system as noted above is complete and has been verified on above noted date.

Attach copy of fire alarm **'VI Inspection Report'** (including actual water flow test, fan shutdown and central reporting) and fire alarm **'certificate'** from fire alarm manufacturer.

Company Name: _____ Date: _____
(General Contractor)

Printed Name: _____ Signature: _____
I hereby verify that the fire alarm system as noted above is complete and has been verified on above noted date.

Witnessing Engineer _____ Date: _____
(Firm name)

Printed Name: _____ Signature: _____
I hereby verify that the fire alarm system as noted above is complete and has been verified on above noted date.
Attach copy of sealed **'Witnessing Engineer's Verification Report'**

Tower Consultant
(Representative to sign at time of witnessing) Date: _____

Printed Name: _____ Signature: _____
I hereby verify that the fire alarm system as noted above is complete and has been verified on above noted date.

The above does not constitute a waiver of any of the contract document requirements.

Part 1 General

1.1 DESCRIPTION

.1 This specification shall cover the layout and rough grading of site features as indicated on the Drawings.

1.2 RELATED SECTIONS

.1 Section 03 30 01 - Concrete Walks, Curbs, and Gutters

.2 Section 32 10 00 - Clearing and Grubbing

.3 CW 3110 – R19 – Sub-grade, Sub-base and Base Course Construction

.4 Section 32 91 19 - Topsoil Placement and Finish Grading

.5 Section 32 92 19 - Mechanical Seeding

.6 Section 32 92 21 - Sodding

1.3 REFERENCES

.1 American Society for Testing and Materials (ASTM)

.1 ASTM D698-91(1998), Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (600 kN-m/m;).

.2 City of Winnipeg Standard Construction Specifications, current edition:

.1 CW 3170 – Earthwork and Grading
.2 CW 2030 – Excavation Bedding and Backfill

1.4 EXISTING CONDITIONS

.1 Known underground and surface utility lines and buried objects as indicated on the drawings. The Contractor shall be responsible for confirming all utilities with utility providers prior to commencing grading operations.

.2 Report discrepancies to Contract Administrator if they impact proposed work.

.3 Any damage to utilities during construction is the responsibility of the Contractor and shall be repaired at no cost to The City.

1.5 PROTECTION

.1 Protect all existing features, benchmarks, pavement, curbs, trees and above / below ground utility lines. If damaged, Contractor to restore to original condition at no cost to The City.

.2 Maintain access roads and to prevent accumulation of construction related debris on roads.

1.6 TESTING

.1 The inspection and testing of fill / subgrade compaction 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 The inspection and testing of fill material will be paid for by the Contractor

.3 Test fill / subgrade at five (5) locations as directed by the Contract Administrator.

.4 Areas that fail minimum compaction requirements shall be re-compacted and tested by the Contractor at no cost to The City.

Part 2 Products

2.1 MATERIALS

.1 Fill Material:

.1 Common fill: to City of Winnipeg Specification CW 3170 – Earthwork and Grading, subject to approval by Contract Administrator.

.2 Fill under landscaped areas: Class 4 backfill to City of Winnipeg Specification CW 2030.

.3 Fill to be:

.1 375mm below finished grade for shrub beds (300 topsoil 75 mulch).
.2 100mm bellow finished grade for sod.
.3 50mm below finished grade for mixed grassland and mixed fescue lawn.

.4 Fill under asphalt, cast in place concrete and crushed granular paving: Class 2 backfill to City of Winnipeg Specification - CW 2030.

.5 Fill material to be unfrozen and free from rocks larger that 75mm, cinders, ashes, sod, refuse or other deleterious materials.

Part 3 Execution

3.1 EXAMINATION

.1 Verify existing conditions before starting work.

3.2 LAYOUT

.1 Engage professional surveyor to layout all major site features as indicated on the drawings.

.2 Stake out key corners, endpoints and centre lies complete with rough grade and finish grade markers.

.3 Report any discrepancies encountered during layout to the Contract Administrator immediately.

.4 Obtain approval of site development layout from Contract Administrator prior to proceeding with rough grading operations.

3.3 ROUGH GRADING AND SHAPING

.1 Rough grade to levels, profiles, and contours allowing for surface treatment as indicated on the Drawings using unfrozen fill materials identified in Part 2 item 2.1.

.2 Compact sub-grade to density requirements noted on the Drawings.

.3 Inspect sub-grade exposed by topsoil stripping with Contract Administrator and identify any problem areas that will require remediation. Cut out these ‘soft areas’ of sub-grade not capable of compaction and fill with Class 2 backfill to CW 2030.

.4 Remove any areas found to be contaminated with fossil fuels or chemicals.

.5 Systematically place fill material to allow maximum time for natural settlement. Do not place fill over porous, wet, frozen or spongy sub-grade surfaces.

.6 Place and compact fill material in equal continuous layers in accordance with specification CW 2030. Layers not to exceed 150mm depth.

.7 Employ a placement method that does not disturb or damage other work. Where areas are too small to be compacted with large machinery use vibratory compaction equipment or hand rollers to achieve required compaction. Obtain Contract Administrator’s approval of alternate equipment prior to use.

.8 Compact existing subgrade and fill areas to the density requirements noted on the Drawings. Maintain optimum moisture content of fill materials to attain required compaction density.

3.4 SURPLUS MATERIAL

.1 Remove surplus material and material unsuitable for fill, grading or landscaping off site.

3.5 ACCEPTANCE

.1 Obtain final approval of rough grading via site inspection with Contract Administrator.

.2 Produce final compaction test results for deficient areas prior to proceeding with hard and soft landscape site development operations.

3.6 CLEANING

.1 Upon completion of installation, remove construction and accumulated environmental dirt, surplus materials, rubbish, tools and equipment barriers in accordance with Section 01 74 00 – Cleaning and Waste Processing.

END OF SECTION

Part 1 GENERAL

1.1 REFERENCES

.1 American Society for Testing and Materials International (ASTM) – Latest Editions

.1 ASTM C117- 03 Standard Test Method for Material Finer Than 0.075 mm (No.200) Sieve in Mineral Aggregates by Washing.

.2 ASTM C136-01, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.

.3 ASTM D422-63 2002, Standard Test Method for Particle-Size Analysis of Soils.

.4 ASTM D698-00ae1, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft ^{3}) (600 kN-m/m ^{3}).

.5 ASTM D1557-02e1, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft ^{3}) (2,700 kN-m/m ^{3}).

.6 ASTM D4318-00, Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-8.2-M88, Sieves, Testing, Woven Wire, Metric.

.3 Canadian Standards Association (CSA International)

.1 CAN/CSA-A3000-03, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).

.2 CSA-A3001-03, Cementitious Materials for Use in Concrete.

.3 CAN/CSA-A23.1/A23.2, Concrete Materials and Methods of Concrete Construction/Methods of Test for Concrete.

.4 City of Winnipeg Standard Construction Standard Specifications (CW)

.1 CW 2030 – Excavation, Bedding and Backfill

1.2 DEFINITIONS

.1 Excavation classes: two classes of excavation will be recognized; common excavation and rock excavation.

.1 Rock: any solid material in excess of 0.50 m^3 and which cannot be removed by means of heavy-duty excavating equipment with 0.95 to 1.15 m^3 bucket. Frozen material not classified as rock.

.2 Common excavation: excavation of materials of whatever nature, which are not included under definitions of rock excavation.

.2 Unclassified excavation: excavation of deposits of whatever character encountered in Work.

.3 Topsoil: material capable of supporting good vegetative growth and suitable for use in top dressing, landscaping and seeding.

.4 Waste material: excavated material unsuitable for use in Work or surplus to requirements.

.5 Borrow material: material obtained from locations outside area to be graded, and required for construction of fill areas or for other portions of Work.

.6 Unsuitable materials:

.1 Weak, chemically unstable, and compressible materials.

.2 Frost susceptible materials:

.1 Fine grained soils with plasticity index less than 10 when tested to ASTM D4318, and gradation within limits specified when tested to ASTM D422 and ASTM C136: Sieve sizes to CAN/CGSB-8.1.

.2 Table:

Sieve Designation	% Passing
2.00 mm	100
0.10 mm	45 – 100
0.02 mm	10 - 80
0.005 mm	0 - 45

.3 Coarse-grained soils containing more than 20% by mass passing 0.075 mm sieve.

.7 Unshrinkable fill: very weak mixture of Portland cement, concrete aggregates and water that resists settlement when placed in utility trenches, and capable of being readily excavated.

1.3 SAMPLES

.1 Submit samples of bedding, backfill and fill materials to be used, prior to beginning Work. Pack tightly in containers to prevent contamination, and inform Consultant of proposed source of materials.

1.4 QUALITY ASSURANCE

.1 The inspection and testing of soil compaction will be carried out by a testing agency designated and paid for by the City The Contractor shall coordinate the timing of this testing in an efficient way.

.2 The City will pay for the cost of one (1) series of tests only, on the area being evaluated. The Contractor shall pay for costs of additional testing as required due to improper performance of work.

1.5 LAYOUT OF WORK

.1 The Contractor shall be responsible for the layout of work, including providing and paying for all survey supplies, equipment and labour required to set stakes, levels, control lines, and benchmarks. The Contractor shall be responsible for the careful preservation of all stakes and marks so set whether relating to his own or to other work.

.2 All layouts shall be reviewed and approved by the Contract Administrator prior to Construction.

1.6 WASTE MANAGEMENT AND DISPOSAL

.1 Separate waste materials for disposal or recycling in designated areas, in accordance with Waste Management Plan.

1.7 EXISTING CONDITIONS

.1 Examine test hole logs in geotechnical reports available upon request from the City.

.2 Existing buried utilities and structures:

.1 Sizes, depths and locations of existing utilities and structures indicated on drawings, are for guidance only. Their completeness and accuracy shall be confirmed on site by the Contactor.

.2 Prior to commencing any excavation Work, notify all applicable utility authorities, having jurisdiction, to clearly mark related locations on site and prevent the disturbance of these markers during the Work. Establish the location and state of use of all buried utilities and structures.

.3 Confirm the locations of all buried utilities by careful test excavations.

.4 Maintain and protect water, sewer, gas, electric, telephone and other utilities and structures encountered, from damage.

.5 Where utility lines or structures exist in area of excavation, notify the Consultant before re-routing.

.6 Carefully record the location, size, type, and depth of all maintained, re-routed, and abandoned underground lines on the Project Record Set.

.7 Confirm the locations of all recent excavations adjacent to area of excavation.

.3 Existing surface features:

.1 Conduct a condition survey of all existing, trees and other plants, lawns, fencing, service poles, wires, pavement, survey benchmarks and monuments, which may be affected by Work of this Contract.

.2 Protect existing surface features from damage while Work is in progress. In event of damage, immediately make repairs to the approval of the Consultant.

.3 Only where required in the area of excavation, carefully trim roots or branches to the approval of the Consultant.

Part 2 PRODUCTS

2.1 MATERIALS

.1 Backfill material shall consist of either unfrozen clay material excavated from the trench with no lumps or stones exceeding 150mm in diameter, or Type 1 material consisting of well –graded pit run material.

.1 Type 1 material gradations to be within limits specified when tested to ASTM C136 and ASTM C117. Sieve sizes to CAN/CGSB-8.1/ CAN/CGSB-8.2.

Sieve Designation	% Passing Type 1
75 mm	90-100
28 mm	80-100
20 mm	-
10 mm	-
5 mm	40-80
2.5 mm	-
0.630 mm	-
0.315 mm	10-35
0.080 mm	5-30

.2 Bedding material shall consist of clean, dry, unfrozen sand or Type 2/3 material consisting of sound, hard, crushed gravel free from organic or soft material that would disintegrate through decay or weathering and well-graded throughout.

.1 Type 2/3 material gradations to be within limits specified when tested to ASTM C136 and ASTM C117. Sieve sizes to CAN/CGSB-8.1/ CAN/CGSB-8.2.

Sieve Designation	% Passing Type 2	Type 3	Sand
75 mm	-	-	-
28 mm	-	100	-
20 mm	100	-	-
10 mm	-	-	100
5 mm	40-70	0-5	90-100
2.5 mm	25-60	-	-
0.630 mm	-	-	25-60
0.315 mm	8-25	-	-
0.080 mm	6-17	-	0-3

Part 3 EXECUTION

3.1 SITE PREPARATION

.1 Remove obstructions, ice and snow, from surfaces to be excavated.

.2 Cut pavement or sidewalk neatly along limits of proposed excavation in order that surface may break evenly.

3.2 DEWATERING AND HEAVE PREVENTION

.1 Keep excavations free of water while Work is in progress.

.2 Submit for Consultant's review details of proposed dewatering or heave prevention methods, including dikes, and well points.

.3 Avoid excavation below groundwater table if quick condition or heave is likely to occur. Prevent piping or bottom heave of excavations by groundwater lowering, sheet pile cut-offs, or other means.

.4 Protect open excavations against flooding and damage due to surface run-off.

3.3 EXCAVATION

.1 Excavate down to designated lines, grades, elevations and dimensions as indicated and/or native subgrade levels and advise Consultant of any obvious silty and soft areas. Protect the exposed native sub grade from freezing, excessive soil moisture loss or gain, water ponding and excessive wheel loads at all times.

.2 Excavation must not interfere with adjacent foundations. Pile foundations shall be protected from damage. Excavation to be at least 10 feet from pile foundations unless approved by the Consultant.

.3 Do not disturb soil within branch spread of trees or shrubs that are to remain. If excavating through roots, excavate by hand and cut roots with sharp axe or saw.

.4 For trench excavation, unless otherwise authorized by Consultant in writing, do not excavate more than 30 m of trench in advance of installation operations and do not leave open more than 15 m at end of day's operation.

.5 Keep excavated and stockpiled materials safe distance away from edge of trenches.

.6 Restrict vehicle operations directly adjacent to open trenches.

.7 Dispose of surplus and unsuitable excavated material in approved locations.

.8 Earth bottoms of excavations to be undisturbed soil, level, free from loose, soft or organic matter.

.9 Notify Consultant when bottom of excavation is reached.

.10 Hand trim, make firm and remove loose material and debris from excavations. Where material at bottom of excavation is disturbed, compact foundation soil to density at least equal to undisturbed soil.

3.4 BEDDING AND SURROUND OF UNDERGROUND SERVICES

.1 Bedding and surround of underground services shall consist of a 200mm minimum thickness of bedding sand or Type 2/3 material, above and below each pipe.

.2 Place bedding and surround material in unfrozen condition.

3.5 BACKFILLING

.1 Class 4 Backfill shall be used for proposed pipes installed in open trenches or coring shafts under proposed landscaped areas.

.1 Backfill the excavation with suitable common excavation material in maximum 200 millimetre thick layers to the grade required for backfill in accordance with the Drawings. Compact each layer by mechanical means to a density equivalent to that of the surrounding unexcavated material.

.2 Class 2 Backfill shall be used for proposed pipes installed in open trenches or coring shafts under existing or proposed pavements and granular surfaces.

.1 Backfill the excavation with Type 1 material in maximum 300 millimetre thick layers to underside of the pavement structure in accordance with the Drawings. Compact each layer with a vibratory compactor to at least 98% Standard Proctor Density.

.3 Do not proceed with backfilling operations until the Contract Administrator has reviewed and approved installations.

.4 Do not use backfill material which is frozen or contains ice, snow or debris.

.5 Backfilling around installations.

.1 Place bedding and surround material as specified elsewhere.

.2 Do not backfill around or over cast-in-place concrete within 24 hours after placing of concrete.

.3 Place layers simultaneously on both sides of installed Work to equalize loading. Difference not to exceed 1.0 m.

.4 Where temporary unbalanced earth pressures are liable to develop on walls or other structures:

.1 Permit concrete to cure for minimum 14 days or until it has sufficient strength to withstand earth and compaction pressure and approval obtained from Consultant.

.2 If approved by Consultant, erect bracing or shoring to counteract unbalance, and leave in place until removal is approved by Consultant.

.6 Consolidate and level unshrinkable fill with internal vibrators.

3.6 RESTORATION

.1 Upon completion of Work, remove waste materials and debris in in accordance with Waste Management Plan.

.2 Replace topsoil within boulevard areas as directed by Consultant.

.3 Reinstate boulevard lawns to elevation which existed before excavation.

