



THE CITY OF WINNIPEG
PEMBINA TRAILS COLLEGIATE
VOCATIONAL WING
WINNIPEG, MANITOBA
TENDER NO. 954-2023B

SPECIFICATIONS

ISSUED FOR CONSTRUCTION: APRIL 01, 2024

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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 Contract Administrator 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 Contract Administrator, 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 *C3.1 Site Investigation of General Conditions* and *B3: Site Investigation of Bidding Procedures*, 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 Refer to Appendices for copies of the following Geotechnical Investigation Reports prepared by KGS Group Consulting Engineers:

Appendix 1: "Waverley West Schools Geotechnical Investigation - Additional Services - Phase 2", dated December 23, 2020.

Appendix 2: "Two Design-Build Schools, Waverley West, Winnipeg, Manitoba, Site Contract Administrator for Geotechnical Survey", dated February 2019.

Appendix 3: "Waverley West Schools, Geotechnical Investigation - Extra Services", dated March 2, 2020.
- .2 The Geotechnical Investigation and Assessment Reports provides properties of soils, and by its nature, cannot reveal all conditions that exist or can occur on the site. Contractors are responsible for assuring themselves of actual site conditions.

Part 2 Products

Part 3 Execution

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 01 31 00 – Project Management and Coordination.
- .2 Section 01 33 00 – Submittal Procedures.
- .3 Section 01 45 00 – Quality Control.
- .4 Section 01 50 00 – Temporary Facilities and Controls.
- .5 Section 01 79 00 – Demonstration and Training.

1.2 REFERENCES

- .1 National Building Code of Canada 2020, complete with current Manitoba Building Code amendments (NBCC).
- .2 National Fire Protection Association (NFPA).

1.3 WORK COVERED BY CONTRACT DOCUMENTS

- .1 The project consists of a new one storey 16,700 square foot (1,551.5 square meter) vocational addition on a clean site in a new residential development in southwest Winnipeg, Manitoba. The construction will include concrete grade beams on concrete piles, a combination of both hollow core and structural concrete slab construction for the floor composition, and a steel framed roof system. The building superstructure consists of concrete unit masonry and structural steel framing with steel stud infill. The exterior wall finish of the will be brick veneer, while the upper exterior wall finish of a partial mechanical mezzanine will be prefinished steel wall cladding. The site will include concrete drive aisles, walkways and curbing.
- .2 The Sustainability Consultant along with the Contract Administrator will be co-ordinating the requirements for this project on behalf of the City in reference to the Canada Green Building Council LEED Certification program. The project is to follow a LEED v4.1 Silver Shadow process. Therefore, the bid documents have incorporated LEED and sustainable requirements which the General Contractor and Trade Contractors must consider in their bid and adhere to during the course of the contract.
- .3 Construct project in accordance with contract documents including Project Manual and project drawings. Contractor and Subcontractors are responsible for co-ordination between trades. Distribution of documents by Contractor to his Subcontractors does not absolve Contractor or his Subcontractors from provisions stated in Division 1 - General Requirements of contract or coordination between parties.
- .4 *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 the National Building Code of Canada (NBCC), complete with Manitoba Building Code amendments (MBC), 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 CONTRACTOR'S USE OF PREMISES

- .1 Except as otherwise specified, *Contractor* has use of Place of the *Work*, restricted to the areas affected by the *Work* only, from time of *Contract* award until *Total Performance of the Work*.
- .2 Confine *Construction Equipment*, *Temporary Work*, storage of *Products*, waste products and debris, and all other construction operations to limits required by laws, ordinances, permits, and *Contract Documents*, whichever is most restrictive. Do not unreasonably encumber *Place of the Work*.

1.6 ALTERATIONS, REPAIRS TO EXISTING BUILDING

- .1 Execute *Work* with least possible interference or disturbance to occupants, building operations, public, and normal use of premises. Arrange with the City and *Contract Administrator* to facilitate execution of *Work*.

1.7 EXISTING SERVICES

- .1 Notify, *the City*, *Contract Administrator*, and utility companies of intended interruption of services and obtain required permission.
- .2 Where *Work* involves breaking into or connecting to existing services, give *the City and Contract Administrator* a minimum of three (3) *working days* notice for necessary interruption of mechanical or electrical service throughout course of *Work*. Minimize duration of interruptions. Carry out *Work* at times as directed by governing authorities with minimum disturbance to pedestrian, vehicular traffic, tenant operations.
- .3 Provide alternative routes for personnel, pedestrian, and vehicular traffic.
- .4 Establish location and extent of service lines and utilities in area of *Work* before starting *Work*. Notify *Contract Administrator* of findings with a report.
- .5 Submit schedule to and obtain approval from *the City and Contract Administrator* for any shut-down or closure of active service or facility including power and communications services. Adhere to approved schedule and provide notice to affected parties.
- .6 Provide temporary services to maintain critical building and tenant systems.
- .7 Provide adequate bridging over trenches which cross sidewalks or roads to permit normal traffic.
- .8 Where unknown services are encountered, immediately advise *the City and Contract Administrator* and confirm findings in writing.

- .9 Protect, relocate or maintain existing active services. When inactive services are encountered, cap off in manner approved by authorities having jurisdiction.
- .10 Record locations of maintained, re-routed and abandoned service lines.
- .11 Construct barriers in accordance with Section 01 50 00.

1.8 DEMONSTRATION AND TRAINING

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

1.9 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.
- .3 Upon commencement of work, provide 24 hour/7 day security (when Contractor not on site) to secure work areas from unauthorized entry and/or vandalism in part by provision of webcam/construction camera (TrueLook Construction Camera or similar), complete with sharable direct link to camera made available to the City. Camera system to provide real-time security supervision after hours, and at minimum periodic still photos during workday to confirm progress.

1.10 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.

1.11 BUILDING PERMIT

- .1 The City shall pay for the building permit. The Contract Administrator 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.

1.12 NO SMOKING POLICY

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

1.13 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.

1.14 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 Contract Administrator, 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 RELATED SECTIONS

- .1 Refer to *Form B: Prices* and *E5: Cash Allowance for Additional Work*.

1.2 CASH ALLOWANCES

- .1 Total amount of cash allowance will be separated from Total Bid Price, by Contract Administrator, 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 Contract Administrator in subsequent Change in Work.
- .2 Total Bid Price to include Contractor's overhead and profit in connection with cash allowances, rather than being included with cash allowance.

1.3 SCHEDULE OF ALLOWANCES

(excluding GST)

.1 CASH ALLOWANCE

- .1 **CA01:** Inspections and Testing
- .1 Foundation Inspections
 - .2 Base Inspection and Compaction Testing
 - .3 Concrete Strength and Masonry Mortar Testing
 - .4 Structural Steel Inspections
 - .5 Indoor Air Quality Testing
 - .6 Soil Testing
- .2 **CA03:** Security and Intrusion Alarm System/Card Access
- .3 **CA06:** Unfavourable Site Conditions Silt Removal
- .4 **CA07:** Unforeseen Piling Replacement & Concrete Foundation Revisions
- .5 **CA08:** Site Dewatering
- .6 **CA09:** Interior Information/Wayfinding Signage and Vinyl Graphics

TOTAL

\$207,000.00

Part 2 Products

Part 3 Execution

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Refer to *B18 Evaluation of Bids* of the Bidding Procedures, and *Form B: Prices*.

1.2 DEFINITIONS

- .1 Separate Price: a price required by this Section, for the specified separate work listed below, to be included on Form B and are to be part of the Total Bid Price. Include all costs for co-ordination of the related work and modify surrounding work as required to complete the project under each Separate Price.

1.3 SEPARATE PRICES

- .1 Separate Price No. 01 – Outdoor Food Services Amenities.
 - .1 Base Bid: All items as shown on Landscape drawings.
 - .2 Separate Price: Contract to add exterior arbour and piles, exterior site picnic tables and concrete headers, raised steel planters and planting medium, and rock mulch as shown on the Landscape Separate Price drawings. Landscaper to include top soil and sod credit and replace material with rock mulch per drawings and specifications.
- .2 Separate Price No. 02 - Lightspeed Sound Field Systems.
 - .1 Base Bid: Provision of rough-in only for the devices as shown in the Electrical drawings.
 - .2 Separate Price: Contract to provide all required device cabling for the Lightspeed Sound Field system as shown in the Electrical drawings, and install all devices which shall be Division furnished and Contractor installed. Contractor to include required adjustments, and testing of devices to ensure proper operation.
- .3 Separate Price No. 03 – CCTV System.
 - .1 Base Bid: Provision of rough-in only for the devices as shown in the Electrical drawings.
 - .2 Separate Price: Contractor to provide all camera cabling and install all Division furnished and Contractor installed cameras. Contractor to include all required camera view adjustments, and testing of all the cameras to ensure proper operation.
- .4 Separate Price No. 04 – Master Clock and Public Address System.
 - .1 Base Bid: Provision of rough-in and cabling for the speaker and speaker/master clock devices only as shown in the Electrical drawings.
 - .2 Separate Price: Contractor to install all Division furnished speakers and speaker/master clock devices. Contractor to include required testing of all devices to ensure proper operation.

Part 2 Products

Part 3 Execution

END OF SECTION

Part 1 General

1.1 GENERAL

- .1 Upon award of Contract, all Itemized Prices listed in the Section shall be provided by successful Contractor upon request of the Contract Administrator.

1.2 DEFINITIONS

- .1 Itemized Price: price required by this Section, to be included in contract for part of Work, but shown separately for the City's accounting and financial reporting purposes. Itemized Prices must accurately and completely determine cost for work, including all costs such as proportionate share of general conditions and overhead and profit.

1.3 ITEMIZED PRICES

- .1 Itemized Price No. 1.
 - .1 Provide itemized price for the supply of all lighting related to the interior of the building, as well as all lighting controls related to the full project.
- .2 Itemized Price No. 2.
 - .1 Provide itemized price for the supply of all lighting related to the exterior of the building, as well as site lighting.

Part 2 Products

Part 3 Execution

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Refer to *D26: Job Meetings in Supplemental Conditions*.
- .2 Section 01 11 00 – Summary of Work.
- .3 Section 01 33 00 – Submittal Procedures.
- .4 Section 01 45 00 – Quality Control.
- .5 Section 01 50 00 – Temporary Facilities and Controls
- .6 Section 01 61 00 – Common Product and Requirements
- .7 Section 01 78 00 – Closeout Submittals.

1.2 CONSTRUCTION SCHEDULE

- .1 Refer to *D17: Detailed Work Schedule*.
- .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 Contract Administrator, 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 Refer to *D26: Job Meetings in Supplemental Conditions*.

- .2 Schedule and administer project meetings once every second week throughout progress of work. Provide physical space for meetings.
- .3 Contractor, Subcontractors involved in Work, Contract Administrator and the City are to be in attendance.
- .4 Person attending meetings to be empowered to act on behalf of organizations they represent.
- .5 Prepare agenda and record minutes of meetings and circulate to attending parties and affected parties not in attendance within four (4) days after meeting.
- .6 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 The *Contractor* shall maintain a set of *drawings* on which the *Contractor* shall make any changes to the *Work*. These *drawings* shall be called "As-Built Drawings". As-Built Drawings shall be kept in good order and shall be available to the *Contract Administrator* and its representatives for review at the Place of the *Work*. The *Contractor* shall record on the As-Built Drawings the changes in *Work* as they occur. Keep the following documents at *Place of the Work*, stored securely and in good order and available to *the City* and *Contract Administrator* in hard copy and electronic form:
 - .1 Current *Contract Documents*, including *Drawings*, *Specifications* and addenda.
 - .2 *Change Orders*, *Change Directives*, and *Supplementary Instructions*.
 - .3 Reviewed *Shop Drawings*, *Product* data and samples.
 - .4 Field test reports and records.
 - .5 Construction progress schedule.
 - .6 Meeting minutes.
 - .7 Manufacturer's certifications.
 - .8 Permits, inspection certificates, and other documents required by authorities having jurisdiction.
 - .9 Current as-built drawings.
 - .10 Material Safety Data Sheets (MSDS) for all controlled *Products*.
 - .11 COR Certification.
 - .12 Labour and Material Bond.
 - .13 Site Safety Plan.
 - .14 Daily Sign-In Sheets

1.6 JOB LOG

- .1 Keep permanent, written record on site of progress of work. Make record available for inspection by Contract Administrator 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 Contract Administrator in the form specified.
 - .2 Contract Administrator will return RFIs submitted to Contract Administrator 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 Contract Administrator.
 - .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 Contract Administrator's Action: Contract Administrator will review each RFI, determine action required, and respond. Allow ten (10) Working Days for Contract Administrator's response for each RFI. RFIs received by Contract Administrator 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 Contract Administrator's actions on submittals.
- .8 Incomplete RFIs or inaccurately prepared RFIs.
- .2 Contract Administrator's action may include a request for additional information, in which case Contract Administrator'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 Contract Administrator 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 organized 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 Contract Administrator.
 - .4 RFI number including RFIs that were returned without action or withdrawn.
 - .5 RFI description.
 - .6 Date the RFI was submitted.
 - .7 Date Contract Administrator's response was received.
- .6 On receipt of Contract Administrator action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Contract Administrator 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 Contract Administrator 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 Contract Administrator 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 Contract Administrator 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 Contract Administrator 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 jpeg format.
- .3 Copy each set of images onto a USB drive.
- .4 Identify each USB with name and number of project, date of exposure, set number.
- .5 Pre-Construction Photographs
 - .1 Provide photographs of existing site and general photos prior to start of construction work.
 - .2 Provide photos of all mechanical and electrical panels, devices, prior to demolition. Photos to provide general context of location and a close up for model/brand and condition.
 - .3 Allow for minimum 30 interior and 15 exterior images.
 - .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 Contract Administrator.
- .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 Contract Administrator, 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 Contract Administrator.

- .7 Photographs of Mock Ups.
 - .1 Number of sets required: one for each mock-up.
 - .2 Allow for approximately 25 images of each set.
 - .3 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 Contract Administrator.

- .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 affected side of building.
 - .2 Interior of rooms and finishes as determined by Contract Administrator. Allow for approximately ten (10) photographs of each room.
 - .3 Close ups of specific details as determined by Contract Administrator.
 - .4 Locations of viewpoints as determined by Contract Administrator.

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 45 00 – Quality Control.
- .4 Section 01 61 00 – Common Product Requirement.
- .5 Section 01 78 00 – Closeout Submittals.

1.2 ADMINISTRATIVE

- .1 Submit to Contract Administrator 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 Contract Administrator. 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 Contract Administrator, 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 Contract Administrator review of submittals.
- .9 Contractor's responsibility for deviation in submission from requirements of Contract Documents is not relieved by Contract Administrator review.
- .10 Keep one reviewed copy of each submission on site.

1.3 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 Contract Administrator, 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) electronic copy (e.g. Adobe PDF format) of shop drawings for each requirement requested in specification sections and as the Contract Administrator may reasonably request. A hardcopy and electronic copy of shop drawings are to be included in Operation and Maintenance Manual as specified in Section 01 78 00.
- .6 Submit 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 Contract Administrator where shop drawings will not be prepared due to standardized manufacture of product.
- .7 Submit one (1) electronic copy (e.g. Adobe PDF) of test reports for requirements requested in specification Sections and as requested by Contract Administrator.
 - .1 Report signed by authorized official of testing laboratory that material, product or system identical to material, product or system to be provided has been tested in accord with specified requirements.
 - .2 Testing must have been within three (3) years of date of contract award for project.
- .8 Submit one (1) electronic copy (e.g. Adobe PDF format) of certificates for requirements requested in specification Sections and as requested by Contract Administrator.
 - .1 Statements printed on manufacturer's letterhead and signed by responsible officials of manufacturer of product, system or material attesting that product, system or material meets specification requirements.
 - .2 Certificates must be dated after award of project contract, complete with project name.
- .9 Submit one (1) electronic copy (e.g. Adobe PDF format) of manufacturers' instructions for requirements requested in specification Sections and as requested by Contract Administrator.
 - .1 Pre-printed material describing installation of product, system or material, including special notices and Material Safety Data Sheets concerning impedances, hazards and safety precautions.
- .10 Submit one (1) electronic copy (e.g. Adobe PDF format) of Manufacturer's Field Reports for requirements requested in specification Sections and as requested by Contract Administrator.
 - .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 Contract Administrator'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 Contract Administrator, electronic AutoCAD drawing files subject to following:
 - .1 Removal by Contract Administrator of Contract Administrators' professional seals from electronic drawing file; and
 - .2 Receipt of Licence Agreement prepared by Contract Administrator and signed by Contractor(s) or user(s) of electronic files; and
 - .3 Receipt of payment to Contract Administrator 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 Contract Administrator are not intended to change contract price. If adjustments affect value of work, state such in writing to Contract Administrator prior to proceeding with work.
- .14 Make changes in shop drawings as Contract Administrator may require, consistent with contract documents. When resubmitting, notify Contract Administrator 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 Contract Administrator'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 Contract Administrator, 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 Contract Administrator's rejection of shop drawings.
- .22 Shop drawings which contain deviations from the Contract Documents which are not presented to the Contract Administrator 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 Submitted samples will be retained by Contract Administrator and will not be returned to Contractor. Should samples be required to be returned for Contractor's use, Contractor shall provide multiple sets of samples per submission, with one set to be retained by Contract Administrator.
- .3 Deliver samples prepaid to Contract Administrator's business address.
- .4 Notify Contract Administrator in writing, at time of submission of deviations in samples from requirements of contract documents.
- .5 Where colour, pattern or texture is criterion, submit full range of samples.
- .6 Adjustments made on samples by Contract Administrator are not intended to change contract price. If adjustments affect value of work, state such in writing to Contract Administrator prior to proceeding with work.
- .7 Make changes in samples which Contract Administrator may require, consistent with contract documents.
- .8 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 RELATED SECTIONS

- .1 LEED® relates to ALL Sections
 - .2 Section 01 35 43 Environmental Protection
 - .3 Section 01 56 15 Temporary Indoor Air Quality
 - .4 Section 01 57 13 Temporary Erosion and Sediment Control
 - .5 Section 01 74 19 Waste Management and Disposal
 - .6 Section 03 10 00 Concrete Forming and Accessories
 - .7 Section 03 20 00 Concrete Reinforcing
 - .8 Section 03 30 00 Cast-in-Place Concrete
 - .9 Section 03 35 05 Special Concrete Floor Finishes
 - .10 Section 04 10 00 Masonry Units and Mortar
 - .11 Section 04 20 00 Masonry Procedures
 - .12 Section 05 12 00 Structural Steel
 - .13 Section 05 21 00 Steel Joists
 - .14 Section 05 31 00 Steel Decking
 - .15 Section 06 01 00 Rough Carpentry
 - .16 Section 06 15 00 Wood Decking
 - .17 Section 06 40 00 Architectural Woodwork and Casework
 - .18 Section 07 21 13 Board Insulation
 - .19 Section 07 21 16 Batt and Blanket Insulation
 - .20 Section 07 52 00 Modified Bituminous Roofing
 - .21 Section 07 92 00 Joint Sealants
 - .22 Section 08 14 00 Flush Wood Doors
 - .23 Section 09 51 13 Acoustical Panel Ceilings
 - .24 Section 09 64 66 Wood Flooring
 - .25 Section 09 65 17 Resilient Sheet Flooring
 - .26 Section 09 68 13 Carpet Tile
 - .27 Section 09 91 23 Interior Painting
 - .28 Division 22 Plumbing
 - .29 Section 31 62 13 Dynamically Cast-in-Place Concrete Piles
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.30 Section 31 63 23 Bored Piles

.31 Section 32 92 23 Sodding

1.2 REFERENCES

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

1.3 INTRODUCTION

- .1 The project will not be submitted to the CaGBC for third party certification. However, a LEED shadow approach will be taken, and final documentation will be submitted to the applicable Project Manager with the Province of Manitoba to demonstrate adherence to the Manitoba Green Building Policy.

1.4 REQUIREMENTS

- .1 The Contractor shall be responsible in part or in whole for ensuring that the following LEED® credits are achieved:
 - .1 SSp Construction Activity Pollution Prevention
 - .2 WEp/WEc Outdoor Water Use Reduction
 - .3 EAp Fundamental Commissioning and Verification
 - .4 EAc Enhanced Commissioning
 - .5 MRp Construction and Demolition Waste Management Planning
 - .6 MRc Building Life-Cycle Impact Reduction
 - .7 MRc Building Product Disclosure and Optimization, including:
 - .1 Environmental Product Declarations
 - .2 Sourcing Raw Materials
 - .3 Material Ingredients
 - .8 MRc Construction and Demolition Waste Management
 - .9 EQc Low-Emitting Materials
 - .10 EQc Construction Indoor Air Quality Management Plan
 - .11 EQc Indoor Air Quality Assessment
 - .2 The Contractor shall assist with all LEED® prerequisites and credits by helping to gather required information and documentation.
 - .3 All submittals as required by Article 3.2.
-

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- .4 The Contractor shall provide bi-weekly reports, as specified in Article 3.1 LEED® Tracking, to the City and Contract Administrator on the status and progress of the credits specified in paragraph 1.4.1 and 1.4.2.
 - .1 Where required for clarification purposes, dated and labelled digital photographs shall be included.

1.5 ENVIRONMENTAL PERFORMANCE

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

The following are the VOC limits from Rule 1168:

- .1 Architectural Sealants – 250 g/L
 - .2 Non-membrane Roof Sealant – 300 g/L
 - .3 Roadway – 250 g/L
 - .4 Other Sealants – 420 g/L
 - .5 Non-porous Architectural Sealant Primer – 250 g/L
 - .6 Porous Architectural Sealant Primer – 775 g/L
 - .7 Modified Bituminous Sealant Primer – 500 g/L
 - .8 Other Sealant Primer – 750 g/L
 - .9 Indoor Carpet and Carpet Pad Adhesives – 50 g/L
 - .10 Wood Flooring Adhesives – 100 g/L
 - .11 Rubber Floor Adhesives – 60 g/L
 - .12 Subfloor Adhesives – 50 g/L
 - .13 Ceramic Tile Adhesives – 65 g/L
 - .14 VCT and Asphalt Tile Adhesives – 50 g/L
 - .15 Gypsum Board and Panel Adhesives – 50 g/L
 - .16 Cove Base Adhesive – 50 g/L
 - .17 Multipurpose Construction Adhesives – 70 g/L
 - .18 Structural Glazing Adhesive – 100 g/L
 - .19 PVC Welding – 510 g/L
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- .20 CPVC Welding – 490 g/L
 - .21 ABS Welding – 325 g/L
 - .22 Plastic Cement Welding – 250 g/L
 - .23 Adhesive Primer for Plastic – 550 g/L
 - .24 Contact Adhesive – 80 g/L
 - .25 Special Purpose Contact Adhesive – 250 g/L
 - .26 Structural Wood Member Adhesive – 140 g/L
 - .27 Sheet Applied Rubber Lining Operations – 850 g/L
 - .28 Top and Trim Adhesive – 250 g/L
 - .29 Metal to Metal Adhesive – 30 g/L
 - .30 Plastic Foams Adhesive – 50 g/L
 - .31 Porous Material Adhesive (except wood) – 50 g/L
 - .32 Wood Adhesive – 30 g/L
 - .33 Fiberglass Adhesive – 80 g/L
 - .34 Duct Sealants – 250 g/L
- .3 Paints and Coatings must have a General Emissions Evaluation AND conform to the following standards in order of descending importance:
- .1 California Air Resources Board (CARB) 2007, Suggested Control Measure (SCM) for Architectural Coatings, or the South Coast Air Quality Management District (SCAQMD) Rule #1113, amended February 5, 2016, effective date January 1, 2019.
 - .2 The following is a list of applicable VOC limits
 - .1 Interior Flat Coating or Primer – 50 g/L
 - .2 Interior Non Flat Coating or Primer – 150 g/L
 - .3 Anti-Corrosive/Anti Rust Paint – 250 g/L
 - .4 Clear Wood Finishes: Lacquer – 550 g/L
 - .5 Clear Wood Finishes: Sanding Sealers – 350 g/L
 - .6 Clear Wood Finishes: Varnishes – 350 g/L
 - .7 Clear Brushing Lacquer- 680 g/L
 - .8 Floor coatings – 100 g/L
 - .9 Sealers and Undercoaters – 200 g/L
 - .10 Shellac: Clear – 730 g/L
 - .11 Shellac: Pigmented – 550 g/L
 - .12 Stain – 250 g/L
 - .13 Concrete Curing Compounds – 350 g/L
 - .14 Japans/Faux Finishing Coatings – 350 g/L
 - .15 Magnesite Cement Coatings – 450 g/L
 - .16 Pigmented Lacquer – 550 g/L
-

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- .17 Waterproofing Sealers – 250 g/L
 - .18 Waterproofing Concrete/masonry Sealers – 400 g/L
 - .19 Wood Preservatives – 350 g/L
 - .20 Low – Solids Coatings – 120 g/L (including water)
- .4 All hard surface flooring covered must be tested and determined compliant with the General Emissions Evaluation criteria. Products covered include vinyl, linoleum, laminate flooring, engineered wood flooring, ceramic flooring, rubber flooring and wall base.
 - .5 All composite woods as defined by the California Air Resources Board, Airborne Toxic Measure to Reduce Formaldehyde Emissions from Composite Wood Products Regulation, must be documented to have low formaldehyde emissions that meet the California Air Resources Board ATCM for formaldehyde requirements for ultra-low-emitting formaldehyde (ULEF) resins or no added formaldehyde resins.
 - .6 Ceilings, walls, thermal and acoustic insulation (if applicable to project) must be tested and determined compliant with the General Emissions Evaluation criteria.
 - .7 Furniture (if applicable to project) must be tested in accordance with ANSI/BIFMA Standard Method M7.1-2011. Comply with ANSI/BIFMA e3-2011 Furniture Sustainability Standard, Sections 7.6.1 (for half credit, by cost) OR 7.6.2. (for full credit, by cost), using either the concentration modeling approach or the emissions factor approach.
- .2 Trade Contractors shall ensure all products incorporated into the work meet the specified VOC limits as described above.
 - .3 All landscaping planting material shall be native or adaptive mixes.
 - .1 Irrigation of planting material is acceptable during establishment period only, maximum two years.

Part 2 Products

NOT USED

Part 3 Execution

3.1 LEED® TRACKING

- .1 Submit bi-weekly reports to the City and Contract Administrator, including up to date status of the credit progress.
 - .1 SSp Construction Activity Pollution Prevention
 - .1 Details on the inspection of erosion and sedimentation control measures.
 - .2 Dated and labelled photos per Section 01 57 13
-

-
- .2 EQc Construction Indoor Air Quality Management Plan
 - .1 Dated and labelled photos per Section 01 56 15
 - .3 MRc Construction and Demolition Waste Management Planning:
 - .1 The following is a list of items that must be included in the Construction Waste Management Plan:
 - .1 Identify at least five construction or demolition material streams for diversion from landfill
 - .2 Specify the means and methods of diversion for each of the five selected material streams
 - .3 Plan must account for all materials including land clearing debris
 - .4 Safe removal of hazardous materials must be included
 - .5 Create a final waste report on the total construction and demolition waste produced by the project and the total waste diverted
 - .2 The Construction and Demolition Waste Management Tracking Table is to include a minimum of the following information (measurement units are to be metric tonnes):
 - .1 Material Stream Description
 - .2 Destination (including company information)
 - .3 Description (landfill, recycle, crush for rubble, re-use, waste-to-energy etc.)
 - .4 Weight Reused
 - .5 Weight Recycled
 - .6 Weight Sent to Landfill
 - .7 Sum of the Total Weight Diverted from the Landfill
 - .8 Sum of the Total Weight Sent to the Landfill
 - .9 Percentage of Materials Diverted from the Landfill
 - .10 Dated and labelled photos per Section 01 74 19

3.2 LEED® SUBMITTALS

- .1 Submit technical data sheets and completed LEED® Product Check Sheets for:
 - .1 Materials with recycled content
 - .2 Materials with regional content
 - .3 Materials with life-cycle information: Manufacturer Inventory, Health Product Declaration (HPD), Environmental Product Declaration (EPD), Cradle to Cradle, Declare labels designated as Red List Free or Declared, ANSI/BIFMA e3 Furniture Sustainability Standard, Product_Lens Certification, Facts – NSF/ANSI 336: Sustainability Assessment for Commercial Furnishing Fabric at any certification level, or USGBC Approved Program
-

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

LEED® v4 PRODUCT CHECK SHEET	
PROJECT NAME:	DATE (yyyy mm dd):

GENERAL INFORMATION:	
Note: Each different product requires a separate check sheet.	
Subtrade/Installer:	Contact Name:
Manufacturer:	Contact Phone Number:
Product Name:	Product Description/Use:
Total Material Cost:	OR Unit Cost: Quantity Used:

ENVIRONMENTAL PRODUCT DECLARATION (EPD):
Does the product have an EPD? <input type="checkbox"/> Yes <input type="checkbox"/> No (If no, skip this section)
Attach a copy of product specific or industry wide EPD to this form.