.4 Reinstate pavements and sidewalks disturbed by excavation to thickness, structure and elevation which existed before excavation, in accordance to and applicable local regulations

.5 Clean and reinstate areas affected by Work as directed by Consultant.

.6 Use temporary plating to support traffic loads over unshrinkable fill for initial 24 hours.

END OF SECTION

Part 1 General

1.1 SECTION OVERVIEW

.1 Work in this Section includes, but is not limited to, requirements for erosion and sedimentation controls during construction, which forms the Contractor's commitment for Green Globes Site Disturbance and Erosion as follows:

.1 Contractor's responsibilities for development and implementation of an Erosion and Sedimentation Control Plan

.2 Contractor's responsibilities to confirm compliance with requirements of the Erosion and Sedimentation Control Plan.

.2 This Section includes guidelines and recommendations for developing an Erosion and Sedimentation Control Plan.

1.2 RELATED SECTIONS

.1 01 33 29 General Green Globes Requirements

1.3 REFERENCES

.1 Washington State Department of Ecology's Stormwater Management Manual for Western Washington, Volume II, Construction Stormwater Pollution Prevention (2005 edition) https://fortress.wa.gov/ecy/publications/summarypages/0510030.html

.2 Environmental Protection Agency (EPA) Construction General Permit (CGP) 2012: cfpub.epa.gov/npdes/stormwater/cgp.cfm

1.4 OBJECTIVES

.1 Prevent loss of soil during construction by stormwater runoff and/or wind erosion, including protecting topsoil by stockpiling for reuse.

.2 Prevent sedimentation of storm sewer or receiving streams.

.3 Prevent pollution of the air with dust and particulate matter.

.4 Meet or exceed the requirements of Green Globes Site Disturbance and Erosion which requires compliance with 2012 U.S. EPA Construction General Permit OR local standards and codes, whichever is more stringent.

1.5 DESCRIPTION OF WORK

.1 A Green Globes Champion (site superintendent or other individual designated by the Contractor) shall be responsible for coordinating all aspects of Green Globes coordination (during construction) related to erosion and sedimentation control

.2 Assess which ESC measures are needed based on a site evaluation that identifies the following:

.1 The slope of the project site and where water will drain

.2 The total area and duration of ground disturbance to identify air quality and rainwater runoff effects on neighboring properties

.3 The location of existing rainwater management systems that must be protected

.4 Planned construction sequencing that may require additional ESC measures over time

.5 Weather and soil conditions that could cause rainwater runoff or generate dust

.6 Construction entrances and their erosion and sedimentation effects on local roads servicing the project site

.3 Erosion and Sedimentation Control activities shall include:

.1 Implementing erosion and sedimentation control measures shown on drawings and described in this Section

.2 Installing erosion and sedimentation control products in accordance with manufacturer instructions and the prescribed installation procedures in the referenced EPA document

.3 Supervising on site erosion and sedimentation control activities on a daily basis

.4 Coordinating erosion and sedimentation control tasks with subcontractors to ensure timely and orderly progress of the work

.5 Conducting erosion and sedimentation control inspections and making necessary repairs

.6 Maintaining an erosion and sedimentation control inspection log to document observations, deficiencies and corrective actions

.7 Preparing erosion and sedimentation control documentation and submittals as detailed herein

.8 Reporting erosion and sedimentation control progress to the Consultant

1.6 SUBMITTALS

.1 Submit an Erosion and Sedimentation Control Plan to the Consultant for approval a minimum of 14 days prior to construction, the plan shall include all the requirements outlined in the Environmental Protection Agency (EPA) Construction General Permit (CGP) 2012 Section 2:

.1 Section 2.1, erosion and sedimentation control

.1 Providing natural buffers

.2 Installing perimeter controls

.3 Minimizing sediment track-out

.4 Controlling discharges from stockpiled sediment or soil

.5 Minimizing dust

.6 Minimizing the disturbance of steep slopes

.7 Preserving topsoil

.8 Minimizing soil compaction

1.7 PROTECTING STORM DRAIN INLETS

.1 Maintaining control measures

.2 Section 2.2, stabilization

.1 Deadlines for initiating and completing stabilization

.2 Criteria for stabilization

.3 Section 2.3, pollution prevention

.1 Prohibited discharges

.2 General maintenance requirements

.3 Pollution prevention standards

.4 Emergency spill notification

.5 Fertilizer discharge restrictions

.4 Identify whether ESC plan is in compliance with EPA standards or local codes. If local codes are used, submit a description on how they are more stringent than EPA standards.

.5 Identify measures to be implemented on site for the following:

.1 Site Arrangement

.2 Stabilized Construction Entrance

.3 Material Stockpiling

.4 Stabilization Practices (i.e. seeding, mulching, etc.)

.5 Structural Practices (i.e. silt fence, outlet protection, sediment trap etc.)

.6 Submit product data indicating actual materials used for erosion and storm water controls

.7 Inspections should follow the requirements the CGP, section 4.1.

.8 Submit Schedule E1 – ESC Inspection Log

.1 Complete the ESC Inspection log on a weekly basis. The log shall commence when the site is “disturbed” (i.e. when site work begins) and carry through until final landscaping is complete

.2 The ESC Inspection log shall be completed for each inspection and must document:

.1 Deficiencies related to the ESC measures

.2 Corrective actions taken to remedy the deficiencies

.9 Each deficiency must be initialed and each report signed after all corrective measures have been completed and documented

.10 All ESC Inspection Log shall include digital photographs showing:

.1 A minimum of 2 photographs of each ESC measure implemented on site

.2 Date Stamp: Standard indicating Year, Month and Day

.3 Identify what ESC measure is shown in each photo

.11 Submit an up-to-date copy of the ESC Inspection Report comprising the Schedule E1 and photographs to the Consultant on a monthly basis

Part 2 Products

2.1 NOT USED

Part 3 Execution

3.1 EROSION AND SEDIMENTATION CONTROL

.1 Establish control measures before construction begins, according to requirements in CGP Section 2.1. Implement additional measures as needed based on site conditions and as construction progresses.

3.2 STABILIZATION REQUIREMENTS

.1 Stabilize exposed portions of the site, according to requirements in CGP Section 2.2. Implement additional measures as needed based on site conditions and as construction progresses.

3.3 POLLUTION PREVENTION

.1 Establish control measures before construction begins, according to requirements in CGP Section 2.3. Implement additional measures as needed based on site conditions and as construction progresses.

.2 The following discharges are prohibited:

.1 Wastewater from washout of concrete, unless managed by an appropriate control as described in CGP, Part 2.3.3.4

.2 Wastewater from washout and cleanout of stucco, paint, form release oils, curing compounds and other construction materials, unless managed by an appropriate control as described in CGP, Part 2.3.3.4

.3 Fuels, oils, or other pollutants used in vehicle and equipment operation and maintenance;

.4 Soaps, solvents, or detergents used in vehicle and equipment washing

.5 Toxic or hazardous substances from a spill or other release.

3.4 BEST MANAGEMENT PRACTICES (BMPS)

.1 Vehicle Wash-Down Area:

.1 Establish a wash down area for trucks and cars to remove mud and soil adhered to traffic

.2 Equip wash down area with sedimentation control devices and water supply

.3 Establish a filtering system to prevent gasoline, diesel fuel or anti-freeze from being flushed into surface drainage system.

.4 For storage of soaps, detergents, or solvents, you must provide either (1) cover (e.g., plastic sheeting or temporary roofs) to prevent these detergents from coming into contact with rainwater, or (2) a similarly effective means designed to prevent the discharge of pollutants from these areas.

.5 Do not allow mud and soil to accumulate on public roadways

.2 Sedimentation Control Basins, Silt Fences and Erosion Control Blankets:

.1 Establish a sedimentation pond of sufficient size or geotextile filtering system to control sedimentation from entering surface drainage or street drainage and sewerage systems.

.2 Regularly remove accumulations of silt and dispose off site at a recognized landfill facility.

.3 Reapply erosion control polymer as it biodegrades or is worn away from construction activities.

.4 Repair silt fences and erosion control blankets when torn; securely attach fabric to posts; firmly embed posts into ground.

.5 Weight and peg erosion control blankets so that blankets are in full contact with ground; spaces and gaps under blankets will result in increased erosion rendering this measure ineffective.

.3 Stabilized Construction Entrance:

.1 Establish a clean gravel pad at construction entrances of sufficient length and depth to trap clay and excavation debris; clean gravel on a regular basis to prevent build up of clay and prevent sediment from being tracked onto roadways.

.4 Housekeeping:

.1 Monitor vehicles for leaks and repair where leakage of polluting liquids are observed; liquids include, but are not limited to: gasoline, oil, diesel fuel, anti-freeze, brake or transmission fluid or other substance that may be harmful if released into the environment or storm drainage systems.

.2 Store petroleum products in clearly labelled sealed containers; provide spill kits at fueling and maintenance areas; provide impermeable tarp at fueling and maintenance areas.

.3 Provide a covered hopper or collection skid for waste materials.

.4 Tightly seal and store paint containers and sealing or curing compounds when not required and store in a protected location; do not discharge excess materials into storm drainage system.

.5 Do not allow concrete trucks to washout, or discharge surplus concrete or drum wash water on site; dispose of at recognized disposal facility.

.6 Place absorbent materials to soak up excess form release agents; replace absorbent materials when they become saturated at a recognized disposal facility.

3.5 INSPECTION AND MAINTENANCE

.1 Inspect all erosion and sedimentation control measures at least once each week and following any significant storm event (0.25 inches of precipitation or greater).

.2 All erosion and sedimentation control measures must be maintained in good working order. If maintenance or repairs are identified they must be completed within 24 hours.

.3 Schedule E1 – ESC Inspection Report must be completed for each inspection.

.4 Inspection procedures specified below summarize the EPA document and shall be followed in conjunction with details, drawings, and manufacturer requirements.

.1 Stabilized Construction Entrance: Apply additional gravel as required, remove sediments and other materials from all areas to minimize clogging. Keep adjacent public roadway(s) free of sediment.

.2 Material Stockpile: Inspect for effective prevention of runoff and erosion.

.3 Temporary Seeding: If plants do not grow quickly or thick enough to prevent erosion, reseed the area as soon as possible. Keep seeded areas adequately moist. If irrigation is required, over-watering shall be avoided. Phosphorus-containing fertilizers are not to be used.

.4 Permanent Seeding: Inspect for sufficient growth and water conditions. Replant areas as per installation instructions (refer to 3.01C.2) if cover does not provide erosion control.

.5 Mulching: Inspect to ensure mulching is not loose or removed. Apply additional mulch or reseed if necessary. If mulch binder is required, apply at rates specified by the manufacturer. Employ alternative controls if current measures are not effective.

.6 Preservation of Natural Vegetation: Routine maintenance shall include mowing, fertilizing, liming, irrigating, pruning, and weed and pest control, depending on the specific species and environmental conditions. Remove any debris, and ensure area is protected from traffic.

.7 Buffer Zones: Routine maintenance shall include mowing, fertilizing, liming, irrigating, pruning, and weed and pest control, depending on the specific species and environmental conditions. Remove any debris, and ensure area is protected from traffic.

.8 Soil Retaining Measures: Inspect for structural damage and repair as required.

.9 Sod Stabilization: Remove and replace dead sod. Ensure area receives sufficient water. If irrigation is required do not over-water.

.10 Silt Fence: Silt fence to be inspected for depth of sediment, tears, loose fabric attachment at the fence posts, channel erosion beneath fence, sagging or collapse and to ensure the fence posts are firmly in the ground. Built up sediment is to be removed from silt fence when it has reached one-third the height of the fence. Repair such that fence is in original installation condition.

.11 Outlet Protection: Inspect outlet for erosion and pooling of water. Necessary repairs to be made as required to reduce exit velocity of runoff. If a riprap apron is used, inspect for riprap displacement and damage to filter fabric.

.12 Inlet Protection: Inspect that measures are in original installed condition. Ensure measures are effectively trapping sediment. Remove accumulated sediment and debris when it reaches ½ the design depth of the trap. Repair protection measures as required.

.13 Surface Roughening: Inspect for small eroded watercourses, as little as a few inches deep, or washout of roughened grading. Fill, regrade, and reseed immediately.

.14 Check Dams: Inspect for sediment and debris accumulation and erosion of sides. Sediment should be removed when it reaches one half the original dam height. Repair dams as required.

.15 Drainage Swale: Inspect for dips or low points along the swale where water is pooling and ensure that runoff is being directed to sediment trapping measure used onsite.

.16 Interceptor Dikes and Swales: For swales inspect for dips or low points along the swale where water is pooling and ensure that runoff is being directed to sediment-trapping measure used onsite. For dikes ensure runoff is being directed to sediment-trapping measure used onsite and that it is compacted and free of low points for water collection.

.17 Earth Dike: Ensure runoff is being directed to sediment-trapping measure used onsite and that it is compacted and free of low points for water collection.

.18 Gravel or Stone Filter Berm: Inspect for breach in structure caused by vehicles and accumulated sediment. Replace filter material if needed, and remove and properly dispose of accumulated sediment.

.19 Sediment Trap: Remove sediment when it reaches 300mm in depth. If outlet becomes clogged with sediment it must be cleaned to restore flow capacity. Maintain until site area is permanently stabilized and/or permanent structures are in place. Ensure bank is sufficiently compacted and stabilized such that erosion into the basin does not occur.

.20 Temporary Sediment Basin: Remove sediment when it reaches 300mm in depth. If outlet becomes clogged with sediment it must be cleaned to restore flow capacity. Maintain until site area is permanently stabilized and/or permanent structures are in place. Ensure bank is sufficiently compacted and stabilized such that erosion into the basin does not occur.

.21 Pipe Slope Drains: Ensure runoff does not bypass the inlet, undercutting the structure. Repair undercutting at inlet if needed. If required, install a headwall, riprap, or sandbags around the inlet. Inspect pipes for leakage. Repair leaks and restore damaged slopes. If evidence exists of pipe movement, install additional anchor stakes to secure slope.

.22 Subsurface Drains: Inspect for pipe breaks or clogging by sediment, debris, or tree roots. Remove blockage immediately, replace any broken sections, and re-stabilize the surface. Check inlets and outlets for sediment or debris, and remove and dispose of these materials properly.

.23 Temporary Storm Drain Diversion: Ensure flow is being properly directed towards sediment-trapping device. When construction is complete, move diversion, flush storm drain prior to removal of sediment trap/basin, stabilize outfall, and restore grade areas.

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

.6 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal. Erosion and sedimentation control measures shall be maintained and inspected until final landscaping is complete

END OF SECTION

Complete at least weekly, submit to Consultant monthly. Include three photo references for each measure listed (as applicable), photos are to be date stamped and submitted to the Consultant as .jpeg files.

General Information

Company Name:		Inspection Date:	

Inspection Frequency *(Note: you may be subject to different inspection frequencies in different areas of the site. Check all that apply.)*

Standard Frequency: ☐ Weekly OR ☐ Every 14 days and within 24 hours of a 6mm rain

Increased Frequency: ☐ Every 7 days and within 24 hours of a 0.25" rain (for areas of sites discharging to Sensitive Waters)

Reduced Frequency:

☐ Once per month (for stabilized areas)

☐ Once per month and within 24 hours of a 6mm rain (for arid, semi-arid, or drought-stricken areas during seasonally dry periods or during drought)

☐ Once per month (for frozen conditions where earth-disturbing activities are being conducted)

Was this inspection triggered by a 6mm storm event? ☐ Yes ☐ No **If yes, how was it determined?** ☐ Rain gauge on site ☐ Local weather station

Specify Weather station source: **Total rainfall amount that triggered the inspection (in mm):**

Check for the presence of conditions that could lead to spills, leaks, or other accumulations of pollutants on the site. Inspect the following (if applicable):

☐ Fueling and maintenance of equipment or vehicles

☐ Washing of equipment and vehicles;

☐ Storage, handling, and disposal of construction materials, products, and wastes;

☐ Washing of applicators and containers used for paint, concrete, or other materials.

Erosion and Sediment Controls (CGP Part 2.1) & Pollution Prevention (CGP Part 2.3) Inspection Log

ID #	E&S/PP Control Measure	Repairs or Other Maintenance Required?	Corrective Action Required?	Notes – Repairs, maintenance and/or corrective actions taken	Photo Reference (attached as .jpeg)
01	Silt Fence	☒ Yes ☐ No	☒ Yes ☐ No	*Tear noticed in section along North perimeter, replaced filter fabric in this section.*	*100100.jpeg*
02	Stabilized Construction Entrance	☐ Yes ☐ No	☐ Yes ☐ No		
03	Stockpiled Soil	☐ Yes ☐ No	☐ Yes ☐ No		
04	Dust Control	☐ Yes ☐ No	☐ Yes ☐ No		
05	Storm Drain Inlet	☐ Yes ☐ No	☐ Yes ☐ No		

Other Observations

I hereby certify that the information provided above is complete and correct

Name, Title | Phone Number | Signature

Part 1 General

1.1 RELATED SECTIONS

.1 Section 31 22 13 - Rough Grading.

1.2 DEFINITIONS

.1 Clearing consists of cutting off trees and brush vegetative growth to not more than a specified height above ground and disposing of felled trees, previously uprooted trees, brush and stumps, and surface debris.

.2 Grubbing consists of excavation and disposal of stumps and roots, boulders and rock fragments larger than 300 mm Ø to not less than a specified depth below existing ground surface.

1.3 STORAGE AND PROTECTION

.1 Prevent damage to fencing, trees, landscaping, natural features, bench marks, existing buildings, existing pavement, utility lines, site appurtenances, water courses, and root systems of trees, which are to remain.
- .1 Repair any damaged items to approval of Contract Administrator.
- .2 If damaged, replace any trees designated to remain, as directed by Contract Administrator.

Part 3 Execution

3.1 PREPARATION

.1 Site was previously a City of Winnipeg green field. Trees and shrubs exist on site that need to be removed. Inspect site and verify with Contract Administrator if rock removal is required.

.2 Locate and protect utility lines. Preserve in operating condition active utilities traversing site.

.3 Notify utility authorities before starting clearing and grubbing.

3.2 GRUBBING

.1 Grub out visible rock fragments, foundations, concrete, and boulders, greater than 300 mm in greatest dimension, but less than 0.25 m^3.

3.3 REMOVAL AND DISPOSAL

.1 Remove cleared and grubbed materials off site. Recycle materials if possible.

3.4 FINISHED SURFACE

.1 Leave ground surface in condition suitable for grading operations or stripping of topsoil.

3.5 CLEANING

.1 Remove all debris, cleared materials and equipment off site. Leave site clean and tidy ready for topsoil stripping and rough grading.

END OF SECTION

Part 1 GENERAL

1.1 REFERENCES

.1 American Society for Testing and Materials (ASTM) – Latest Editions

.1 ASTM C117-95, Standard Test Methods for Material Finer Than 0.075 mm Sieve in Mineral Aggregates by Washing.

.2 ASTM C131-96, Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.

.3 ASTM C136-96a, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.

.4 ASTM D698-00a, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400ft-lbf/ft^3) (600kN-m/m^3).

.5 ASTM D1557-00, Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000ft-lbf/ft^3) (2,700kN-m/m^3).

.6 ASTM D1883-99, Standard Test Method for CBR (California Bearing Ratio) of Laboratory Compacted Soils.

.7 ASTM D4318-00, Standard Test Methods for Liquid Limit, Plastic Limit and Plasticity Index of Soils.

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-8.1-88, Sieves, Testing, Woven Wire, Inch Series.

.2 CAN/CGSB-8.2-M88, Sieves, Testing, Woven Wire, Metric.

.3 City of Winnipeg Standard Construction Standard Specifications (CW)

.1 CW 3130 – Sub-grade, Sub-base and Base Course Construction

1.2 SAMPLES

.1 Submit samples of bedding, backfill and fill materials to be used, prior to beginning Work. Pack tightly in containers to prevent contamination, and inform Consultant of proposed source of materials.

1.3 QUALITY ASSURANCE

.1 The inspection and testing of base compaction will be carried out by a testing agency designated and paid for by the City. The Contractor shall coordinate the timing of this testing in an efficient way.

.2 The City will pay for the cost of one (1) series of tests only, on the area being evaluated. The Contractor shall pay for costs of additional testing as required due to improper performance of work.

1.4 LAYOUT OF WORK

.1 The Sub-Contractor shall be responsible for the layout of work, including providing and paying for all survey supplies, equipment and labour required to set stakes, levels, control

lines, and benchmarks. The Sub-Contractor shall be responsible for the careful preservation of all stakes and marks so set whether relating to his own or to other work.

.2 All layouts shall be reviewed and approved by the Contract Administrator prior to Construction.

1.5 WASTE MANAGEMENT AND DISPOSAL

.1 Separate waste materials for disposal or recycling in designated areas, in accordance with Waste Management Plan.

Part 2 PRODUCTS

2.1 MATERIALS

.1 Sub-base material shall consist of unfrozen, well-graded 50 millimetre crushed limestone.

.1 Gradations to be within limits specified when tested to ASTM C136 and ASTM C117. Sieve sizes to CAN/CGSB-8.1/ CAN/CGSB-8.2.

Sieve Designation	% Passing 50 mm Max.
200 mm	-
150 mm	-
100 mm	-
50 mm	100
25 mm	-
5 mm	25-60
0.080 mm	4-15

.2 50 millimetre crushed sub-base material when subjected to the abrasion test will have a loss of not more than 40% when tested in accordance with grading 1 of ASTM C131.

.2 Base course material shall consist of unfrozen, well-graded 19 millimetre crushed limestone, free from organic or soft material that would disintegrate through decay or weathering.

.1 Gradations to be within limits specified when tested to ASTM C136 and ASTM C117. Sieve sizes to CAN/CGSB-8.1/ CAN/CGSB-8.2.

Sieve Designation	% Passing 19 mm Max.
25 mm	-
20 mm	100
5 mm	40-70
2.5 mm	25-60
0.315 mm	8-25
0.080 mm	6-17

.2 Crushed base course material when subjected to the abrasion test will have a loss of not more than 35% when tested in accordance with grading B of ASTM C131.

.3 Crushed gravel material passing the 315 sieve will have a liquid limit not greater than 25 and a plasticity index not greater than 6.

.4 Where base course is being placed under an asphaltic concrete pavement, the aggregate retained on a No. 5 000 sieve will contain not less than 35% crushed aggregate as determined by actual particle count. Crushed aggregate will be considered as that aggregate having at least one fractured face.

Part 3 EXECUTION

3.1 SEQUENCE OF OPERATION

.1 Place granular sub-base after sub-grade is reviewed and approved by the Consultant.

.2 Place granular base course after sub-base surface is reviewed and approved by the Consultant.

.3 Placing

.1 Construct granular sub-base and base to depth and grade in areas indicated.

.2 Ensure no frozen material is placed.

.3 Place material only on clean unfrozen surface, free from snow and ice.

.4 Begin spreading base material on crown line or on high side of one-way slope.

.5 Place material using methods which do not lead to segregation or degradation of aggregate.

.6 For spreading and shaping material, use spreader boxes having adjustable templates or screeds which will place material in uniform layers of required thickness.

.7 Place material to full width in uniform layers not exceeding 150 mm compacted thickness. The Consultant may authorize thicker lifts (layers) if specified compaction can be achieved.

.8 Shape each layer to smooth contour and compact to specified density before succeeding layer is placed.

.9 Remove and replace that portion of layer in which material becomes segregated during spreading.

.4 Compaction Equipment

.1 Compaction equipment to be capable of obtaining required material densities.

.2 Efficiency of equipment not specified to be proved at least as efficient as specified equipment at no extra cost and written approval must be received from the Consultant before use.

.5 Compacting

.1 Compact to density not less than 100% maximum dry density unless noted otherwise in the Geotechnical Report.

.2 Shape and roll alternately to obtain smooth, even and uniformly compacted base.

.3 Apply water as necessary during compacting to obtain specified density.

.4 In areas not accessible to rolling equipment, compact to specified density with mechanical tampers approved by the Consultant.

.5 Correct surface irregularities by loosening and adding or removing material until surface is within specified tolerance.

.6 Proof rolling

.1 For proof rolling use standard roller of 45400 kg gross mass with four pneumatic tires.

.2 Make sufficient passes with proof roller to subject every point on surface to three separate passes of loaded tire.

.3 Where proof rolling reveals areas of defective subgrade:

.1 Remove base, sub-base and subgrade material to depth and extent as directed by the Consultant.

.2 Backfill excavated subgrade with sub-base material and compact.

.4 Where proof rolling reveals defective base or sub-base, remove defective materials to depth and extent as directed by the Consultant and replace with new materials at no extra cost.

3.2 PROTECTION

.1 Maintain finished base in condition conforming to this Section until succeeding material is applied or until acceptance by the Consultant.

END OF SECTION

Part 1 GENERAL

1.1 RELATED SECTIONS

.1 Section 32 11 23 - Aggregate Base Courses.

.2 Section 32 17 23 – Pavement Marking.

1.2 REFERENCES

.1 American Society for Testing and Materials International, (ASTM) – Latest Editions

.1 ASTM D698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3 (600 kN-m/m^3)).

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-1.5, Low Flash Petroleum Spirits Thinner.

.2 CAN/CGSB-1.74, Alkyd Traffic Paint.

.3 City of Winnipeg Standard Construction Standard Specifications (CW)

.1 CW 3410 – Asphaltic Concrete Pavement Works

1.3 QUALITY ASSURANCE

.1 Materials testing required shall include laboratory and field testing in accordance to CW 3410 – Asphaltic Concrete Pavement Works, which will be carried out by a testing agency designated and paid for by the City. The Contractor shall coordinate the timing of this testing in an efficient way.

.2 The City will pay for the cost of one (1) series of tests only, on the area being evaluated. The Contractor shall pay for costs of additional testing as required due to improper performance of work.

1.4 LAYOUT OF WORK

.1 The Contractor shall be responsible for the layout of work, including providing and paying for all survey supplies, equipment and labour required to set stakes, levels, control lines, and benchmarks. The Contractor shall be responsible for the careful preservation of all stakes and marks so set whether relating to his own or to other work.

.2 All layouts shall be reviewed and approved by the Contract Administrator prior to Construction.

1.5 WASTE MANAGEMENT AND DISPOSAL

.1 Separate waste materials for disposal or recycling in designated areas, in accordance with Waste Management Plan.

.2 Place materials defined as hazardous or toxic in designated containers.

.3 Dispose of unused paint and paint thinner materials at official hazardous material collections site.

.4 Do not dispose of unused paint and paint thinner material into sewer system, into streams, lakes, onto ground or in other location where it will pose health environmental hazard.

.5 Divert unused asphalt from landfill to facility capable of recycling materials.

Part 2 PRODUCTS

2.1 MATERIALS

.1 Aggregates: to CW 3410 – Asphaltic Concrete Pavement Works.

.2 Asphalt Cement: to CW 3410 – Asphaltic Concrete Pavement Works

.3 Mineral Filler: to CW 3410 – Asphaltic Concrete Pavement Works

.4 Prime Coat and Tack Coat shall consist of either an emulsified or cutback asphalt. Selection shall be based upon field conditions and subject to the approval of the Consultant. Method of application shall conform to manufacturer's recommendations.

.5 Granular sub-base and base course: to Section 32 11 23 - Aggregate Base Courses

.6 Traffic paint: to Section 32 17 23 – Pavement Marking

2.2 MIX DESIGN STATEMENT

.1 The Contractor shall submit a Mix Design Statement certifying the constituent materials and mix proportions that are proposed for use in the asphaltic concrete paving mix. The Contractor shall also supply reasonable evidence to the Consultant that the mix proportions selected will produce asphaltic concrete confirming to the design requirements specified in CW 3410 – Asphaltic Concrete Pavement Works.

Part 3 EXECUTION

3.1 FOUNDATIONS

.1 Asphalt pavement granular foundations for roadway and parking lot pavements to comprise of:

.1 150 mm compacted thickness of granular base.

.2 300 mm compacted thickness of granular sub-base course.

.2 Construction of granular foundations: to Section 32 11 23 - Aggregate Base Courses

3.2 PAVEMENT THICKNESS

.1 Pavements for roadways and parking lots shall be 100mm thickness, Type 1A (Surface Course) as specified in CW 3410 – Asphaltic Concrete Pavement Works.

3.3 BASE PREPARATION

.1 Do base preparation in accordance with Section 32 11 23 - Aggregate Base Courses.

.2 The placing of the asphaltic concrete paving mixture shall not commence until the construction of the granular base has been completed and the Consultant has approved the condition and grade of the compacted base course.

3.4 PAVEMENT CONSTRUCTION

.1 Placing asphaltic concrete mixture: to CW 3410 – Asphaltic Concrete Pavement Works.

.2 Main line paving, tie-ins and approaches: to CW 3410 – Asphaltic Concrete Pavement Works.

.3 Joints: to CW 3410 – Asphaltic Concrete Pavement Works.

.4 Compaction of asphaltic concrete paving mixture: to CW 3410 – Asphaltic Concrete Pavement Works.

3.5 REQUIREMENTS AFTER FINAL ROLLING

.1 After final rolling the surface shall be smooth and true to the established crown and grade. Any low or defective spots shall immediately be remedied by cutting out the course, or planning to a depth of 40 millimetres, at such spots and replacing it with a fresh hot mixture that shall be immediately compacted to confirm with the surrounding area and shall be thoroughly bonded to it. The surface if the finished pavement shall be free from depressions exceeding 5 millimetres as measured with a 3 metre straight edge.

.2 The measured in-place density of the completed course shall be an average of ninety-seven (97%) percent of the 75 Blow Marshall Density of the paving mixture, with no individual test being less than ninety-five (95%) percent.

3.6 OPENING TO TRAFFIC

.1 In no case shall traffic or construction equipment be allowed on the asphaltic concrete pavement until completion of quality control testing by the Consultant and until the completed pavement has cooled to atmospheric temperature or to such other temperature, as may be approved by the Consultant, that will ensure no deformation of the pavement surface under traffic loading.

3.7 TRAFFIC MARKINGS

.1 Paint parking space divisions and other pavement markings in accordance with Section 32 17 23 – Pavement Marking

END OF SECTION

Part 1 General

1.1 DESCRIPTION

.1 This specification shall cover the supply and installation of crushed granular paving.

1.2 RELATED SECTIONS

.1 Section 32 91 19 - Topsoil Placement and Finish Grading

1.3 REFERENCES

.1 ASTM International

- .1 ASTM C136-06, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
- .2 ASTM C117-04, Standard Test Method for Material Finer Than 0.075 mm (No. 200) Sieve in Mineral Aggregates by Washing.
- .3 ASTM D4318-05, Standard Test Method for Liquid Limit, Plastic Limit and Plasticity Index of Soils.
- .4 ASTM D698-07e1, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3 (600 kN-m/m^3).

.2 Canadian General Standards Board (CGSB)

- .1 CAN/CGSB-8.1-88, Sieves, Testing, Woven Wire, Inch Series.
- .2 CAN/CGSB-8.2-M88, Sieves, Testing, Woven Wire, Metric.

.3 City of Winnipeg Standard Construction Specifications, current edition.

- .1 CW 3110 - Sub-Grade, Sub-Base and Base Course Construction.
- .2 CW 3130 - The Supply and Installation of Geotextile Fabrics.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver and stockpile aggregates in locations that are accessible to construction, but will not damage existing structures or landscape elements designated to remain. Stockpile minimum 50% of total granular material required prior to beginning operation.

1.5 TESTING

.1 The inspection and testing of crushed granular paving 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 The inspection and testing of crushed granular paving will be paid for by the Contractor.

.3 Test each course at fifteen (5) locations as directed by the Contract Administrator.

.4 Areas that fail minimum compaction requirements shall be re-compacted and tested by the Contractor at no cost to The City.

Part 2 Products

2.1 MATERIALS

.1 Crushed granite surface

.2 Crushed limestone base course to CW 3110.

.3 Non-woven geotextile fabric to CW 3130.

Part 3 Execution

3.1 INSTALLATION

.1 Ensure sub-grade preparation conforms to levels and compaction required per CW 3110. Obtain approval of subgrade from Contract Administrator prior to commencing crushed stone walkway installation.

.2 Place geotextile and granular base course immediately after sub-grade is inspected and approved by Contract Administrator.

.3 Install crushed granular paving walkway in close coordination with planting medium placement and finish grading per Section 32 91 19.

.4 Layout crushed granular paving walkway on site for Contract Administrator's approval. Obtain approval of layout and make any necessary adjustments prior to proceeding.