RECYCLED CONTENT:	
Does this product contain recycled content? <input type="checkbox"/> Yes <input type="checkbox"/> No (If no, skip this section)	
Post Consumer Recycled Content (%):	Pre Consumer Recycled Content (%):
Information Source: (i.e. data sheet, letter from manufacturer, etc.):	
Attach above information source to this form.	

SOURCING OF RAW MATERIALS	
Does this manufacturer participate in an extended producer program?: <input type="checkbox"/> Yes <input type="checkbox"/> No	
Is the product a bio-based material (other than wood) <input type="checkbox"/> Yes <input type="checkbox"/> No	
Is the wood product FSC certified/Sustainable Forestry Initiative (SFI) /American Tree Farm System (ATFS) /Canadian Standards Association (CSA) or Programme for the Endorsement of Forest Certification (PEFC) <input type="checkbox"/> Yes <input type="checkbox"/> No	
Has the product been salvaged, refurbished or reused: <input type="checkbox"/> Yes <input type="checkbox"/> No	
Is the product sourced (extracted, manufactured and purchased) within 160 km of the project site? <input type="checkbox"/> Yes <input type="checkbox"/> No	
Manufacture Location (city, province/state):	
Distance from Manufacture to project site: km	
Extraction/Harvest/Collection Location (city, province/state):	
Distance from Extraction to project site: km	
Information Source: (letter from manufacturer, chain of custody certificate, etc.):	
Attach above information source to this form.	

MATERIAL INGREDIENTS
Does this manufacturer report the chemical inventory of the product through either CASRN, Greenscreen List Translator score, Full GreenScreen or Benchmark, Globally Harmonized System of Classification and Labelling (GHS)? <input type="checkbox"/> Yes <input type="checkbox"/> No
Is there a Health Product Declaration? <input type="checkbox"/> Yes <input type="checkbox"/> No
Is the product Cradle to Cradle certified? <input type="checkbox"/> Yes <input type="checkbox"/> No

Does the product have a Declared or Red List Free Declare label?:	<input type="checkbox"/> Yes	<input type="checkbox"/> No
Is the product sourced (extracted, manufactured and purchased) within 160 km of the project site?	<input type="checkbox"/> Yes	<input type="checkbox"/> No
Does the furniture meet ANSI/BIFMA e3 Sustainability Standard? (at least 3 points under 7.5.1.3 in e3-2014)	<input type="checkbox"/> Yes	<input type="checkbox"/> No
Does the product have a Product Lens Certification?	<input type="checkbox"/> Yes	<input type="checkbox"/> No
Is the product sourced (extracted, manufactured and purchased) within 160 km of the project site?	<input type="checkbox"/> Yes	<input type="checkbox"/> No
Information Source: Attach verification of above certification with this form.		

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



Technical Bulletin



July 30, 2012

T-054

Concrete Producer Guidelines to Using the Portland Cement Reduction Calculator for LEED Canada

This Technical Bulletin has been developed for the use of **Concrete Producers** to assist them in correctly utilizing the new Portland Cement Reduction Calculator for use when pursuing MR credit 4 with LEED Canada NC and LEED Canada CS 2009 projects. While anyone can review the contents of this Bulletin, the RMCAO wishes to stress the fact that the calculator contains **privileged and confidential information that will not be distributed to third parties**. The results of this calculator will be distributed to the construction team via a **summary letter only**. **The concrete producer will not supply this calculator to anyone.**

The screenshot shows an Excel spreadsheet titled "LEED Canada for New Construction and Major Renovations (NC) 2009 and LEED Canada for Core and Shell Development (CS) 2009 Portland Cement Reduction Calculator". It includes input fields for "Project: Project name" and "Date or Period: Date". Below these are instructions: "Enter the Mix No., Concrete Design Strength, whether concrete is Air-Entrained, actual Portland Cement Used in the Mix, Cost of all Cementitious Materials and Volume of Mix." and a note: "Recycled content is based on the cost of cementitious materials rather than the concrete cost. If it is not possible to obtain the cost of cementitious materials, the cost of the concrete mix is apportioned based on the weight of the each component." The main data table has the following columns:

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

The calculator shown above is used to determine the “**Total Recycled Content Value of the Cementitious Materials**” in a dollar value for the concrete supplied to the project. As will be shown later, the program does this via one of two basic ways:

- Based on cost of the concrete mix and proportioning based on % by weight of the cementing materials (column I in the Excel spreadsheet), or
- Based on the cost of the cementitious material actually used in the concrete (column J in the Excel spreadsheet).

RMCAO recommends calculating the costs based on both methods, since the spreadsheet automatically selects the most beneficial result for determination of the recycled material dollar amount used in the LEED documentation.

To ensure uniform usage of the calculator we will now do a column by column review of the spreadsheet and follow this up with a sample project to demonstrate usage of the program.

Column B – Mix No.

- Simply enter you mix design number in this box (information only).

Column C – Base Concrete Design Strength @ 28 Days

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

Column D – Air Entrainment

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

Column E – Base Portland Cement (kg/m³)

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

Column F – Portland Cement Used (kg/m³)

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

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

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

Column H – Cost of Concrete (\$/m³)

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

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

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

recycled cementitious products).

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

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

- This represents the costs of all cementitious (Portland and all supplementary cementing materials) used in the concrete mix design.
- This cost represents the cost of the cementitious materials delivered to the final jobsite. Unfortunately, most concrete producers only know the costs delivered to the concrete plant so we will have to address this fact later in the calculations.
- Most concrete producers are used to describing cement costs based on the cost per metric tonne of cementitious material (\$/MT). Please note that the units for this calculation are \$/m³ and that you will have to use the conversion factor of 1 Metric Ton = 1,000 kg to convert the units correctly.
 - **Step 1** – Converting cement costs from \$/MT to \$/m³. For example, if your mix design contains 400 kg/m³ of GU cement and the cement costs \$170/MT then your cost of cementitious materials would be = 400*170/1000 = \$68/m³.
 - **Step 2** – Converting plant cement costs to jobsite cement costs. Since the standard cement costs are based upon **transportation to the concrete plant, not the jobsite**, we must now factor in the cement portion of the concrete transportation costs into this value. The suggested industry method is as follows: Jobsite Cement Costs = Plant Cement Costs + Transportation Costs prorated for the cement component only. **For example:** If the cement costs at the plant are \$68/m³ (see above) and the shipping costs are \$30/m³ and the density of the concrete is 2,350 kg/m³, we are left with the following: = 68 + 30x400/2350 = \$73.11/m³. That is \$30 x (400/2350) or \$5.11 above the cementing material cost to account for the cement delivery to the site.

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

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

Column L – Volume of Mix (m³)

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

Column M – Total Recycled Value (\$)

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

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

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

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

SAMPLE PROJECT – Stand Alone Parking Garage

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

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

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

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

Mix #3 – Non-Structural Mud Slab “A”

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

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

Mix #4 – Non-Structural Mud Slab “B”

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

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

Portland Cement Reduction Calculator

for use when pursuing MR credit 4

Project: Project name

Date or Period: Date

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

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

Footnotes
1. Base Portland Cement calculated from the table found in the CAC & PCA publications EB101.08T, Design & Control of Concrete Mixtures.
2. This column includes any cementitious ingredient not recycled. It should exclude the recycled and limestone component(s) of a blended cement or a PLC.
3. If both values are entered, the calculation method that is most beneficial is used.

Total Recycled Content Value of Cementitious Materials: \$0

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

END OF SECTION

Part 1 General

1.1 RELATED 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 *Part C: General Conditions.*

1.3 INDEPENDENT INSPECTION AGENCIES

- .1 Independent Inspection/Testing Agencies will be engaged by Contract Administrator 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 Provide and pay for heating and hording if required in order for independent inspection/testing agencies to perform inspections and testing. Window testing during winter months would require a heated enclosure around test specimen with heating up to 8 hours before and after the test.
- .4 Employment of inspection/testing agencies does not relieve Contractors of their responsibility to perform work in accordance with contract documents.
- .5 If defects are revealed during inspection and/or testing, appointed agency will request additional inspection and/or testing to ascertain full degree of defect. Contractor to correct defect and irregularities as advised by Contract Administrator, 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 Contract Administrator.

- .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 Contract Administrator 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 Contract Administrator.
- .3 Prepare mock-ups and sample work for Contract Administrator'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.
- .5 Section 01 74 19 – Waste Management and Disposal.

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 for temporary power and lighting required during construction.
 - .2 New permanent building power and lighting systems may be used during construction, at the City's option. If used during construction:
 - .1 Contractor shall pay utility costs resulting from the use of permanent systems.
 - .2 Operate systems in a non-wasteful and energy efficient manner. Be responsible for any system damage.
 - .3 Just prior to completion for the Work, replace LED lamps which have been used for more than three (3) months.
 - .4 Ensure that systems manufacturers' warranties do not commence until the date of completion of the Work or, if manufacturers' warranties do commence earlier when systems are put into use, arrange for necessary extension of manufacturers' warranties or provide equivalent coverage under Contractor's warranty.
- .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.
 - .2 Protect existing devices that are remaining for reuse. Damage occurred during construction to existing devices intended for reuse shall be repaired or replaced by the Contractor.
- .3 Temporary Heating and Ventilation.
 - .1 Provide for temporary heating and ventilation required during construction.
 - .2 Vent construction heaters in enclosed spaces to the outside or use flameless type of construction heaters.
 - .3 Provide temporary heat for the Work as required to:
 - .1 Facilitate progress of Work.
 - .2 Protect the Work against dampness and cold.

- .3 Prevent moisture condensation on surfaces, freezing, or other damage to finishes or stored Products.
- .4 Maintain specified minimum ambient temperatures and humidity levels for storage, installation and curing of Products.
- .5 After building is enclosed, maintain interior temperature of minimum 10°C.
- .4 Provide temporary ventilation for the Work as required to:
 - .1 Prevent accumulations of dust, fumes, mists, exhaust, vapours, gases and other hazardous, noxious, or volatile substances in enclosed spaces, as required to maintain a safe Work environment meeting applicable regulatory requirements.
 - .2 Provide local exhaust ventilation to prevent harmful accumulation of hazardous substances into atmosphere of occupied areas.
 - .3 Ensure hazardous, noxious, or volatile substances do not migrate to occupied spaces.
 - .4 Dispose of exhaust materials in manner that will not result in harmful exposure to persons.
 - .5 Ventilate storage spaces containing hazardous or volatile materials.
 - .6 Ventilate temporary sanitary facilities.
- .5 New permanent building heating and ventilation systems may be used during construction, at the City's option and must be in writing. If used during construction:
 - .1 Before systems are put into use, Mechanical Contract Administrator must perform an inspection of the system and approve use in writing.
 - .2 Contractor shall pay utility costs resulting from the use of permanent systems.
 - .3 Operate systems in a non-wasteful and energy efficient manner. Be responsible for any system damage.
 - .4 Just prior to Total Performance of the Work, at the Contractor's cost replace filters, and perform other required maintenance to ensure systems are in as near as new condition as possible.
 - .5 Ensure that systems manufacturers' warranties do not commence until the date of Total Performance of the Work or, if manufacturers' warranties do commence earlier when systems are put into use, arrange for necessary extension of manufacturers' warranties or provide equivalent coverage under Contractor's warranty.
- .4 Temporary Telephone Service.
 - .1 Arrange, pay for and maintain temporary telephone service (landline or cellular) used during construction in accordance with authorities having jurisdiction. Provide at least one telephone in Contractor's field office available for use by the City, Contractor, Subcontractors and Contract Administrator.
- .5 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 Contract Administrator for prompt co-ordination and response.
- .6 Temporary Water Supply.
 - .1 Contractor may connect to existing potable water supply for construction use within construction area. Cost of water reasonably so used will be provided without charge.

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 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 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.
- .3 First Aid.
 - .1 Provide and maintain clearly marked and fully stocked first-aid case in readily available location.
- .4 Sanitary Facilities.
 - .1 Provide sufficient sanitary facilities for work force in accordance with authorities having jurisdiction. Use of the City's sanitary facilities will not be allowed.
 - .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 Locations of sanitary facilities to be adjacent to Contractor's field office. Post notices and take such precautions as required by local health authorities.

1.5 PROTECTION AND MAINTENANCE OF TRAFFIC

- .1 Refer also to *E6 Traffic Control of Specifications*.
- .2 Provide and maintain adequate access to project site.
- .3 Build and maintain temporary roads, sidewalk crossings, ramps, and construction runways to maintain access, and snow removal during period of Work.

- .4 If authorized to use existing roads for access to project site, maintain such roads for duration of Contract and make good damage resulting from Contractors' use of roads.
- .5 Conform to requirements of governing authorities when required and, when necessary, make arrangements with adjacent property owners.
- .6 Provide and maintain competent signal flag operators, traffic signals, barricades and flares, lights, or lanterns as required to perform Work and protect the public.
- .7 Maintain access to property including overhead clearances for use by emergency response vehicles.
- .8 parking permitted on site, limited to the existing parking lot.
- .9 Provide snow removal during period of Work, including to complete parking lot. Snow piling is permitted in the rear (west) parking lot along the western fence. Removal of snow pile is required; pile shall not exceed 10 feet in height and Contractor shall maintain access to existing Sea Cans and storage sheds.

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 Contract Administrator at least three (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.
- .3 Vibration Monitoring.
 - .1 Vibration monitoring will be carried out by a third party agency retained and paid for by the City.

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 Contract Administrator.
- .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 Contract Administrator.

Part 2 Products

Part 3 Execution

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

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

1.2 REFERENCES

- .1 LEED® Canada Reference Guide for Green Building Design and Construction V4 Edition and v4.1 with addenda.
 - .1 Indoor Environmental Quality Credit Construction Indoor Air Quality Management Plan
 - .2 Indoor Environmental Quality Credit Indoor Air Quality Assessment
- .2 Sheet Metal and Air Conditioning National Contractors Association (SMACNA) IAQ Guideline for Occupied Buildings Under Construction, 2nd Edition, 2007, ANSI/SMACNA 008-2008, Chapter 3.
- .3 American Society of Heating, Refrigeration, and Air-Conditioning Engineers Inc. (ASHRAE).
 - .1 ASHRAE 52.2-2007: Methods of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size.
- .4 Credit Interpretation Requests relating to the credits specified in 1.2.1.1 and 1.2.1.2 of this Section may apply in projects exhibiting exceptional circumstances as deemed necessary by the Contract Administrator.
- .5 www.cagbc.org

1.3 REQUIREMENTS

- .1 The Contractor shall develop and implement an *Indoor Air Quality (IAQ) Management Plan* for the construction of the project. A preliminary IAQ plan has been appended to section 01 56 15. The *IAQ Management Plan* is to be approved by the City and Contract Administrator and must include the following:
 - .1 During construction meet or exceed the recommended control measures of the SMACNA IAQ Guideline for Occupied Buildings Under Construction, 2nd Edition, 2007, ANSI/SMACNA 008-2008, Chapter 3.
 - .2 Protect stored on-site or installed absorptive materials from moisture damage.
 - .3 Ensure installation of absorbent materials, such as ceiling tiles, gypsum, carpet etc., are sequenced such that VOC-emitting materials have off-gassed their air contaminants.
 - .4 If air handlers must be used during construction, filtration media with a Minimum Efficiency Reporting Value (MERV) of 8 must be used at each return

- air grille and return or transfer duct inlet opening such that there is no bypass around the filtration media, as determined by ASHRAE 52.2-2017.
- .5 Install new air filtration media in regularly occupied areas immediately prior to occupancy for all air handling equipment with a maximum flow rate of more than 283/L/s. These filters must provide a minimum efficiency reporting value (MERV) 8 or higher.
 - .6 Prohibit the use of tobacco and vaping (including cannabis) inside the building and within 25 feet (8 meters) of the building entrance during construction.
 - .7 Make provisions for inspections, to be coordinated with the commissioning authority, of building and HVAC systems for deficiencies that could adversely affect the IAQ and correct any of these deficiencies.
 - .8 Ensure all return and supply grilles are completely sealed off in areas of high dust and pollution activities for the duration of the task.
 - .9 Ensure that adequate time is allocated in the construction schedule for building air flush and or air quality testing. If air quality testing is planned, ensure there is adequate time for a flush-out and retesting if a sampling point exceeds the concentration limit.

1.4 SUBMITTALS

- .1 Submit the IAQ Management Plan to the City and Contract Administrator for approval.
- .2 Submit a list of air filters to be used, include the MERV value, manufacturer name and model number.
- .3 Submit at least 6 dated digital photographs on a minimum of 3 different occasions throughout the construction process (minimum 18 photos total). Include identification of SMACNA approach featured by each photograph, examples include:
 - .1 Protection of the HVAC System - photograph the ductwork and HVAC taped and protected from being contaminated with dust and debris
 - .2 Pathway Interruption - photograph tarps that separate spaces where drywall sanding, painting, or any tasks producing a high dust or VOC load is taking place.
 - .3 House Keeping - photograph housekeeping procedures that minimize the accumulation of dust and prevent it from becoming airborne: ie sweeping, vacuuming, removing packaging.
 - .4 Scheduling - photograph the construction sequences as it has been scheduled in order to reduce absorption of VOCs and dust by porous materials. See examples below:
 - .1 Application of paints, sealants, and coatings being completed before installation of ceiling tiles, or fabric covered furnishings.
 - .2 Furnishings that are expected to off-gas VOCs (i.e. cubical systems, etc.) will not be stored on site prior to installation.

- .5 Source Control - photograph Low Emitting Materials also make sure they are closed when not in use and remove used containers from the site promptly.
- .4 Submit product volume or surface area for adhesives and sealants, paints and coatings, flooring, ceilings, wall panels, thermal and acoustic insulation, and composite wood and agrifibre products used within the outermost weather-proofing layer of the wall/roof assembly.
- .5 If testing, submit test results report.
- .6 If flush-out, submit flush-out report that includes:
 - .1 Flush-out duration calculations based on capacity of HVAC units used. Indicate which HVAC units are permanent and which temporary.
 - .2 Describe flush-out procedure and include a log of dates, hours, and recorded temperature and humidity.

Part 2 Products

NOT USED

Part 3 Execution

3.1 IMPLEMENTATION

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

SAMPLE - Construction Indoor Air Quality Management Plan

Project Name:
Project Location:
Contractor:
Reviewed By:

Date:

Responsible Party

Teams and individuals involved in activities pertaining to the policy:

Facility Manager: TBD
Contractor: TBD
Building Owner: TBD

Scope

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

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

EQ Credit Construction Indoor Air Quality Management Plan

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

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

¹ Sheet Metal and Air Conditioning National Contractors Association

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

Protection of the HVAC System

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

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

Pathway Interruption

These procedures will be used to reduce the flow of contamination throughout the buildings:

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

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

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

Housekeeping

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

- Workers engaged in dust generating activities will be asked to clean up as quickly as possible to prevent it from becoming airborne or being tracked throughout the site.

- Workers will be asked to clean areas before they are enclosed. Coring dust, insulation debris, packaging, etc., can provide a medium for mold growth and will be removed.
- The Contractor's Site Supervisor will require immediate clean up of areas that have the potential to create IAQ problems.
- The Contractor will provide and maintain shop vacuums equipped with HEPA filters to facilitate the above procedures.

Scheduling

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

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

Source Control

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

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

Additional Requirements

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

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

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

- All HVAC equipment has been properly sealed and cleaned,

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

EQ Credit Indoor Air Quality Assessment

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

Requirements

- **Building Flush**
 - 4300 cubic meters of outdoor air per square meter of floor area must pass through all spaces. Flush can be done all prior to occupancy or split between pre and post occupancy. However, if split between pre and post occupancy, a minimum of 1,075 cubic metres must pass through spaces prior to occupancy with the remainder after occupancy. If shorter duration is desired, or if the HVAC system is unable to provide at least 1.5 L/s/m² for an occupied flush-out, supplemental units may be used.
 - Space temperature must maintain 15-27 degrees Celsius, and relative humidity shall remain less than 60% during the building flush for 24 hours per day.
 - The Mechanical Subcontractor or controls Contractor must keep a log of when the flush began and ended, when filters were changed, and the total of volume of outdoor air that was used.
 - If the flush was stopped for anytime during the flush period, additional time must be added to compensate for the stoppage.
- **Air Quality Testing**
 - If the testing option is chosen, a third-party testing agent should be employed.
 - Testing must be done after construction is complete but prior to occupancy.
 - Testing should be done in accordance with the requirements outlined in LEED credit Indoor Air Quality Assessment, Option 2. Air Testing.
 - If the maximum concentrations are exceeded on any of the test points, the building should be flushed with outdoor air and the noncompliant concentrations should be retested.

Quality Assurance and Quality Control Processes:

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

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

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 01 35 20 – LEED® Sustainable Requirements
- .2 Section 01 35 43 – Environmental Protection
- .3 Division 31 – Earthwork
- .4 Division 32 – Exterior Improvements
- .5 Division 33 – Utilities

1.2 REFERENCES

- .1 LEED® Canada Reference Guide for Green Building Design and Construction V4 Edition and v4.1 addenda as applicable.
 - .1 Sustainable Sites Prerequisite 1 Construction Activity Pollution Prevention
 - .2 www.cagbc.org
- .2 2017 United States Environmental Protection Agency (EPA) Construction General Permit (CGP)
- .3 Credit Interpretation Requests relating to the credits specified in this Section may apply in projects exhibiting exceptional circumstances as deemed necessary by the Contract Administrator.

1.3 INTRODUCTION

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

1.4 REQUIREMENTS

- .1 The Contractor shall design and implement a *Construction Activity Pollution Prevention Plan* which must describe the measures implemented specific to the site that conforms to 2017 EPA Construction General Permit, or local erosion and sedimentation control standards and codes, whichever is more stringent. The preliminary plan has been attached to the spec section 01 57 13; however, more measures may be added or removed dependent on changing site conditions. Measures will be reviewed on an

ongoing basis during construction to ensure the plan adequately meets the following objectives in accordance with the 2017 EPA Construction General Permit:

- .1 Prevent loss of soil during construction by storm water runoff and/or wind erosion, including protecting topsoil by stockpiling for reuse.
- .2 Prevent sedimentation of storm sewer or receiving streams.
- .3 Prevent polluting the air with dust and particulate matter.

Part 2 Products

NOT USED

Part 3 Execution

3.1 IMPLEMENTATION

- .1 Implement and follow the *Construction Activity Pollution Prevention Plan*. Plan must be approved prior to the start of construction and include a site plan with the location of the CAPP measures clearly marked.
- .2 CAPP measures must be in place prior to the start of any construction on site.
- .3 Provide dated digital photographs of the various erosion and sedimentation control measures implemented biweekly throughout the project. Photographs could include, as applicable, but not limited to:
 - .1 *Preconstruction* – Photos showing site’s preconstruction condition, and proof that CAPP measures were in place prior to start of construction.
 - .2 *Sediment Control (Silt Fencing, or equivalent)* - routine checks of the silt fencing will be made at least every 14 days and prior to any anticipated storm to maintain its effectiveness. Photograph any deficiencies before and after fixing them.
 - .3 *Storm Drain Inlet Protection* - photograph the catch basins and manholes protected with filters used to prevent sediment from entering the storm drainage systems.
 - .4 *Dewatering of Site* - Capture the settling ponds that water is pumped into prior to entering the water drainage system.
 - .5 *Dust Control* - If dust becomes excessive or a concern the problem areas will be moistened to prevent the dust. Photograph all piles of soil and how dust is mitigated.
 - .6 *Construction Exit* - Photograph the gravel strip in place at the exit of the construction site and the dirt-free roadway.

- .7 *Storage and Collection of Materials* - Photograph on-site facilities for collection, handling, and storage of anticipated quantities of reusable and/or recyclable materials.
- .8 *Soil Stockpile* – Photograph any sediment barriers, covering or seeding of stockpile if soil is to remain for more than 2 weeks.
- .9 *Any added measures due to unusual weather events or spills.*
- .10 *Others as appropriate to sufficiently document all CAPP measures.*

SAMPLE - CAPP Plan

Project Name:

Project Location:

Contractor:

Reviewed by:

Date:

Construction Activity Pollution Prevention Plan

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

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

This CAPP Plan has the following objectives:

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

1. Site Description and Site Plan

Include detailed site description and site plan here.

2. Erosion and Sedimentation Control Measures:

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

Describe control measures that meet one of the options below:

- *Provide and maintain a 50 foot (15 m) undisturbed natural buffer; or*
- *Provide and maintain an undisturbed natural buffer that is less than 50 feet (15 m) and is supplemented by erosion and sediment controls that achieve, in combination, the sediment load reduction equivalent to a 50 foot (15 m) undisturbed natural buffer or;*
- *If infeasible to provide and maintain an undisturbed natural buffer of any size, implement erosion and sediment controls to achieve the sediment load reduction equivalent to a 50-foot undisturbed natural buffer.*

- *If no body of water present within 50 feet (15m) of disturbed area of the site, mark as not applicable.*

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

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

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

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

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

2.4 Minimize Sediment Track-out

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

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

2.5 Soil Stockpile

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

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

2.6 Minimize Dust

- For areas with exposed soil, dust will be minimized through the appropriate application of water or other dust suppression techniques to control the generation of pollutants that could be discharged in stormwater from
- Describe any existing slopes and any that are expected to be created during construction.
- *Describe how this measure is, or is not, appropriate and applicable to the project site.*

2.7 Minimize Steep Slope Disturbances

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

2.8 Preserve Native Topsoil, Unless Infeasible

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

2.9 Minimize Soil Compaction

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

2.10 Storm Drain Inlet Protection

- Inlet protection measures will be installed that remove sediment from discharges prior to entry into any storm drain inlet that carries stormwater flow from the site to a body of water. In the event of flood conditions.
- The project site and adjacent area catch basins and manholes will have filters put in place to prevent sediment from entering the storm drainage systems. The filter will consist of a geotextile fabric that will be placed underneath the grate.

- Checks of the sediment level and possible damage to filters will be made at least 14 days. Checks will also be made prior to any anticipated storm. Any visible sediment will be removed and returned to an appropriate place on site.
- *Describe how this measure is, or is not, appropriate and applicable to the project site.*

2.11 Control Stormwater Discharges

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

2.12 Sediment Basin

- Any sediment basin or similar impoundment will be situated outside of any water body and any natural buffers established under 2.1.
- The basin will be designed to avoid collecting water from wetlands.
- The basin will be designed to provide storage for either:
 - The calculated volume of runoff from a 2-year, 24-hour storm or 3600 cubic feet (101 cubic metres).
- Outlet structures that withdraw water from the surface of the sediment basin will be used unless infeasible.
- Erosion controls and velocity dissipation devices to prevent erosion will be used.
- Any accumulated sediment will be removed to maintain at least one-half of the design capacity in order to ensure the basin remains in effective operating condition.
- *Describe how this measure is or is not appropriate and applicable to the project site.*

2.13 Stabilizing exposed portions of the site

- Stabilization measures (e.g. seeding protected by erosion controls until vegetation is established, sodding, mulching, erosion control blankets, hydro-mulch, gravel) that minimize erosion from exposed portions of the site will be implemented.
- For areas of disturbance 5 acres (2.02 ha), or less:
 - Stabilization will be initiated immediately in any areas of exposed soil where construction activities have permanently ceased or will be temporarily inactive for 14 or more calendar days.
 - Installation of the stabilization measures will be completed as soon as practicable, but no later than 14 days after initiation.
- For areas of disturbance greater than 5 acres (2.02 ha)
 - Stabilization measures will be initiated immediately in any areas of exposed soil where construction activities have permanently ceased or will be temporarily inactive for 14 or more calendar days.

- Installation of the stabilization measures will be completed as soon as practicable but no later than 7 days after initiation.
- If installation is not practicable within stated timeline, explain circumstances or unforeseen challenges.

3. Pollution Prevention Requirements

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

3.1 Equipment and Vehicle Fueling Maintenance

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

3.2 Equipment and Vehicle Washing

- Any vehicle washing, including wheel washing, that may happen on site will be located away from bodies of water or stormwater inlets or conveyance.
- Wash waters will be directed to a sediment basin, sediment trap and will be filtered appropriately so that there is no discharge of soaps, solvents or detergents.
- Any soaps or detergents used on site will be stored in a secure covered container to eliminate the risk of exposure to precipitation or stormwater.

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

- For building products where exposure to precipitation will result in a discharge of pollutants, and possible contamination of stormwater, building products will be covered to minimize risk.
- For pesticides, herbicides, insecticides, fertilizers and landscape materials:
 - Covered storage (plastic sheeting, temporary roofing) will be provided to minimize exposure to precipitation and stormwater.
 - All application and disposal requirements included on the pesticide, herbicide, insecticide or fertilizer label will be followed.
- For diesel fuel oil, hydraulic fluids, other petroleum products and other chemicals
 - Chemicals will be stored in water-tight chemicals and covered to minimize exposure to precipitation or stormwater.