.5 Place granular base course as indicated on Drawings. Spread and compact granular base course in uniform layers not exceeding 100mm.

.6 Compact each layer in accordance with CW 3110. Add water as necessary between passes to achieve required compaction.

.7 Submit compaction test results to Contract Administrator for review and approval prior to proceeding with limestone surface installation.

.8 Place granite surface and compact as indicated on the Drawings.

.9 Compact each layer in accordance with CW 3110. Add water as necessary between passes to achieve required compaction.

3.2 SURPLUS MATERIAL

.1 Remove surplus material and material unsuitable for fill, grading or landscaping off site.

3.3 ACCEPTANCE

.1 Obtain approval of crushed granular paving from Contract Administrator prior to proceeding with soft landscape installation.

.2 Produce final compaction test results for deficient areas prior to proceeding with soft landscape installation.

3.4 CLEANING

.1 Upon completion of installation, remove construction and accumulated environmental dirt, surplus materials, rubbish, tools and equipment barriers in accordance with Section 01 74 00 – Cleaning and Waste Processing.

END OF SECTION

Part 1 GENERAL

1.1 RELATED SECTIONS

.1 Section 31 23 10 – Excavating, Trenching and Backfilling

.2 Section 32 11 23 - Aggregate Base Courses.

.3 Section 32 13 13 – Concrete Paving.

1.2 REFERENCES

.1 American Society for Testing and Materials International (ASTM) – Latest Editions

.1 ASTM D698-00ae1, Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400ft-lbf/ft^3) (600 kN-m/m^3).

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-3.3-99, Kerosene, Amend. No. 1, National Standard of Canada.

.2 CAN/CGSB-8.1-88, Sieves, Testing, Woven Wire, Inch Series.

.3 Canadian Standards Association (CSA International)

.1 CSA-A23.1-04/A23.2-04, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.

.4 City of Winnipeg Standard Construction Standard Specifications (CW)

.1 CW 3310 – Portland Cement Concrete Pavement Works

.2 CW 3325 – Portland Cement Concrete Sidewalk

1.3 QUALITY ASSURANCE

.1 Materials testing required shall include laboratory and field testing in accordance to CW 3310 – Portland Cement Concrete Pavement Works, which will be carried out by a testing agency designated and paid for by the City. The Contractor shall coordinate the timing of this testing in an efficient way.

.2 The City will pay for the cost of one (1) series of tests only, on the area being evaluated. The Contractor shall pay for costs of additional testing as required due to improper performance of work.

1.4 LAYOUT OF WORK

.1 The Contractor shall be responsible for the layout of work, including providing and paying for all survey supplies, equipment and labour required to set stakes, levels, control lines, and benchmarks. The Contractor shall be responsible for the careful preservation of all stakes and marks so set whether relating to his own or to other work.

.2 All layouts shall be reviewed and approved by the Contract Administrator prior to Construction.

1.5 WASTE MANAGEMENT AND DISPOSAL

.1 Separate waste materials for disposal or recycling in designated areas, in accordance with Waste Management Plan.

.2 Place materials defined as hazardous or toxic in designated containers.

Part 2 PRODUCTS

2.1 MATERIALS

.1 Concrete mixes and materials: in accordance with CW 3310 – Portland Cement Concrete Pavement Works.

.2 Reinforcing steel: to CW 3310 – Portland Cement Concrete Pavement Works.

.1 All reinforcing steel shall be supplied according to the type and dimensions as shown on the Drawings.

.3 Curing Compound: to CW 3310 – Portland Cement Concrete Pavement Works.

.4 Granular Base: to Section 32 11 23 - Aggregate Base Courses.

.5 Non-staining mineral type form release agent: chemically active release agents containing compounds that react with free lime to provide water soluble soap.

.6 Fill material: to Section 31 23 10 – Excavating, Trenching and Backfilling.

Part 3 EXECUTION

3.1 GRADE PREPARATION

.1 Do grade preparation work in accordance with Section 31 23 10 - Excavating, Trenching and Backfilling.

.2 Construct embankments using excavated material free from organic matter or other objectionable materials. Dispose of surplus and unsuitable excavated off site.

.3 Place fill in maximum 150 mm layers and compact as specified in the Geotechnical Report.

3.2 BASE PREPARATION

.1 Do base preparation in accordance with Section 32 11 23 - Aggregate Base Courses.

.2 The placing of reinforcing steel and concrete shall not commence until the construction of the granular base has been completed and the Consultant has approved the condition and grade of the compacted base course.

3.3 CONCRETE

.1 No concrete shall be placed until the Contract Administrator has examined and approved the layout of the forms, reinforcing steel, dowels, tie bars and joints and the condition and grade of the compacted base course.

.2 Placing concrete pavement: to CW 3310 – Portland Cement Concrete Pavement Works.

.3 Finishing: to CW 3310 – Portland Cement Concrete Pavement Works.

.4 Slip-form pavers equipped with string line system for line and grade control may be used if quality of work acceptable to Contract Administrator can be demonstrated.

3.4 TOLERANCES

.1 Finish surfaces to within 3 mm in 3 m as measured with 3 m straightedge placed on surface.

3.5 EXPANSION AND CONTRACTION JOINTS

.1 Install tooled transverse contraction joints after floating, when concrete is stiff, but still plastic, at intervals of 1500mm or as per drawings. Install expansion joints as indicated at intervals of 6m.

3.6 ISOLATION JOINTS

.1 Install isolation joints around manholes and catch basins and along length adjacent to concrete curbs, catch basins, buildings, or permanent structure.

.2 Install joint filler in isolation joints in accordance with CW 3310 – Portland Cement Concrete Pavement Works

.3 Seal isolation joints with sealant approved by the Consultant.

3.7 CURING

.1 Immediately following concrete finishing and after any excess moisture due to bleeding has evaporated, the surface of the concrete shall be uniformly treated with a white-pigmented water based liquid membrane-forming curing compound, in accordance with the manufacturer's recommendations. The rate of application shall not be less than that recommended by the manufacturer. Where forms are used, as soon as the side forms are stripped, the edges of all concrete slabs shall be sprayed with liquid membrane-forming curing compound.

.2 After application, the white-pigmented liquid membrane-forming curing compound shall be protected as per the manufacturer's recommendations from rain or snow.

.3 Curing compound shall not be used when the pavement is otherwise protected from cold weather by polyethylene film for a period of not less than five days.

3.8 WEATHER CONDITIONS

.1 The Sub-Contractor shall be responsible for taking all necessary measures to protect freshly laid concrete from adverse weather conditions, including hot weather, wind, rain, sleet, snow and cold weather, to the satisfaction of the Consultant.

.2 Concrete shall be adequately protected from freezing for a minimum of five days after completion of paving operations. A minimum requirement for protection shall be provided as follows when the air temperature as forecast by Environment Canada is:

0°C to 3°C	The concrete shall be covered with polyethylene film.
-3°C to -5°C	Insulated tarp(s) or two sheets of polyethylene film covering, separated by 300 mm of dry straw.

.3 Concrete damaged as a result of inadequate protection against weather conditions shall be removed and replaced by the Sub-Contractor at his own expense.

.4 When air temperature is at or will be above 27°C during the basic curing period, curing shall be accomplished in accordance with the requirements of CSA A23.1.

3.9 BACKFILL

.1 Allow concrete to cure for 7 days prior to backfilling.

.2 Backfill to designated elevations with material approved by Consultant. Compact and shape to required contours as indicated or as directed by Consultant.

END OF SECTION

Part 1 General

1.1 DESCRIPTION

.1 This specification shall cover the supply and installation of painted parking stall lines, and painted accessible parking symbols.

1.2 RELATED SECTIONS

.1 CW 3410- R12 – Asphaltic Concrete Pavement Works

1.3 REFERENCES

.1 CAN/CGSB-1.5-M91, Low Flash Petroleum Spirits Thinner.

.2 CGSB1-GP-12c-68, Standard Paint Colours.

.3 CGSB1-GP-71-83, Method, of Testing Paints and Pigments.

.4 CGSB1-GP-74M-79, Paint, Traffic, Alkyd.

1.4 SUBMITTALS

.1 Proof of Non-Toxic Composition:
- .1 Product data confirming chemical composition for traffic paint conforms to the latest health and environmental standards.

1.5 SAMPLES

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

.2 Submit to Contract Administrator 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 CGSB1-GP-71.

.3 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:
- .1 To CGSBI-GP-74M, alkyd traffic paint.

.2 Colour:
- .1 White CGSBI – GP – 12C; yellow 505-308;

.3 Thinner: to CAN/CGSB-1.5.

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 4 hours after installation.

3.4 APPLICATION

.1 Lay out parking stall lines, accessible parking symbols and pavement games as indicated on the Drawings. Obtain Contract Administrator's approval prior to painting.

.2 Unless otherwise approved by Contract Administrator, apply paint only when air temperature is above 10°C, wind speed is less than 60 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 Paint lines to be 100mm wide, of uniform colour and density with sharply defined edges.

.5 Paint parking stall lines yellow. Paint accessible parking symbols white.

.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 in accordance with Section 01 74 00 – Cleaning and Waste Processing.

END OF SECTION

Part 1 General

1.1 DESCRIPTION

.1 This specification shall cover the supply and installation of: bike racks and waste receptacles.

1.2 SUBMITTALS

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

.2 Submit product data for: bike racks and waste receptacles. Product data to indicate dimensions, sizes, assembly, anchorage and installation details for each furnishing specified.

.3 Order all furnishings immediately after award of Contract once product data sheets are reviewed by the Contract Administrator.

.4 Provide templates, patterns, fixing diagrams as required or requested and list hardware and miscellaneous items.

1.3 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 scheduling.

.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.

Part 2 Products

2.1 SITE FURNITURE

.1 Bike Racks: two bikes per rack, aluminum or galvanized steel frame, powdercoated silver, surface mounted.

.2 Waste and Recycling Receptacle: front loading, triple unit, perforated steel panels and body, solid top, powdercoated silver, surface mounted. Signage placement: 8” x 8” Multi-Use Opening. Signage choices: 01 “Paper”, 06 “Aluminum Glass Plastic” and 13 “Waste Only”.

Part 3 Execution

3.1 RELATED WORK

.1 Ensure that all related work has been approved by the Contract Administrator prior to commencing site furniture, and log stump installation.

3.2 GENERAL SITE FURNITURE INSTALLATION

.1 Assemble furnishings in accordance with manufacturer's instructions. Obtain Contract Administrator approval of assembled furnishings prior to mounting.

.2 Stake out or mark site furniture locations on site for Contract Administrator approval prior to installation.

.3 Install all furnishings true, plumb, anchored and firmly supported to the manufacturers express written specifications, and as shown on the Drawings.

.4 Touch-up damaged finishes with matching paint available from the supplier, to approval of Contract Administrator.

3.3 READING AREA ELEMENTS INSTALLATION

.1 Log Stump: Install at locations indicated on the Drawings. Verify layout on site with Contract Administrator prior to installation. Install logs over compacted granular and backfill with compacted ¼ down granular.

3.4 CLEANING

.1 Upon completion of installation, remove construction and accumulated environmental dirt, surplus materials, rubbish, tools and equipment barriers in accordance with Section 01 74 00 – Cleaning and Waste Processing.

3.5 ACCEPTANCE

.1 Site furnishings, including log stumps, will be subject to a thorough field inspection and will not be accepted until all workmanship and deficiencies have been addressed.

END OF SECTION

Part 1 General

1.1 DESCRIPTION

.1 This specification shall cover the supply and installation of reflective metal traffic and information signs as indicated on the Drawings.

1.2 REFERENCES

.1 American Society for Testing and Materials International (ASTM)
- .1 ASTMA276-91a, Specification for Stainless and Heat-Resisting Steel Bars and Shapes.
- .2 ASTMB209M-92a, Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
- .3 ASTMB210M-92a, Specification for Aluminum-Alloy Drawn Seamless Tubes.
- .4 ASTMB211M-92a, Specification for Aluminum and Aluminum-Alloy Bar, Rods and Wire.

.2 Canadian Standard Association (CSA)
- .1 CAN/CSA-G40.21-M92, Structural Quality Steels.
- .2 CAN/CSA-G164-M92, Hot Dip Galvanizing of Irregularly Shaped Articles.
- .3 CSAW47.2-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, Semigloss Alkyd Air Drying and Baking Enamel.
- .4 CAN/CGSB-1.132-M90, Zinc Chromate Primer, Low Moisture Sensitivity.
- .5 CGSB1-GP-12c-65, Standard Paint Colours.
- .6 CGSB31-GP-3M-88, Corrosion Preventive Compound, Cold Application, Soft Film.
- .7 CGSB31-GP-101Ma-89, Chemical Conversion Films for Aluminum and Aluminum Alloys.

1.3 SUBMITTALS

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

.2 Submit product data for reflective metal signs indicating dimensions, sizes, assembly, anchorage, colour and installation details for each sign type specified.

.3 Contract Administrator shall submit original artwork to the Contractor in format required by sign fabricator (vector based Illustrator, DXF, DWG and PDF formats possible). Contact Danielle Loeb at 204-944-9907 to obtain graphic data.

.4 Submit product data and shop drawings for exterior interpretive signs indicating dimensions, sizes, assembly, anchorage, graphic quality, finish and installation details. Sample to be min 300x300mm.

1.4 QUALITY ASSURANCE

.1 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.

.2 Strict conformance to the Specification will be enforced. 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.

.3 The Contract Administrator reserves the right to reject any materials or works that are not in accordance with the requirements of this Specification.

Part 2 Products

2.1 REFLECTIVE METAL SIGNS

.1 Aluminum Metal Panel: 0.90 gauge thick metal plate, sign grade, aluminum panel 5052 H36 or H38, size and shape as indicated on drawings.

.2 Sheeting: Engineering Grade Reflective Sheeting, complete with permanent pressure sensitive adhesive backing. Sheeting colours as noted on drawings. Sheeting to comply with ASTM D4956-90.

.3 Inks: Matched, UV stable, waterproof transparent inks as required. Enamel baked ink system or approved equal in accordance with B6.

.4 Artwork: to be provided in digital (DXF or EPS) format or any other standard, cross-platform required by manufacturer. This artwork is the property of The City, and shall not be reproduced in any quantity or for any purpose outside the parameters of this Contract without the express written permission of The City.

.5 Final Design of artwork for parking signs to be coordinated with the Contract Administrator and The City.

.6 Mounting Hardware:
- .1 Schedule 63mm diameter, hot dipped galvanized sign posts.
- .2 Hot-dipped galvanized screws capable of securely fixing signage in place. Sizes as noted on Drawings.

Part 3 Execution

3.1 REFLECTIVE METAL SIGNS FABRICATION AND INSTALLATION

.1 Debur, degrease, & etch edges of sign plates to accept reflective sheeting decals in accordance with decal manufacturer’s recommendations.

.2 Apply sheeting in accordance with manufacturer's specifications. Decals shall be centred precisely on base plate. Trim sheeting to form clean, smooth edge along perimeter of base plates.

.3 Install cast-in-place concrete pile bases. Concrete as per section 03 30 00 – Cast-in-Place Concrete.

.4 Fasten signage as indicated on Drawings. Confirm sign orientation on site with Contract Administrator.

3.2 TOUCH UP

.1 Clean any damaged sign frame surfaces with wire brush and touch-up with clear exterior zinc rich sealant.

.2 Touch up graphic signs as recommended by the sign product supplier.

.3 Signs that can not be touched up in the field to the Contract Administrators satisfaction will need to be removed , reproduced and reinstalled prior to final approval.

3.3 CLEANING

.1 Upon completion of installation, remove construction and accumulated environmental dirt, surplus materials, rubbish, tools and equipment barriers in accordance with Section 01 74 00 – Cleaning and Waste Processing.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

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

.2 Section 03 30 01 – Concrete Walks, Curbs, and Gutters.

.3 Section 32 22 13 – Rough Grading.

1.2 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
  .1 PN1340-2005, Guidelines for Compost Quality.

.3 U.S. Environmental Protection Agency (EPA)/Office of Water
  .1 EPA 832R92005, Storm Water Management for Construction Activities: Developing Pollution Prevention Plans and Best Management Practices.

1.3 SUBMITTALS

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

.2 Quality control submittals:
  .1 Soil testing: submit certified test reports showing compliance with specified performance characteristics and physical properties as described in PART 2 - SOURCE QUALITY CONTROL.
  .2 Certificates: submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

1.4 QUALITY ASSURANCE

.1 Pre-installation meetings: conduct pre-installation meeting to verify project requirements, installation instructions and warranty requirements in accordance with Construction Progress Schedules – Horizontal Bar Chart.

Part 2 Products

2.1 IMPORTED TOPSOIL

.1 Topsoil: mixture of particulates, micro organisms and organic matter which provides suitable medium for supporting intended plant growth.
  .1 Soil texture based on The Canadian System of Soil Classification, to consist of 20 to 70% sand, minimum 7 % clay, and contain 2 to 10 % organic matter by weight.
  .2 Topsoil shall be free of subsoil contamination, roots, stones, or clay lumps over 40 mm in diameter and other extraneous matter. Salinity rating less than 2.5 dS/m and a pH range of 6.5-8.0. Topsoil shall not contain quack grass rhizomes, Canada thistle roots or other noxious weeds.
  .3 Fertility: major soil nutrients present in following amounts:
    .1 Nitrogen N: 20 to 40 micrograms of available N per gram of topsoil.
    .2 Phosphorus P: 40 to 50 micrograms of phosphate per gram of topsoil.
    .3 Potassium K: 75 to 110 micrograms of potassium per gram of topsoil.

.4 Calcium, magnesium, sulphur and micro-nutrients present in balance ratios to support germination and/or establishment of intended vegetation.

.4 Topsoil shall not be blown dirt deposited in ditches along wind erosion sites.

.5 Topsoil shall not be taken from fields abandoned to corn production where such soil may contain soil-incorporated herbicides with lasting residual effects such as Eradicane and Atrazine.

.6 Contain no toxic elements or growth inhibiting materials.

.7 Finished surface free from:

.1 Debris and stones over 50 mm diameter.

.2 Course vegetative material, 10 mm diameter and 100 mm length, occupying more than 2% of soil volume.

.8 Consistence: friable when moist.

2.2 SOIL AMENDMENTS FOR IMPORTED AND STOCKPILED TOPSPOIL

.1 Fertilizer:

.1 Synthetic slow relese starter fertilizer with a N-P-K analysis of 12-36-15 ration at a rate of 4 kg/ 100 m2 (8 lb / 100 ft. 2)

.2 Peatmoss:

.1 Derived from partially decomposed species of Sphagnum Mosses.

.2 Elastic and homogeneous, brown in colour.

.3 Free of wood and deleterious material which could prohibit growth.

.4 Shredded particle minimum size: 5 mm.

.3 Sand: washed coarse silica sand, medium to course textured.

.4 Organic matter: compost Category B in accordance with CCME PN1340, unprocessed organic matter, such as rotted manure, hay, straw, bark residue or sawdust, meeting the organic matter, stability and contaminant requirements.

.5 Limestone:

.1 Ground agricultural limestone.

.2 Gradation requirements: percentage passing by weight, 90% passing 1.0 mm sieve, 50% passing 0.125 mm sieve.

2.3 SOURCE QUALITY CONTROL

.1 Advise Contract Administrator of sources of imported topsoil and site topsoil to be utilized with sufficient lead time for testing.

.2 Contractor is responsible for amendments to the planting medium as specified.

.3 Planting mix testing shall be completed by a by recognized testing facility for pH, P and K, organic matter, and conductivity.

.4 Testing of planting mix will be carried out by testing laboratory designated by Contract Administrator as set our in Section 01 21 00 Allowances.

.1 Planting medium sampling, testing and analysis to be in accordance with Provincial standards.

Part 3 Execution

3.1 PLANTING MIX

.1 Planting beds and seeded areas:
- .1 45% Topsoil (imported or stockpiled)
- .2 35% Peat
- .3 15% Sand
- .4 5% Compost

.2 All components of planting medium mix must be well mixed, following crushing and screening.

.3 Test soil after mixing to determine amendments necessary after placement.

3.2 PREPARATION OF EXISTING GRADE

.1 Verify that subgrades are correct.
- .1 If discrepancies occur, notify Contract Administrator immediately.

.2 Grade soil, eliminating uneven areas and low spots, ensuring positive drainage.

.3 Remove debris, roots, branches, stones in excess of 50 mm diameter and other deleterious materials.
- .1 Remove soil contaminated with calcium chloride, toxic materials and petroleum products.
- .2 Remove debris which protrudes more than 75 mm above surface.
- .3 Dispose of removed material off site.

.4 Cultivate entire area which is to receive planting medium to minimum depth of 150 mm.
- .1 Cross cultivate those areas where equipment used for hauling and spreading has compacted soil.

3.3 PLACING AND SPREADING OF PLANTING MEDIUM

.1 Place planting medium after Contract Administrator has accepted subgrade.

.2 Spread topsoil in uniform layers not exceeding 150 mm.

.3 For sodded areas keep topsoil 15 mm below finished grade.

.4 Spread topsoil to following minimum depths after settlement.
- .1 100 mm for seeded areas.
- .2 100 mm for sodded areas.
- .3 300 mm for shrub beds.

.5 Manually spread topsoil/planting soil around trees, shrubs and obstacles.

3.4 SOIL AMENDMENTS

.1 Apply lime, sulphur or other soil amendment at rate determined and recommended by the soil testing laboratory.

.2 Mix soil amendment well into full depth of planting medium by cultivating or rototilling prior to application of fertilizer.

3.5 APPLICATION OF FERTILIZER

.1 Spread fertilizer over entire area of planting medium at rate determined by soil testing.

.1 Incorporate into top 50mm depth of planting media by means of cultivation or raking.

3.6 FINISH GRADING

.1 Grade to eliminate rough spots and low areas and ensure positive drainage.
  .1 Prepare loose friable bed by means of cultivation and subsequent raking.

.2 Consolidate topsoil to required bulk density using equipment approved by Contract Administrator.
  .1 Leave surfaces smooth, uniform and firm against deep footprinting.

3.7 ACCEPTANCE

.1 Contract Administrator will inspect and take final samples to test installed planting mix to determine acceptance of material, depth of topsoil and finish grading.

.2 Should tests deem planting mix does not meet the physical and chemical requirements of this specification the Contractor shall amend mix and pay for additional testing until such time as mix meets requirements and is accepted by the Contract Administrator.

.3 Obtain final approval of topsoil placement and finish grading from Contract Administrator prior to installing all soft landscape finishes.

3.8 SURPLUS MATERIAL

.1 Dispose of materials except topsoil not required off site.

3.9 CLEANING

.1 Proceed in accordance with Section 01 74 00 – Cleaning and Waste Processing.

.2 Upon completion of installation, remove 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 mixed grassland areas, as indicated on the Drawing L-200 Site Layout & Materials Plan.

1.2 SUBMITTALS

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

.2 Submit product data for:
- .1 Seed.
- .2 Fertilizer.

.3 Submit samples for:
- .1 Mixed Grassland Seed Mix

1.3 QUALITY ASSURANCE

.1 Installer:
- .1 Seed

Part 2 Products

2.1 TOPSOIL

.1 Topsoil per Section 32 91 19 – Topsoil Placement and Finish Grading.

2.2 MIXED GRASSLAND SEED

.1 All seed is to be Certified Canada No. 1 in accordance with Government of Canada “Seeds Act” and “Seeds Regulations”, having minimum purity of 97%, free of disease, weed seeds, or other foreign materials and meeting the standard mix blend listed below.

.2 Mixed Grassland Seed:

- .1 90% native grass mix
- .2 10% wildflower

.3 All seed to be delivered in packages individually labeled in accordance with “Seeds Regulations” and indicating name of supplier and date bagged.

.4 All seed to be from local sources.

.5 Provide the following product data for each type of seed mix:

- .1 Seed Analysis
  - .1 % of pure seed by weight.
  - .2 % of germination or % of pure living seed.
  - .3 Year of seed production.
- .2 Seed Tags Starting

.1 Date when tagged.
.2 Location.
.3 Weight.
.4 Name and address of distributor.
.5 % of seed variety by weight in seed mixture.

2.3 WATER

.1 Free of impurities that would inhibit germination and growth.

2.4 HERBICIDES

.1 Herbicides shall be standard commercial products registered for sale and use in Canada under the Pest Control Products Act.

2.5 FERTILIZER

.1 Synthetic start-up slow release fertilizer with a N-P-K analysis of 12-36-15 ratio at a rate of 4 kg per 100 m2 which is 8 Pounds per 100 sq ft., to Canada "Fertilizers Act" and "Fertilizers Regulations".

2.6 SNOW FENCE

.1 Barrier Material: plastic UV stabilized, high density polyethylene web snow fence, international orange colour, 1.22 meter height, or approved equal in accordance with B6.

.2 Snow Fence Supports: rolled steel T-bar fence posts, or approved equal in accordance with B6.

2.7 HYDRO MULCH

.1 Per section 32 92 20 - Hydro Mulching.

2.8 EQUIPMENT

.1 All equipment shall be of a type approved by the Contract Administrator and shall be kept in good working order. Ensure equipment will not damage existing vegetation.

Part 3 Execution

3.1 SCHEDULING

.1 Schedule seeding immediately following planting medium placement and finished grading, within 48 hours.

.2 If seed installation cannot be completed within 48 hours and weeds germinate in the seeded areas, weed eradication via manual and chemical means, soil sterilization and soil re-fertilization measures shall be completed by the Contractor, at no additional cost to The City.

.3 Schedule seeding immediately prior to 32 92 20 - Hydro Mulching.

.4 Schedule installation of snow fence immediately after Hydro Mulching.

3.2 SEED BED PREPARATION

.1 Do not perform work under adverse field conditions such as frozen soil, excessively wet or dry soil covered with snow, windy conditions, ice, or standing water.

.2 Remove and dispose of weeds; debris; stones 50mm in diameter and larger; soil contaminated by oil, gasoline and other deleterious materials; off site as directed by Contract Administrator.

.3 Fine grade surface free of humps and hollows to smooth, even grade per Section 32 91 19 – Topsoil Placement and Finish Grading.

.4 Verify that finish grades are correct and planting medium has no settled adversely since acceptance. If discrepancies occur, notify Contract Administrator and do not commence seeding until instructed by Contract Administrator.

.5 Cultivate and roll seed bed prior to seeding.

.6 Fertilize areas to be seeded two (2) weeks or less, prior to seeding operations, with starter fertilizer.

3.3 SEED PLACEMENT

.1 The Contractor shall not commence seeding operations until the finished surface is inspected and approved by the Contract Administrator.

.2 The Contract Administrator shall be notified minimum seventy-two (72) hours prior to commencing seeding, and will provide full time monitoring of seeding operations. The Contractor is not to proceed with any Work under this section without the Contract Administrator present on site.

.3 Sow all seed mixes using a "Brillion" type mechanical landscape seeder, which accurately places seed at specified depth and rate and rolls in single operation.

.4 Sow half of the required amount of seed in one direction and remainder at right angles to the original pass.

.5 Incorporate seed by light raking in cross directions. Blend applications into existing adjacent grass areas to form uniform surfaces where applicable.

.6 Consolidate seeded areas by rolling area to form a uniform even surface, level with adjoining curbs, sidewalks or sod, using equipment approved by the Contract Administrator.

.7 Seeding operations shall be completed within a forty-eight hour period after the commencement of operations. This shall be deemed to include the application of seed, hydro mulching, and snow fence installation.

.8 Install snow fence around seeded areas to prevent foot traffic and access during seed establishment. Maintain snow fence until final acceptance.

3.4 MAINTENANCE DURING ESTABLISHMENT PERIOD

.1 Perform following operations from time of installation until acceptance by Contract Administrator:

.1 Water seeded area in sufficient quantities and at frequency required to maintain optimum soil moisture condition to depth of 75 to 100mm.

.2 Repair and reseed dead or bare spots to allow establishment of seed prior to acceptance.

.3 For the first growing season, mow the weeds when they reach 200-300mm cut to 100-150mm, approximately four (4) to six (6) times within the first year, or once every three (3) weeks.

.4 In the second growing season year, mow the seeded areas very low, about 2.5cm or 1 inch. Do not mow the planted perennials.

.5 If weeds are still present in the second year, mow in mid June to a height of 30 cm / 12". Do not mow the planted perennials.

.6 Maintain seeded areas 95% weed free.

.7 Fertilize as recommended by soil test results.

3.5 FINAL ACCEPTANCE

.1 Final acceptance of seeded areas shall be performance based not time based.

.2 Seeded areas will be accepted provided that:

.1 Seeded areas meet the seed mixture requirements specified when a 1 x 1 meter random sample is taken at three (3) locations on site.

.2 Seeded areas are properly established and turf is free of rutted, eroded, bare or dead spots and free of all noxious weeds.

.3 Seeded area show signs of vigorous and even growth to the satisfaction of the Contract Administrator.

.4 Seeded area has been cut at least twice (proof must be provided).

.5 Seeded area has been fertilized at least once (proof must be provided).

3.6 CLEANING

.1 Upon completion of installation, remove construction and accumulated dirt, surplus materials, rubbish, tools and equipment barriers in accordance with section 01 74 00 – Cleaning and Waste Processing.

END OF SECTION

PART 1 General

1.1 RELATED SECTIONS

.1 Section 32 92 19 - Mechanical Seeding.

PART 2 Products

2.1 MULCH

.1 Wood cellulose fibre product free of germination or growth inhibiting ingredients and shall form, after application, a blotter-like ground cover which will allow absorption and percolation of water.

2.2 TACKIFIER

.1 All wood cellulose fibre mulch shall be applied in a slurry containing a tackifier at a rate as directed by the manufacturer.

PART 3 Execution

3.1 CONSTRUCTION METHOD

.1 Obtain approval of seeding by the Contract Administrator prior to hydro mulching operations.

.2 Apply hydro mulch within 24 hours of seeding.

.3 Prior to beginning hydro mulching operations, the Contractor shall place marker stakes throughout the project site to delineate the area to be covered by each tank load of slurry mix. Each tank load of mix shall be completely and evenly discharged over the entire area bounded by the stakes. Materials shall be mixed as required and installed to meet the following rates of application and as required by mulch and tackifier manufacturer's specifications:

.1 Mulch: 2000 kg/ha; (20 kg/100 m^2).
.2 Tackifier: 50 kg/ha; (0.5 kg/100 m^2).
.3 Water: As required to completely suspend all material.

END OF SECTION

Part 1 General

1.1 DESCRIPTION

.1 This specification shall cover the supply and installation of sod over topsoil as noted on L-200 Site Layout & Materials Plan.

1.2 RELATED SECTIONS

.1 Section 32 91 19 – Topsoil and Finished Grading

1.3 SUBMITTALS

.1 Submittals in accordance with section 01 33 00 – Submittal Procedures.

.2 Submit:
- .1 Sod sample.
- .2 Install approved sample in one square meter mock-ups and maintain in accordance with maintenance requirements during establishment period.

.3 Obtain approval of sample by Contract Administrator.

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.

Part 2 Products

2.1 MATERIALS

.1 Number One Turf Grass Nursery Sod: sod that has been especially sown and cultivated in nursery fields as turf grass crop.
- .1 Turf Grass Nursery Sod types:
  - .1 Number One Kentucky Bluegrass Sod: Nursery Sod grown solely from seed of cultivars of Kentucky Bluegrass, containing not less than 100% Kentucky Bluegrass cultivars with a minimum of three (3) number one named Kentucky Bluegrass cultivars.
- .2 Turf Grass Nursery Sod quality:
  - .1 Not more than 2 broadleaf weeds or 10 other weeds per 40 square meters.
  - .2 Density of sod sufficient so that no soil is visible from height of 1500 mm when mown to height of 50mm.
  - .3 Mowing height limit: 35 to 65mm.
  - .4 Soil portion of sod: 6 to 15mm in thickness.
- .3 Water: potable
- .4 Fertilizer:
  - .1 To Canada "Fertilizers Act" and "Fertilizers Regulations".
  - .2 Complete, synthetic, slow release with 65% of nitrogen content in water-insoluble form.

2.2 SOURCE QUALITY CONTROL

.1 Obtain approval from Contract Administrator of sod at source.

.2 When proposed source of sod is approved, use no other source without written authorization from Contract Administrator.

Part 3 Execution

3.1 PREPARATION

.1 Verify that grades are correct and prepared in accordance with section 32 91 19. If discrepancies occur, notify Contract Administrator and do not commence work until instructed by Contract Administrator.