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

3.4 Emergency Spill Notification

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

- Manitoba: Environmental Emergency: 204.944.4888
- Ontario: Spill Action Centre: 1-800-268-6060

4. Dewatering of Site Requirements

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

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

5. Site Inspection Requirements

5.1 Person Responsible for Inspecting Site

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

5.2 Inspection Frequency

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

5.3 Areas of Inspection

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

5.4 Requirements for Inspections

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

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.
- .5 Section 01 74 19 – Waste Management and Disposal.

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 with Contract Administrator 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 Contract Administrator 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 *B7: 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, Contract Administrator 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 Contract Administrator of such, in order that substitutions or other remedial action may be authorized in ample time to prevent delay in performance of work.
- .2 In event of failure to notify Contract Administrator at commencement of work and should it subsequently appear that work may be delayed for such reason, Contract Administrator reserves right to substitute more readily available products of similar character, at no increase in contract price or contract time.

1.6 QUALITY AND CONFORMANCE

- .1 When material or equipment is specified by standard or performance specifications, upon request of Contract Administrator, 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 Contract Administrator based upon requirements of Contract Documents.
- .5 Unless otherwise indicated in specifications, maintain uniformity of manufacture for any particular or like item throughout building.
- .6 Permanent labels, trademarks and nameplates on products are not acceptable in prominent locations, except where required for operating instructions, or when located in mechanical or electrical rooms.

1.7 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 Contract Administrator.
- .9 Touch-up damaged factory finished surfaces to Contract Administrator's satisfaction. Use touch-up materials to match original. Do not paint over name plates.
- .10 Cleaning in accordance with Section 01 74 00.
- .11 Waste Management and Disposal in accordance with Section 01 74 19.

1.8 TRANSPORTATION

- .1 Pay costs of transportation of products required in performance of work.
- .2 Transportation costs of products supplied by 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 Contract Administrator in writing, of conflicts between specifications and manufacturer's instructions, so that Contract Administrator may establish course of action.
- .3 Improper installation or erection of products, due to failure in complying with these requirements authorizes Contract Administrator to require removal and re-installation at no increase in Contract Price or Contract Time.

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

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. Contract Administrator 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 Contract Administrator of conflicting installation. Submit field drawings to indicated relative position of various services and equipment when required by Contract Administrator. 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 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 Contract Administrator 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 Contract Administrator.

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 *B7: 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 Contract Administrator 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 Contract Administrator 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 Contract Administrator to properly evaluate the proposal.
 - .2 Identify changes required in the applicable Work which would become necessary to accommodate the substitute.
- .6 The Contract Administrator 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 (by the Pembina Trails School Division, the “Division”) of Division Furnished Products for installation by the Contractor as indicated DFP-A on the drawings.
- .2 In addition, the Division will purchase equipment under a separate supply and installation contract with a Vendor, or Vendor’s authorized representative as indicated DFP-B on the drawings.

1.2 RELATED SECTIONS

- .1 Section 11 06 00 – Equipment Schedule.

1.3 DEFINITIONS

- .1 Division: Pembina Trails School Division or authorized Pembina Trails School Division representative.
- .2 Refer to drawings for the Division Furnished Product listed as follows:
 - .1 Division Furnished Products (DFP-A), Contractor Installed.
 - .2 Division Furnished Products (DFP-B), Vendor Installed (under contract with the Division), Contractor Co-ordinated.
- .3 Vendor: equipment manufacturer or equipment manufacturer’s authorized supply and installation representative.
- .4 Assemble or Assembly: fit together of multiple components and accessories in accordance with manufacturer’s printed instructions/manuals, and specifications.
- .5 Install or Installation: provide structural support and/or blocking, placing into position, anchorage and adjusting of DFP as indicated by drawings, specifications and manufacturer’s printed installation instructions/manuals.
- .6 Connect or Connection: provide 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 Division to obtain and issue to Contractor, one printed copy or one electronic copy of manufacturer’s product/equipment data, shop drawings, electrical and mechanical connections, installation instructions, O & M Manuals, and all other relevant information for each DFP to assist Contractor with his work.
 - .2 Contractor to review shop drawings received from the Division and forward to Contract Administrator in accordance with Section 01 33 00.

- .2 Closeout Submittals.
 - .1 Division to obtain and issue to Contractor, operating and maintenance instructions, parts lists, wiring diagrams, installation instructions/manuals, etc. for each DFP for incorporation into Operations and Maintenance Manual provided by Contractor as specified in Section 01 78 00.
 - .2 Contractor to turn over to the Division, 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 Division, confirmation of insurance carried on DFP.
- .4 Record Drawings.
 - .1 Contractor to incorporate DFP into Project Record Drawings as specified in Section 01 78 00.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Division to arrange and pay for delivery of DFP in accordance with Contractor's construction schedule. Contractor to provide the Division with delivery and packing slips accompanying deliveries.
- .2 Division and Contractor to inspect DFP delivered to site, and jointly record shortages and damaged or defective DFP. Division to submit claims for transportation damage of DFP, and arrange for replacement of damaged, defective, or missing DFP.
- .3 Contractor to receive, unload, inventory, unpackage, transport, and set in place in designated room all DFP-A items in accordance with Section 01 61 00. Refer to 3.2.2 for similar responsibilities for DFP-B items.
- .4 Contractor to be responsible for temporary storage in heated, secure, off-site facility including delivery charges for all DFP 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 for.
- .5 Cleaning and Waste Management in accordance with Section 01 74 00.
- .6 Waste Management and Disposal in accordance with Section 01 74 19.

1.6 SCHEDULING

- .1 Contractor to provide Division with dates required for receipt of submittals as specified in this Section, and for required delivery dates of DFP to site for incorporation into project. Contractor to incorporate DFP installation dates into construction schedule.
- .2 Contractor to be responsible for safety and overall co-ordination of DFP installed by the Division's Vendor or Vendor's authorized supply and installation representative within overall project schedule, and ensure their attendance at regular project safety and toolbox meetings.

1.7 WARRANTY

- .1 Division to obtain and issue to Contractor, copy of manufacturer's standard warranty documents for each DFP for incorporation into Operations and Maintenance Manual provided by Contractor in accordance with Section 01 78 00.

1.8 INSURANCE

- .1 Contractor to include value of all DFP under the Building Contract insurance policy.
- .2 Insurance coverage for all DFP shall commence on the date DFP is delivered to the site and has been accepted by Division and Contractor.

1.9 COMMISSIONING

- .1 Division to arrange and pay for commissioning and certification of all installed DFP as required.

Part 2 Products

2.1 DIVISION FURNISHED PRODUCTS (DFP)

- .1 Refer to drawings for the Division Furnished Product listed as follows:
 - .1 DFP-A - Division Furnished Products, Contractor Installed.
 - .2 DFP-B - Division Furnished Products, Vendor Installed (under contract with the Division), Contractor Co-ordinated.

Part 3 Execution

3.1 PREPARATION

- .1 Contractor to develop and co-ordinate project schedule with the Division who will in turn co-ordinate with their Vendor or Vendor's authorized supply and installation representative.
- .2 Contractor to obtain from Division, manufacturer's shop drawings for DFP including mechanical and electrical requirements relating to details of service connections or rough-ins.
- .3 Contractor to provide necessary rough-ins for DFP -B including but not limited to, blocking, backing, supports, conduits, wiring, electrical boxes, piping, ductwork, inserts, depressions, trimming, openings, drains, canting and core drilling as indicated on shop drawings and as directed by Division's Vendor or Vendor's authorized supply and installation representative.
- .4 Contractor to allow Division's Vendor or Vendor's authorized supply and installation representative access to the site, and co-ordinate the work performed by the Vendor or Vendor's authorized supply and installation representative.

3.2 INSTALLATION

- .1 Planning Code A: Division Furnished Products (DFP-A), Contractor Installed.
 - .1 Contractor to receive, unload, inventory, unpackage, transport, and set DFP-A in designated rooms.
 - .2 Contractor to assemble, install and connect DFP-A 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 Contract Administrator.
 - .4 Contractor to install DFP-A 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 Division arranged commissioning and certification.

- .7 Contractor to repair or replace DFP-A damaged by own forces on site (under Contractor control).
- .2 Planning Code B: Division Furnished Products (DFP-B), Vendor Installed (under contract with the Division), Contractor Co-ordinated.
 - .1 Contractor to be responsible for preparation and co-ordination as described in item 3.1 Preparation above.
 - .2 Division to employ the servicers of a Vendor or Vendor's authorized supply and installation representative for the supply and installation of DFP-B.
 - .3 Supply and installation costs for DFP-B are not included. However, Contractor co-ordination is included.
 - .4 Unless the Contractor and Vendor mutually agree otherwise, the Vendor or Vendor's authorized supply and installation representative shall:
 - .1 Receive, unload, inventory, unpackage, transport, and set DFP-B in designated rooms.
 - .2 Assemble, install, and connect DFP-B 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 DFP-B including supplied trim pieces as applicable in strict accordance with manufacturer's printed instructions/manuals.
 - .5 Contractor and Vendor or Vendor's authorized supply and installation representative shall co-ordinate final locations of services and equipment as shown on reviewed shop drawings and Contract Documents. Report any discrepancies to Contract Administrator.
 - .6 Clean, lubricate, adjust, and do initial start-up and testing to ensure proper function.
 - .7 Contractor and Vendor or Vendor's authorized supply and installation representative shall participate as required in Division 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 DFP.
- .2 Site Tests, Inspection.
 - .1 Contractor or Vendor (based on who is responsible for installation) to perform initial start-up of DFP with the Division and manufacturer's representative present.
 - .2 Contractor or Vendor (based on who is responsible for installation) 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 Contractor or Vendor (based on who is responsible for installation) to repair (if acceptable to the Division), or replace worn or damaged parts or improperly operating items with replacement parts supplied by the Division.

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, Contractor or Vendor (based on who is responsible for installation) to recheck components and perform required additional cleaning.

3.6 DEMONSTRATION

- .1 Division will arrange for demonstration and maintenance instruction of all DFP to facility personnel as required in accordance with Section 01 79 00.

3.7 PROTECTION

- .1 Contractor to provide protection from damage during construction for all DFP.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 01 74 11 – Cleaning.
- .2 Section 01 74 19 – Waste Management and Disposal.
- .3 Section 02 41 19 – Selective Demolition.
- .4 Section 07 84 00 – Firestopping and Smoke-seals.

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, 2020 (NBCC), complete with current Manitoba Building Code amendments (MBC).
 - .1 NBCC Division B Part 8, Safety Measures at Construction and Demolition Sites.

1.3 DEFINITIONS

- .1 Cutting: removal of existing construction necessary to permit installation or performance of other work and includes coring.
- .2 Patching: fitting and repair work required to restore surfaces to original conditions after installation of other work.

1.4 SUBMITTALS

- .1 Submit, to Contract Administrator, for approval, method(s) of cutting or coring and protection plan for each.
- .2 Include following information:
 - .1 Extent: describe cutting and patching, show how they will be performed, and indicate why they cannot be avoided.
 - .2 Changes to Existing Construction: describe anticipated results. Include changes to structural elements and operating components as well as changes in building's appearance and other significant visual elements.
 - .3 Products: list products to be used and firms or entities that will perform work.
 - .4 Dates: indicate when cutting and patching will be performed.
 - .5 Utilities: list utilities that cutting and patching procedures will disturb or affect. List utilities that will be relocated and those that will be temporarily out of service. Indicate how long service will be disrupted.

- .6 Structural Elements: prior to cutting which effects structural safety, or where cutting and patching involve adding reinforcement to structural elements, submit written request to Contract Administrator for permission to proceed with cutting. Include structural calculation prepared by professional engineer licensed to practice in jurisdiction of Place of Work and show integration of reinforcement with original structure as applicable.

1.5 QUALITY ASSURANCE

- .1 Use adequate numbers of skilled workers who are thoroughly trained and experienced, and who are completely familiar with specified requirements and methods needed for proper performance of work of this Section.
- .2 Observe safety provisions of applicable laws, building and construction codes.
- .3 Do not cut structural elements in manner that would reduce their load-carrying capacity. Obtain approval of cutting proposal before cutting any structural elements.
- .4 Do not cut operating elements or safety related components in manner that would result in reducing their capacity to perform as intended, or result in increased maintenance, or decreased operational life or safety. Obtain approval of cutting proposal before cutting and patching any operating elements. Cutting and Patching Proposal: submit proposal describing procedures at least ten (10) days before time cutting and patching will be performed, requesting approval to proceed.
- .5 If no deposition of existing detail of existing improvements or conditions is indicated, be responsible to provide necessary site investigations to obtain site information at no additional cost to the City. Submit site information as part of submittal.
- .6 Do not cut construction exposed on exterior or in occupied spaces, in manner that would, in Contract Administrator's opinion, reduce building's aesthetic qualities, or result in visual evidence of cutting and patching.
- .7 Pre-installation Meeting: before proceeding, meet at place of work with parties involved in cutting and patching, including mechanical and electrical trades. Review areas of potential interference and conflict. Co-ordinate procedures and resolve potential conflicts before proceeding.

1.6 SITE CONDITIONS

- .1 Should conditions of work or schedule indicate required change of materials or methods for cutting or patching, so notify the Contract Administrator and secure written permission prior to proceeding.

Part 2 Products

2.1 MATERIALS

- .1 General: Comply with requirements specified in other Sections of these Specifications.
- .2 Existing Materials: use materials identical or similar to existing materials. For exposed surfaces, use materials that visually match existing adjacent surfaces to fullest extent possible. If identical materials are unavailable or cannot be used, use materials that, when installed, will match visual and functional performance of existing materials.

Part 3 Execution

3.1 SURFACE CONDITIONS

- .1 Inspection.
 - .1 Inspect existing conditions, including elements subject to movement or damage prior to cutting or coring.
 - .2 Identify existing utilities. Protect and maintain service to occupied areas in accordance with Section 02 41 19.
 - .3 Inspect and determine location of existing reinforcing steel in masonry and/or concrete walls or flooring prior to cutting.
 - .4 Compatibility: before patching, verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
 - .5 After uncovering work, inspect conditions affecting installation of new work.
- .2 Discrepancies.
 - .1 If uncovered conditions are not as anticipated, immediately notify in writing the Contract Administrator and secure needed directions.
 - .2 Do not proceed until unsatisfactory conditions are corrected.

3.2 PREPARATION

- .1 Temporary Support: provide bracing, shoring, and underpinning as required.
- .2 Protection: protect existing construction during cutting and coring to prevent damage. Provide protection from adverse weather conditions for portions of work that might be exposed during cutting operations.
- .3 Adjoining Areas: avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.
- .4 Existing Services: Where existing services are required to be removed, relocated, or abandoned, bypass such services before cutting to minimize interruption of services to occupied areas.

3.3 QUALITY ASSURANCE

- .1 General: employ qualified workers to perform cutting and patching. Proceed with cutting and patching at earliest feasible time, and complete without delay.
 - .1 Cut existing construction to provide for installation of other components or performance of other construction specified under other pertinent Sections of specifications.
- .2 Cutting: cut existing construction using methods least likely to damage elements to be retained or adjoining construction. Where possible, review proposed procedures with original installer. If Construction Manager does not concur with original installer's recommendations, notify Contract Administrator and request instructions.
 - .1 In general, where cutting is required, use hand or small power tools designed for sawing or grinding, not hammering and chopping. Impact tools are not to be used in building. Cut holes and slots neatly to size required with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
 - .2 To avoid marring existing finished surfaces, cut or drill from exposed or finished side into concealed surfaces, or spaces.

- .3 Cut through concrete and masonry using cutting machine such as carborundum saw or diamond core drill. Use methods or locations that could avoid cutting rebar. Round off cut rebar (approved by Contract Administrator) to remove any sharp edges and dabbed with coat of protective coating against rusting.
 - .4 By-pass utility services such as pipe or conduit, before cutting, where services are shown or required to be removed, relocated or abandoned. Cut-off pipe or conduit in walls, partitions or floor slabs to be removed. Cap, valve or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after bypassing and cutting. Do not interrupt any existing service.
 - .5 Proceed with patching after construction operations requiring cutting are complete.
- .3 Patching: patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other work. Patch with durable seams that are as invisible as possible. Provide materials and comply with installation requirements specified in other Sections.
- .1 Inspection: where feasible, test and inspect patched areas after completion to demonstrate integrity of installation.
 - .2 Exposed Finishes: restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in manner that will eliminate indicated evidence of patching and refinishing.
 - .3 Walls: where walls are damaged or deteriorated, repair wall surfaces in new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove existing wall coatings and replace with new materials, if necessary, to achieve uniform colour and appearance.
 - .1 Where patching occurs in painted surface, apply primer and intermediate paint coats over patch and apply final paint coat over entire unbroken surface containing patch. Provide additional coats until patch blends with adjacent surfaces.

3.4 CLEANING

- .1 Thoroughly clean areas and spaces where cutting is performed or used as access.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 01 50 00 – Temporary Facilities and Controls.
- .2 Section 01 61 00 – Common Product Requirement.
- .3 Section 01 73 29 – Cutting and Patching.
- .4 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: *General Conditions*.

1.3 PROJECT CLEANLINESS

- .1 Maintain Work in tidy condition, free from accumulation of waste products and debris, including that caused by the City or other Contractors.
- .2 Remove waste materials from site at daily regularly scheduled times or dispose of. Do not burn waste materials on site.
- .3 Clear snow and ice from access to building, remove from site.
- .4 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.
- .5 Provide on-site containers for collection of waste materials and debris.
- .6 Provide and use marked separate bins for recycling. Refer to Section 01 74 19 – Waste Management and Disposal.
- .7 Dispose of waste materials and debris off site.
- .8 Clean interior areas prior to start of finishing work, and maintain areas free of dust and other contaminants during finishing operations.
- .9 Store volatile waste in covered metal containers, and remove from premises at end of each working day.
- .10 Provide adequate ventilation during use of volatile or noxious substances. Use of building ventilation systems is not permitted for this purpose.

- .11 Use only cleaning materials recommended by manufacturer of surface to be cleaned, and as recommended by cleaning material manufacturer.
- .12 Schedule cleaning operations so that resulting dust, debris and other contaminants will not fall on wet, newly painted surfaces nor contaminate building systems.

1.4 FINAL CLEANING

- .1 When Work is Substantially Performed remove surplus products, tools, construction machinery and equipment not required for performance of remaining Work.
- .2 Remove waste products and debris other than that caused by others, and leave Work clean and suitable for occupancy.
- .3 Prior to final review remove surplus products, tools, construction machinery and equipment.
- .4 Remove waste products and debris including that caused by the City or other Contractors.
- .5 Remove waste materials from site at regularly scheduled times or dispose of. Do not burn waste materials on site.
- .6 Make arrangements with and obtain permits from Authorities Having Jurisdiction for disposal of waste and debris.
- .7 Clean and polish glass, mirrors, hardware, wall tile, stainless steel, chrome, porcelain enamel, baked enamel, plastic laminate, and mechanical and electrical fixtures. Replace broken, scratched or disfigured glass.
- .8 Remove stains, spots, marks and dirt from decorative work, electrical and mechanical fixtures, furniture fitments, walls and floors.
- .9 Clean lighting reflectors, lenses, and other lighting surfaces.
- .10 Vacuum clean and dust building interiors, behind grilles, louvres and screens.
- .11 Wax, seal, shampoo or prepare floor finishes, as recommended by manufacturer.
- .12 Inspect finishes, fitments and equipment and ensure specified workmanship and operation.
- .13 Broom clean and wash exterior walks, steps and surfaces; rake clean other surfaces of grounds as applicable.
- .14 Remove dirt and other disfiguration from exterior surfaces.
- .15 Clean equipment and fixtures to sanitary condition; replace filters of mechanical equipment.
- .16 Remove debris and surplus materials from crawl areas and other accessible concealed spaces.

1.5 WASTE MANAGEMENT AND DISPOSAL

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

Part 2 Products

Part 3 Execution

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

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

1.2 REFERENCES

- .1 LEED® Canada Reference Guide for Green Building Design and Construction V4 Edition and v4.1 with Addenda
 - .1 Materials and Resources Prerequisite Construction and Demolition Waste Management Planning
 - .2 Materials and Resources Credit Construction and Demolition Waste Management
- .2 Credit Interpretation Requests relating to the prerequisite and credit outlined in 1.2.1 and 1.2.2 may apply in projects exhibiting exceptional circumstances as deemed necessary by the LEED® Contract Administrator.
- .3 www.cagbc.org

1.3 INTRODUCTION

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

1.4 REQUIREMENTS

- .1 All sub-trades are to conform to the Construction and Demolition Waste Management requirements.
- .2 The contractor is to develop and implement a *Construction Waste Management Plan*. The plan must include the following:

- .1 An overall project waste diversion goal
 - .2 At least five kinds of materials streams that will be diverted from landfills or incineration.
 - .3 Specify whether materials will be separated or commingled
 - .4 Expected diversion rate for each material.
 - .5 Describe diversion strategies planned for the project. Describe where the materials will be taken and how the recycling facility will process the material.
- .3 The contractor shall be responsible for sourcing appropriate recycling and reuse facilities. A draft preliminary plan has been attached to spec 01 74 19.
 - .4 Weekly construction waste progress reports, as described in Section 01 35 20 clause 3.1.4, are to be submitted to the LEED® Contract Administrator and the City during both demolition and construction.
 - .5 A consistent method of measurement is to be used; all information is to be provided in metric tonnes.

1.5 INFORMATIONAL SUBMITTALS

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

1.6 STORAGE AND HANDLING

- .1 Provide on-site facilities for collection, handling, and storage of anticipated quantities of reusable and/or recyclable materials.
- .2 Provide containers to deposit reusable and/or recyclable materials.
- .3 Place containers in strategic locations to facilitate deposit of materials without hindering daily operations. Recycle/Salvage containers are to be located closer to the work area and be more readily accessible than waste containers to encourage recycling.
- .4 Separate salvaged materials into separate piles or containers on site and protect them from damage. Transport offsite to approved and authorized recycling facility.
- .5 Mark containers and/or stockpile areas.
- .6 Stockpile areas to be consistent with applicable fire regulations.
- .7 Unless otherwise specified, materials for removal becomes Contractor's property.
- .8 On site sale of salvaged, reusable, or recyclable materials is not permitted.
- .9 Material destined for the landfill to be used as alternative daily cover cannot be counted as diverted material.
- .10 Land clearing debris is not considered construction, demolition or renovation waste and therefore should not be counted as waste or diverted material.
- .11 Asbestos or other hazardous materials having specific disposal requirements as governed by Provincial regulations should not be counted as waste or diverted materials.

1.7 CLEANING

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

Part 2 Products

2.1 NOT USED

Part 3 Execution

3.1 APPLICATION

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

- .2 Burning and incineration of rubbish and waste cannot be used as an alternative method for diverting waste from the landfill.
- .3 Burying of waste and rubbish is prohibited, unless approved by the LEED® Contract Administrator.

3.2 DIVERSION OF MATERIALS

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

3.3 DISPOSAL OF WASTES

- .1 Hazardous materials are to be disposed of in accordance with Section 01 35 43, and 01 57 13.
- .2 Disposal of waste, volatile materials, mineral spirits, oil, and/or paint thinner into waterways, water table, storm, and/or sanitary sewers is prohibited.

SAMPLE - Construction Waste Management Plan

Project Name:
Project Location:
Contractor:
Reviewed By:

Date:

Waste Management Goal

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

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

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

Education and Awareness

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

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

Material Waste and End Use

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

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

Required Documentation

The Contractor will provide Crosier Kilgour with:

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

Tracking

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

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

Total Waste =
Total Diverted Materials =
% Diverted =

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 *D30: Warranty, of Supplemental Conditions and General Conditions*.
- .2 Pre-warranty Meeting:
 - .1 Convene meeting one (1) week prior to contract completion with Contractor's representative, the City and Contract Administrator:
 - .1 Verify Project requirements.
 - .2 Review manufacturer's installation instructions and warranty requirements.
 - .2 Contract Administrator to establish communication procedures for:
 - .1 Notifying construction warranty defects.
 - .2 Determine priorities for type of defects.
 - .3 Determine reasonable response time.
 - .3 Contact information for bonded and licensed company for warranty work action: provide name, telephone number and address of company authorized for construction warranty work action.
 - .4 Ensure contact is located within local service area of warranted construction, is continuously available, and is responsive to inquiries for warranty work action.

1.3 ACTION AND 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 Contract Administrator for their review prior to submitting final copies. One (1) copy will be returned after final review, with Contract Administrator's comments.
- .4 Revise content of documents as required prior to final submittal.
- .5 Submit to Contract Administrator, 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 one (1) hard copy.
- .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 Contract Administrator 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 Contract Administrator.

1.5 PROJECT RECORD DOCUMENTS

- .1 Maintain at construction site, three (3) sets of white prints for record drawing purposes. Mark one (1) 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 Contract Administrator along with field drawings. In addition, submit on USB, AutoCAD files of project with all changes included to reflect “as-built” conditions. Drawings must be generated in most current AutoCAD version, and consistent with Bid Documents prepared in AutoCAD 2023.
 - .1 For Contractors’ use in preparation of “as-built” drawings required under this contract, Contractors may purchase from Contract Administrator, 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 Contract Administrator.
 - .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 Contract Administrator.
 - .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 Contract Administrator.
 - .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 Contract Administrator.

1.7 OPERATION AND MAINTENANCE MANUALS

- .1 Prepare one (1) hardcopy and one (1) electronic copy (PDF) of Operation and Maintenance Manual for the project as indicated above. Electronic (PDF) file to be tabbed and OCR'd.
- .2 Prepare Operation and Maintenance Manuals for each Architectural, Mechanical and Electrical component of project.
- .3 Format.
 - .1 Organize data in form of an instructional manual.
 - .2 Binders for hardcopy: 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 Hardcopy drawings: provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.
- .4 Contents (each volume).
 - .1 Table of Contents: provide title of project; date of submission; names, addresses, and telephone numbers of Contract Administrator 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 parts.
 - .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.
 - .6 A hardcopy and electronic copy of shop drawings as specified in Section 01 33 00.
- .5 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.
- .6 Materials and Finishes.
- .1 Building Products, Applied Materials and Finishes: include product data, with catalogue number, size, composition, and colour and texture designations. Provide information for re-ordering custom manufactured products 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 BUILDING LOCATION CERTIFICATE

- .1 Submit building location certificate in accordance with Section 01 11 00.

1.11 UNDERGROUND SERVICES AS-BUILT DRAWING

- .1 Submit underground services as-built drawing in accordance with Section 01 11 00.

1.12 WARRANTIES AND BONDS

- .1 Refer to *D30: Warranty, of Supplemental Conditions and General Conditions*.
- .2 Develop warranty management plan to contain information relevant to Warranties.
- .3 Submit warranty management plan, 30 days before planned pre-warranty conference, to Contract Administrator approval.
- .4 Warranty management plan to include required actions and documents to assure that Contract Administrator 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 Contract Administrator 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 Contract Administrator 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 Contract Administrator.
 - .2 Attach tags with copper wire and spray with waterproof silicone coating.
 - .3 Leave date of acceptance until project is accepted for occupancy.
 - .4 Indicate 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 11 00 – Summary of Work
- .2 Section 01 78 00 – Closeout Submittals.

1.2 DESCRIPTION

- .1 Provide comprehensive demonstration and training program to the Division'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 Total Performance of the Work.
- .2 The Division 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 USB's if available for demonstration purposes.
- .4 In event that manufacturer produced training USB's are not available, video record demonstration and training sessions digitally recorded on USB in digital format.

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 Division'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 Division's personnel present.

1.4 CONDITIONS FOR DEMONSTRATION AND TRAINING

- .1 Equipment and systems have been reviewed by Contract Administrator.
- .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 Division'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 Division's satisfaction by quality persons knowledgeable in operation and maintenance of installed equipment and systems, and for duration acceptable to the Division.

Part 2 Products

Part 3 Execution

END OF SECTION

Part 1 General

1.1 SUMMARY

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

1.2 GENERAL

- .1 Commissioning is a formal, systematic process of ensuring that building systems perform interactively according to the design intent and the Division'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 Division'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 excessive retesting of systems.

1.4 COORDINATION

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

1.5 CONFLICTS (BETWEEN SPECIFICATION SECTIONS)

- .1 Report conflicts between requirements of this section and other specification sections to the 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 Commissioning site visits
 - .2 Component verification completion
 - .3 Startup and pre-functional testing activities
 - .4 Functional testing dates
 - .5 Division training
 - .6 Seasonal or deferred testing.
 - .7 10-Month occupancy review
- .3 All parties are responsible to address scheduling problems and make necessary notifications in a timely manner in order to expedite the commissioning process.