.2 Do not perform work under adverse field conditions such as frozen soil, excessively wet soil or soil covered with snow, ice, or standing water.

.3 Fine grade surface free of humps and hollows to smooth, even grade, to contours and elevations indicated, per section 32 91 19.

.4 Remove and dispose of weeds; debris; stones 50mm in diameter and larger; soil contaminated by oil, gasoline and other deleterious materials; off site in location as directed by Contract Administrator.

3.2 SOD PLACEMENT

.1 Lay sod within 24 hours of being lifted if air temperature exceeds +20˚ C.

.2 Lay sod sections in rows, joints staggered. Butt sections closely without overlapping or leaving gaps between sections. Cut out irregular or thin sections with sharp implements.

.3 Roll sod with 90 kg roller.

3.3 ESTABLISHMENT PERIOD

.1 Perform the following operations from time of installation until thirty (30) days following the issuance of Certificate of Substantial Completion.

.2 Water sodded areas in sufficient quantities and at frequency required to maintain optimum soil moisture condition to depth of 75 to 100mm.

.3 Cut grass to 50mm when or prior to it reaching height of 75mm. Remove clippings which will smother sodded areas.

.4 Maintain sodded areas weed free 95%.

3.4 ACCEPTANCE

.1 Turf Grass Nursery Sod areas will be accepted by the Contract Administrator provided that:
- .1 Sod has clearly rooted into the planting medium below and growing vigorously.
- .2 Sod is free of bare and dead spots with no surface soil visible from height of 1500mm after grass has been cut to 50mm ht.
- .3 Sodded areas have been cut a minimum two (2) times.

.2 Areas sodded in fall will be accepted in following spring one month after start of growing season provided acceptance conditions are fulfilled.

3.5 CLEANING

.1 Upon completion of installation, remove construction and accumulated environmental dirt, surplus materials, rubbish, tools and equipment barriers in accordance with section 01 74 00 – Cleaning and Waste Processing.

END OF SECTION

Part 1 General

1.1 DESCRIPTION

.1 This specification shall cover the maintenance of trees and shrubs, planting beds, and sodded areas. In general, work shall include spring-cleaning, watering, mowing, weed control, pest and disease control, pruning, and winter preparation.

1.2 RELATED SECTIONS

.1 32 93 10 Trees, Shrubs and Groundcover Planting

.2 32 92 19 Mechanical Seeding

.3 32 92 21 Sodding

1.3 MAINTENANCE PERIOD

.1 Provide maintenance of sodded areas, planting beds, shrubs, perennials and groundcovers from date of installation until one (1) year after the date of issuance of Certificate of Total Performance.

.2 This maintenance is in addition to the maintenance during establishment period specified in Section 32 92 20 and 32 92 21.

.3 Maintenance Period begins on the first day of the month after which the 30 day establishment period is completed in sections 32 92 20 and 32 92 21.

1.4 PROTECTION

.1 Prevent damage to all completed site amenities including site fencing, trees, landscaping, naturalize areas, lawns, bench marks, buildings, pavement, play features, site furnishings, site lighting, surface and underground utilities. Make good any damage.

Part 2 Products

2.1 MATERIALS

.1 Materials to conform to the requirements of related specification Sections.

.2 Herbicide: (for control of weed flushes). To meet Manitoba Non-Essential Pesticide and Herbicide use regulations MR 286/2014 or latest. Go to the following site for additional resources: http://www.gov.mb.ca/agriculture/crops/guides-and-publications/#wclta

2.1 EQUIPMENT

.1 Provide all equipment to properly execute work and maintain such equipment in a workable, safe condition during use of this project.

.2 Obtain approval by Contract Administrator of equipment to be used to execute work. Use only approved equipment.

Part 3 Execution

3.1 GENERAL

.1 Schedule start up meeting with Contract Administrator prior to proceeding with maintenance procedures

.2 Keep detail log record of maintenance operations with time, location, operation, amount of material and equipment used.

.3 Submit log record to Contract Administrator on weekly bases and in compliance with specification Section 01 33 00 Submittal Procedures.

.4 Prepare a Maintenance Operations Log Book for the maintenance crew foreman to fill out upon each maintenance visit to Bill and Helen Norrie Library listing time in, time out and operations completed. House log book at the Bill and Helen Norrie Library reception/book return desk and train the foreman to complete this task upon each visit.

.5 Program timing of operations to growth, weather conditions and use of site.

.6 Do each operation continuously and complete within reasonable time period.

.7 Store equipment and materials off site unless express provisions to store equipment on site have been reached with The City.

.8 Collect and dispose of debris or excess material off site during every visit. Do not leave refuse on the site or dump maintenance by product or debris into the Facilities waste and recycling bins.

3.2 SPRING CLEANING

.1 Sodded Areas: Rake areas and remove dead vegetation, leaves and debris. Do heavy raking with flexible grass rake on areas with "snow mould". Roll lightly areas where grass plants have lifted due to frost action.

.2 Planting Beds: Clean beds and planters of debris, refuse and dead plant material. Weed as necessary and top up mulch where degraded to below the original specified depths.

3.3 WATERING

.1 Apply water as required to supplement rainfall and to maintain optimum growing conditions. In general, water once a week to achieve rates as indicated. Allow soil to adequately dry between watering to prevent over saturation without creating water stress.

.2 Sodded Areas:

- .1 During establishment period, water as required to maintain moisture penetration of 100mm. Ensure minimum moisture penetration of 100mm for each application.
- .2 Thereafter, water as required to replenish available moisture to a depth of 100mm (approximately 25mm precipitation per week).

.3 Planting Beds:

- .1 Water heavily once a week after 30 day establishment period is complete.
- .2 Provide supplemental water during extended periods with no precipitation.

.4 Apply water in soft spray to avoid packing of soil. Do not impede use of sidewalk and other paved areas.

3.4 MOWING OF SODDED AREAS

.1 Mow sod at regular intervals to maintain grass to a height of 50 mm. Cut grass before it reaches 75 mm height. Remove grass clippings. Hand trim or use edger for grass adjacent to buildings, pavement, trees, fences. Trim grass edges around planting beds neatly in lines as in original layout.

.2 Sod cutting operations include picking up and disposal of paper and refuse accumulated on landscaped areas prior to mowing.

1.2 **SEEDED AREAS**

.1 Maintenance of seeded areas is not part of this section and shall be completed by the pre-qualified certified installers identified in section 32 92 17 Mechanical Seeding.

3.5 FERTILIZING

.1 To Canada "Fertilizers Act" and "Fertilizers Regulations".
.2 Rate, ratio and frequency as recommended by soil test results and plant health.

3.6 WEED CONTROL

.1 Maintain site free of weeds using manual weeding operations in planting beds and sodded areas. Do not allow weeds to establish for a period longer than 3 weeks.

.2 Apply herbicide in keeping with provincial regulations only when it will not cause damage to other plantings. Do not use of dicambal and picloram solutions.

3.7 PEST AND DISEASE CONTROL

.1 Control pests and disease through pruning or application of pesticides. Use species specific pesticides where possible. Use only pesticides of low mammalian toxicity that meet MB Non-Essential Pesticide Regulation MR 286/2014. Strictly follow manufacturer's written instructions.

3.8 WINTER PREPARATION

.1 Rake and assemble leaves after they have been shed by trees. Remove from site.

.2 Clean out planting beds. Remove debris from site.

.3 Protect trees from rodent damage using approved plastic protector beyond snow line or by applying rodent repellent sprays. Use spray to protect shrubs as required.

.4 Water planting beds and trees thoroughly during the fall season. Ensure adequate moisture in root zones of plant material prior to freeze-up.

.5 Apply anti-desiccant to evergreen trees and shrubs susceptible to winter desiccation.

3.9 FINAL ACCEPTANCE

.1 The Contract Administrator, City and soft landscape Contractor will conduct a one year plant warranty

and landscape maintenance review.

.2 Sodded and Planted Areas installed under sections 32 92 20 to 32 92 21 will be accepted by the Contract Administrator provided that:

.1 Sodded areas are healthy and vigorous and meet the acceptance standards specified in Section 32 92 21 - Sodding.
.2 Trees, shrubs and groundcovers are showing growth and vigour satisfactory to the Contract Administrator.

.3 Sodded and Planted Areas will not be considered accepted until the Contract Administrator issues a final report stipulating that the installation is complete and accepted as maintained.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 31 22 13 - Rough Grading.

.3 Section 32 91 19 – Topsoil Placement and Finish Grading.

1.2 REFERENCES

.1 Agriculture and Agri-Food Canada (AAFC).
  .1 Plant Hardiness Zones in Canada-2000.

.2 Canadian Nursery Landscape Association (CNLA).
  .1 Canadian Standards for Nursery Stock-2006, 8th Edition

1.3 SUBMITTALS

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

.2 Submit product data for:
  .1 Fertilizer.
  .2 Anti-desiccant.
  .3 Guying assembly including clamps, collar, guying wire, anchors and wire tightener.
  .4 Wood chip mulch.

.3 Submit samples for:
  .1 Wood chip mulch.

1.4 QUALITY ASSURANCE

.1 Obtain approval or plant material at source.

.2 Notify Contract Administrator of source of material at least seven (7) days in advance of shipment. No work under this Section is to proceed without approval.

.3 Acceptance of plant material at source does not prevent rejection on site prior to or after planting operations.

.4 Imported plant material must be accompanied with necessary permits and import licenses. Conform to federal and provincial regulations.

1.5 STORAGE AND PROTECTION

.1 Protect plant material from frost, excessive heat, wind and sun during delivery.

.2 Immediately store and protect plant material which will not be installed within 4 hours after arrival at site in storage location approved by Contract Administrator.

.3 Protect plant material from damage during transportation:

.1 When delivery distance is less than 30 km and vehicle travels at speeds under 80 km/h, tie tarpaulins around plants or over vehicle box.
.2 When delivery distance exceeds 30 km or vehicle travels at speeds over 80 km/h, use enclosed vehicle where practical.
.3 Protect foliage and root balls using anti-desiccants and tarpaulins, where use of enclosed vehicle is impractical due to size and weight of plant material.

.4 Protect stored plant material from frost, wind and sun and as follows:
.1 For pots and containers, maintain moisture level in containers.
.2 For balled and burlapped and wire basket root balls, place to protect branches from damage. Maintain moisture level in root zones.

1.6 SCHEDULING

.1 Obtain approval of species alternatives prior to ordering plant material.

.2 Order plant material as soon as possible after award of Contract to ensure plant availability.

.3 Obtain approval from Contract Administrator of schedule 14 days in advance of shipment of plant material.

.4 Schedule to include:
.1 Quantity and type of plant material.
.2 Shipping dates.
.3 Arrival dates on site.
.4 Planting Dates.

1.7 WARRANTY

.1 The Contractor shall warrant that plant material as itemized on plant list will remain free of defects in accordance with General Conditions, for twelve (12) months, after the date of Substantial Performance, providing adequate maintenance has been provided.

.2 End-of-warranty inspection will be conducted by Contract Administrator.

.3 The Contract Administrator reserves the right to extend Contractor's warranty responsibilities for an additional one year if, at end of initial warranty period, leaf development and growth is not sufficient to ensure future survival.

.4 All replacement plant material subject to an additional one (1) year of warranty.

Part 2 Products

2.1 PLANT MATERIAL

.1 Type of root preparation, sizing, grading and quality: comply to Canadian Standards for Nursery Stock.
.1 Source of plant material: grown in Zone 2b in accordance with Plant Hardiness Zones in Canada.
.2 Plant material must be planted in zone indicated as appropriate for its species.

.2 Plant material: free of disease, insects, defects or injuries and structurally sound with strong fibrous root system.

.3 Trees: with straight trunks, well and characteristically branched for species except where specified otherwise.

2.2 PLANTING MEDIUM MIX

.1 Planting soil mix: as specified in Section 32 91 19 – Topsoil Placement and Finish Grading.

2.3 WATER

.1 Free of impurities that would inhibit plant growth.

2.4 STAKES

.1 Wooden, 76mm (3") dia. x 2.4m (8').

2.5 WIRE TIGHTENER

.1 PG wire tightener.

2.6 GUYING WIRE

.1 9 gauge, flexible, non-corrosive stand wire.

2.7 CLAMPS

.1 U-bolt: galvanized, 12 mm diameter, c/w curved retaining bar and hex nuts.

2.8 ANCHORS

.1 Drive-in type.
.1 13 mm diameter x 75 mm long, aluminum.

2.9 TRUNK PROTECTION

.1 Tube: plastic, 100 mm diameter, nylon reinforced, cut on site.

2.10 GUYING COLLAR

.1 Plastic, 12mm diameter, nylon reinforced garden house over guy wire.

2.11 MULCH

.1 Wood chip: varying in size from 50 mm to 75 mm and 6 mm to 16 mm thick, free of bark, small branches and leaves.

2.12 FERTILIZER

.1 Synthetic commercial type as per Section 32 92 19 – Topsoil Placement and Finish Grading.

.2 Horticultural bonemeal; raw bonemeal, finely ground with minimum analysis of 3% nitrogen and 10% phosphoric acid.

2.13 ANTI-DESICCANT

.1 Wax-like emulsion.

2.14 FLAGGING TAPE

.1 Fluorescent, orange colour surveyors flagging tape, length as required.

2.15 SOURCE QUALITY CONTROL

.1 Obtain approval from Contract Administrator of plant material prior to planting.

.2 Imported plant material must be accompanied with necessary permits and import licenses. Conform to Federal, Provincial or Territorial regulations.

Part 3 Execution

3.1 RELATED WORK

.1 Obtain approval of site grading, and tree and shrub planting holes and beds prior to commencing work in this section.

3.2 PRE-PLANTING PREPARATION

.1 Ensure plant material is acceptable to Contract Administrator.

.2 Remove damaged roots and branches from plant material.

.3 Apply anti-desiccant to conifers and deciduous trees in leaf in accordance with manufacturer's instructions.

3.3 EXCAVATION AND PREPARATION OF PLANTING BEDS

.1 Establishment of sub-grade for planting beds is specified in Section 31 22 13 - Rough Grading.

.2 Preparation of planting beds is specified in Section 32 91 19 – Topsoil Placement and Finish Grading.

.3 For individual planting holes:
- .1 Stake out location and obtain approval from Contract Administrator prior to excavating.
- .2 Excavate to depth and width as indicated.
- .3 Remove rocks, roots, debris and toxic material from excavated material that will be used as planting soil for trees and individual shrubs. Dispose of excess material.
- .4 Scarify sides of planting hole.
- .5 Remove water which enters excavations prior to planting. Notify Contract Administrator if water source is ground water.

3.4 PLANTING

.1 For jute burlapped root balls, cut away top one third of wrapping and wire basket without damaging root ball. Do not pull burlap or rope from under root ball.

.2 For container stock or root balls in non-degradable wrapping, remove entire container or wrapping without damaging root ball.

.3 Plant vertically in locations as indicated. Orient plant material to give best appearance in relation to structure, roads and walks.

.4 For trees and shrubs:
- .1 Backfill soil in 150 mm lifts. Tamp each lift to eliminate air pockets. When two thirds of depth of planting pit has been backfilled, fill remaining space with water. After water has penetrated into soil, backfill to finish grade.
- .2 Form watering saucer as indicated.

.5 For ground covers, backfill soil evenly to finish grade and tamp to eliminate air pockets.

.6 Water plant material thoroughly to fully saturate soil for an area the minimum of double the width of the rootball.

.7 After soil settlement has occurred, fill with additional topsoil to achieve finish grades.

.8 Dispose of burlap, wire and container material off site.

3.5 TRUNK PROTECTION

.1 Install trunk protection on deciduous trees as indicated.

.2 Install trunk protection prior to installation of tree supports when used.

3.6 TREE SUPPORTS

.1 Install tree supports as indicated.

.2 Use 2 stakes tree support for deciduous trees less than 3 m.
- .1 Place stakes along prevailing wind side and 150 mm from trunk.
- .2 Drive stakes minimum 150 mm into undisturbed soil beneath roots. Ensure stake are secure, vertical and unsplit.
- .3 Install 150 mm long guying collar 1500 mm above grade.
- .4 Thread Type 1 guying wire through guying collar tube. Twist wire to form collar and secure firmly to stake. Cut off excess wire.

.3 Use three guy wires and anchors for coniferous trees over 1.5 m height as shown on the detail drawing.
- .1 Install flagging tape to guys as indicated.