1.7 SYSTEMS TO BE COMMISSIONED

- .1 The following systems will be commissioned for this project (if applicable):
 - Electrical**
 - Lighting and Lighting Controls

Electric Heaters

Plumbing

Domestic hot water heaters

Recirculation pumps

Sump Pumps

HVAC

Energy Recovery Ventilators

Air Handling Units

Condensing Units

Hydronic Heating/Cooling Coils

Fan Coil Units

VAV Terminal Units

Ceiling Fans

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

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

1.12 SYSTEM START-UP

- .1 Start-up Plan. The 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.
- .4 Submit required startup documentation including, but not limited to:
 - .1 Mechanical Systems
 - .1 Major equipment manufacturers startup reports (AHUs, Boilers, Heat Pumps, etc.)
 - .2 Piping pressure tests
 - .3 TAB report
 - .2 Electrical Systems
 - .1 Electrical equipment test reports (megger tests, harmonic distortion testing)
 - .2 Low voltage lighting system test report
 - .3 Fire Alarm verification report.
 - .3 Controls
 - .1 Control point end-to-end verification report

1.13 FUNCTIONAL TESTING

- .1 Refer to Section 1.7 for the list of systems to be commissioned.
- .2 Functional testing demonstrates that each system is operating according to the documented design intent and Contract documents. Each system should be operated through all modes of operation (seasonal, occupied, unoccupied, warm-up, cool-down, part and full load). Verifying the sequences of operation is required for all modes. Proper responses to modes and conditions such as power failure, freeze conditions, fire alarm conditions, equipment failure, etc. may also be tested.
- .3 Functional Tests will be developed in an electronic format (pdf) by the CxA and electronic copies will be provided to Contractors.
- .4 The CVFs for a given system's 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

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

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

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

1.15 SEVEN (7) DAY INTEGRATED SYSTEM TESTING

- .1 A 7-Day Integrated Systems Test will be completed to ensure proper building performance and operation. An additional test will be completed during seasonal testing.
- .2 General Acceptance requires that the systems operate as one entity as intended and that documentation is provided indicating such.
- .3 Issues identified during seven day testing will be documented by the CxA on the issue tracking log.
 - .1 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 DIVISION 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 sessions with attendance sheets.
- .16 A training evaluation form has been attached (Section 1.19) for bid purposes.

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1.19 SAMPLE TRAINING EVALUATION FORM



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

[Project Name]
[Location]

Owner Training Survey

Date:

Name:

Training Covered:

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

- 4. Overall, are you satisfied? Yes No
- Comments

1.20 SYSTEMS MANUAL

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

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

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

- .1 Refer to *E4 Hazardous Materials of Specifications*.
- .2 Section 01 73 29 – Cutting and Patching.

1.2 REFERENCES

- .1 American Society for Testing and Materials (ASTM).
 - .1 ASTM E1971-19, 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 Canadian Standards Association (CSA).
 - .1 CSA S350-M1980 (R2003), Code of Practice for Safety in Demolition of Structures.
- .4 National Building Code of Canada, 2020 (NBCC), complete with current Manitoba Building Code amendments (MBC).
 - .1 NBCC Division B Part 8, Safety Measures at Construction and Demolition Sites.

1.3 QUALITY ASSURANCE

- .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 SUBMITTALS

- .1 Submit written request in advance of cutting or alteration which affects the following:
 - .1 Structural integrity of any element of project.
 - .2 Integrity of weather-exposed or moisture-resistant elements.
 - .3 Efficiency, maintenance, or safety of any operational element.
 - .4 Visual qualities of sight-exposed elements.
- .2 Include in request the following:
 - .1 Identification of Project.
 - .2 Location and description of affected work.
 - .3 Statement on necessity for cutting or alteration
 - .4 Description of proposed work, and products to be used.
 - .5 Date and time work will be executed.

1.5 SITE CONDITIONS

- .1 Existing Services.
 - .1 Do not, under any circumstances drill, cut or chase openings of any description in any part of existing building structure, without written approval from the City. The City will supervise any work of this type and will require x-ray inspection or Ground Penetrating Radar (GPR) of structure to be cut prior to drilling at Contractor's expense.
 - .2 No employee of the City is authorized to give approval of Contractor for any drilling unless results of x-ray inspection or Ground Penetrating Radar (GPR) are provided to the City prior to drilling and approval of the City is communicated to Contractor in writing.
 - .3 Before commencing work, establish location and extent of service lines in area of work. Be absolutely certain of their origin and destination.
 - .4 Where unknown services are encountered, immediately advise the Contract Administrator, and confirm findings in writing.
 - .5 Record locations of maintained, rerouted and abandoned service lines on project record documents in accordance with section 01 78 00.
- .2 Existing Hazardous Materials.
 - .1 Removal and handling of hazardous materials is to be performed only by persons trained in methods, procedures and industry practices for safe handling and removal of hazardous materials.
 - .2 Asbestos: immediately stop work should any unidentified or unforeseen disturbance of asbestos-containing or contaminated materials be encountered during course of work, and notify Contract Administrator and the City upon discovery of material.
 - .3 Polychlorinated Biphenyls (PCB's): fluorescent light fixtures scheduled for demolition within work area may contain PCB light ballasts. Be familiar with procedures concerning handling and storage of PCB materials, and as outlined in latest edition of "Handbook on PCB's in Electrical Equipment" as prepared by Environment Canada.
 - .4 Mould: immediately stop work should any unidentified or unforeseen mould contaminated materials be encountered during course of work and notify Contract Administrator and the City upon discovery of material.

1.6 SCHEDULING

- .1 Co-ordinate demolition and removal of debris to ensure minimal disruption to existing building.
- .2 Execute work with least possible interference, inconvenience or disturbance to occupants, public and normal use or premises. Keep noise and dust to minimum.
- .3 Use only spark proof tools and equipment where explosive fumes may exist either from demolition work, renovation work, or existing operations.

Part 2 Products

Part 3 Execution

3.1 PREPARATION

- .1 Inspect existing conditions, including elements subject to damage or movement during demolition. Photograph existing conditions in accordance with the City. Conduct a condition survey of building areas to remain before commencing demolition.

- .2 Utilize dustproof hoarding and temporary partitions in accordance with the City instructions to fully isolate the demolition work from existing building areas to remain to separate dust generating activities from occupied facility. Maintain until such work is complete. Contractor will be responsible for any and all demolition contamination to the City's occupied facilities adjacent to the demolition area.
- .3 Where security of existing building areas to remain has been reduced by work, provide temporary means to maintain security acceptable to the Contract Administrator and the City.
- .4 Provide and maintain temporary fire protection equipment during performance of work required by and governing codes, regulations and bylaws.
- .5 Protect building systems, services and equipment as follows:
 - .1 Do not disrupt active or energized utilities designated to remain undisturbed. Post warning signs on electrical lines and equipment which must remain energized to serve other properties during period of demolition.
 - .2 Provide temporary dust screens, covers, railings, supports and other protection as specified.
 - .3 Provide protection from elements for areas which may be exposed by uncovering work.
- .6 Prior to start of any demolition ensure contaminated or hazardous materials have been removed from site and dispose of at designated disposal facilities in safe manner and in accordance with TDGA.
- .7 Prior to providing openings in structural elements of work for penetrations of mechanical and electrical work, non-invasive ground penetrating scanning of the existing structure must be conducted to determine rebar and structural steel support locations, area for work penetration are to be mapped out.
 - .1 When penetrating concrete floor, test holes are to be taken to determine the depth of the existing concrete topping, and shall not interfere with the existing structure. Scanning work must be co-ordinated with the City to ensure facility operations are not interrupted.
- .8 Disconnect electrical and telephone service lines entering areas to be demolished. Co-ordinate and schedule disconnects with the City. Post warning signs on electrical lines and equipment which must remain energized to serve other properties during period of demolition.
- .9 Disconnect and cap mechanical services in accordance with locations and requirements of local authority having jurisdiction and as follows:
 - .1 Sewer and water lines to be removed and capped by qualified tradesmen to prevent leakage in accordance with locations and requirements of authority having jurisdiction.
 - .2 Do not disrupt active or energized utilities designated to remain undisturbed.

3.2 DEMOLITION

- .1 Demolish structures and parts of structures to permit construction of renovations indicated.
- .2 Provide openings in non-structural elements of work for penetrations of mechanical and electrical work.
- .3 Execute work by methods to avoid damage to other work, and which will provide proper surfaces to receive patching and finishing.

- .4 Cut rigid materials using masonry saw or core drill. Pneumatic or impact tools not allowed on masonry work without prior approval of the City.

3.3 REPAIR/RESTORATION

- .1 Where penetrations through existing walls or floors result from removal or relocation of existing equipment, repair to standard of construction of surrounding material.
- .2 Refinish wall, ceiling and floor surfaces to match adjacent finished unless otherwise indicated.
- .3 Fit work to pipes, sleeves, ducts, conduit and other penetrations through surfaces.
- .4 Conceal pipes, ducts and wiring in floor, wall and ceiling construction of finished areas except where otherwise indicated.
- .5 Patch holes (abandoned and not required for future services) in existing walls, floor and roofs resulting from demolition and removal of mechanical pipes and or ducts and electrical services.

3.4 CLEANING AND WASTE MANAGEMENT

- .1 Cleaning in accordance with Section 01 74 11.
- .2 Waste Management and Disposal in accordance with Sections 01 74 19.
- .3 Equipment and re-useable items remain property of the City and must be stored as directed.
- .4 Maintain progressive cleaning of work and surrounding areas during renovations. Comply with provincial and local fire and safety laws, ordinances, codes, and regulations.
- .5 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 renovations are ready for occupancy.
- .6 When work is substantially performed, remove remaining waste materials, tools, equipment, machinery and surplus materials not required for performance of remaining work.
- .7 Provide final cleaning in accordance with ASTM E1971 and leave work clean and suitable for occupancy.

3.5 PROTECTION

- .1 Conduct demolition operations to prevent injury to people and damage to adjacent building areas.
 - .1 Ensure safe passage of people around demolition area.
 - .2 Provide temporary dust screens, barriers, warning signs in locations where renovation and alteration work is adjacent to occupied areas.
- .2 At end of each day's work, leave work in safe and stable condition so that no part is in danger of toppling or falling.

END OF SECTION

Part 1 General

1.1 RELATED WORK

- .1 Section 03 20 00 – Concrete reinforcing
- .2 Section 03 30 00 – Cast-in-place concrete
- .3 Section 03 35 10 – Sandblasting
- .4 Section 04 00 00 – Masonry
- .5 Section 05 12 00 – Anchor bolts, base plates, etc.
- .6 Section 05 31 00 – Steel decking
- .7 Section 05 50 00 – Metal fabrication to be embedded in concrete
- .8 Divisions 22 and 23 – Mechanical items to be embedded in concrete
- .9 Division 26 – Electrical items to be embedded in concrete

1.2 REFERENCE STANDARDS

- .1 American Concrete Institute (ACI)
 - .1 ACI 303.1-97 – Standard Specification for Cast-In-Place Architectural Concrete
 - .2 ACI 303R-12 – Guide to Cast-In-Place Architectural Concrete
- .2 American Society of Testing and Materials (ASTM)
 - .1 ASTM D412-16(2021) – Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers – Tension
 - .2 ASTM D624-00 (2020) – Standard Test Method for Tear Strength of Conventional Vulcanized and Thermoplastic Elastomers
 - .3 ASTM D1751-18 – Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
- .3 Canadian Standards Association (CSA)
 - .1 CAN/CSA-A23.1-19/A23.2-19 – Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete
 - .2 CSA S269.1-16 (R2021) – Falsework for Construction Purposes
- .4 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-51.34-M86 – Vapour Barrier, Polyethylene Sheet for Use in Building Construction

1.3 QUALITY ASSURANCE

- .1 Construct and erect concrete formwork in accordance with CAN/CSA-A23.1, and all applicable construction safety regulations for the place of Work.
- .2 Smooth architectural finishes:
 - .1 Formwork used for smooth architectural concrete finishes shall be in accordance with ACI 303.1 and ACI 303R.

- .2 Contractor shall submit proposed formwork materials and methods to Contract Administrator for review and approval prior to pouring concrete where smooth architectural finishes are required.
- .3 Proposed formwork materials and methods shall be submitted minimum two (2) weeks prior to commencement of concrete work to allow for Contract Administrator's review.

1.4 SHOP DRAWINGS

- .1 Submit shop drawings if requested for formwork and false-work for elevated concrete work, in accordance with Section 01 33 00, Submittals.
- .2 Each shop drawing submission shall bear the stamp and signature of a qualified professional engineer licensed in the Province of Manitoba.
- .3 Comply with CAN/CSA-S269.1 for formwork drawings and CSA S269.1 for falsework drawings.

Part 2 Products

2.1 WOOD FORM MATERIALS

- .1 Plywood: Douglas fir species sheathing, medium density, sound, undamaged sheets, with clean true edges.
- .2 Lumber: Spruce, shiplap species, #3 Grade, with grade stamp clearly visible.
- .3 Nails, spikes, lag bolts, through bolts, anchorages: sized as required, of sufficient strength and character to maintain formwork in place while pouring concrete.

2.2 PREFABRICATED FORMS

- .1 Steel type: tight fitting, and adequately stiffened to support weight of concrete without deflection detrimental to structural tolerances and appearances of finished concrete surfaces.
- .2 Tubular column type: round, spirally wound, laminated fibre material, internally treated with release agent, of sizes required.
- .3 Tubular column type for sand-blast finish: Poli-Perma Form Fibre Tubes as manufactured by Perma Tubes Ltd., and distributed by Specialty Construction Products Ltd. All tubes shall be of spiral construction with wall thicknesses as indicated. All tubes have a plastic liner on the inner ply to prevent the transfer of spiral markings to the concrete. The outer surface shall be treated with wax to improve its weather and moisture resistance.

2.3 FORMWORK FOR SMOOTH ARCHITECTURAL FINISH

- .1 Formwork for smooth architectural finish concrete shall meet the following requirements, and be acceptable to Contract Administrator:
 - .1 Form face, form liner and molds shall produce a smooth finished surface.
 - .2 Forms shall be new. Previously used and cleaned forms shall not be acceptable.
 - .3 Board formed finishes shall not be acceptable.
 - .4 Mylar faced forms will be acceptable for use.

2.4 FORMWORK ACCESSORIES

- .1 Form ties: removable, snap-off metal type, of adjustable length, free of devices that will leave holes larger than 25mm (1") diameter in concrete surface.
- .2 Form ties for smooth architectural finish concrete: form ties shall be type required to minimally affect the smooth finish of the finished concrete face. Washers shall not be used with snap ties.
- .3 Form stripping agent: colourless mineral oil, which will not stain concrete or impair natural bonding or colour characteristics of coating intended for use on concrete.
- .4 Form stripping agent (at waterproofing): to be compatible with membrane waterproofing, to ensure bonding.
- .5 Fillets for chamfered corners: type 25mm x 25mm (1" x 1") size, of maximum possible lengths.

2.5 CONCRETE ACCESSORIES

- .1 Polyethylene: to CAN/CGSB-51.34, 0.150mm (6 mil) thickness, minimum, unless indicated otherwise.
- .2 Void forms: shall be honeycomb type, wax coated, biodegradable cardboard, 150mm (6") thick, treated to provide sufficient structural support for concrete until concrete is cured.
- .3 Hardboard: shall be 3mm (1/8"), untempered hardboard.
- .4 Water stops: ribbed, extruded PVC, of sizes as indicated to following properties:
 - .1 Tensile strength: to ASTM D412, Die "C" method
 - .2 Elongation: to ASTM D412, Die "C" method
 - .3 Tear resistance: to ASTM D624, Die "B" method, minimum 275%
- .5 Waterstop: controlled expansion adhesive sealing gasket. Standard of acceptance: ConSeal CS-231 Waterstop, as distributed by Specialty Construction Products Ltd.
- .6 Joint filler:
 - .1 Exposed locations: Styrene Expansion Joint Cap, sizes required, as distributed by Specialty Construction Products Ltd.
 - .2 Concealed locations: pre-molded, bituminous impregnated fibreboard, to ASTM D1751.

Part 3 Execution

3.1 FORMWORK ERECTION

- .1 Verify lines, levels and centres before proceeding with formwork. Ensure that dimensions agree with drawings. Notify the Contract Administrator of discrepancies.
- .2 Construct formwork, shoring, and bracing to meet design and code requirements, accurately, so the resultant finished concrete conforms to shapes, lines and dimensions indicated on drawings.
- .3 Arrange and assemble formwork to permit easy dismantling and stripping, so that concrete is not damaged during its removal.

- .4 Arrange forms to allow stripping without the removal of principal shores, where these are required to remain in place.
- .5 Shoring shall be supported to grade.
- .6 Provide bracing to ensure stability of formwork as a whole. Prop or strengthen all previously constructed parts liable to be overstressed by construction loads.
- .7 Align joints and make watertight to prevent leakage of mortar and disfigured appearance of concrete. Keep form joints to minimum.
- .8 Obtain Contract Administrators review before framing openings in structural members, which are not indicated on drawings.
- .9 Construction joints shall be of the type and at a location acceptable to the Contract Administrator.
- .10 Provide chamfer strips on external corners of beams and drop panels (where exposed).
- .11 Construct formwork to maintain the following tolerances:
 - .1 Deviation from horizontal and vertical lines 6mm in 3m (1/4" in 10ft)
 - .2 Deviation of building dimensions indicated on drawings and position of columns, walls, and partitions of 6mm (1/4")
 - .3 Deviation in cross-sectional dimensions of columns or beams, or in thicknesses of slabs and walls \pm 6mm (1/4")
- .12 Camber slabs and beams 6mm per 3m (1/4" per 10ft) of span, unless otherwise indicated on drawings.
- .13 Apply form release agent on formwork in accordance with the manufacturer's directions. Apply prior to placing reinforcing steel, anchoring devices and embedded parts. Do not apply form release agent where concrete surfaces are to receive special finishes or applied coverings, which are affected by agent. Soak inside surfaces of untreated forms with clean water. Keep surfaces wet prior to placing concrete.
- .14 Exterior grade beam bottoms to be formed with void forms supported on grade. Where beam bottom is above existing grade level, filling, leveling and compaction to be completed before forming is placed.
- .15 Install 0.150mm (6 mil) polyethylene slip-sheet under exterior concrete slabs-on-grade.
- .16 Install 0.150mm (6 mil) polyethylene vapour barrier under interior concrete slabs-on-grade. Lap and seal joints and tears.

3.2 INSERTS/EMBEDDED PARTS/OPENINGS

- .1 Provide formed opening where required for pipes, conduits, sleeves, and other Work to be embedded in and passing through concrete members.
- .2 Accurately locate and set in place items, which are to be cast directly into concrete.
- .3 Coordinate work of other sections and cooperate with trade involved in forming and/or setting openings, slots, recesses, chased, sleeves, bolts, anchors and other inserts. Do not perform Work unless specifically indicated on drawings or approved prior to installation.

- .4 Install all concrete accessories in accordance with drawings and manufacturer's recommendations, straight, level and plumb. Ensure items are not disturbed during concrete placement.
- .5 Provide temporary ports or openings in formwork where required to facilitate cleaning and inspection. Locate openings at bottom of forms to allow flushing water to drain. Close temporary ports or openings with tight-fitting panels, flush with inside face of form, neatly fitted so that joints will not be apparent in exposed concrete surfaces.
- .6 Install continuous waterstops where indicated and to manufacturer's instructions. Do not distort or pierce waterstop to hamper performance. Do not displace reinforcement when installing waterstops. Only straight butt welds permitted in field. All other heat welds to be performed at factory by manufacturer.
- .7 Locate and form expansion joints as indicated. Install joint filler to manufacturer's instructions. Unless otherwise indicated, use 13mm (1/2") thick joint filler to separate slabs-on-grade from vertical surfaces. Extend joint filler from bottom of slab to within 13mm (1/2") of finished slab surface.

3.3 FIELD QUALITY CONTROL

- .1 Inspect and check completed formwork, shoring and bracing to ensure that Work is in accordance with formwork design, and that supports, wedges, fastenings, ties and parts, are secure.
- .2 Inform Contract Administrator when formwork is complete and has been cleaned to allow for inspection.

3.4 CLEANING

- .1 Clean forms as erection proceeds to remove foreign matter. Remove cuttings, shavings and debris from within forms. Flush completely with water to remove remaining foreign matter. Ensure that water and debris drain to exterior through cleanout ports.
- .2 During cold weather, remove ice and snow from within forms. Do not use de-icing salts. Do not use water to clean out complete forms, unless formwork and concrete construction proceed within heated enclosure. Use compressed air, or other means, to remove foreign matter.

3.5 FORM REMOVAL

- .1 Notify Contract Administrator prior to removing formwork.
- .2 Do not remove forms and bracing until concrete has gained sufficient strength to carry its own weight, construction loads, and design loads, which are liable to be imposed upon it. Verify strength of concrete by compressive test results.
- .3 Remove formwork progressively and in accordance with code requirements and so that no shock loads or unbalance loads are imposed on the structure.
- .4 Loosen forms carefully. Do not wedge pry bars, hammers or tools against concrete surfaces.

- .5 Leave forms loosely in place, against vertical surfaces, for protection until complete removal is acceptable to the Contract Administrator.
- .6 Re-shore structural members where required due to design requirements or construction conditions and as required to permit progressive construction. Remove load-supporting forms only when concrete has attained seventy-five percent (75%) of required 28 day compressive strength, provided construction is re-shored.
- .7 Remove forms not directly supporting weight of concrete as soon as stripping operations will not damage concrete.
- .8 If void forms are plastic wrapped, the plastic shall be punctured after the concrete is set, and the void form shall be soaked with a water hose.
- .9 Remove sonotube forms to permit review of concrete Work, and to reduce potential for mould growth.
- .10 Remove forms in accordance with table below:

	Concrete Curing Temperatures (°C)		
	21 – 35	16 – 21	10 – 16
Walls, columns, and beam sides	2 days	3 days	4 days
Beam soffits, slabs, and other structural members	14 days	17 days	21 days

- .11 Break off ties at surfaces to be sand-blasted and paint with a two (2) component grey epoxy paint.

END OF SECTION

Part 1 General

1.1 RELATED WORK

- .1 Section 03 10 00 – Concrete formwork
- .2 Section 03 30 00 – Cast-in-place concrete
- .3 Division 4 – Placing reinforcing for masonry

1.2 REFERENCES

- .1 American Concrete Institute (ACI)
 - .1 ACI 315 – Manual of Standard Practice
- .2 Canadian Standards Association (CSA)
 - .1 CAN/CSA-A23.1-19/A23.2-19 – Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete
 - .2 CSA A23.3-19 – Design of Concrete Structures
 - .3 CAN/CSA-G30.18-21 – Carbon Steel Bars for Concrete Reinforcement

1.3 QUALITY ASSURANCE

- .1 Perform concrete reinforcing Work in accordance with CAN/CSA-A23.1, unless otherwise indicated otherwise herein.

1.4 TEST REPORTS

- .1 Upon request, provide Contract Administrator with certified copy of mill test report of steel supplied, showing physical and chemical analysis.

1.5 SHOP DRAWINGS

- .1 Submit shop drawings clearly indicating bar sizes, spacing, location and quantities of reinforcement, splice locations, mesh, chairs, spacers and hangers with identifying code marks to permit correct placement without reference to structural drawings, to ACI 315.
- .2 Detail placement of reinforcing where special conditions occur.
- .3 Reproductions of Contract Drawings will not be accepted for use as shop drawings.

Part 2 Products

2.1 REINFORCING

- .1 Reinforcing steel: 400MPa yield grade, deformed billet-steel bars, conforming to requirements of CAN/CSA-G30.18, sizes as indicated on drawings, free from flaws, cracks or other defects of rolling.
- .2 Welded steel wire fabric: plain type, sizes as indicated on drawings, flat sheets.

2.2 ACCESSORY MATERIALS

- .1 Chairs, bolsters, bar supports, spacers: adequately sized and shaped for strength and support of reinforcing during construction conditions.

2.3 FABRICATION

- .1 Fabricate concrete reinforcing in accordance with drawings and CAN/CSA-A23.1 and ACI 315.
- .2 Locate reinforcing splices, not indicated on drawings, at points of minimum stress. Location of splices shall be subject to Contract Administrator's review.
- .3 Obtain Contract Administrator's written approval for locations of reinforcement splices other than those shown on placing drawings.
- .4 Upon approval of Contract Administrator, weld reinforcement in accordance with CSA W186.
- .5 Ship bundles of bar reinforcement, clearly identified in accordance with bar bending details and lists.

2.4 SOURCE QUALITY CONTROL

- .1 Upon request, provide Contract Administrator with certified copy of mill test report of reinforcing steel, showing physical and chemical analysis.
- .2 Upon request inform Contract Administrator of proposed source of material to be supplied.

Part 3 Execution

3.1 FIELD BENDING

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

3.2 REINFORCING STORAGE AND PROTECTION

- .1 Reinforcing steel shall be delivered and stored on site, above grade on a raised platform, in such a manner as to avoid deformation or damage. Steel shall be kept dry, free from rust, mud, clay, or other foreign materials. Storage shall be executed so that no injury or damage can occur to persons, property, other material, or to the structure.
- .2 All reinforcement steel and accessories shall be neatly bundled and tagged.
- .3 Reinforcing steel shall be delivered in accordance with the concrete sections schedule.

3.3 PLACEMENT

- .1 Place reinforcing as indicated on drawings, adequately supported and secured against displacement, with proper accessories. Do not deviate from true alignment.

- .2 Before placing concrete, ensure reinforcing is clean, free from loose scale, dirt, or other foreign coatings, which would reduce the bond to concrete.
- .3 A competent mechanic, more if necessary, shall be exclusively and continuously employed, before and during pouring, in the correcting and replacing of reinforcement and other members embedded, which may have become displaced, and shall keep just ahead of pouring. Reinforcement shall be rigidly wired together at all intersections and carefully maintained in exact positions and clearance, both horizontally and vertically.
- .4 No field cutting or welding of reinforcing shall be permitted unless authorized by the Contract Administrator.
- .5 Supply masonry reinforcing for placement by Division 4, in time for incorporation into the Work.

3.4 DOWELING PROCEDURES

- .1 For bars that are indicated as being dowelled, drill in and grout bars into slab as follows:
 - .1 10M bars, 150 mm
 - .2 15M bars, 200 mm
 - .3 20M bars, 300 mm
- .2 Use only approved adhesive to manufacturer's instructions. Acceptable product:
 - .1 Hilti HIT HY-200 by Hilti Canada.
- .3 Clean hole thoroughly prior to application of adhesive. Use injection or caulking gun to ensure that the adhesive fills the bottom of the hole prior to embedment of bar.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

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

1.2 REFERENCES

- .1 Canadian Standards Association (CSA)
 - .1 CSA-A23.1/A23.2-09, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
 - .2 CAN/CSA-A3000-08, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005)
 - .3 CSA A283-06, Qualification Code for Concrete Testing Laboratories.
- .2 American Concrete Institute (ACI)
 - .1 ACI 309R-96, Guide for the Consolidation of Concrete.
- .3 American Society for Testing and Materials International (ASTM)
 - .1 ASTM C260/C260M-10a (2016), Specification for Air-Entraining Admixtures for Concrete.
 - .2 ASTM C309-19, Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
 - .3 ASTM C494/C494M-17 Standard Specification for Chemical Admixtures for Concrete.
 - .4 ASTM C928/C928M-20a, Standard Specification for Packaged, Dry, Rapid-Hardening Cementitious Materials for Concrete Repairs.
- .4 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-51.34-M86(R1988), Vapour Barrier, Polyethylene Sheet for Use in Building Construction.

1.3 MEASUREMENT PROCEDURES

- .1 No measurement will be made under this section for cast-in-place concrete curbs and pavement.
- .2 Include all costs for concrete required for concrete repairs in appropriate unit prices.

1.4 CERTIFICATES

- .1 Provide certification that mix proportions selected will produce concrete of quality, yield and strength as specified in concrete mixes, and will comply with CSA-A23.1. Certification letter to be sealed by an engineer registered in the Province of Manitoba.
- .2 Provide certification that plant, equipment, and materials to be used in concrete comply with requirements of CSA-A23.1. Certification letter to be sealed by an engineer registered in the Province of Manitoba.

- .3 Provide certification that plant, equipment, and materials to be used in concrete comply with requirements of CSA-A23.1. Certification letter to be sealed by an engineer registered in the Province of Manitoba.

1.5 QUALITY ASSURANCE

- .1 Minimum 4 weeks prior to starting concrete work, submit proposed quality control procedures for review by Contract Administrator on following items:
 - .1 Falsework erection.
 - .2 Hot weather concrete.
 - .3 Cold weather concrete.
 - .4 Curing.
 - .5 Finishes.
 - .6 Formwork removal.
 - .7 Joints.