.4 After tree supports have been installed, remove broken branches with clean, sharp tools.

3.7 MULCHING

.1 Obtain approval of planting before mulching material is applied.

.2 Ensure soil settlement has been corrected prior to mulching with wood chip mulch.

.3 Loosen soil in planting beds and remove debris and weeds. Spread mulch to minimum thickness of 75 mm. Mulch material susceptible to blowing must be moistened and mixed with water before applying. When mulching is placed in fall, place immediately after planting. When mulch is placed in spring, wait until soil has warmed up.

3.8 WARRANTY PERIOD

.1 All plantings under this section of work will be inspected by the Contract Administrator immediately after thirty (30) day establishment period.

.2 A Certificate of Total Performance will be issued at the end of the inspection and the completion of associated replacements / adjustments.

.3 The date of the certificate of total performance will mark the beginning of the one (1) year warranty period.

.4 A plant warranty inspection scheduled and led by the Contract Administrator will be conducted as close to one year after the issuance of the certificate of total performance as possible.

3.9 ACCEPTANCE

.1 Trees, shrubs, perennials, grasses, groundcovers and vines will be inspected at substantial performance and at the end of the one (1) year maintenance period. Trees, shrubs, perennials, grasses, groundcovers will be accepted by the Contract Administrator, provided that:

.1 Plants are showing vigorous well rounded new growth.
.2 Plants are free of disease or pests.
.3 Plants show no signs of malnutrition or stress.

.2 After the warranty inspection the Contractor shall replace trees, shrubs, perennials and grasses that do not meet the standards in 3.11.1 with new plant material as originally specified at no additional cost to The City. All replacement plants shall be subject to a thirty (30) day establishment maintenance period and an additional one (1) year warranty period from the date of replacement.

END OF SECTION

Part 1 GENERAL

1.1 RELATED SECTIONS

.1 Section 31 23 10 – Excavating, Trenching and Backfilling

.2 Section 33 31 13 – Public Sanitary Utility Sewerage Piping.

.3 Section 33 41 00 – Storm Utility Drainage Piping.

1.2 REFERENCES

.1 American Society for Testing and Materials International (ASTM) – Latest Editions

.1 ASTM A48/A48M-00, Standard Specification for Gray Iron Castings.

.2 ASTM C117-04, Standard Test Method for Materials Finer than 75-µm (No. 200) Sieve in Mineral Aggregates by Washing.

.3 ASTM C136-05, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.

.4 ASTM C139-05, Standard Specification for Concrete Masonry Units for Construction of Catch Basins and Manholes.

.5 ASTM C478M-06, Standard Specification for Precast Reinforced Concrete Manhole Sections Metric.

.6 ASTM D698-00a, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3(600 kN-m/m^3).

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-8.2-M88, Sieves, Testing, Woven Wire, Metric.

.3 Canadian Standards Association (CSA International)

.1 CAN/CSA-A23.1-04/A23.2-04, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.

.2 CAN/CSA-A3000-03(R2005), Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).

.3 CSA-A3001-03, Cementitious Materials for Use in Concrete.

.4 CSA-A3002-03, Masonry and Mortar Cement.

.4 City of Winnipeg Standard Construction Standard Specifications (CW)

.1 CW 2130 – Gravity Sewers

.2 CW 2140 – Sewer and Manhole Cleaning

.3 CW 2160 – Concrete Underground Structures and Works

1.3 LAYOUT OF WORK

.1 The Contractor shall be responsible for the layout of work, including providing and paying for all survey supplies, equipment and labour required to set stakes, levels, control lines, and benchmarks. The Contractor shall be responsible for the careful preservation of all stakes and marks so set whether relating to his own or to other work.

.2 All layouts shall be reviewed and approved by the Contract Administrator prior to Construction.

1.4 WASTE MANAGEMENT AND DISPOSAL

.1 Separate waste materials for disposal or recycling in designated areas, in accordance with Waste Management Plan.

.2 Place materials defined as hazardous or toxic in designated containers.

Part 2 PRODUCTS

2.1 MATERIALS

.1 Precast concrete sections: to CSA A257.4 and ASTM Standard C 76 Class II and C 478 (circular sections).

.1 Manholes shall be standard pre-cast concrete 1200mm diameter base and riser sections with flexible plastic gaskets between sections followed by a 1200mm x 750mm flat reducer on top.

.2 Catch basins shall be standard pre-cast concrete, with 900mm base diameter and height as shown on the Drawings, followed by a reducer on top.

.2 Internal joints shall be made watertight using preformed bituminous gaskets or flexible rubber joint sealant. Exterior joints shall be wrapped with "Cretex Wrap" external joint sealer or approved equivalent.

.3 Ladder rungs: in accordance with Approved Products for Underground Use in the City of Winnipeg

.4 Adjusting rings: to CAN/CSA A257.4 and ASTM C478M.

.5 Cast iron frame and covers: in accordance with Approved Products for Underground Use in the City of Winnipeg

.6 Cast-in-place concrete, grout, mortar and cement stabilized fill: in accordance with CW 2160 – Concrete Underground Structures and Works.

.7 Granular bedding and backfill: in accordance with Section 31 23 10 – Excavation, Trenching and Backfilling.

Part 3 EXECUTION

3.1 EXCAVATION AND BACKFILL

.1 Excavate and backfill in accordance with Section 31 23 10 – Excavating, Trenching and Backfilling and as indicated.

.2 Obtain approval of Contract Administrator before installing manholes or catch basins.

3.2 INSTALLATION

.1 Construct manholes and catch basins in accordance with details shown on the Drawings, plumb and true to alignment and grade.

.2 Level bedding to ensure manhole base and catch basin is uniformly supported and the floor is level.

.3 Install approved gasket or joint sealer between pre-cast concrete sections including 750 millimetre diameter riser adjusting rings and between frame and pre-case concrete riser as construction progresses.

.4 Complete units as pipe laying progresses. Connect sewers to manhole bases and catch basins at invert elevations shown on the Drawings and grout in place to make a watertight connection. Coat outside of PVC pipe end for a length equal to the manhole and catch basin wall thickness plus 150 millimetres with an approved cementing agent to which sand has been added and allow mixture to harden before grouting in place. Alternatively PVC pipe may be connected using an approved pre-treated, gasketed PVC insert or an approved interference fit flexible rubber boot or gasket inserted into a hole cored in the manhole base or catch basin.

.5 Bench and channel manhole floor with mortar or concrete. Curve flow channels smoothly and provide smooth transition between inlet and outlet pipes.

.6 Grout and plug lifting holes, joints and frame to make watertight. Remove excess mortar from inside surface of manhole.

.7 Set frame and cover on top section to elevation as indicated. If adjustment required use concrete ring.

.8 Clean units of debris and foreign materials.

.1 Remove fins and sharp projections.

.2 Prevent debris from entering system.

3.3 CLEANING

.1 Proceed in accordance with CW 2140 – Sewer and Manhole Cleaning

.2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 GENERAL

1.1 SECTION INCLUDES

.1 Materials and installation for water mains, hydrants, valves, valve boxes, and valve chambers, including service connections.

1.2 RELATED SECTIONS

.1 Section 31 23 10 – Excavation, Trenching and Backfill

1.3 REFERENCES

.1 American National Standards Institute/American Water Works Association (ANSI/AWWA) – Latest Editions

.1 ANSI/AWWA C651, Disinfecting Water Mains.

.2 ANSI/AWWA C800, Underground Service Line Valves and Fittings

.3 ANSI/AWWA C900, Polyvinyl Chloride (PVC) Pressure Pipe, and Fabricated Fittings, 4 Inch through 12 Inch (100 mm - 300 mm), for Water Distribution.

.2 American Water Works Association (AWWA)/Manual of Practice

.1 AWWA M17, Installation, Field Testing, and Maintenance of Fire Hydrants.

.3 Canadian Standards Association (CSA International)

.1 CAN/CSA-A3000, Cementitious Materials Compendium

.1 CAN/CSA-A8, Masonry Cement.

.2 CSA B137 Series, Thermoplastic Pressure Piping Compendium.

.1 CSA B137.3, Rigid Polyvinyl Chloride (PVC) Pipe for Pressure Applications.

.4 City of Winnipeg Standard Construction Standard Specifications (CW)

.1 CW 2110 – Watermains

.2 CW 2125 – Flushing, Hydrostatic Leakage Testing and Disinfection of Watermains and Water Services

.3 CW 2160 – Concrete Underground Structures and Works

1.4 QUALITY ASSURANCE

.1 The Contractor shall, at his expense, pressure test and disinfect the pipeline in accordance to CW 2125 – Flushing, Hydrostatic Leakage Testing and Disinfection of Watermains and Water Services, under the direct supervision of the Consultant.

.2 Upon completion of the watermains intended to convey potable water, the Contractor shall take water samples and conduct bacteriological tests as the Consultant considers necessary, at the Contractor's expense.

1.5 LAYOUT OF WORK

.1 The Contractor shall be responsible for the layout of work, including providing and paying for all survey supplies, equipment and labour required to set stakes, levels, control lines,

and benchmarks. The Contractor shall be responsible for the careful preservation of all stakes and marks so set whether relating to his own or to other work.

.2 All layouts shall be reviewed and approved by the Contract Administrator prior to Construction.

1.6 WASTE MANAGEMENT AND DISPOSAL

.1 Separate waste materials for disposal or recycling in designated areas, in accordance with Waste Management Plan.

.2 Place materials defined as hazardous or toxic in designated containers.

1.7 SCHEDULING OF WORK

.1 Schedule Work to minimize interruptions to existing services.

.2 Coordinate site water installation with Mechanical and Electrical Sub-Contactor's utility installations.

.3 Submit schedule of expected interruptions to City of Winnipeg for approval and adhere to interruption schedule as approved by Consultant.

.4 Notify City of Winnipeg, Consultant and neighbouring businesses, a minimum of 48 hours in advance of interruption in service.

.5 Notify fire department of any planned or accidental interruption of water supply to hydrants.

.6 Advise local police department of anticipated interference with movement of traffic.

Part 2 PRODUCTS

2.1 PIPE

.1 Polyvinyl Chloride Pipe (PVC): AWWA C900 PVC Water Pipe, in accordance with Approved Products for Underground Use in the City of Winnipeg.

.2 Pipe joints shall be bell and spigot push on type with rubber gasket seals in accordance with ASTM F477, capable of withstanding pressure equal to the rated pressure of the pipe and withstanding thermal expansion and contraction.

2.2 FITTINGS

.1 PVC watermain fittings shall be fabricated for 250 and 300 millimetre tees, elbows, crosses, couplings, reducers, and caps in accordance with AT 4.1.1.64 of the Approved Products for Underground Use in the City of Winnipeg.

2.3 VALVES AND VALVE BOXES

.1 Valves and valve boxes: to CW 2110 – Watermains, and Approved Products for Underground Use in the City of Winnipeg.

.2 Valves shall be direct bury, non-rising stem, resilient seated wedge gate valves rated at 1 MPa. Valve body to be epoxy coated and valve ends to be push-on type with full depth insertion.

2.4 APPURTENANCES

.1 Repair clamps, couplings, tapping sleeves, connection saddles and other appurtenances: to CW 2110 – Watermains, and Approved Products for Underground Use in the City of Winnipeg.

.2 Fasteners, tie rods, clamps, nuts and bolts to be stainless steel in accordance with ASTM A320. ANSI Type 316 marked with raised or indented numerals.

2.5 CAST-IN-PLACE CONCRETE AND GROUT

.1 Cast-in-place concrete, grout, mortar and cement stabilized fill: in accordance with CW 2160 – Concrete Underground Structures and Works.

2.6 BEDDING AND BACKFILL MATERIAL

.1 Bedding and backfill: in accordance with Section 31 23 10 – Excavation, Trenching and Backfilling.

Part 3 EXECUTION

3.1 TRENCHING

.1 Do trenching work in accordance with Section 31 23 10 – Excavation, Trenching and Backfill

3.2 BEDDING

.1 Place and compact sand bedding material in the bottom of the excavation in accordance with Section 31 23 10 – Excavation, Trenching and Backfill, to the grade and elevation shown on the Drawings.

.2 Level across full width of excavation and leave ready for pipe installation.

.3 Do not place material in frozen condition.

3.3 PIPE INSTALLATION

.1 Pipe Installation using trenchless methods: to CW 2110 - Watermains

.2 Handle and join pipes to manufacturer's standard instructions and specifications. Do not exceed permissible deflection at joints as recommended by pipe manufacturer.

.3 Install gaskets to manufacturer's recommendations.

.4 Cut pipes in approved manner as recommended by pipe manufacturer, without damaging pipe or its coating and to leave smooth end at right angles to axis of pipe.

.5 Backfill remainder of trench in accordance with Section 31 23 10 – Excavation, Trenching and Backfill.

3.4 VALVE INSTALLATION

.1 Install valves to manufacturer's recommendations at locations as indicated.

.2 Orient valve box lids to close with the direction of traffic where installed in pavement.

3.5 SERVICE CONNECTIONS

.1 Install building water service within building as per details on the Drawings. Coordinate with Mechanical Drawings and Mechanical Contractor

.2 Do not connect to building plumbing until satisfactory completion of hydrostatic and leakage tests of watermain.

.3 Construct service connections at right angles to water main unless otherwise directed.

.4 Connection to existing watermain shall be done in accordance to CW 2110 – Watermains.

.5 Expose existing watermains, sewers, and other utilities at proposed connection or crossing locations as directed by the Consultant, far enough in advance of watermain installation to allow existing inverts to be determined. The Consultant will modify design grades as required if there is a conflict.

3.6 FITTING AND THRUST BLOCKS

.1 Install approved fittings at locations and elevations shown in the Drawings, where required to connect to existing watermains, and where directed by the Consultant.

.2 Construct cast-in-place concrete thrust blocks for fittings that bear against undisturbed soil, in accordance with CW 2110 – Watermains.

.3 For fittings that bear against disturbed soil, install mechanical joint restraints in combination with the concrete thrust blocks, as directed by and approved by the Consultant.

3.7 FLUSHING, HYDROSTATIC AND LEAKAGE TESTING, DISINFECTING

.1 Filling and flush watermains with potable water before hydrostatic leakage testing and disinfection, in accordance with CW 2125 – Flushing, Hydrostatic Leakage Testing and Disinfection of Watermains and Water Services.

.2 Provide at least 24 hours notice to the Consultant in advance of hydrostatic leakage testing. Perform hydrostatic leakage testing in presence of Consultant, in accordance with CW 2125 – Flushing, Hydrostatic Leakage Testing and Disinfection of Watermains and Water Services.

.3 Provide at least 24 hours notice to the Consultant in advance of disinfection. Perform disinfection in presence of the Consultant, in accordance with CW 2125 – Flushing, Hydrostatic Leakage Testing and Disinfection of Watermains and Water Services.

.4 Disinfection may be done with hydrostatic leakage testing.

3.8 SURFACE RESTORATION

.1 After installing and backfilling over water mains, restore surface to original condition as directed by Consultant.

END OF SECTION

Part 1 GENERAL

1.1 SECTION INCLUDES

.1 Materials and installation for gravity sanitary sewers

1.2 RELATED SECTIONS

.1 Section 31 23 10 - Excavating, Trenching and Backfilling.

.2 Section 33 05 13 – Manholes and Catch Basin Structures

1.3 REFERENCES

.1 American Society for Testing and Materials International, (ASTM) – Latest Edition

- .1 ASTM D698, Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft4-lbf/ft^3 (600 kN-m/m^3)).
- .2 ASTM D3034, Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
- .3 ASTM D3350], Standard Specification for Polyethylene Plastics Pipe and Fittings Materials.

.2 Canadian Standards Association (CSA International)

- .1 CSA B1800, Plastic Non-pressure Pipe Compendium - B1800 Series (Consists of B181.1, B181.2, B181.3, B181.5, B182.1, B182.2, B182.4, B182.6, B182.7, B182.8 and B182.11).
- .2 CSA B182.2, PVC Sewer Pipe and Fittings (PSM Type).
- .3 CSA B182.11, Recommended Practice for the Installation of Thermoplastic Drain, Storm, and Sewer Pipe and Fittings.