Abbreviations

- .2 Cement: hydraulic cement or blended hydraulic cement (XXb - where b denotes blended).
 - .1 Type GU or GUb - General use cement.
 - .2 Type CI - with CaO content ranging from 8 to 20%.
- .3 SCM – Supplemental cementing materials.
- .4 SSD - Saturated surface dry.
- .5 WRA – Water reducing agent.

1.6 DELIVERY, STORAGE AND HANDLING

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

Part 2 Products

2.1 MATERIALS

- .1 The concrete constituents shall comply with the following standards:
 - .1 Cement: to CAN/CSA-A3001.
 - .2 Blended Hydraulic cement: to CAN/CSA-A3001.
 - .3 Supplementary cementing materials: to CAN/CSA-A3001.
 - .4 Water: To CSA-A23.1.
 - .5 Aggregates: to CSA-A23.1. Coarse aggregates to be normal density.
 - .6 Air entraining admixture: ASTM C260.
 - .7 Chemical admixtures: ASTM C494/C494M. Contract Administrator to approve accelerating or set retarding admixtures during cold and hot weather.

2.2 ACCESSORIES

- .1 Vapour Barrier: 10 mil polyethylene film to CAN/CGSB-51.34.
- .2 Floor Cleanouts for Weeping Tile Access.
 - .1 Adjustable floor cleanout c/w lacquered cast iron body, secondary closure plug, scoriated combined cover and nickel bronze top assembly with stainless steel vandal proof (T-20 torx and pin) security screws. Pipe size to accommodate 150 mm dia. weeping tile.
 - .2 Install floor cleanouts flush with Elevation 100 000 floor slabs at locations indicated to provide access to weeping tile.
 - .3 Acceptable Products.
 - .1 Mifab C1220 Series (top assembly design) Floor Cleanout with Adjustable Cover and Secondary Closure Plug, Nickel Bronze Top Assembly, T-20 Torx and Pin Security Screws.

2.3 GRANULAR BASE

- .1 Comply with the specifications contained in the geotechnical report.

Part 3 Execution

3.1 PREPARATION

- .1 Obtain Contract Administrator's approval before placing concrete. Provide 48 hours notice prior to placing of concrete.
- .2 Ensure reinforcement and inserts are not disturbed during concrete placement.
- .3 Prior to placing of concrete obtain Contract Administrator's approval of proposed method for protection of concrete during placing and curing in adverse weather.
- .4 Maintain accurate records of poured concrete items to indicate date, location of pour, quality, air temperature and test samples taken.
- .5 In locations where new concrete is dowelled to existing work, drill holes in existing concrete. Place steel dowels of deformed steel reinforcing bars and epoxy grout to anchor and hold dowels in positions as indicated. Refer to Section 03 20 00.
- .6 Do not place load upon new concrete until authorized by Contract Administrator.
- .7 Provide formwork and falsework to Section 03 10 00 - Concrete Forms and Accessories.
- .8 Place reinforcing steel and install dowels to Section 03 20 00 - Concrete Reinforcement. Provide dowels at locations shown on the drawings.
- .9 Provide temporary bridging as required to permit access to all areas during placement, finishing and curing.
- .10 Do not place concrete until screed rails for hand operated strike-off devices are in place and firmly secured.

- .1 Rails to be of type, and so installed, that no springing or deflection will occur due to weight of finishing equipment.
- .2 Set rails or headers to elevations to produce deck true to required grade and cross section.
- .3 Use polyethylene film or plastic coated tape if necessary to prevent concrete from bonding to rails.
- .4 Do not treat rails with release agents or parting compounds.
- .5 Subject to approval of the Contract Administrator, screed rail anchors which remain in the concrete may be used provided they are non-corroding and sit a minimum of 30 mm below the finished surface of the concrete.

3.2 MIX PRODUCTION

- .1 Concrete to be mixed, delivered and placed in accordance with CSA A23.1.
- .2 Concrete to be batched and mixed at a ready mix plant and delivered to site in ready to place form.
- .3 Control of slump on the job site to be in accordance with CSA-A23.1 except as otherwise specified below:
 - .1 The addition of water to increase slump is strictly prohibited unless prior written permission from concrete supplier is obtained.
 - .2 The use of WRA may be required to aid in placement of the concrete and obtain adequate consolidation in heavily reinforced sections.
 - .3 WRA addition shall occur at the batch plant or on site. For site addition, concrete supplier to provide written notice minimum 2 weeks prior to commencement of concrete work, indicating recommended dosages based on slump at point of discharge.
 - .4 Site addition WRA will be the responsibility of the concrete supplier.
 - .5 Slump and air must be measured both before and after addition of WRA.

3.3 PLACEMENT

- .1 Place concrete work in accordance with CSA-A23.1.
- .2 When concrete is placed by pump, the initial slurry used to prime the pump shall not be incorporated into the pour. The slurry shall be trapped and disposed off-site.
- .3 Ensure high points and slopes to drains as shown on drawings are maintained.
- .4 Pour concrete continuously between predetermined construction and control joints. Do not break or interrupt successive pours such that cold joints occur. Install a construction dam or bulkhead in case of a delay longer than 60 minutes. During delays between 5 and 60 minutes, protect the end of the placement with damp burlap.
- .5 Protect freshly placed concrete from exposure to dust, debris and precipitation.
- .6 Sleeves and inserts.
 - .1 No sleeves, ducts, pipes or other openings shall pass through concrete members except where indicated or approved by Contract Administrator.

- .2 Electrical conduits, junction and fixture boxes shall not be embedded within concrete members.
- .3 Sleeves and openings greater than 100 x 100 mm not indicated, must be approved by Contract Administrator.
- .4 Do not eliminate or displace reinforcement to accommodate hardware. If inserts cannot be located as specified, obtain approval of modifications from Contract Administrator before placing of concrete.
- .5 Check locations and sizes of sleeves and openings shown on drawings.
- .6 Set special inserts for strength testing as indicated and as required by non-destructive method of testing concrete.
- .7 Notify all trades sufficiently in advance to ensure provision is made for openings, inserts and fasteners.
- .8 Ensure reinforcement, inserts, and embedded parts are not disturbed during concrete placement.
- .9 Ensure all anchors, seats, plates and all other items to be cast into concrete are placed, held securely, and will not cause undue hard-ship in placing concrete. Rectify same and proceed with Work.
- .10 No water may be added after the initial introduction of mixing water for the batch.
- .11 Maintain concrete cover around reinforcing as indicated on the drawings.
- .12 Conveying equipment shall not impart harmful shock or vibration to fresh concrete, or cause misalignment of forms. All conveying and placing equipment shall be kept clean of hardened concrete and foreign materials at all times. Carts, wheelbarrows, etc., shall not be run directly over reinforcing.
- .13 Concrete shall be placed in its final position as soon as possible after mixing and must be in place within 1.5 hours after the water has been added to the dry materials. Any concrete sitting more than 1.5 hours since mixing cement and water, or having a partial set before placing, shall not be used.
- .14 Any concrete that splashes or otherwise coats reinforcing, which is not to be cast within 2 hours shall be cleaned off.
- .15 Pour concrete continuously between predetermined construction and control joints. Do not “break” or interrupt successive pours, such that “cold” joints occur.
- .16 The vertical height of free fall of concrete shall not exceed 1500mm (5ft). For greater falls, concrete shall be deposited by chute or spout to prevent segregation of material.
- .17 The use of high-frequency internal vibrators is mandatory for all concrete work on this job and the use of such shall strictly conform to CAN/CSA-A23.1, Section 19.
- .18 Provide concrete for placement by Division 4 in masonry lintels, bond beams, columns, and at steel beam bearings. Refer to drawings.

3.4 FINISHING

- .1 Finish concrete in accordance with CSA-A23.1/A23.2.

- .2 Consolidate concrete in accordance with CSA A23.1 and ACI 309.
- .3 Under adverse conditions only, excess bleed water may be removed from the surface using procedures acceptable to Contract Administrator and those noted in CSA-A23.1. Ensure surface is not damaged.
- .4 Immediately after final finishing apply approved evaporation retardant at indicated coverage rate. Evaporation retardant is not to be applied during finishing operations nor should it be worked into the surface.
- .5 Flatwork:
 - .1 Continuously consolidate and finish to specified elevations, ensuring thickness and required elevations are maintained.
 - .2 Use of a floating vibratory screed to consolidate the top surface of the concrete will be mandatory.
 - .1 The use of screed rails may be required to meet required surface tolerances.
 - .2 Move vibrating screed forward as rapidly as possible while allowing proper consolidation and finishing of the concrete surface. Extended use of a vibratory screed may result in segregation of the concrete producing excessive mortar at the surface which can result in a weak surface layer.
 - .3 Immediately after concrete has been placed and consolidated, bull-float slab surface to a smooth uniform surface.
 - .4 When the surface is sufficiently set to accommodate the weight of a person with only minor indentation of the surface, and all bleed water has evaporated, **use one pass of a power float surface to smooth out the surface**. A light hand trowel will then be necessary to smooth out irregularities and provide a hard, dense surface.
 - .5 Use of hand trowels will be required to hand finish areas the finishing machine cannot reach.
 - .6 Surface free of all trowel marks and ridges.
- .6 Vertical Formed Surface
 - .1 Where applicable finishing of formed surfaces shall commence immediately after stripping the forms.
 - .2 All form ties and other metal items shall be removed or cut back to a depth of at least 20 mm from the surface of the concrete.
 - .3 Patch surface defects as directed by Contract Administrator.
 - .4 Unless otherwise indicated in the Schedule of Finishes all formed surfaces shall receive a smooth-form finish in accordance with CSA-A23.1.
 - .5 Vertical surfaces of curbs, walls, upstands, etc. shall receive a smooth-rubbed finish in accordance with CSA A23.1.
 - .6 Rub exposed sharp edges of concrete with carborundum to produce 3 mm radius edges unless otherwise indicated.

3.5 JOINTS

- .1 Install control joints at locations shown on the drawings. Joints shall correspond to location of slip dowels.
- .2 Location of control and construction joints:
 - .1 Concrete pavements: As shown on Drawings.

- .2 Other flatwork not shown on drawings: not more than 4.5m on-centre and matching joints in adjacent work.
- .3 Control joints in upstand walls and curbs to be formed matching joints in adjacent work (no more than 4.5m on-centre) and using a 12mm x 12mm form strip on each face. Tool in joints along top surface corresponding to form strips.
- .3 Control joints and construction joints shall be formed or tooled at locations shown. Refer to Drawings for paving patterns and joint locations.
 - .1 All joints to be sawcut via specialized dry-process cutting.
 - .1 Sawcut to a minimum of 38mm or one-quarter of the depth of the slab, whichever is greater, following initial set of concrete.
 - .2 Timing of the saw cutting will vary with weather conditions however are typically completed within 1 to 4 hours after final finishing. Timing of the saw cutting will be the responsibility of the Contractor. Sawcutting 24 hours following placement will not be permitted.
- .4 Where paving abuts curbs, walls and other vertical surfaces use 12 mm asphalt impregnated fibre board.
- .5 Unless otherwise indicated, all control and construction joints to be filled with a flexible joint sealant in accordance with 07910.

3.6 CURING

- .1 Cure and protect concrete in accordance with requirements CSA A23.1.
- .2 Concrete surfaces to be cured at a minimum temperature of 10°C for the entire curing period.
- .3 Curing methods shall be in accordance with CSA A23.1 unless otherwise indicated.
 - .1 Basic curing methods shall consist of one of the following:
 - .1 polyethylene sheet;
 - .2 forms in contact with concrete surface; or
 - .3 curing compounds to ASTM C309 at manufacturer's specified applications rates, when approved by Contract Administrator.
 - .2 Requirements for wet-curing:
 - .1 Immediately after final finishing, protect exposed surface against plastic shrinkage by means of a fog spray and/or evaporation reducer, until the concrete has enough strength to support the placement of the wetted burlap. When an evaporation reducer is used, intermittent reapplication may be required if the film evaporates before initiation of the wet cure.
 - .2 Burlap to be thoroughly presoaked by immersing it in water for a period of at least 24 hours immediately prior to placement.
 - .3 Commence wet curing with burlap and water as soon as the surface will support the weight of the wetted burlap without deformation. Burlap to be applied in one layer with strips overlapping at least 75 mm and be securely held in place without marring the concrete surface.
 - .4 Wet curing with burlap and water must be maintained for the periods indicated. Periodic rewetting by means of a soaker hoses, sprinklers, or other suitable methods approved by the Contract Administrator may be necessary.

- .4 Curing Schedule:
 - .1 Structural concrete work, curbs, etc.
 - .1 7d at $\geq 10^{\circ}\text{C}$ and for time necessary to attain 70% of the specified strength with a **wet-curing period of not less than 4d**.
 - .2 Concrete paving slabs, slabs-on-grade, sidewalks, and exposed curbs subject to foot or vehicular traffic:
 - .1 7d at $\geq 10^{\circ}\text{C}$ and for time necessary to attain 70% of the specified strength with a **wet-curing period of not less than 3d** followed by the application of a cure and sealing compound.
- .5 Unless noted otherwise the curing regime shall be consistent with the Class of Exposure. Refer to related sections for curing of concrete repair materials.

3.7 COLD WEATHER CONCRETING

- .1 The following items are minimum requirements for protecting concrete during and after placement in freezing weather. Except as follows, concrete curing and protection to be in accordance with CAN/CSA-A23.1, Section 21.
- .2 Before any concrete is placed, all ice, snow, and frost shall be completely removed from all formwork and other surfaces against which concrete shall be placed, and temperature of such surfaces shall be raised to and maintained at 5°C minimum, prior to and during concreting. Where concrete Work is to come in contact with earth, the surfaces of the earth shall be completely free of frost when the concrete is placed thereon.
- .3 Concrete aggregates and water shall be heated to not over 80°C . Concrete shall not be less than 20°C nor more than 30°C in temperature when deposited. Concrete when placed during freezing weather (or if freezing is anticipated during curing period) shall be fully enclosed, and the temperature of same maintained at no less than 20°C for three (3) days and not less than 5°C for an additional four (4) days.
- .4 All protecting coverings shall be kept clear of the concrete and form surfaces to permit full circulation of air, and shall be maintained intact for at least 24 hours after the artificial heat is discontinued.
- .5 Heating enclosures shall be strong and windproof but, well ventilated, and heating units so located as to prevent local overheating, drying of the concrete, or damage from combustion gasses. Units must be vented outside the building. No direct-fired units will be acceptable.

3.8 FIELD QUALITY CONTROL

- .1 Inspection and testing of concrete and concrete materials will be carried out by a Testing Laboratory designated by Contract Administrator in accordance with CSA-A23.1 and Section 01450 - Quality Control and as described herein.
 - .1 Testing laboratory to be certified in accordance with CSA A283.
- .2 The Contractor will pay for costs of tests via the testing cash allowance as per Section 01210 - Allowances.
- .3 Frequency and Number of Tests:

- .1 Not less than one strength test per 50 m³ of concrete placed and not less than one test for each class of concrete placed on any one day.
- .2 Slump and air measurements will be completed on each of the initial 3 loads of concrete per day of casting to ensure satisfactory control of the air content is established. If adequate control of air content is not established within the first 3 loads of concrete or if a test falls outside the specified limits, the testing frequency shall revert to one test per load until satisfactory control is re-established. Costs for additional testing will be the responsibility of the concrete supplier.
- .4 Contract Administrator may take additional test cylinders during cold weather concreting or when concrete quality is suspect. Cure cylinders on job site under same conditions as concrete which they represent.
- .5 Non-destructive Methods for Testing Concrete shall be in accordance with CSA-A23.2.
- .6 Inspection or testing by Contract Administrator will not augment or replace Contractor quality control nor relieve contractual responsibility.

3.9 DEFECTIVE CONCRETE

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

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 03 30 00 – Cast-in-place Concrete.

1.2 REFERENCES

- .1 American Society for Testing and Materials (ASTM).
 - .1 ASTM C109/C109M-20b, 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 (WHMIS).

1.3 SUBMITTALS

- .1 Product Data.
 - .1 Submit product data in accordance with Section 01 33 00.
 - .2 Provide 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.
 - .3 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 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 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 in accordance with Section 01 45 00.
 - .2 Locate mock-up on site as part of final installation. Mock-up will be reviewed for quality of workmanship and overall appearance.
 - .3 Once approved, mock-up will set standard of acceptance for remaining installations.
 - .4 Do not proceed with concrete surface hardener/sealer installation until mock-up area is complete and approved by Contract Administrator.

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.
- .5 Waste Management and Disposal in accordance with Section 01 74 19.

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 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 MANUFACTURERS

- .1 Basis of Design Products.
 - .1 Concrete Surface Hardener/Sealer.
 - .1 BASF MasterKure HD 200WB Hardening, Sealing and Dustproofing Compound.
- .2 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes of the Bidding Procedures*.
- .3 Supply all products from single manufacturer.

2.2 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, VOC content: none, colour: clear.

Part 3 Execution

3.1 INSTALLATION

- .1 Concrete Surface Hardener/Sealer.
 - .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-aggressive 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 SECTION INCLUDES

- .1 Floor and roof planks.
- .2 Connection plates, brackets, and hangers.
- .3 Grouting plank joint keys.

1.2 RELATED SECTIONS

- .1 Section 03 30 00 - Cast-in-place Concrete.

1.3 REFERENCES

- .1 American Society for Testing and Materials (ASTM)
 - .1 ASTM A 775/A 775M-19 Standard Specification for Epoxy-Coated Reinforcing Steel Bars.
 - .2 ASTM C 260, Standard Specification for Air-entraining Admixtures for Concrete.
 - .3 ASTM C 494/C 494M-08a, Standard Specification for Chemical Admixtures for Concrete.
 - .4 ASTM D 412, Standard Test Methods for Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers - Tension.
 - .5 ASTM D 2240, Standard Test Method for Rubber Property - Durometer Hardness.
 - .6 ASTM A 416, Standard Specification for Steel Strand, Uncoated Seven-Wire for Prestressed Concrete.
 - .7 ASTM A 185, Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete.
 - .8 ASTM A 82, Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-1.40, Anticorrosive Structural Steel Alkyd Primer.
 - .2 CAN/CGSB-1.181, Ready Mixed Organic Zinc-Rich Coating.
- .3 Canadian Standards Association (CSA)
 - .1 CAN/CSA-A3000, Cementitious Materials Compendium (Consists of A5, A8, A23.5, A362, A363, A456.1, A456.2, A456.3).
 - .2 CAN/CSA-A23.1/A23.2, Concrete Materials and Methods of Concrete Construction/Methods of Test for Concrete.
 - .3 CAN3-A23.3, Design of Concrete Structures for Buildings.
 - .4 CAN3-A23.4/A251, Precast Concrete - Materials and Construction/Qualification Code for Architectural and Structural Precast Concrete Products.
 - .5 CAN/CSA-A23.5, Supplementary Cementing Materials.
 - .6 CSA-A3000, Cementitious Materials Compendium.
 - .7 CAN/CSA-G30.18, Billet-Steel Bars for Concrete Reinforcement.
 - .8 CAN/CSA-G40.20/G40.21, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
 - .9 CAN/CSA-G164, Hot Dip Galvanizing of Irregularly Shaped Articles.

- .10 CSA - G279, Steel for Prestressed Concrete Tendons.
- .11 CSA-W47.1, Certification of Companies for Fusion Welding for Steel Structures.
- .12 CSA-W48.01, Filler Metals and Allied Materials for Metal Arc Welding
- .13 CSA W55.3, Resistance Welding Qualification Code for Fabricators of Structural Members Used in Buildings.
- .14 CSA-W59, Welded Steel Construction (Metal Arc Welding).
- .15 CSA-W186, Welding of Reinforcing Bars in Reinforced Concrete Construction.
- .4 American Concrete Institute (ACI)
 - .1 ACI 303R, Guide to Cast-in-Place Architectural Concrete Practice.
- .5 Canadian Precast/Prestressed Concrete Institute (CPCI)
 - .1 Design Manual (4th edition) – Precast and Prestressed Concrete
- .6 UL - Underwriters' Laboratories Inc., Fire Resistance Directory.

1.4 DESIGN REQUIREMENTS

- .1 Size components to withstand design loads as indicated on the structural drawings.
- .2 Maximum Allowable Deflection of Floor Planks: $1/360$ span, cambered to achieve flat surface under dead load.
- .3 Design components to accommodate construction tolerances, deflection of other building structural members and clearances of intended openings.
- .4 Grouted Keys: Capable of transmitting a factored horizontal shear force of 10 kN/m minimum or as required by design.
- .5 Calculate structural properties of framing members in accordance with CSA A23.3.
- .6 Utilize the CPCI Design Manual.

1.5 TOLERANCES

- .1 Tolerance of precast elements to CAN3-A23.4, Section 10.
- .2 Length of precast elements not to vary from design length by more than plus or minus 25 mm.
- .3 Maximum variation from design camber shall be $L/1000$ but at no point greater than 20mm. Differential camber between adjacent slabs shall be a maximum of $L/600$ but at no point greater than 25 mm.

1.6 SUBMITTALS

- .1 Shop Drawings:
 - .1 Indicate plank locations, unit identification marks, connection details, edge conditions, bearing requirements, support conditions, dimensions, openings, openings intended to be field cut, camber, finishing schedules, methods of handling and erection, sleeves, inserts, and relationship to adjacent materials.
 - .2 Ensure each drawing submitted bears stamp and signature of qualified professional engineer licensed in province of Manitoba, Canada.
 - .3 Indicate design loads, deflections, and cambers.

- .2 Mock-up: Contract Administrator to be notified when first plank is cast to review surface finish.
- .3 Fabricator's Installation Instructions: Indicate special procedures, perimeter conditions requiring special attention.

1.7 QUALITY ASSURANCE

- .1 Maintain plant records and quality control program during production of precast planks. Make records available upon request.

1.8 QUALIFICATIONS

- .1 Precast concrete elements to be fabricated and erected by manufacturing plant certified by Canadian Standards Association in appropriate categories according to CSA-A251.
- .2 Precast concrete manufacturer to be certified in accordance with CSA's certification procedures for precast concrete plants prior to submitting tender and to specifically verify as part of tender that plant is currently certified in appropriate categories: Structural Prestressed.
- .3 Only precast elements fabricated in such certified plants to be acceptable to the City, and plant certification to be maintained for duration of fabrication, erection, and until warranty expires.
- .4 Welding companies certified to CSA-W47.1.
- .5 Design precast concrete members under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in the Province of Manitoba.

1.9 REGULATORY REQUIREMENTS

- .1 Conform to CSA 23.3 and the National Building Code of Canada 2020 amended by the Manitoba Building Code and any other applicable Codes and documents.

1.10 DELIVERY, STORAGE, AND HANDLING

- .1 Deliver, store, protect and handle products to site.
- .2 Lifting or Handling Devices: Capable of supporting member in positions anticipated during manufacture, storage, transportation, and erection.

1.11 COORDINATION

- .1 Coordinate the Work of framing components not tensioned but directly associated with the Work of this section.
- .2 Coordinate field cut openings with affected section.
- .3 Coordinate location of hanger tabs and devices for mechanical and electrical work.

1.12 WARRANTY

- .1 Contractor hereby warrants that precast element will not spall or show visible evidence of corrosion of embedded steel and cracking, except for normal hairline shrinkage cracks, in accordance with General Conditions, but for 10 years.

Part 2 Products

2.1 MATERIALS

- .1 Cement, aggregates, water, admixtures, colouring admixture: to CAN/CSA- A23.1 and CAN3-A23.4.
- .2 Cementitious materials: to CAN/CSA-A3000.
- .3 Use same brands and source of cement and aggregate for entire project to ensure uniformity of colouration and other mix characteristics.
- .4 Reinforcing steel: to CAN/CSA-G30.18, ASTM A775/A775M.
- .5 Prestressing steel tendons to CSA-G279.
- .6 Hardware and miscellaneous materials: to CAN/CSA-A23.1.
- .7 Forms: to CAN/CSA-A23.4/ A251.
- .8 Anchors and supports: to CAN/CSA G40.21, Type 350 W.
- .9 Welding materials: to CSA-W47.1.
- .10 Welding electrodes: to CSA-W48.1 and certified by Canadian Welding Bureau.
- .11 Galvanizing: hot dipped galvanizing with minimum zinc coating of 610 g/m² to CAN/CSA-G164.
- .12 Steel primer: to CAN/CGSB-1.40.
- .13 Zinc-rich primer: to CAN/CGSB-1.181.
- .14 Bearing pads: smooth, ultra-high molecular weight polyethylene plastic.
- .15 Air entrainment admixtures: to ASTM C260. The use of chloride containing admixtures is strictly forbidden.
- .16 Chemical admixtures: to ASTM C494/C494M.
- .17 Shims: smooth, ultra-high molecular weight polyethylene plastic.
- .18 Weephole tubes: purpose made plastic.

2.2 MIXES

- .1 Concrete.
 - .1 Proportion normal density concrete in accordance with CSA-A23.1-04, Alternative 1 to give properties as required by design.
- .2 Grout.
 - .1 Cement grout: 1 parts type 10 Portland cement, 2 parts sand, sufficient water for placement and hydration.
 - .2 Minimum compressive strength: 25 MPa.
 - .3 Shrinkage compensating grout: to Section 03 30 00 - Cast-in-Place Concrete.

2.3 MANUFACTURED UNITS

- .1 Manufacture units in accordance with CAN3-A23.4, and CSA-A251.

- .2 Mark each precast unit to correspond to identification mark on shop drawings for location with date cast on part of unit that will not be exposed.
- .3 Provide hardware suitable for handling elements.

2.4 FABRICATION

- .1 Embed anchors, inserts, plates, angles, and other items at locations indicated.
- .2 Provide openings required by other sections, at locations indicated.

2.5 COMPONENTS

- .1 Size as noted on structural drawings.

Part 3 Execution

3.1 EXAMINATION

- .1 Verify that site conditions are ready to receive work.
- .2 Verify supporting structure is ready to receive work.

3.2 PREPARATION

- .1 Prepare support devices for the erection procedure and temporary bracing.

3.3 ERECTION

- .1 Do precast concrete work in accordance with CAN3-A23.4 AND CAN3-A23.3.
- .2 Erect members without damage to structural capacity, shape, or finish. Replace or repair damaged members.
- .3 Align and maintain uniform horizontal and end joints, as erection progresses.
- .4 Maintain temporary bracing in place until final connection is made. Protect members from staining.
- .5 Install bearing pads.
- .6 Adjust differential camber between precast members to tolerance before final attachment and grouting.
- .7 Adjust differential elevation between precast members to tolerance before final attachment.
- .8 Grout plank joints, trowel smooth.
- .9 Prevent grout leakage.
- .10 Secure units in place. Perform welding in accordance with CSA W59.

3.4 ERECTION TOLERANCES

- .1 Erect members level and plumb within allowable tolerances.

3.5 PROTECTION OF FINISHED WORK

- .1 Protect finished Work.
- .2 Protect members from damage caused by field welding or erection operations.
- .3 Provide non-combustible shields during welding operations.

3.6 CLEANING

- .1 Clean weld marks, dirt, or blemishes from surface of exposed members.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 05 50 00 – Metal Fabrications.
- .2 Section 31 23 00 – Excavation, Trenching and Backfilling.
- .3 Section 07 11 19 – Sheet Dampproofing.
- .4 Section 33 46 13 – Foundation Drainage Piping.

1.2 REFERENCES

- .1 Canadian Standards and Association (CSA).
 - .1 CSA A23.4-16, Precast Concrete - Materials and Construction.
 - .2 CSA A231.1-19/A231.2-19, Precast Concrete Paving Slabs/Precast Concrete Pavers.

1.3 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.
- .3 Waste Management and Disposal in accordance with Section 01 74 19.

Part 2 Products

2.1 MANUFACTURERS

- .1 Basis of Design Products.
 - .1 Precast Concrete Sump Pit.
 - .1 Con-Force Structures Ltd.
 - .2 Lafarge Canada.
 - .2 Precast Concrete Slabs (crawlspaces and roof access ladders).
 - .1 Barkman Concrete #102557 Diamondface Slab.
 - .3 Precast Concrete Splash Pads.
 - .1 Barkman Concrete #105608, Natural.
- .2 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes* of the *Bidding Procedures*.
- .3 Supply similar products from single manufacturer.

2.2 MANUFACTURED UNITS

- .1 Precast Concrete Sump Pit.
 - .1 Interlocking precast concrete rings in accordance with CSA A23.4, 1200 mm inside dia. x modular lengths as required c/w galvanized ladder rungs.
- .2 Precast Concrete Slabs (crawlspaces and roof access ladders).
 - .1 Finish: diamond face.
 - .2 Size: 610 mm x 610 mm x 44 mm thick.
 - .3 Colour: Natural.

- .3 Precast Concrete Splash Pads.
 - .1 Size: 368 mm (14-1/2") wide x 1295 mm (51") long x 127 mm (5") high.
 - .2 Colour: Natural.

Part 3 Execution

3.1 INSTALLATION

- .1 Precast Concrete Sump Pits.
 - .1 Excavate for sump pit in accordance with Section 31 23 00. Provide compacted granular base. Install and level section of concrete pipe on granular base.
 - .2 Stack additional concrete pipe sections on base section of modular lengths as required to suit depth of sump pit.
 - .3 Install cast-in-place concrete slab inside precast pipe to elevation as indicated in accordance with Structural Drawings.
 - .4 Coordinate installation of drain inlets in accordance with Section 33 46 13.
 - .5 Backfill around concrete pipe in accordance with Section 31 23 00. Do not damage drain pipe.
 - .6 Install cast-in-place concrete pad around top of pipe in accordance with Structural Drawings.
 - .7 Install sump pit cover in accordance with Section 05 50 00.
- .2 Precast Concrete Slabs.
 - .1 Install precast concrete slabs in crawlspace and roof access ladders where indicated. Install slabs level, true to grade and free of movement. Joints and lippage not to exceed 1 mm between slabs.
- .3 Precast Concrete Splash Pads.
 - .1 Install precast concrete splash pads where indicated. Install slabs level, true to grade and free of movement.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 03 30 00 – Cast-In-Place Concrete.
- .2 Section 05 12 23 – Structural Steel for Buildings.
- .3 Section 05 21 00 – Steel Joist Framing.
- .4 Section 05 31 00 – Steel Decking.
- .5 Section 05 41 00 – Structural Metal Stud Framing.
- .6 Section 05 50 00 – Metal Fabrications.
- .7 Section 06 10 00 – Rough Carpentry.
- .8 Section 07 21 00 – Thermal Insulation.
- .9 Section 07 26 00 – Air/Vapour Barrier Membrane - Self Adhesive.
- .10 Section 07 62 00 – Sheet Metal Flashing and Trim.
- .11 Section 07 92 00 – Joint Sealants.
- .12 Section 08 54 13 – Fiberglass Windows.
- .13 Section 09 29 00 – Gypsum Board.

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 A153/A153M-16a, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
 - .3 ASTM A666-15, Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
 - .4 ASTM A1011/A1011M-18a, Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength.
 - .5 ASTM C119-20, Standard Terminology Relating to Dimension Stone.
 - .6 ASTM C129-17, Standard Specification for Nonloadbearing Concrete Masonry Units.
 - .7 ASTM C216-19, Standard Specification for Facing Brick (Solid Masonry Units Made from Clay or Shale).
 - .8 ASTM C270-19ae1, Standard Specification for Mortar for Unit Masonry.
 - .9 ASTM C979/C979M-16, Standard Specification for Pigments for Integrally Colored Concrete.
 - .10 ASTM C1515-20, Standard Guide for Cleaning of Exterior Dimension Stone, Vertical And Horizontal Surfaces, New or Existing.
 - .11 ASTM E96/E96M-16, Standard Test Methods for Water Vapor Transmission of Materials.
 - .12 ASTM E283/E283M-19, Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.

- .2 Brick Industry Association (BIA).
 - .1 Technical Note #1, Hot and Cold Weather Construction, 2018.
 - .2 Technical Note #20, Cleaning Brickwork, 2018.
- .3 Canadian Standards Association (CSA).
 - .1 CSA A23.1-19/A23.2-19, Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.
 - .2 CSA A82-14 (R2018), Fired Masonry Brick Made from Clay or Shale.
 - .3 CSA A165 SERIES-14 (R2019), CSA Standards on Concrete Masonry Units.
 - .4 CAN/CSA A179-14 (R2019), Mortar and Grout for Unit Masonry.
 - .5 CSA A370-14 (R2018), Connectors for Masonry.
 - .6 CAN/CSA A371-14 (R2019), Masonry Construction for Buildings.
 - .7 CSA G30.18-09 (R2019), Carbon Steel Bars for Concrete Reinforcement.
 - .8 CSA S304-14 (R2019), Design of Masonry Structures.
- .4 National Building Code of Canada, 2020 (NBCC), complete with Manitoba Building Code amendments (MBC).

1.3 SUBMITTALS

- .1 Shop Drawings.
 - .1 Submit shop drawings in accordance with Section 01 33 00.
 - .2 Provide drawings stamped and signed by professional engineer registered or licensed in Province of Manitoba, Canada.
- .2 Samples.
 - .1 Submit samples in accordance with Section 01 33 00.
 - .2 Submit full size exterior brick veneer samples for review and final approval prior to ordering.
- .3 Product Data:
 - .1 Provide manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, limitations and colours.
- .4 Informational Submittals.
 - .1 Submit manufacturer's installation instructions.
 - .2 Test reports and product certificates.

1.4 QUALITY ASSURANCE

- .1 Qualifications.
 - .1 The following qualifications are mandatory for Masonry Contractors:
 - .1 Member in good standing with Manitoba Masonry Contractors Association (MMCA), and Manitoba Masonry Institute (MMI).
 - .2 All associated trade certification is mandatory including Red Seal Certification.
 - .3 Minimum five (5) years' experience on projects of similar size and complexity.
 - .4 If the successful Masonry Contractor chooses to sub-contract the work or portions of the work, that sub-contractor must also be a current member in good standing with MMCA and MMI. If the successful Masonry Contractor chooses to form a relationship with another entity which will undertake the work of portions of the work, that entity must also be a current member in good standing with MMCA and MMI.

- .2 Mock-ups.
 - .1 Concrete Masonry Unit (CMU).
 - .1 Mock-up 1800 mm x 1800 mm CMU wall assembly in accordance with Section 01 40 00. Locate mock-up on site as part of final installation.
 - .2 Include in mock-up a mechanical and an electrical penetration.
 - .3 Mock-up will be reviewed for quality of workmanship and overall appearance.
 - .4 Once approved, mock-up will set standard of acceptance for remaining installations.
 - .5 Do not proceed with CMU installation until mock-up is complete and reviewed by Contract Administrator.
 - .2 Brick Veneer.
 - .1 Co-ordinate with Section 07 08 00 for visual review requirements.
 - .2 Mock-up 1800 mm x 1800 mm masonry cavity wall assembly in accordance with Section 01 40 00. Locate mock-up on site as part of final installation.
 - .3 Include masonry ties, drip and through-wall flashing, weep holes, mortar net, mortar colour, jointing and coursing as specified.
 - .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.
 - .6 Do not proceed with masonry installation until mock-up is complete and reviewed by Contract Administrator.
 - .3 Graffiti-Resistance Coating.
 - .1 Mock-up graffiti-resistant coating on 1800 mm x 1800 mm area of brick veneer in accordance with Section 01 45 00. Locate mock-up on site as part of final installation.
 - .2 Mock-up will be reviewed for quality of workmanship and overall appearance.
 - .3 Once approved, mock-up will set standard of acceptance for remaining installations.
 - .4 Do not proceed with graffiti-resistant coating installation until mock-up is complete and reviewed by Contract Administrator.
- .3 Test Reports.
 - .1 Certified test reports showing compliance with specified performance characteristics and physical properties.
- .4 Submit laboratory test reports certifying compliance of masonry units and mortar with specification requirements.
 - Certificates.
 - .1 Product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

1.5 DELIVERY, STORAGE, AND HANDLING

- .1 Deliver and store masonry units on pallets and cover with tarpaulins adequately secured. Keep units protected from materials which could stain them.
- .2 Store bagged products, such as lime, cement and metal accessories in dry, waterproof sheds.
- .3 Keep masonry materials completely free from ice and frost.
- .4 Cleaning and Waste Management in accordance with Section 01 74 00.

- .5 Waste Management and Disposal in accordance with Section 01 74 19.

1.6 SITE CONDITIONS

- .1 Hot and Cold Weather Protection: in accordance with CAN/CSA A371 and BIA Technical Notes on Brick Construction #1 - Hot and Cold Weather Construction.
- .2 Ambient Conditions: assemble and erect components when temperatures are above 4°C.
- .3 Cold Weather Requirements.
 - .1 To CAN/CSA A371 with following requirements.
 - .1 Maintain temperature of mortar between 5°C and 50 °C until batch is used or becomes stable.
 - .2 Maintain ambient temperature of masonry work and it's constituent materials between 5°C and 50 °C and protect site from windchill.
 - .3 Maintain temperature of masonry above 0°C for minimum of seven days after mortar is installed.
 - .4 Preheat unheated wall sections in enclosure for minimum 72 hours above 10°C before applying mortar.
 - .4 Hot Weather Requirements.
 - .1 To CAN/CSA A371 with following requirements.
 - .1 Protect freshly laid masonry from drying too rapidly by means of waterproof non-staining coverings.
 - .2 Keep masonry dry using waterproof non-staining coverings that extend over walls and down sides sufficient to protect walls from wind driven rain until masonry work is completed and protected by flashings or other permanent construction.
 - .3 Spray mortar surface at intervals and keep moist for maximum of three days after installation.

Part 2 Products

2.1 MANUFACTURERS

- .1 Basis of Design Products.
 - .1 Interior Standard Concrete Masonry Units (CMU).
 - .1 Expocrete Standard Concrete Masonry Units.
 - .2 Exterior Brick Veneer.
 - .1 Hebron Brick Company Onyx Ironspot Norman, 60% smooth and 40% velour texture, complete-with Interstar CM-931, Dark Mahogany.
 - .3 Graffiti-Resistance Coating (exterior brick veneer).
 - .1 Fabrikem Fabrishield Paint Repellent PR 61 (brick veneer) complete-with Fabrikem PR Cleaner (1 gal) to hand over to the City.
 - .4 Masonry Wire Reinforcement.
 - .1 Dur-O-Wall DW 100 Truss.
 - .2 Blok-Lok.
 - .3 Blok-Truss.
 - .5 Masonry Ties for Exterior Masonry Veneer on Insulated Concrete Block Wall Assembly.
 - .1 Fero Block Shear Connector System (stainless steel) or approved equal.

- .6 Masonry Ties for Exterior Masonry Veneer on Insulated Steel Stud Wall Assembly.
 - .1 Fero Stud-Shear Connector System (stainless steel) or approved equal.
- .7 Mortar Net.
 - .1 Mortar Net Solutions MortarNet with Insect Barrier.
- .8 Weep Hole Vents.
 - .1 Dur-O-Wal DA1006 Cell Vent.
 - .2 Mortar Net Solutions CellVent.
- .2 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes* of the *Bidding Procedures*.
- .3 Supply similar products from single manufacturer and from same production run

2.2 MATERIALS

- .1 Concrete Masonry Units (CMU).
 - .1 Interior Standard CMU: to CSA A165 for structural load bearing walls.
 - .1 Classification: H/30/A/M (hollow normal weight).
 - .2 Size: metric modular as indicated.
 - .3 Special shapes: provide square and bull nose corner units for exposed corners as indicated. Provide purpose-made shapes for lintels and bond beams. Provide additional special shapes as indicated.
 - .4 Radius block (bull nose corner units): with excessive ridging will not be acceptable. Grind to smooth finish to satisfaction of Contract Administrator.
 - .5 Mortar: Type "S"-13 MPa, unless otherwise indicated on structural drawings.
 - .2 Interior Standard Light Weight CMU: to CSA A165 for interior non-load bearing walls.
 - .1 Classification: H/15/A/M or H/10/C/M (hollow light weight where specified).
 - .2 Size: metric modular as indicated.
 - .3 Special shapes: provide square and bull nose corner units for exposed corners as indicated. Provide purpose-made shapes for lintels and bond beams. Provide additional special shapes as indicated.
 - .4 Radius block (bull nose corner units): with excessive ridging will not be acceptable. Grind to smooth finish to satisfaction of Contract Administrator.
 - .5 Mortar: Type "N"-5 MPa.
- .2 Exterior Brick Veneer: to ASTM C216 and CSA A82.
 - .1 Size: 3-5/8" wide x 3-5/8" high x 11-5/8" long (Utility).
 - .2 Grade: SW.
 - .3 Type: FBS.
 - .4 Coursing: 1/3 bond coursing.
 - .5 Manufactured from one continuous batch to ensure minimum colour and texture variations.
 - .6 Special shapes: as required and shown on drawings.
 - .7 Coloured Mortar: to ASTM C270 and ASTM C979/C979M.
- .3 Masonry Reinforcement and Connectors.
 - .1 Bar reinforcement to CAN/CSA A371 and CSA G30.18.

- .2 Masonry Wire reinforcement consisting of 3.66 mm (9-gauge) longitudinal wires and 3.66mm cross or diagonal wires Class 3 truss joint reinforcement, to meet ASTM A641 with minimum yield strength of 480 MPa.
 - .1 3.66 mm diameter deformed wire for single block wythes, for interior wall locations: mill galvanized for exterior wall locations: hot dipped galvanized after fabrication, ASTM A153/A153M, Class B-2, minimum of 457g/m² zinc coating; sized 50 mm narrower than wall or partition.
 - .2 Connectors: to CSA A370 and CSA S304.1.

- .4 Masonry Ties for Exterior Masonry Veneer on Insulated Concrete Block Wall Assembly: to CSA A370 and CSA S304, adjustable anchors that allow vertical adjustment but resist tension and compression forces perpendicular to plane of wall consisting of a connector plate, V-tie, and insulation support.
 - .1 Connector plate fabricated of minimum 1.61 mm (16-gauge) stainless sheet steel to CSA A370 and ASTM A666, length of plate to suit thickness of vapour permeable air barrier membrane or air/vapour barrier membrane, and insulation.
 - .2 V-tie fabricated of 4.76 mm diameter stainless steel factory formed wire to CSA A370. V-tie to sit in middle third, and as close as possible to centerline of masonry veneer.
 - .3 Insulation support fabricated from polyethylene, purpose made for insertion over connector plate to hold insulation boards tight to backup wall.

- .5 Masonry Ties for Exterior Masonry Veneer on Insulated Steel Stud Wall Assembly: to CSA A370 and CSA S304, adjustable anchors that allow vertical adjustment but resist tension and compression forces perpendicular to plane of wall consisting of a connector plate, V-tie, and insulation support.
 - .1 Connector plate fabricated of minimum 1.61 mm (16-gauge) stainless sheet steel to CSA A370 and ASTM A666, length of plate to suit thickness of vapour permeable air barrier membrane or air/vapour barrier membrane, and insulation. 75 mm high plate with 4 - 6 mm diameter screw holes in the stud width portion of the connector plate provide for adequate fixity of the plate to the steel stud.
 - .2 V-tie fabricated of 4.76 mm diameter stainless steel factory formed wire to CSA A370. V-tie to sit in middle third, and as close as possible to centerline of masonry veneer.
 - .3 Insulation support fabricated from polyethylene, purpose made for insertion over connector plate to hold insulation boards tight to backup wall.
 - .4 Fasteners: to CSA A370, stainless steel, four (4) per plate.

- .6 Graffiti-Resistance Coating (exterior brick veneer): series of clear, penetrating sealers and liquid repellents which provide protection of masonry surfaces against both water ingress and graffiti application (paint and marker). The products are formulated with a unique, proprietary blend of polymers, organo-silanes, and siloxanes.

- .7 Sheet Metal Cavity Closures (masonry control joints): 0.6 mm (24-gauge) galvanized sheet metal cavity closures of profile shown on drawings.

- .8 Mortar Net: trapezoidal shaped nylon and polyester woven material complete-with insect barrier to suspend mortar droppings at unequal heights allowing moisture to drain from the cavity and maintain airflow within the cavity wall, thickness to suit cavity depth x 250 mm high.

- .9 Weep Hole Vents: purpose-made clear UV resistant polypropylene, size to suit application: standard size 10 mm wide x 64 mm high x length required to abut mortar net insect fabric in cavity.

- .10 Joint Sealants: in accordance with Section 07 92 00.

2.3 MORTAR AND MASONRY GROUT

- .1 Mortar and Masonry Grout.
- .1 Use same brands of materials and source of aggregate for entire project.
 - .2 Mortar and grout to CAN/CSA A179.
 - .3 Do grouting of masonry work with concrete using white non-staining cement where mortar has white non-staining cement and standard gray Portland cement where mortar has standard gray Portland cement.
- .2 Mixing: prepare and mix mortar materials and pigment under strict supervision, and in small batches for immediate use only. Use and mix proprietary mortar, and use and store ready mixed mortars, in strict accordance with CAN/CSA A179. Do not use re-tempered mortars except for ready mixed mortar; re-tempered in accordance with manufacturer's instruction.
- .3 For Bedding Steel Bearing Plates, Lintels, for Laying Bearing Courses under Concentrated Loads and for Laying Masonry as indicated on Structural Drawings: use Type "N" cement mortar as per CAN/CSA A179, unless otherwise indicated on structural drawings.
- .4 For Masonry Work as indicated on Structural Drawings: use Type "S" cement mortar as per CAN/CSA A179, unless otherwise indicated on structural drawings.

Part 3 Execution

3.1 INSTALLATION

- .1 General.
- .1 Install masonry connectors and reinforcement in accordance with CSA A370, CAN/CSA A371, CSA A23.1/A23.2 and CSA S304 unless indicated otherwise.
 - .2 Prior to placing concrete, mortar and grout, obtain Contract Administrator's approval of placement of reinforcement and connectors.
 - .3 Tie masonry veneer to backing in accordance with CAN/CSA A371, CSA S304, NBCC, and as indicated.
 - .4 Grout masonry in accordance with CSA S304 and as indicated.
 - .5 Do lateral support and anchorage in accordance with CSA S304 and as indicated.
 - .6 Build masonry plumb, level and true to line, with vertical joints in alignment.
 - .7 Layout coursing and bond to achieve correct coursing heights, and continuity of bond above and below openings, with minimum of cutting.
 - .8 Buttering corners of units, throwing mortar droppings into joints, deep or excessive furrowing of bed joints will not be permitted. Do not shift or tap units after mortar has taken initial set. Where adjustment must be made after mortar has started to set, remove mortar and replace with fresh supply.
 - .9 Do not field bend reinforcement or connectors except where indicated or authorized by Contract Administrator. Replace bars and connectors which develop cracks or splits.
 - .10 All vertical CMU wall reinforcing to be centered within the width of the block by the use of spacers. Offsetting vertical reinforcing to accommodate installation of hollowcore, mechanical or electrical items is not allowed without approval from engineer.

- .2 Exposed Masonry.
 - .1 Keep exposed faces free from stains, chips and cracks. Remove chipped, cracked, and otherwise damaged units in exposed masonry and replace with undamaged units.
 - .2 Keep masonry walls clean and free of mortar and stains during laying. Allow mortar drippings which adhere to wall to dry but not set. Remove mortar from exposed masonry surfaces with wood paddles and scrapers. Use a natural fiber brush to remove all remaining traces.
- .3 Jointing.
 - .1 Allow joints to set just enough to remove excess water, then tool with round jointer to provide smooth, joints true to line, compressed, and uniformly concave joints.
 - .2 Strike flush all joints concealed in walls and joints in walls to receive insulation or other applied material except paint or similar thin finish coating.
 - .3 Use sufficient force to press mortar tight against masonry units on both sides of joints.
 - .4 Remove excess material or burrs left after jointing. Use trowel or rub with burlap bag.
 - .5 Lay all joints approximately 10 mm thick unless otherwise specified or otherwise shown on drawings. All joints full of mortar except where specifically designated to be left open.
- .4 Cutting.
 - .1 Cut out for recessed or built-in objects. Make cuts straight, clean, and free from uneven edges.
- .5 Built-ins.
 - .1 Build in items occurring in masonry provided by other Sections including windows, steel door frames, anchor bolts, sleeves, inserts, loose steel lintels, shelf angles, and other such items. Build in items to present neat, rigid, true and plumb installation. Brace door jambs to maintain plumb. Leave wall openings required for ducts, grilles, pipes and other items.
 - .2 Fill voids between masonry and metal frames with masonry mortar or insulation as indicated.
 - .3 Prevent displacement of built-in items during construction. Check plumb, location and alignment frequently, as work progresses.
- .6 Wetting of Bricks.
 - .1 Except in cold weather, wet bricks having initial rate of absorption exceeding 1 g/minute/1000 mm². Wet to uniform degree of saturation, 3 to 24 hours before laying, and do not lay until surface dry.
 - .2 Wet tops of walls built of bricks qualifying for wetting, when recommencing work on such walls.
- .7 Support of Loads.
 - .1 Use concrete strength specified on Structural drawings where concrete fill is used. Refer to structural drawings for reinforcing steel.
 - .2 Install building paper below voids to be filled with concrete. Keep paper 25 mm back from faces of units.
- .8 Control and Expansion Joints.
 - .1 Provide control and expansion joints in exterior masonry veneer as indicated on drawings.

- .2 Provide control and expansion joints in CMU walls at maximum 7315 mm (24'-0") on-centre unless indicated otherwise on structural drawings. Submit proposed locations of all control and expansion joints in CMU walls for review prior to commencing work. Bond beam reinforcing in load bearing walls to be continuous through joints.
- .3 Leave space between top of non-load bearing walls and partitions and structural elements as shown on structural drawings. Do not use wedges.
- .4 Build masonry to tie-in with stabilizers, with provision for vertical movement.
- .5 Leave minimum 6 mm space below shelf angles.
- .9 **Masonry Lintels (CMU).**
 - .1 Masonry lintels for all openings to be 190 mm high U-block with standard 190 mm high coursing above if required as per structural drawings. Installation of 390 mm high vertical U-block is not acceptable above openings. Refer to structural drawings for reinforcing.
- .10 **Loose Lintels.**
 - .1 Co-ordinate location of all loose lintels at window openings. Size of loose lintels are as indicated on structural drawings.
- .11 **Sheet Metal Cavity Closures.**
 - .1 Install sheet metal cavity closures as detailed at all masonry control joints indicated on the drawings.
- .12 **Membrane Flashing.**
 - .1 Install flashings under exterior masonry bearing on shelf angles, and steel angles over openings. Install flashings under weep hole courses and as indicated.
 - .2 Install membrane flashings through full thickness of exterior wythe horizontally across cavity and through insulation to terminate with a minimum 150 mm vertical leg against air/vapour barrier membrane.
- .13 **Mortar Net.**
 - .1 Install continuous row of mortar net complete-with insect barrier as specified at base of all exterior masonry veneer cavity walls, and over all wall openings, shelf angles, sills or lintels. Mortar net to rest directly on flashing and tightly up against rigid board insulation (trapezoidal side up with insect barrier fabric facing masonry veneer).
- .14 **Weep Hole Vents.**
 - .1 Install weep hole vents as specified in vertical joints of masonry veneer at base of all masonry veneer cavity walls, over all wall openings, shelf angles, sills or lintels, and at maximum horizontal spacing of 600 mm on-centre. Extend weep hole vents back to abut mortar net insect barrier fabric. Ensure that holes in vents are not plugged with mortar or debris. Keep cavity free of mortar.

3.2 REINFORCEMENT AND REINFORCING TIES

- .1 **Masonry Ties for Exterior Masonry Veneer on Insulated Concrete Block Wall Assembly:** set connector plates in mortar joints of concrete block. Co-ordinate with installation of cavity wall insulation. Ensure connector plates are centred on horizontal joints of insulation boards. Install insulation supports over connector plates to hold insulation tight to backup wall. Provide one insulation support at each connector plate. Insert wire ties into connector plates and embed into mortar joints of masonry veneer. Ensure wire ties are aligned with horizontal joints of masonry veneer.

- .2 Masonry Ties for Exterior Masonry Veneer on Insulated Steel Stud Wall Assembly: install stud shear connector plate to the side face of the stud (wide face) with stainless steel screw fasteners (four (4) per plate). Co-ordinate with installation of cavity wall insulation. Ensure stud shear connector plates are centered on horizontal joints of insulation boards. Install insulation supports over stud shear connector plates to hold insulation tight to backup wall. Provide one insulation support at each stud shear connector plate. Insert wire ties into stud shear connector plates and embed into mortar joints of masonry veneer. Ensure wire ties are aligned with horizontal joints of masonry veneer.
- .3 Install masonry ties 200 mm below top of parapets and continue down 400 mm on-centre for 800 mm minimum. Provide masonry ties 200 mm below roof bearing. Maximum spacing of masonry ties to be 600 mm vertical and 800 mm horizontal.
- .4 Install masonry ties around openings in a masonry veneer wall spaced not more than 600 mm apart around the openings and located not more than 300 mm from the edge of the openings, but with not less than two (2) masonry ties per side.
- .5 Masonry reinforcement not permitted to correct poorly laid masonry. Bending of masonry ties not permitted.
- .6 Fastening systems connecting masonry ties for masonry veneer to the back-up walls must not compromise the performance of the air/vapour barrier specified and tested in Section 07 26 00 with respect to air leakage and water penetration.
- .7 Insert wire tie into connector plate and embed into mortar joints of masonry veneer. Ensure wire tie is aligned and level with horizontal joints of masonry veneer.

3.3 STANDARD CONCRETE MASONRY UNITS

- .1 Lay concrete masonry units in running $\frac{1}{2}$ bond coursing as indicated in full bed of mortar. Lay-up walls plumb and true with courses level, accurately spaced and co-ordinated with other work.
- .2 All mortar joints to be 10 mm in width. Mortar in all vertical and horizontal joints to be concave where exposed where paint or other finish coating is specified, and flush where air/vapor barrier membrane is indicated.
- .3 Minimize cutting block. Cut exposed block with power driven abrasive cutting disc or diamond cutting wheel where cutting is required and for flush mounted electrical outlets, grilles, pipes, conduit, leaving 3 mm maximum clearance.
- .4 Do not wet concrete masonry before or during laying.
- .5 Use full bed of mortar for first course. For remaining courses bed face shells and cross and end webs and vertical end joints fully in mortar. Compress end joint mortar.
- .6 Stagger end joints in every course. Align joints plumb over each other in every other course.
- .7 Bond intersecting concrete masonry walls in alternate courses. Where block work abuts concrete, bond each block course with dovetail anchors. Locate corners accurately.
- .8 Install reinforced concrete unit masonry lintels over openings where indicated and as specified.
 - .1 End bearing: not be less than 200 mm in non-bearing walls and 400 mm in bearing walls unless otherwise shown on drawings.
 - .2 Place and grout reinforcement in accordance with CSA S304.

- .9 Install welded ladder reinforcing at vertical spacing of 400 mm in all block walls. Provide ladder reinforcing in first mortar joint above and below all openings extending minimum 400 mm beyond edge of opening. Place joint reinforcement continuous in first joint below top of walls. Lap joint reinforcement ends minimum 150 mm unless as indicated on drawings.

3.4 EXTERIOR BRICK VENEER

- .1 Lay brick veneer in coursing as indicated and in full bed of mortar, taking care to build best face to outside. Lay-up walls plumb and true with courses level, accurately spaced and co-ordinated with other work.
- .2 Use sufficient mortar on end of stretchers to ensure end joints are compressed full when brick is pressed into place. When laying closures provide full joints both sides of closure brick.
- .3 Mix units within each pallet and with 3 other pallets to ensure uniform blend of colour and texture.
- .4 Locate vertical control joints as indicated. Brick veneer at control joints to be sawn for best appearance.
- .5 All mortar joints to be 10 mm in width. Mortar in all vertical and horizontal joints to be concave where exposed.

3.5 CONSTRUCTION TOLERANCES

- .1 Lay masonry units plumb, level and true to line within tolerances as per MSJC requirements and as follows:
 - .1 Maximum variation from plumb.
 - .1 In 3 m - 6 mm.
 - .2 In 6 m - 10 mm.
 - .3 In 12 m or more - 13 mm.
 - .2 Maximum variation from level.
 - .1 In any bay or up to 6 m - 6 mm.
 - .2 In 12 m or more - 13 mm.
 - .3 Maximum variation from linear building lines.
 - .1 In any bay or up to 6 m - 13 mm.
 - .2 In 12 m or more - 19 mm.
 - .4 Maximum variation in cross-sectional dimensions of columns and thickness of walls from dimensions shown.
 - .1 Minus 6 mm.
 - .2 Plus 13 mm.
 - .5 Maximum variation in prepared opening dimensions.
 - .1 Accurate to minus 0 mm.
 - .2 Plus 6 mm.

3.6 CLEANING

- .1 Brick Veneer.
 - .1 Clean brick veneer walls in accordance with Interstate Brick Technical Bulletin 4 Brick Cleaning Recommendations, Section 04 01 20 and BIA Technical Note #20 Cleaning Brickwork. Do not use muriatic acid or sand blasting.

3.7 GRAFFITI-RESISTANCE COATING (exterior brick veneer)

- .1 Install graffiti-resistant coating in accordance with manufacture's printed instructions.
- .2 All surfaces to be treated must be clean, free of stains, rust, vegetative growth, efflorescence, or any other loose, unsound, or foreign materials which might inhibit the penetration, adhesion, and long term performance of the product.
- .3 After the surface has been properly cleaned and allowed to dry (24 - 72 hours) depending on ambient conditions and manufacturer's instructions, coating to be applied using low pressure spray. The surface should receive an initial light "mist" coat to break the surface tension followed immediately by a flood coat, applying just enough material to carry an approximate 100 mm rundown from the contact point. Care must be taken to provide a uniform application of the material. Excessive flooding of the surface could lead to a surface deposition and unsightly darkening. Do not dilute coating in any way.
- .4 Instruct the City on procedures for graffiti removal.