.3 City of Winnipeg Standard Construction Standard Specifications (CW)

- .1 CW 2130 – Gravity Sewers
- .2 CW 2140 – Sewer and Manhole Cleaning
- .3 CW 2145 – Sewer and Manhole Inspection.
- .4 CW 2160 – Concrete Underground Structures and Works

1.4 QUALITY ASSURANCE

.1 The Contractor shall, at his expense, perform deflection testing and video inspection of all installed sanitary sewers in accordance to CW 2130 – Gravity Sewers and CW 2145 – Sewer and Manhole Inspection, under the direct supervision of the Consultant.

1.5 LAYOUT OF WORK

.1 The Contractor shall be responsible for the layout of work, including providing and paying for all survey supplies, equipment and labour required to set stakes, levels, control lines, and benchmarks. The Contractor shall be responsible for the careful preservation of all stakes and marks so set whether relating to his own or to other work.

.2 All layouts shall be reviewed and approved by the Contract Administrator prior to Construction.

1.6 WASTE MANAGEMENT AND DISPOSAL

.1 Separate waste materials for disposal or recycling in designated areas, in accordance with Waste Management Plan.

.2 Place materials defined as hazardous or toxic in designated containers.

1.7 SCHEDULING OF WORK

.1 Schedule Work to minimize interruptions to existing services and maintain existing sewage flows during construction.

.2 Coordinate site sanitary sewer installation with Mechanical and Electrical Sub-Contactor's utility installations.

.3 Submit schedule of expected interruptions to City of Winnipeg for approval and adhere to interruption schedule as approved by Consultant.

.4 Notify City of Winnipeg, Consultant and neighbouring businesses, a minimum of 48 hours in advance of interruption in service.

.5 Advise local police department of anticipated interference with movement of traffic.

Part 2 PRODUCTS

2.1 PIPE

.1 Polyvinyl Chloride Pipe (PVC): SDR 35 in accordance with CAN/CSA B182.2, ASTM D3034, and Approved Products for Underground Use in the City of Winnipeg.

.2 Pipe joints shall be bell and spigot push on type with rubber gaskets in accordance with ASTM F477

2.2 FITTINGS

.1 PVC Sewer fittings shall be PVC injection moulded fittings in accordance with ASTM D3034, SDR 35, and Approved Products for Underground Use in the City of Winnipeg.

2.3 CAST-IN-PLACE CONCRETE AND GROUT

.1 Cast-in-place concrete, grout, mortar and cement stabilized fill: in accordance with CW 2160 – Concrete Underground Structures and Works.

2.4 BEDDING AND BACKFILL MATERIAL

.1 Bedding and backfill: in accordance with Section 31 23 10 – Excavation, Trenching and Backfilling.

Part 3 EXECUTION

3.1 TRENCHING

.1 Do trenching work in accordance with Section 31 23 10 – Excavation, Trenching and Backfill

3.2 BEDDING

.1 Place and compact sand bedding material in the bottom of the excavation in accordance with Section 31 23 10 – Excavation, Trenching and Backfill, to the grade and elevation shown on the Drawings.

.2 Level across full width of excavation and leave ready for pipe installation.

.3 Do not place material in frozen condition.

3.3 PIPE INSTALLATION

.1 Pipe Installation using trenchless methods: to CW 2130 – Gravity Sewers

.2 Handle and join pipes to manufacturer's standard instructions and specifications. Lay pipe with bell upgrade.

.3 Make watertight connections to manholes, in accordance to Section 33 05 13 – Manholes and Catch Basin Structures

.4 Backfill remainder of trench in accordance with Section 31 23 10 – Excavation, Trenching and Backfill.

3.4 SERVICE CONNECTIONS

.1 Install building sewer service within building as per details on the Drawings. Coordinate with Mechanical Drawings and Mechanical Contractor

.2 Connection to existing sewer shall be done in accordance to CW 2130 – Gravity Sewers.

.3 Expose existing watermains, sewers, and other utilities at proposed connection or crossing locations as directed by the Consultant, far enough in advance of sewer installation to allow existing inverts to be determined. The Consultant will modify design grades as required if there is a conflict.

.4 The Contractor shall maintain service to affected residents throughout construction. At no time shall raw sewage be allowed to discharge into any trenches. Bypass pumping will be required to divert sewer flows to permit continuity of sanitary sewer service.

3.5 CLEANING

.1 Proceed in accordance with CW 2140 – Sewer and Manhole Cleaning

.2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

3.6 SEWER AND MANHOLE INSPECTION

.1 Conduct video inspections of all new sewers and manholes for the purposes of assessing thoroughness of cleaning, observing and recording structural and service defects and construction features and to verify new sewer construction prior to acceptance.

.2 Video inspection shall be done in accordance to CW 2145 – Sewer and Manhole Inspection.

.3 Existing sewers shall be televised from the nearest manhole to a minimum of 2 metres past the new connection.

3.7 SURFACE RESTORATION

.1 After installing and backfilling over sewer mains, restore surface to original condition as directed by Consultant.

END OF SECTION

Part 1 GENERAL

1.1 SECTION INCLUDES

.1 Materials and installation for storm sewer.

1.2 RELATED SECTIONS

.1 Section 31 23 10 - Excavating, Trenching and Backfilling.

.2 Section 33 05 13 – Manholes and Catch Basin Structures

1.3 REFERENCES

.1 American Society for Testing and Materials International, (ASTM) – Latest Edition

.1 ASTM D698, Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft4-lbf/ft^3 (600 kN-m/m^3).

.2 ASTM D3034, Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.

.3 ASTM D3350, Standard Specification for Polyethylene Plastics Pipe and Fittings Materials.

.2 Canadian Standards Association (CSA International)

.1 CSA B1800, Plastic Non-pressure Pipe Compendium - B1800 Series (Consists of B181.1, B181.2, B181.3, B181.5, B182.1, B182.2, B182.4, B182.6, B182.7, B182.8 and B182.11).

.2 CSA B182.2, PVC Sewer Pipe and Fittings (PSM Type).

.3 CSA B182.11, Recommended Practice for the Installation of Thermoplastic Drain, Storm, and Sewer Pipe and Fittings.

.3 City of Winnipeg Standard Construction Standard Specifications (CW)

.1 CW 2130 – Gravity Sewers

.2 CW 2140 – Sewer and Manhole Cleaning

.3 CW 2145 – Sewer and Manhole Inspection.

.4 CW 2160 – Concrete Underground Structures and Works

1.4 QUALITY ASSURANCE

.1 The Contractor shall, at his expense, perform deflection testing and video inspection of all installed storm sewers in accordance to CW 2130 – Gravity Sewers and CW 2145 – Sewer and Manhole Inspection, under the direct supervision of the Consultant.

1.5 LAYOUT OF WORK

.1 The Contractor shall be responsible for the layout of work, including providing and paying for all survey supplies, equipment and labour required to set stakes, levels, control lines, and benchmarks. The Contractor shall be responsible for the careful preservation of all stakes and marks so set whether relating to his own or to other work.

.2 All layouts shall be reviewed and approved by the Contract Administrator prior to Construction.

1.6 WASTE MANAGEMENT AND DISPOSAL

.1 Separate waste materials for disposal or recycling in designated areas, in accordance with Waste Management Plan.

.2 Place materials defined as hazardous or toxic in designated containers.

1.7 SCHEDULING OF WORK

.1 Schedule Work to minimize interruptions to existing services and maintain existing land drainage flows during construction.

.2 Coordinate storm sewer installation with Mechanical and Electrical Sub-Contactor's utility installations.

.3 Submit schedule of expected interruptions to City of Winnipeg for approval and adhere to interruption schedule as approved by Consultant.

.4 Notify City of Winnipeg, Consultant and neighbouring businesses, a minimum of 48 hours in advance of interruption in service.

.5 Advise local police department of anticipated interference with movement of traffic.

Part 2 PRODUCTS

2.1 PIPE

.1 Polyvinyl Chloride Pipe (PVC): SDR 35 in accordance with CAN/CSA B182.2, ASTM D3034, and Approved Products for Underground Use in the City of Winnipeg.

.2 Pipe joints shall be bell and spigot push on type with rubber gaskets in accordance with ASTM F477

2.2 FITTINGS

.1 PVC Sewer fittings shall be PVC injection moulded fittings in accordance with ASTM D3034, SDR 35, and Approved Products for Underground Use in the City of Winnipeg.

2.3 CAST-IN-PLACE CONCRETE AND GROUT

.1 Cast-in-place concrete, grout, mortar and cement stabilized fill: in accordance with CW 2160 – Concrete Underground Structures and Works.

2.4 BEDDING AND BACKFILL MATERIAL

.1 Bedding and backfill: in accordance with Section 31 23 10 – Excavation, Trenching and Backfilling.

Part 3 EXECUTION

3.1 TRENCHING

.1 Do trenching work in accordance with Section 31 23 10 – Excavation, Trenching and Backfill

3.2 BEDDING

.1 Place and compact sand bedding material in the bottom of the excavation in accordance with Section 31 23 10 – Excavation, Trenching and Backfill, to the grade and elevation shown on the Drawings.

.2 Level across full width of excavation and leave ready for pipe installation.

.3 Do not place material in frozen condition.

3.3 PIPE INSTALLATION

.1 Pipe Installation in a trench or using trenchless methods: to CW 2130 – Gravity Sewers

.2 Handle and join pipes to manufacturer's standard instructions and specifications. Lay pipe with bell upgrade.

.3 Make watertight connections to manholes and catch basins, in accordance to Section 33 05 13 – Manholes and Catch Basin Structures

.4 Backfill remainder of trench in accordance with Section 31 23 10 – Excavation, Trenching and Backfill.

3.4 SERVICE CONNECTIONS

.1 Connection to existing sewer shall be done in accordance to CW 2130 – Gravity Sewers.

.2 Expose existing watermains, sewers, and other utilities at proposed connection or crossing locations as directed by the Consultant, far enough in advance of sewer installation to allow existing inverts to be determined. The Consultant will modify design grades as required if there is a conflict.

3.5 CLEANING

.1 Proceed in accordance with CW 2140 – Sewer and Manhole Cleaning

.2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

3.6 SEWER AND CATCH BASIN INSPECTION

.1 Conduct video inspections of all new sewers and catch basins for the purposes of assessing thoroughness of cleaning, observing and recording structural and service defects and construction features and to verify new sewer construction prior to acceptance.

.2 Video inspection shall be done in accordance to CW 2145 – Sewer and Manhole Inspection.

.3 Existing sewers shall be televised from the nearest manhole to a minimum of 2 metres past the new connection.

3.7 SURFACE RESTORATION

.1 After installing and backfilling over storm sewer mains, restore surface to original condition as directed by Consultant.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 American Society for Testing and Materials (ASTM).
- .1 ASTM C88/C88M-18, Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate.
- .2 ASTM C131/C131M-14, Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
- .3 ASTM D698-12e2, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3 (600 kN-m/m^3).
- .4 ASTM D1248-16, Standard Specification for Polyethylene Plastics Extrusion Materials For Wire and Cable.
- .5 ASTM E11-17, Standard Specification for Wire Cloth and Sieves for Testing Purposes.

.2 Canadian General Standards Board (CGSB).
- .1 CAN/CGSB 8.2-M88, Sieves, Testing, Woven Wire, Metric.

.3 American Association of State Highway and Transportation Officials (AASHTO).
- .1 AASHTO M92-05, Standard Specification for Wire-Cloth Sieves for Testing Purposes.

1.2 DELIVERY, STORAGE, AND HANDLING

.1 Deliver all material to site in manufacturer's original unopened packaging with labels clearly identifying product name and manufacturer.

.2 Store materials in a dry, enclosed area protected from exposure to moisture, construction activity, and direct sunlight in strict accordance with manufacturer's recommendations.

.3 Handle all products with appropriate precautions and care as stated manufacturer's instructions.

.4 Cleaning and Waste Management in accordance with Section 01 74 00.

Part 2 Products

2.1 MANUFACTURERS

.1 Basis of Design Products

.2 Cleanout Covers.
- .1 Jay R Smith 4250S for exterior areas, surfaced and unsurfaced.

.2 Requests for substitutions will be considered subject to specified requirements and in accordance with Bidding Procedures B8.

.3 Supply all products from single manufacturer.

2.2 MATERIALS

.1 Perforated Pipe: to ASTM D1248, 100 mm diameter corrugated high density polyethylene tubing for subdrainage applications with fittings and clean-outs with solid cap. Provide geotextile sock filter for perforated pipe sections.

.2 Filter Aggregate.

.1 Drainage material to consist of clean natural gravel, crushed stone or other materials of similar characteristics having hard, strong, durable, uncoated particles free from injurious amounts of soft, friable, thin, elongated or laminated pieces, alkali, organic or other deleterious matter graded within the following limits:

Canadian Metric Sieve Series (CAN/CGSB 8.2)	Sieves Sizes (AASHTO; ASTM E11)	Percentage Of Total Dry Weight Passing Each Sieve
40,000	37.5 mm	100%
25,000	25.0 mm	50% - 80%
20,000	19.0 mm	5% - 20%
12,500	12.5 mm	0% - 5%
80	0.075 mm	0% - 3%

.2 Drainage material when subjected to 5 cycles of the soundness test to have a weighted loss of not more than 13% in accordance with ASTM C88/C88M.

.3 Drainage material when subjected to the abrasion test will have a loss of not more than 30% when tested in accordance with ASTM C131, Grading A.

.3 Cleanout Cover.

.1 Round flanged housing with heavy duty cast iron cover. Provide high flanged and/or low flanged cover to suit surface conditions for each location.

Part 3 Execution

3.1 INSPECTION

.1 Ensure subgrade conforms with required drainage pattern before placing bedding material.

.2 Ensure improper slopes, unstable areas, areas requiring additional compaction of other unsatisfactory conditions are corrected to approval of Consultant. Do not begin installation of foundation drainage until deficiencies have been corrected.

.3 Ensure foundation grade beam damp proofing has been installed and approved by Consultant before placing bedding material.

3.2 INSTALLATION

.1 Pipe Bedding Preparation.

.1 Cut trenches in subgrade and place bedding material in uniform layers not exceeding 150 mm compacted thickness to depth as indicated. Excavation must not interfere with the normal 45 degree bearing splay of foundations.

.2 Remove boulders, old construction rubble, and other obstructions encountered in course of excavation.

.3 Shape bed true to grade and to provide continuous, uniform bearing surface for pipe.

.4 Shape transverse depressions, as required, to suit joints.

.5 Compact each layer full width of bed to at least 95% maximum density to ASTM D698.

.2 Pipe Laying.

.1 Install foundation drainage piping in accordance with ASTM D2321 and manufacturer's printed instructions.

.2 Ensure pipe interior and coupling surfaces are clean before laying. Connect pipes using manufacturer's recommended fittings.
.3 Lay perforated pipe to minimum slope of 1:100. Place pipe face perforations and coupling slots downward.
.4 Lay non-perforated pipe to slope of 1:50 from perforated pipe to disposal area. Make joints watertight.
.5 Grade bedding to establish pipe slope. Do not use concrete, masonry, stones, wood, or any type of shim to establish pipe slope.
.6 Install end plugs at ends of collector piping to protect pipe ends from damage and ingress of foreign material.
.7 Connect non-perforated pipe to sump pit by appropriate adapters manufactured for this purpose.
.8 Provide cleanouts on non-perforated pipes as indicated, at changes of pipe direction and in runs greater than 15 m.
.9 Extend cleanouts up above floor of crawlspace min. 500 mm.

.3 Pipe Surround Material.
.1 Upon completion of pipe laying and after Consultant has inspected work in place, surround and cover pipe as indicated.
.2 Hand place surround material in uniform layers not exceeding 150 mm compacted thickness as indicated. Do not drop material within 300 mm of pipe to prevent displacement of pipe.
.3 Place layers uniformly and simultaneously on each side of pipe.
.4 Compact each layer from pipe invert to mid-height of pipe to at least 95% maximum density to ASTM D698.
.5 Compact each layer from mid-height of pipe to underside of backfill to at least 90% maximum density to ASTM D698.

.4 Cleanout Cover.
.1 Install cleanout covers at exterior locations indicated to provide access to weeping tile.

.5 Backfill Material.
.1 Place backfill material above pipe surround in uniform layers not exceeding 150 mm compacted thickness up to grades as indicated.
.2 Under paving and walks, compact backfill to at least 95% maximum density to ASTM D698. In other areas, compact to at least 90% maximum density to ASTM D698.

END OF SECTION