3.8 PROTECTION

- .1 Protect laid CMU from damage by weather. At end of each day or shutdown period, cover exposed tops of masonry with canvas or strong waterproof membrane securely clamped down and overhanging on each side of wall at least 600 mm.
- .2 Protect laid masonry veneer from damage by weather. At end of each day or shutdown period, cover exposed top course of masonry veneer with tarps or 3M 8088 Construction Sheathing Tape (taped to top of masonry veneer and face of wall insulation) to avoid rain water from draining down wall surface above and entering cavity.
- .3 Protect masonry and other work from marking and other damage. Protect completed work from mortar droppings. Use non-staining coverings.
- .4 Provide temporary bracing of masonry work during and after erection until permanent lateral support is in place.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 05 21 00 – Steel Joist Framing.
- .2 Section 05 31 00 – Steel Decking.
- .3 Section 05 41 00 – Structural Metal Stud Framing.

1.2 REFERENCES

- .1 ASTM International Inc.
 - .1 ASTM A36/A36M-19, Standard Specification for Carbon Structural Steel.
 - .2 ASTM A193/A193M-20, Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature or High-Pressure Service and Other Special Purpose Applications.
 - .3 ASTM A307-21, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
 - .4 ASTM A325-14, Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.
 - .5 ASTM A325M-14, Standard Specification for Structural Bolts, Steel, Heat Treated 830 MPa Minimum Tensile Strength (Metric).
 - .6 ASTM A490M-14a Standard Specification for High-Strength Steel Structural Bolts, Classes 10.9 and 10.9.3, for Structural Steel Joints (Metric).
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-85.10-99, Protective Coatings for Metals.
- .3 Canadian Institute of Steel Construction (CISC)/Canadian Paint Manufacturer's Association (CPMA)
 - .1 CISC/CPMA 2-75, Quick-Drying, Primer for Use on Structural Steel.
 - .2 CISC/CPMA 1-73a, Quick-Drying, One-Coat Paint for Use on Structural Steel.
- .4 Canadian Standards Association (CSA International)
 - .1 CSA G40.20-13 (R2018)/G40.21-13 (R2018), General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
 - .2 CAN/CSA-G164-18(R2023), Hot Dip Galvanizing of Irregularly Shaped Articles.
 - .3 CAN/CSA-S16-19 – Design of Steel Structures
 - .4 CAN/CSA-S136-07 (R2012), North American Specifications for the Design of Cold Formed Steel Structural Members.
 - .5 CSA W47.1--2019, Certification of Companies for Fusion Welding of Steel.
 - .6 CSA W48-2023, Filler Metals and Allied Materials for Metal Arc Welding.
 - .7 CSA W55.3-08(R2018), Resistance Welding Qualification Code for Fabricators of Structural Members Used in Buildings.
 - .8 CSA W59-18(R2023), Welded Steel Construction (Metal Arc Welding).
- .5 The Society for Protective Coatings (SSPC) and National Association of Corrosion Engineers (NACE) International
 - .1 SSPC SP-2, SP-7.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Shop Drawings:
 - .1 Provide drawings stamped and signed by professional engineer registered or licensed in Province of Manitoba, Canada.
 - .2 Reproduction of Contract Drawings will not be accepted for use as shop drawings.
- .3 Erection drawings:
 - .1 Submit erection drawings indicating details and information necessary for assembly and erection purposes including:
 - .1 Description of methods.
 - .2 Sequence of erection.
 - .3 Type of equipment used in erection.
 - .4 Temporary bracings.
- .4 Fabrication drawings:
 - .1 Submit fabrication drawings showing designed assemblies, components and connections are stamped and signed by qualified professional engineer licensed in the Province of Manitoba, Canada.
- .5 Samples :
 - .1 Upon request, prepare sample of typical exposed structural connections in accordance with AISC Specifications of Architecturally exposed structural steel for approval of Contract Administrator. Samples to be judged upon alignment of surfaces, uniform contact between surfaces, smoothness and uniformity of finished welds. When approved, sample units will serve as a standard for workmanship, appearance and material acceptable for entire project.
- .6 Source Quality Control Submittals:
 - .1 Upon request submit 2 copies of mill test reports 4 weeks prior to fabrication of structural steel.
 - .1 Mill test reports to show chemical and physical properties and other details of steel to be incorporated in project.
 - .2 Provide mill test reports certified by metallurgists qualified to practice in Province of Manitoba, Canada.
- .7 Fabricator Reports:
 - .1 Upon request, provide structural steel fabricator's affidavit stating that materials and products used in fabrication conform to applicable material and products standards specified and indicated.

1.4 DELIVERY, STORAGE AND HANDLING

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

Part 2 Products

2.1 DESIGN REQUIREMENTS

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

2.2 FABRICATION

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

2.3 SHOP PAINTING

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

Part 3 Execution

3.1 APPLICATION

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

3.2 GENERAL

- .1 Structural steel work: in accordance with CAN/CSA-S16, CAN/CSA-S136.
- .2 Welding: in accordance with CSA W59.
- .3 Companies to be certified under Division 1 or 2.1 of CSA W47.1 for fusion welding of steel structures and/or CSA W55.3 for resistance welding of structural components.
- .4 Fabricator shall have sufficient plant capacity to ensure the required delivery of the finished product.
- .5 All structural steel connections shall be as shown on drawings or standard framed beam connections using 19mm (3/4") diameter H.S. bolts and minimum 8mm (0.3") thick angles.
- .6 Provide openings in structural members as required for other building components. Reinforce openings with steel plates sized and welded in place to restore members to original strength. Locate holes so as not to cause any appreciable reduction in strength of members. Allow Contract Administrator to review prior to proceeding.
- .7 Accurately cut and mill column ends and bearing plates to ensure full contact of bearing surfaces prior to welding. All surfaces shall be smooth finish.
- .8 All items for building-in shall be supplied in ample time for incorporation into the Work, without delay to other trades.
- .9 Anchor bolts shall be provided by steel supplier and set by General Contractor.

3.3 CONNECTION TO EXISTING WORKS

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

3.4 MARKING

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

3.5 ERECTION

- .1 Erect structural steel, as indicated and in accordance with CAN/CSA-S16, CAN/CSA-S136, and in accordance with reviewed erection drawings.
- .2 Field cutting or altering structural members: to be approved by Contract Administrator.

- .3 Clean with mechanical brush and touch up shop primer to bolts, rivets, welds and burned or scratched surfaces at completion of erection.
- .4 Continuously seal members by continuous welds where indicated. Grind smooth.
- .5 Set steel columns to proper elevation with steel shims and cooperate with concrete Section in grouting-in base plates with non-shrinking cement grout.

3.6 FIELD QUALITY CONTROL

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

3.7 FIELD PAINTING

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

3.8 CLEANING

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

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

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

1.2 REFERENCES

- .1 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-85.10-99, Protective Coatings for Metals.
- .2 Canadian Institute of Steel Construction (CISC)/Canadian Paint Manufacturer's Association (CPMA)
 - .1 CISC/CPMA 2-75, Quick-Drying, Primer for Use on Structural Steel.
 - .2 CISC/CPMA 1-73a, Quick-Drying, One-Coat Paint for Use on Structural Steel.
- .3 Canadian Standards Association (CSA International)
 - .1 CSA-G40.20{-04 (R2009)}/G40.21{-04(R2009)}, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
 - .2 CAN/CSA-S16-19, Design of Steel Structures
 - .3 CSA-S136-16, Cold Formed Steel Structural Members.
 - .4 CSA-W47.1-2019, Certification of Companies for Fusion Welding of Steel
 - .5 CSA-W55.3—08(R2018), Resistance Welding Qualification Code for Fabricators of Structural Members Used in Buildings.
 - .6 CSA-W59-18(R2023), Welded Steel Construction (Metal Arc Welding).

1.3 QUALITY ASSURANCE

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

1.4 DESIGN OF STEEL JOISTS AND BRIDGING

- .1 Design steel joists and bridging to carry loads indicated on drawings in accordance with CAN/CSA-S16, CSA-S136.
- .2 Design joists and anchorages for uplift forces as indicated.
- .3 Ensure joists are manufactured to consider load effects due to fabrication, erection and handling.

- .4 Limit roof joist deflection due to specified live load to L/360 and deflection due to specified total load to L/240.
- .5 Camber joists to accommodate for dead load deflection.
- .6 Upon request, submit 2 copies of calculations and joist design drawings for typical joists for Contract Administrator review at least 4 weeks prior to fabrication and/or delivery.

1.5 SHOP DRAWINGS

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

Part 2 Products

2.1 MATERIALS

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

2.2 FABRICATION

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

2.3 SHOP PAINTING

- .1 Clean, prepare surfaces and shop prime structural steel as follows:
 - .1 Steel not receiving finish painting: One coat of CISC / CPMA 1-73a quick drying shop primer. Steel to be cleaned in conformance with SSPC-SP2.
- .2 Clean members of loose mill scale, rust, oil, dirt and other foreign matter.

- .3 Apply one coat of primer in shop to steel surfaces, except:
 - .1 Surfaces and edges to be field welded.
 - .2 Faying surfaces of slip-critical connections.
- .4 Apply paint under cover, on dry surfaces when surface and air temperatures are above 5 degrees C.
- .5 Maintain dry condition and 5 degrees C minimum temperature until paint is thoroughly dry.
- .6 Strip paint bolts, nuts, sharp edges and corners before prime coat is dry.

Part 3 Execution

3.1 GENERAL

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

3.2 CONNECTION TO EXISTING WORK

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

3.3 FIELD QUALITY CONTROL

- .1 Inspection and testing of materials and workmanship will be carried out by testing laboratory designated by Contract Administrator.
- .2 Testing laboratory will inspect representative joists for integrity, accuracy of fabrication and soundness of welds. Contract Administrator will determine extent of and identify all inspections.
- .3 Submit test report to Contract Administrator 2 weeks after completion of inspection.
- .4 The City will pay costs of tests as specified in Section 01 21 00 – Allowances.

3.4 ERECTION

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

- .5 Unless shown otherwise on drawings, extend joist legs to centre line of beams when bearing on both sides, and minimum 25mm (1") past centre line when bearing on one side only. Where joists bear from both sides on beams narrower than 140mm (5-1/2"), offset the joists and extend bearing past centre line.
- .6 During erection, provide all temporary bracing required as a result of induced loads and stresses.
- .7 Do not permit erection of decking until joists are sufficiently braced.
- .8 See mechanical drawings for ducts in joist space. Provide special joist panels if required for duct passage.
- .9 Joist supplier to refer to mechanical drawings for location and weights of equipment supported by joists.

3.5 FIELD PAINTING

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

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 05 12 23 – Structural Steel for Buildings.
- .2 Section 05 21 00 – Steel Joist Framing.

1.2 REFERENCES

- .1 American Society for Testing and Materials International, (ASTM)
 - .1 ASTM A653/A653M-18, Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - .2 ASTM A792/A792M-10, Specification for Steel Sheet, 55%Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-1.181-99, Ready-Mixed Organic Zinc-Rich Coating.
- .3 Canadian Standards Association (CSA International)
 - .1 CSA-S16-19 – Design of Steel Structures
 - .2 CSA-S136-16, Cold Formed Steel Structural Members.
 - .3 CSA W47.1-19 Certification of Companies for Fusion Welding of Steel
 - .4 CSA W55.3-2008(R2018), Resistance Welding Qualification Code for Fabricators of Structural Members Used in Buildings.
 - .5 CSA W59-18(R2023), Welded Steel Construction (Metal Arc Welding).
- .4 Canadian Sheet Steel Building Institute (CSSBI)
 - .1 CSSBI 10M-18, Standard for Steel Roof Deck.

1.3 SHOP DRAWINGS

- .1 Submit shop drawings erection and shoring drawings in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit drawings stamped and signed by qualified professional engineer registered or licensed in Province of Manitoba, Canada.
- .3 Submit design calculations if requested by Contract Administrator.
- .4 Indicate deck plan, profile, dimensions, base steel thickness, metallic coating designation, connections to supports and spacings, projections, openings, reinforcement details and accessories.

Part 2 Products

2.1 MATERIALS

- .1 Zinc-iron Alloy (ZF) coated steel sheet: to ASTM A653/A653M structural quality Grade 230, with ZF75 coating, for interior surfaces not exposed to weather, unpainted finish, thickness as indicated on structural drawings.

- .2 Decks to be painted: zinc-iron alloy coated decks suitable for finish painting.
- .3 Zinc (Z) coated steel sheet: to ASTM A653/A653M structural quality Grade 230 minimum, with Z275, coating, for exterior surfaces exposed to weather, thickness as indicated on structural drawings.
- .4 Acoustic insulation: fibrous glass 17.5 kg/m³ density profiled to suit deck flutes.
- .5 Cover plates, cell closures and flashings: steel sheet with minimum base steel thickness of 0.76 mm. Metallic coating same as deck material.
- .6 Primer: zinc rich, ready mix to CAN/CGSB-1.181.

2.2 TYPES OF DECKING

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

Part 3 Execution

3.1 GENERAL

- .1 Structural steel work: in accordance with CAN/CSA-S136.
- .2 Welding: in accordance with CSA W59, except where specified otherwise.
- .3 Companies to be certified under Division 1 or 2.1 of CSA W47.1 for fusion welding of steel and/or CSA W55.3 for resistance welding.
- .4 Steel deck shall be delivered as required for erection.
- .5 On site storage shall be as recommended by CSSBI 10M.

3.2 ERECTION

- .1 Erect steel deck as indicated and in accordance with CSA S136, and in accordance with reviewed erection drawings.
- .2 Butt ends: to 1.5 to 3 mm gap. Install steel cover plates over gaps wider than 3 mm.
- .3 Lap ends: to 50 mm minimum.
- .4 Immediately after deck is permanently secured in place, touch up metallic coated top surface with compatible primer where burned by welding.
- .5 Erect metal decking in accordance with drawings and as recommended by CSSBI 10M. Properly align and level on structural supports.
- .6 Fasten deck to supports, and button punch side laps as per Contract Drawings.
- .7 Leave deck surfaces clean and free of foreign substances, ready for work of others, and finishes where exposed.

3.3 CONNECTIONS

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

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 04 00 00 – Masonry.
- .2 Section 06 10 00 – Rough Carpentry.
- .3 Section 07 21 00 – Thermal Insulation.
- .4 Section 07 52 00 – 2 Ply Modified Bituminous Membrane Roofing.
- .5 Section 08 11 00 – Metal Doors and Frames.
- .6 Section 08 54 13 – Fiberglass Windows.
- .7 Section 09 29 00 – Gypsum Board.

1.2 REFERENCES

- .1 American Society for Testing and Materials (ASTM).
 - .1 ASTM A653/A653M-20, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - .2 ASTM A780/A780M-20, Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.
 - .3 ASTM C754-20, Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products.
- .2 Canadian Sheet Steel Building Institute (CSSBI).
 - .1 CSSBI S5-2019, Guide Specification for Wind Bearing Steel Studs.
- .3 Canadian Standards Association (CSA).
 - .1 CSA S136-16, North American Specification for the Design of Cold-Formed Steel Structural Members.
 - .2 CSA S304-14 (R2019), Design of Masonry Structures.
- .4 National Building Code of Canada, 2020 (NBCC), complete with current Manitoba Building Code amendments (MBC).

1.3 SYSTEM DESCRIPTION

- .1 Design Requirements.
 - .1 Design shall be based on Limit States Design principles using factored loads and resistances.
 - .2 Design and size structural metal stud framing and screws to withstand loads caused by pressure and suction of wind acting normal to wall plane as calculated in accordance with National Building Code of Canada, Climatic and Seismic Information for Building Design for at the Place of the Work, and CSA S136.
 - .3 Wall studs supporting masonry veneer to meet the requirements of CSA S304 regarding maximum flexural deflections under specified wind loads.
 - .4 Stud depths, gauge, and spacings are shown on the drawings. Adjust stud material thicknesses and spacings, as required by the design criteria.
 - .5 Design connections to accommodate vertical deflection movement of the structure, frame shortening and vertical tolerances without imposing axial loads onto the framing.

- .6 Design bridging to prevent member rotation and member translation perpendicular to the minor axis.

1.4 SUBMITTALS

- .1 Shop Drawings.
 - .1 Submit shop drawings in accordance with Section 01 33 00.
 - .2 All steel stud framing to be designed and detailed on shop drawings, and bear the signature and stamp of a qualified professional Engineer registered in the jurisdiction of the Place of the Work.
 - .3 Indicate design loads, stud depth, stud spacing, gauge, section properties, zinc coating specifications, connection and bracing details, screw sizes and spacing, and anchors as required.
 - .4 Indicate locations, dimensions, openings and requirements of related 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, 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.
- .5 Waste Management and Disposal in accordance with Section 01 74 19.

Part 2 Products

2.1 MANUFACTURERS

- .1 Basis of Design Products.
 - .1 Slotted Top Track.
 - .1 Dietrich Metal Framing Canada SLP-TRK.
- .2 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes of the Bidding Procedures*.
- .3 Supply similar products from single manufacturer.

2.2 MATERIALS

- .1 Structural Metal Stud Framing Forming Part of Exterior Building Envelope: to CSA S136 and ASTM A653/A653M fabricated from Z275 zinc coating steel. Stud depth, spacing, and gauge to be engineered in accordance with item 1.3 and 1.4 of this Section. Colour code to CSSBI S5.
- .2 Slotted Top Track: to be of same gauge and zinc coating as steel studs and sized to suit. Leg length of top track to be 63 mm long, and slotted to suit vertical deflection of structure.
- .3 Bottom Track: to be of same gauge and zinc coating as steel studs in accordance with CSA S136 and ASTM A653/A653M, sized to suit. Leg length of bottom track to be 30 mm.

- .4 Steel Stud Girts and Clip Angles for Girts: minimum 0.91 mm (standard duty 20-gauge) steel thickness in accordance with CSA S136 and ASTM A653/A653M.
- .5 Bridging: fabricated from same material and finish as studs, min. 0.91 mm (standard duty 20-gauge) steel thickness in accordance with CSA S136 and ASTM A653/A653M.
- .6 Screws: pan head, self-drilling, self-tapping sheet metal screws, corrosion protected to minimum requirements of CSSBI S5, length as noted. For structural connections, fasteners of styles, sizes, and lengths shown on drawings.
- .7 Tension Straps and Accessories: as recommended by manufacturer.
- .8 Touch-up Primer: to ASTM A780/A780M.
- .9 Thermal Insulation: in accordance with Section 07 21 00.

Part 3 Execution

3.1 INSTALLATION

- .1 Install structural metal stud framing in accordance with reviewed shop drawings and CSSBI S5 and ASTM C754.
- .2 Install metal stud framing to accommodate vertical deflection of structure to avoid transmission of structural loads onto framing by use of 63 mm leg slotted top tracks. Metal stud framing to be 13 mm short of underside of floor/roof structure and free to move.
- .3 Anchor top and bottom tracks securely to structure at 800 mm on-centre maximum, unless lesser spacing prescribed on shop drawings. Seat studs into slotted top track and bottom track plumb, aligned and securely attached with screws and manufacturer's printed instructions.
- .4 Install studs at not more than 50 mm from abutting walls, openings, and each side of corners and terminations with dissimilar materials.
- .5 Brace steel studs with horizontal internal bridging at 1220 mm maximum. Fasten bridging to steel clips fastened to steel studs with screws or by welding.
- .6 Frame openings in stud walls to adequately carry loads by use of additional full height studs and other framing members and bracing as detailed on shop drawings.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 04 00 00 – Masonry.
- .2 Section 05 51 00 – Metal Stairs.
- .3 Section 09 90 00 – Painting and Coating.

1.2 REFERENCES

- .1 American Society for Testing and Materials (ASTM).
 - .1 ASTM A53/A53M-20, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
 - .2 ASTM A123/A123M-17, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
 - .3 ASTM A500/A500M-21, Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
 - .4 ASTM A666-15, Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
 - .5 ASTM A780/A780M-20, Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.
 - .6 ASTM F1554-20, Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength.
 - .7 ASTM F3125/F3125M-19e2, Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength.
- .2 Canadian Institute of Steel Construction (CISC)/Canadian Paint Manufacturer's Association (CPMA).
 - .1 CISC/CPMA Standard 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 W48-18, Filler Metals and Allied Materials for Metal Arc Welding.
 - .3 CSA W59-18, Welded Steel Construction.
- .4 National Building Code of Canada, 2020 (NBCC), complete with current Manitoba Building Code amendments (MBC).
- .5 The Society of Protective Coatings (SSPC).
 - .1 SSPC Painting Manual, Volume 2, 2011 Edition, SSPC SP-3 Power Tool Cleaning Surface Preparation Standard.

1.3 SUBMITTALS

- .1 Shop Drawings.
 - .1 Submit shop drawings in accordance with Section 01 33 00.
 - .2 Each drawing submission to bear the signature and stamp of a qualified professional Engineer licensed in the jurisdiction of the Place of the Work.

- .3 Indicate construction details, sizes of steel sections and thickness of steel sheet.
- .4 Indicate materials, core thicknesses, finishes, connections, joints, method of anchorage, number of anchors, supports, reinforcement, details, and accessories.
- .5 Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length and type of each weld. Identify grinding, finish and profile of welds.
- .6 Provide product data on specified products indicating material thickness, sizes, finishes and installation instructions.

Part 2 Products

2.1 MANUFACTURED UNITS

- .1 Basis of Design Products.
 - .1 Safety Grating Ladder Rungs.
 - .1 McNichols #M3LRST3460 Traction Tread Galvanized 3-Row Ladder Rung Plank.
 - .2 Safety Grating Tread Planks.
 - .1 McNichols #24N4151410 Grip Strut Galvanized Tread Plank Grating.
- .2 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes* of the *Bidding Procedures*.
- .3 Supply products from single manufacturer.

2.2 MATERIALS

- .1 Angles, Channels and Steel Plate Sections: to CSA G40.20/G40.21, Grade 300W.
- .2 Steel Pipe: to ASTM A53/A53M standard weight, schedule 40, galvanized finish as indicated.
- .3 Hollow Structural Sections: to CSA G40.20/G40.21, Grade 350, Class C or ASTM A500/A500M Grade C.
- .4 Safety Grating Ladder Rungs: 13 ga. galvanized ladder rung plank manufactured with 3-row punched button hole slip-resistant surface, 1-1/8" channel depth x 1-5/8" width.
- .5 Safety Grating Tread Planks: 14 ga. galvanized 4-diamond serrated tread plank grating in accordance with ASTM A653/A653M, 1-1/2" channel depth x 10-1/2" width.

2.3 ACCESSORIES

- .1 Welding Materials: to CSA W59.
- .2 Welding Electrodes: to CSA W48 Series.
- .3 Bolts and Anchor Bolts: to ASTM F1554 Grade 36, with minimum ultimate strength of 415 MPa.
- .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/m² to ASTM A123/A123M.

2.4 FABRICATION

- .1 Fabricate metal fabrications in accordance with reviewed shop drawings.

- .2 Fabricate work square, true, straight and accurate to required size, with joints closely fitted and properly secured. Verify all dimensions prior to fabrication.
- .3 Ensure exposed welds are continuous for length of each joint. File or grind exposed welds smooth and flush.
- .4 Notify the Contact Administrator of any proposed member substitutions and changed connection details.
- .5 Where possible, fit and shop assemble work, ready for erection on site.
- .6 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 min. 6 mm all around fillet welds unless otherwise noted on drawings.
- .7 Welding.
 - .1 Perform to CSA W59. All seams continuously welded and free from any slag or splatter.
 - .2 All full penetration welds to be ground smooth and even with adjacent plate surfaces.

2.5 FINISHES

- .1 Shop Applied Priming.
 - .1 Clean, prepare surfaces and shop prime metal fabrications in accordance with SSPC SP-3 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.
- .2 Galvanizing.
 - .1 Clean, prepare surfaces and hot dip galvanize steel where indicated to ASTM A123/A123M and SSPC SP-3, minimum zinc coating of 600 g/m².
 - .2 Touch up field cut, welded and/or damaged galvanized surfaces with zinc rich paint in accordance with ASTM A780/A780M.

Part 3 Execution

3.1 INSTALLATION

- .1 Install metal work square, plumb, straight, and true, accurately fitted, with tight joints and intersections.
- .2 Exposed fastening devices to match finish and be compatible with material through which they pass.
- .3 Provide components for building by other Sections in accordance with shop drawings and schedule.

- .4 Hand items over for casting into concrete or building into masonry to appropriate trades together with setting templates.
- .5 Do welding work in accordance with CSA W59 unless specified otherwise.
- .6 Touch-up field welds, bolts and burnt or scratched surfaces after completion of erection with suitable primer.
- .7 Install bollard covers in accordance with reviewed shop drawings and manufacturer's printed instruction.

3.2 SCHEDULES (the drawings/details referenced below are for clarity and cross-reference, but do not represent all the metal fabrications required for the project).

- .1 Areaway Grating.
 - .1 Fabricate from galvanized steel shapes and sizes indicated.
 - .2 Secure grate with hold-down clips bolted to frame.
 - .3 Refer to Structural.
- .2 Change Room Bench Strap Hangers.
 - .1 Fabricate from steel shapes and sizes indicated.
 - .2 Finish: shop coat primer (site painted by Section 09 90 00).
- .3 Rung Ladders.
 - .1 Fabricate stringers, brackets, bars, etc. from steel members as indicated.
 - .2 Fabricate with galvanized steel safety grating ladder rungs and tread planks as specified.
 - .3 Finish: hot dip galvanized (unfinished).
- .4 Low Wall Steel Support Framing.
 - .1 Fabricate from steel shapes and sizes indicated.
 - .2 Finish: shop coat primer.
- .5 Sump Pit Cover and Frame.
 - .1 Fabricate from 6 mm thick raised pattern steel plate set in steel angle frame as indicated. Include anchors for embedding in concrete and lift ring recessed into plate.
 - .2 Finish: hot dip galvanized (unfinished).

END OF SECTION

General

1.1 DESCRIPTION

- .1 Provide all labour, materials, methods, equipment and accessories for the fabrication and installation of custom fabricated arbour and planters (both alternate priced).

1.2 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 Seamless.
 - .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.

1.3 SUBMITTALS

- .1 Submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Use construction drawings as reference only in preparing submittals. Field verify as-built conditions and dimensions. Report any discrepancies to Contract Administrator if as-built conditions are significantly different from drawings.
- .3 Submit shop drawings for:
 - .1 Custom Fabricated Arbour – ALTERNATE PRICED
 - .2 Custom Fabricated Planters – ALTERNATE PRICED
- .4 Shop drawings to be stamped by a certified Structural Engineer licensed to practice in Manitoba.
- .5 Drawings to clearly indicate size, assembly, welds, hardware, materials, core thicknesses, finishes, connections, joints, method of anchorage, number and size of anchors, supports, reinforcement, installation details and accessories for all aspects of work.
- .6 Shop drawings shall identify and quantify all hardware and miscellaneous items to be used.
- .7 Shop drawings to indicate related, adjacent materials, and connections.
- .8 Have shop drawings approved prior to providing samples for review and approval.

- .9 Submit product data, samples or full-sized proofs for:
 - .1 Custom Fabricated Arbour: HSS Steel Bend Plate Columns, Beams and Rails.
 - .2 Custom Fabricated Planters: HSS Steel Frame, Braces and Panels.
- .10 Provide templates, patterns, fixing diagrams as required for installation.

1.4 QUALITY ASSURANCE

- .1 Custom metal fabrication shall be performed by trained and qualified craftspeople with demonstrable experience sourcing, fabricating and working with the materials and methods identified in the drawings and described here in.

1.5 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 Temporarily store materials in storage areas as directed by the City.
- .3 Cover exposed stainless steel with pressure sensitive heavy protection paper or apply strippable plastic coating, before shipping to job site.
- .4 Leave protective covering in place until final cleaning of site. Provide instructions for removal of protective covering.
- .5 Store materials in a dry location off the ground and prevent damage.
- .6 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 Measure as-built condition of concrete bases, walls and surfaces metalwork will be attached to prior to producing shop drawings.
- .3 Report any discrepancies or omissions to the Contract Administrator, who will issue written clarification. Oral interpretations or instructions are not acceptable.

1.7 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate metal, plastic, wood and corrugated cardboard packing and place in area designated for disposal and recycling.

Part 2 Products

2.1 CUSTOM FABRICATED ARBOUR

- .1 Steel Bend Plate for Columns, Rails and Beams: 150 x 200 x 6mm, black

- .2 Bend Plate for mounting of light fixtures: 100 x 150 x 6mm, black
- .3 Base Plate: 230 x 280 x 19mm Galvanized Column Base plates anchored to slab with (4) 16 Ø hilti hit-z rod with hilti hilt-hy-200 adhesive, 100 embedment
- .4 Hardware; Exterior grade, as identified on the drawings and of suitable size and strength for intended purpose, inclusive of neoprene or hdpe washers between disparate materials – concrete, metal, wood to prevent corrosion.
- .5 Finish: Black Powdercoat - per section 09 90 10 - Powder Coating.

2.2 CUSTOM FABRICATED PLANTERS

- .1 HSS Steel Frame: 50 x 50 x 6mm, black
- .2 Steel Plate Cross Brace: 9mm thick, rolled steel, black
- .3 Exterior Panels: 9mm thick, rolled steel, black
- .4 Bolts, Nuts, and Washers: Exterior grade, as identified on the drawings and of suitable size and strength for intended purpose, inclusive of neoprene or hdpe washers between disparate materials – concrete, metal, wood to prevent corrosion.
- .5 Finish: Black Powdercoat - per section 09 90 10 - Powder Coating

2.3 ACCESSORIES

- .1 Welding materials: to CSA W59.
- .2 Welding electrodes: to CSA W48 Series.

Part 3 Executions

3.1 FABRICATION OF METAL COMPONENTS

- .1 Obtain approval of all associated shop drawings and samples for each element prior to ordering materials and commencing fabrication.
- .2 Fabricate work square, true, straight and accurate to required sizes, with joints closely fitted and properly secured.
- .3 Use self-tapping, shake-proof, counter-sunk or hidden screws on items requiring assembly by screws.
- .4 Where possible, fit and shop-assemble work, ready for erection.
- .5 Ensure exposed welds are continuous for length of each joint. File or grind exposed welds smooth and flush.
- .6 De-grease and de-bur all sharp edges in the shop left behind after fabrication is complete.
- .7 Obtain approval of shop fabricated elements at the shop prior to delivering elements to site whenever possible.

3.2 INSTALLATION OF METAL COMPONENTS

- .1 Erect metalwork square, plumb, straight and true, accurately fitted, with tight joints and intersections. Contact Contract Administrator immediately should and discrepancies occur on site.
- .2 Provide suitable and acceptable means of anchorage, such as dowels, anchor clips, bar anchors, expansion bolts and shields, and toggles (engineered on shop drawings).
- .3 Exposed fastening devices to match finish and be compatible with material through which they pass.
- .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.
- .7 Obtain approval of field welding from Contract Administrator per section 05 12 23 - Structural Steel for Buildings prior to applying finishes.
- .8 Use a 'fuzzy' or padded wrench on all powder coated bolts when installing to avoid damage to the powder coating.

3.3 ACCEPTANCE

- .1 Contact Contract Administrator for review and approval of final installation prior to applying any items and finishes that will cover up the original work.
- .2 Work will be accepted only if it is erected true to the design intent in conformation with shop drawings and site instructions.
- .3 Work will only be accepted once all maintenance manual data have been received by the City.

3.4 CLEAN-UP

- .1 In accordance with Section 01 74 11 – Cleaning.
- .2 Upon completion of installation, remove construction and accumulated environmental dirt, surplus materials, rubbish, tools and equipment barriers.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 03 30 00 – Cast-In-Place Concrete.
- .2 Section 05 50 00 – Metal Fabrications.
- .3 Section 09 06 00 – Room Finish Schedule.
- .4 Section 09 65 00 – Resilient Flooring.
- .5 Section 09 90 00 – Painting and Coating.

1.2 REFERENCES

- .1 American Society for Testing and Materials (ASTM).
 - .1 ASTM A53/A53M-20, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
 - .2 ASTM A123/A123M-17, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
 - .3 ASTM A500/A500M-21, Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
 - .4 ASTM A653/A653M-20, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - .5 ASTM A780/A780M-20, Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.
 - .6 ASTM F1554-20, Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength.
 - .7 ASTM F3125/F3125M-19e2, Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength.
- .2 American Welding Society (AWS).
 - .1 AWS B1.11M/B1.11-2015, Guide for the Visual Examination of Welds.
- .3 Canadian Institute of Steel Construction (CISC).
 - .1 CISC Handbook of Steel Construction, 11th Edition, 2017.
 - .2 CISC Guide for Specifying Architecturally Exposed Structural Steel, 2nd Edition, 2017.
- .4 Canadian Institute of Steel Construction (CISC)/Canadian Paint Manufacturer's Association (CPMA).
 - .1 CISC/CPMA Standard 1-73a, A Quick-drying One-coat Paint for Use on Structural Steel, 2017.
- .5 Canadian Standards Association (CSA).
 - .1 CSA G40.20-13/G40.21-13 (R2018), General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
 - .2 CSA S16-19, Design of Steel Structures.
 - .3 CSA W48-18, Filler Metals and Allied Materials for Metal Arc Welding.
 - .4 CSA W59-18, Welded Steel Construction.

- .6 National Association of Architectural Metal Manufacturers (NAAMM).
 - .1 NAAMM AMP 510-92, Metal Stairs Manual, Fifth Edition.
 - .2 ANSI/NAAMM AMP 521-01 (R2012), Pipe Railing Systems Manual, Fourth Edition.
- .7 National Building Code of Canada, 2020 (NBCC), complete with current Manitoba Building Code amendments (MBC).
- .8 The Society of Protective Coatings (SSPC).
 - .1 SSPC Painting Manual, Volume 2, 2011 Edition, SSPC SP-3 Power Tool Cleaning Surface Preparation Standard.

1.3 SYSTEM DESCRIPTION

- .1 Design Criteria.
 - .1 Design metal stair stringers, balustrade and landing construction and connections to NBCC vertical and horizontal live load requirements.
 - .2 Detail and fabricate stairs to NAAMM AMP 510.
 - .3 Architectural Specialty Welding and Grinding to CISC Guide for Specifying Architecturally Exposed Structural Steel (AESS) and AWS B1.11M/B1.11 Guide for the Visual Examination of Welds.

1.4 SUBMITTALS

- .1 Shop Drawings.
 - .1 Submit shop drawings in accordance with Section 01 33 00.
 - .2 Each drawing submission to bear the signature and stamp of a qualified professional Engineer licensed in the jurisdiction of the Place of the Work.
 - .3 Indicate construction details, sizes of steel sections and thickness of steel sheet.
 - .4 Indicate materials, core thicknesses, finishes, connections, joints, method of anchorage, number of anchors, supports, reinforcement, details, and accessories.
 - .5 Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length and type of each weld. Identify grinding, finish and profile of welds.
 - .6 Provide product data on specified products indicating material thickness, sizes, finishes/colours and installation instructions.
 - .7 Architectural Specialty Welding and Grinding.
 - .1 Provide erection drawings clearly indicating which members are considered as AESS members and their Category.
 - .2 Include details that clearly identify all the requirements listed in CISC Guide for Specifying Architecturally Exposed Structural Steel with respect to fabrication and erection.
 - .3 Indicate welds by standard CWB symbols, distinguishing between shop and field welds, and show size, length, and type of each weld. In addition, identify grinding, finish, and profile of welds.
 - .4 Indicate type and finish of bolts, and which side of the connection bolt heads are placed.
 - .5 Indicate any special tolerances and erection requirements.
- .2 Samples.
 - .1 Submit samples in accordance with Section 01 33 00.

- .2 Submit sample of interior stair railing and picket assembly of sufficient size to clearly represent quality of architectural specialty welding and grinding proposed for the project.

1.5 QUALITY ASSURANCE

- .1 Qualifications.
 - .1 Fabricator Qualifications: fabricator to have minimum of five (5) years proven satisfactory experience in work similar to that required by this Section, including experienced in fabricating architectural specialty welding and grinding similar to that indicated for this project.
- .2 Mock-ups.
 - .1 Prepare mock-up of metal stair assembly installation in accordance with Section 01 45 00.
 - .2 Prepare mock-up on site as part of final installation. Mock-up will be reviewed for architectural specialty welding and grinding, quality of workmanship, and overall appearance.
 - .3 Once approved, mock-up will set standard of acceptance for workmanship and overall appearance for remaining installations.
 - .4 Do not proceed with other work until mock-up area is complete and approved by the Contract Administrator.

Part 2 Products

2.1 MANUFACTURED UNITS

- .1 Basis of Design Products.
 - .1 Safety Grating Stair Treads/Landing.
 - .1 McNichols #24N4151410 Grip Strut Galvanized Stair Tread Plank Grating.
- .2 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes* of the *Bidding Procedures*.
- .3 Supply products from single manufacturer.

2.2 MATERIALS

- .1 Angle and Channel and Steel Plate Sections: to CSA G40.20/G40.21, Grade 300W.
- .2 Steel Pipe: to ASTM A53/A53M standard weight, schedule 40, seamless black and galvanized finish as indicated.
- .3 Hollow Structural Sections: to CSA G40.20/G40.21, Grade 350, Class C or ASTM A500/A500M Grade C.
- .4 Steel Tubing: to CSA G40.20/G40.21, Grade 350W, sizes and dimensions as indicated, large diameter tube to ASTM A500/A500M, Grade C.
- .5 Safety Grating Stair Treads/Landing: 14 ga. galvanized 4-diamond serrated stair tread plank grating in accordance with ASTM A653/A653M, 1-1/2" channel depth x 10-1/2" width.

2.3 ACCESSORIES

- .1 Welding Materials: to CSA W59.
- .2 Welding Electrodes: to CSA W48 Series.
- .3 Bolts and Anchor Bolts: to ASTM F1554 Grade 36, with minimum ultimate strength of 415 MPa.
- .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 Grout: non-shrink, non-metallic, flowable, 24h, 60 MPa, pull-out strength 7.9 MPa.

2.4 FABRICATION

- .1 General.
 - .1 Fabricate metal fabrications in accordance with reviewed shop drawings and NAAMM AMP 510 and ANSI/NAAMM AMP 521.
 - .2 Weld connections where possible, otherwise bolt connections. Countersink exposed fastenings, cut off bolts flush with nuts. Make exposed connections of same material, colour and finish as base material on which they occur.
 - .3 Accurately form connections with exposed faces flush; mitres and joints tight. Make risers of equal height.
 - .4 Fabricate work square, true, straight and accurate to required size, with joints closely fitted and properly secured. Verify all dimensions prior to fabrication.
 - .5 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 min. 6 mm all around fillet welds unless otherwise noted on drawings.
 - .6 Grind or file exposed welds and steel sections smooth.
 - .7 Shop fabricate stairs in sections as large and complete as practicable.
- .2 Steel Pan Stairs.
 - .1 Structure: fabricate from steel profiles and sections to sizes as indicated.
 - .2 Treads and Landings.
 - .1 Fabricate as closed riser steel pan construction.
 - .2 Reinforce treads with 2 pencil rods per tread.
 - .3 Reinforce landings with 10M reinforcing bars (both ways) at 300 mm o.c.
 - .3 Pipe Railings: fabricate from steel profiles and sections to sizes as indicated.
- .3 Safety Grating Ships Ladder.
 - .1 Structure: fabricate from steel profiles and sections to sizes as indicated.
 - .2 Treads and Landings: diamond serrated stair tread plank grating as specified. Pipe Railings: fabricate from steel profiles and sections to sizes as indicated
- .4 Architectural Specialty Welding and Grinding.
 - .1 Fabricate metal stair assembly in accordance with CISC Guide for Specifying Architecturally Exposed Structural Steel - Category AESS 4 Showcase Elements, and AWS B1.11M/B1.11 Guide for the Visual Examination of Welds.
 - .2 Fabricate with exposed surfaces smooth, square and of surface quality consistent with the approved mock up and as follows:
 - .1 Continuous Welds: to be sound, smooth, contoured and blended, and free from lack of fusion, excessive spatter, undercutting, and arc strikes in accordance with AWS B1.11.

- .2 Contouring and Blending of Welds: where fillet welds are indicated to be ground-contoured or blended, oversize welds as required and grind to provide a smooth transition and to match profile on approved mock-up.
- .3 Minimize Weld Show Through: at locations where welding on the far side of an exposed connection occurs, grind distortion and marking of the steel to a smooth profile with adjacent material.
- .4 Grinding of Welds: grind welds smooth and flush with the base metal in accordance with SSPC SP-3 Power Tool Cleaning Surface Preparation Standard.
- .5 Mill Mark Removal: deliver steel with no mill marks (stenciled, stamped, raised etc) in exposed locations. Mill marks to be omitted by cutting of mill material to appropriate lengths where possible. Where not possible, the fabricator can fill and/or grind to a surface finish consistent with the approved mock up.

2.5 FINISHES

- .1 Shop Priming.
 - .1 Clean, prepare surfaces and shop prime metal stairs in accordance with CSA S16 and SSPC SP-3.
 - .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.
- .2 Galvanizing.
 - .1 Clean, prepare surfaces and hot dip galvanize steel where indicated to ASTM A123/A123M and SSPC SP-3, minimum zinc coating of 600 g/m².
 - .2 Touch up field cut, welded and/or damaged galvanized surfaces with zinc rich paint in accordance with ASTM A780/A780M.

Part 3 Execution

3.1 INSTALLATION

- .1 Install 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.
- .2 Install plumb and true in exact locations, using welded connections wherever possible to provide rigid structure. Provide anchor bolts, bolts and plates for connecting stairs to structure.
- .3 Hand items over for casting into concrete or building into masonry to appropriate trades together with setting templates.
- .4 Do welding work in accordance with CSA W59 unless specified otherwise.

- .5 Touch up shop primer to bolts, welds, and burned or scratched surfaces at completion of erection.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 04 00 00 – Masonry.
- .2 Section 05 41 00 – Structural Metal Stud Framing.
- .3 Section 06 40 00 – Architectural Woodwork.
- .4 Section 07 26 00 – Air/Vapour Barrier Membrane - Self Adhesive.
- .5 Section 07 27 00 – Vapour Permeable Air Barrier Membrane - Self Adhesive.
- .6 Section 07 42 13 – Metal Wall Panels.
- .7 Section 07 52 00 – 2 Ply Modified Bituminous Membrane Roofing.
- .8 Section 07 62 00 – Sheet Steel Flashing and Trim.
- .9 Section 08 11 00 – Metal Doors and Frames.
- .10 Section 09 22 16 – Non-Structural Metal Framing.
- .11 Section 08 54 13 – Fiberglass Windows.
- .12 Section 09 29 00 – Gypsum Board.
- .13 Section 10 28 00 – Toilet, Bath, and Laundry Accessories.

1.2 REFERENCES

- .1 American Society for Testing and Materials (ASTM).
 - .1 ASTM A653/A653M-20, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - .2 ASTM D5456-19, Standard Specification for Evaluation of Structural Composite Lumber Products.
- .2 APA-The Engineered Wood Association (APA).
 - .1 APA PS 1-09, Structural Plywood.
 - .2 APA Engineered Wood Construction Guide, 2016.
- .3 American Wood Protection Association (AWPA).
 - .1 AWPA Book of Standards, 2019.
 - .2 AWPA M25-2018, Standard for Quality Control and Inspection of Preservative Treated Products for Residential and Commercial Use.
- .4 Canadian Standards Association (CSA).
 - .1 CAN/CSA O80 Series-15 (R2020), Wood Preservation.
 - .2 CSA O86-19, Engineering Design in Wood.
 - .3 CSA O121-17, Douglas Fir Plywood.
 - .4 CSA O141-05 (R2019), Softwood Lumber.
 - .5 CSA O151-17, Canadian Softwood Plywood.
 - .6 CSA O153-19, Poplar Plywood.
 - .7 CSA O325-16, Construction Sheathing.
- .5 National Building Code of Canada, 2020 (NBCC), complete with current Manitoba Building Code amendments (MBC).

- .6 National Lumber Grades Authority (NLGA).
 - .1 NLGA Special Products Standard for Fingerjoined Structural Lumber, 2017.
 - .2 NLGA Standard Grading Rules for Canadian Lumber, 2017.

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 CAN/ULC 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 Section 01 74 00.
- .5 Waste Management and Disposal in accordance with Section 01 74 19.

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. Glued end-jointed (finger-jointed) lumber is not acceptable.
- .3 Structural Composite Lumber (SCL) in accordance with ASTM D5456.
- .4 Framing and board lumber: in accordance with NBCC.
- .5 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.
- .6 Pressure Treated Dimension Lumber/Plywood: vacuum pressure impregnated Alkaline Copper Quaternary (ACQ) treated lumber to CAN/CSA O80. Minimum moisture content at treatment in accordance with CAN/CSA O80. Minimum retention for above ground use 4.0 kg/m³ and for ground contact 6.4 kg/m³. 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.

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 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.
- .3 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 lumber and plywood true to line, levels and elevations, square and plumb. Construct continuous members from pieces of longest practical length. Install spanning members with "crown-edge" up.
- .2 Install wood furring and blocking as required to space-out and support door frames, casework, cabinets, wall and ceiling mounted items, washroom accessories, and other work as specified or detailed.
- .3 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 three (3) minute soak on lumber and one (1) minute soak on plywood.
- .4 Use only hot-dipped galvanized steel fasteners with all ACQ pressure treated lumber.
- .5 Install rough bucks, nailers and linings to rough openings as required to provide backing for fiberglass windows and other work.
- .6 Provide plywood 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.
- .7 Frame, anchor, fasten, tie and brace members to provide necessary strength and rigidity.
- .8 Countersink bolts where necessary to provide clearance for other work.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 04 00 00 – Masonry.
- .2 Section 06 10 00 – Rough Carpentry.
- .3 Section 06 61 16 – Solid Surfacing Fabrications.
- .4 Section 07 92 00 – Joint Sealants.
- .5 Section 08 80 00 – Glazing.
- .6 Section 09 29 00 – Gypsum Board.
- .7 Section 09 65 00 – Resilient Flooring.
- .8 Section 10 11 16 – Markerboards.

1.2 REFERENCES

- .1 American National Standards Institute (ANSI)/National Particleboard Association (NPA).
 - .1 ANSI/NAP A208.1-2016, Particleboard.
 - .2 ANSI/NAP A208.2-2016, Medium Density Fiberboard (MDF) For Interior Applications.
- .2 American National Standards Institute/Builders Hardware Manufacturers Association (ANSI/BHMA).
 - .1 ANSI/BHMA A156.9-2015, Cabinet Hardware.
 - .2 ANSI/BHMA A156.11-2019, Cabinet Locks.
 - .3 ANSI/BHMA A156.28-2018, Recommended Practices for Keying Systems.
- .3 American Society for Testing and Materials (ASTM).
 - .1 ASTM A666-15, Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
 - .2 ASTM A1011/A1011M-18a, Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength.
 - .3 ASTM D1037-12(2020), Standard Test Methods for Evaluating Properties of Wood-Base Fiber and Particle Panel Materials.
 - .4 ASTM D5456-19, Standard Specification for Evaluation of Structural Composite Lumber Products.
 - .5 ASTM E84-20, Standard Test Method for Surface Burning Characteristics of Building Materials.
 - .6 ASTM E1333-14, Standard Test Method for Determining Formaldehyde Concentrations in Air and Emission Rates from Wood Products Using a Large Chamber.
- .4 Architectural Woodwork Manufacturers Association of Canada (AWMAC) / Woodwork Institute (WI).
 - .1 North American Architectural Woodwork Standards (NAAWS)- 4.0, 2021.
- .5 Canadian Standards Association (CSA).
 - .1 CSA O121-17, Douglas Fir Plywood.
 - .2 CSA O141-05 (R2019), Softwood Lumber.
 - .3 CSA O151-17, Canadian Softwood Plywood.
 - .4 CSA O153-19, Poplar Plywood.

- .6 National Electric Manufacturer’s Association (NEMA).
 - .1 ANSI/NEMA LD 3-2005, High-Pressure Decorative Laminates (HPDL).
- .7 National Hardwood Lumber Association (NHLA).
 - .1 Rules for Measurement and Inspection of Hardwood and Cypress, 2019.
- .8 National Lumber Grades Authority (NLGA).
 - .1 NLGA Standard Grading Rules for Canadian Lumber, 2017.
- .9 Underwriters Laboratories of Canada (ULC).
 - .1 CAN/ULC S102-18, Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.

1.3 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 (both sides), tops and undersides of upper 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.

1.4 SUBMITTALS

- .1 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 this Section.
- .2 Samples.
 - .1 Submit samples in accordance with Section 01 33 00.
- .3 Closeout Submittals.
 - .1 Submit operation and maintenance data for incorporation into Operations and Maintenance Manual specified in Section 01 78 00.

1.5 QUALITY ASSURANCE

- .1 Qualifications.
 - .1 Manufacturer: minimum five (5) years of 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.
- .2 Regulatory Requirements.
 - .1 Comply with NAAWS for grades of raw materials 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 Contract Administrator of conflicts between NAAWS.
- .3 Mock-Ups.
 - .1 Construct mock-up of typical upper and lower classroom millwork, for in-shop review in accordance with Section 01 45 00.
 - .2 Mock-up of typical upper and lower classroom millwork to consist of plastic laminate faced cabinet complete-with doors, glass insert, drawers, adjustable shelving, countertop and backsplash, PVC edging, and cabinet hardware as specified.
 - .3 Prepare mock-ups in-shop for review by the Contract Administrator. Mock-up will be reviewed for consistency with shop drawings, quality of workmanship, and overall appearance.
 - .4 Once approved, mock-ups will set standard of acceptance for remaining fabrications.
 - .5 Do not proceed with architectural woodwork fabrications until mock-up is complete and approved by the Contract Administrator.

1.6 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 as follows:
 - .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 Contract Administrator and must be removed from the job site and replaced with acceptable materials.
- .4 Cleaning and Waste Management in accordance with Section 01 74 00.
- .5 Waste Management and Disposal in accordance with Section 01 74 19.

1.7 SITE CONDITIONS

- .1 Environmental Requirements.
 - .1 Do not deliver or install architectural woodwork until permanent HVAC systems are operating and temperature and humidity have been stabilized for at least seven (7) calendar days. Manufacturer to advise Contractor of temperature and humidity requirements for architectural woodwork delivery and installation. After installation, control temperature and humidity to maintain same temperature and humidity levels.

1.8 WARRANTY

- .1 Fabrication Contractor's Warranty: provide an extended warranty for Work of this Section for a period of three (3) years from date of Total Performance of the Work. Contractor hereby warrants that architectural woodwork 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 City and Contract Administrator, and at no expense to the City.

Part 2 Products

2.1 MANUFACTURERS

- .1 Basis of Design Products.
 - .1 Wood Particleboard.
 - .1 Arauco Duraflake Vesta NAF Particleboard.
 - .2 Roseburg Skyblend Particleboard.
 - .3 SierraPine Encore Particleboard.
 - .4 Uniboard NU Green Particleboard.
 - .2 Medium Density Fiberboard (MDF).
 - .1 Arauco Trupan Vesta NAF Medium Density Fiberboard.
 - .2 SierraPine Arreis Medium Density Fiberboard.
 - .3 Plastic Laminate (PL).
 - .1 Arborite High Pressure Laminate.
 - .2 Formica High Pressure Laminate.
 - .3 Nevamar High Pressure Laminate.
 - .4 Pionite High Pressure Laminate.
 - .5 Wilsonart High Pressure Laminate.
 - .6 Colours and Finishes: to be selected from manufacturer's entire selection. Contract Administrator may choose from any of the above manufacturers.
 - .4 PVC Edge Trim (for PL).
 - .1 Doellken PVC Edgebanding.
 - .2 EdgeCo PVC Edgebanding.
 - .3 Olon Nexgen PVC Edgebanding.
 - .4 Teknaform PVC Edgebanding.
 - .5 Wilsonart Edgeband PVC Edgebanding
 - .6 Contract Administrator may choose colours from one or all of the above manufacturers.
 - .7 Colours of PVC edge tape must be provided regardless of quantity.
 - .5 Plastic Laminate Wood Grain (PLW).
 - .1 PLW - Tafisa Hardrock Maple, T303 (CR); Series: Prelude, Texture: Crystalite c/w matching edgebanding.
 - .1 PLW (Plastic Laminate Woodgrain) with matching 1 mm, 2 mm and 3mm PVC edge as specified to be typically applied, but not limited to, most vertical upper and lower millwork cabinet surfaces.
 - .2 Final PL and PLW selection and distribution to be finalized at shop drawing stage. Contract Administrator reserves the right to select and assign to surfaces, multiple laminates from any and all PL/PLW manufacturers listed.
 - .6 Edge Trim (for PLW).
 - .1 Matching Edge Trim for PLW1.
 - .1 Doellken #8510 PVC Edgebanding.

- .2 EdgeCo #7042 PVC Edgebanding.
- .3 Teknaform #WR544 PVC Edgebanding.
- .2 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes* of the *Bidding Procedures*.
- .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 Solid Hardwood.
 - .1 “Premium Grade” White Maple, 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 AWMAC/WI 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 MATERIALS

- .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 and ASTM E84.
- .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 and ASTM E84.

2.4 PLASTIC LAMINATE MATERIALS

- .1 Plastic Laminate (PL, PLW).
 - .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 Colours and patterns to be selected by the Contract Administrator from manufacturer’s entire selection.
- .2 Adhesives for Plastic Laminate.
 - .1 Laminating adhesives as recommended by manufacturer for use with product.
 - .2 Laminating adhesives to contain no urea-formaldehyde.

2.5 ACCESSORIES

- .1 Joint Sealants: in accordance with Section 07 92 00.
- .2 Tempered Safety Glass: in accordance with Section 08 80 00.

2.6 CASEWORK HARDWARE

- .1 Casework Hardware.
 - .1 Typical Hinges: to ANSI/BHMA A156.9.
 - .1 Concealed (European institutional) hinge: self-closing hinge c/w 170° opening angle, 3-dimensional adjustment, slide-on hinge arm, full overlay, nickel finish.
 - .1 Basis of Design Products.
 - .1 Blum #91A6580 Modul 170° Hinge.
 - .2 Doors 1220 mm and over in height require 4 hinges per door.
 - .2 Pulls: to ANSI/BHMA A156.9.
 - .1 Metal D-pull (typical doors and drawers: 128 mm centres, matte chrome finish. Provide bolts of sufficient length to pass through total thickness of door front.
 - .1 Basis of Design Products.
 - .1 Richelieu #BP56325128174.
 - .3 Shelf Supports: to ANSI/BHMA A156.9.
 - .1 Shelf Clips: metal shelf support, 6 mm diameter, nickel plated finish.
 - .1 Basis of Design Products.
 - .1 Richelieu #5833180 Shelf Supports.
 - .4 Door Bumpers: to ANSI/BHMA A156.9.
 - .1 Door Bumpers: 7 mm diameter (nominal) install in pairs, clear.
 - .1 Basis of Design Products.
 - .1 3M model SJ5302.
 - .2 Bumper Specialties BS-27.
 - .3 Knape & Vogt 2680 CL.
 - .4 Mepla-Alfit 630.000.03.07.
 - .5 Cabinet Cam Locks: to ANSI/BHMA A156.11.
 - .1 Basis of Design Products.
 - .1 CompX National #C8103-101-26D.
 - .2 Ilco Wafer Cam Lock.
 - .6 Elbow Latch (to secure inactive door on all locked cabinets): to ANSI/BHMA A156.9, spring loaded, oblong adjustment hole, polished nickel finish.
 - .1 Basis of Design Products.
 - .1 Hafele #245.74.200.
 - .2 Richelieu #5540180.
 - .7 Slides.
 - .1 Small Box Drawer Slides (for drawers up to 150 mm high and up to 610 mm wide): to ANSI/BHMA A156.9, light-duty, 100 lb. load capacity.
 - .1 Side-mount full extension, all steel ball bearing slide with drawer rail and pocket mount/disconnect, finish to be selected by the Contract Administrator.
 - .1 Basis of Design Product.
 - .1 Accuride #3832 - Full Extension.

- .2 Standard Box and File Drawer Slides (for drawers over 150 mm high and up to 610 mm wide): to ANSI/BHMA A156.9, medium-duty, 150 lb. load capacity.
 - .1 Side-mount full-extension plus 38 mm overtravel, all steel ball bearing slide with drawer rail and pocket mount/disconnect, finish to be selected by the Contract Administrator.
 - .1 Basis of Design Product.
 - .1 Accuride 4034 - Full Extension and Overtravel.
- .3 Large Box and File Drawer Slides (for drawers over 150 mm high and up to 1067 mm wide): to ANSI/BHMA A156.9, heavy-duty, 180 lb. load capacity.
 - .1 Side-mount full extension plus 25 mm overtravel, all steel ball bearing slide with drawer rail and pocket mount/disconnect, interlock to prevent more than one drawer from opening at a time, finish to be selected by the Contract Administrator.
 - .1 Basis of Design Product.
 - .1 Accuride 3641 - Full Extension and Overtravel with Interlock.
- .4 Shelf Slides: to ANSI/BHMA A156.9, heavy-duty, 155 lb. load capacity.
 - .1 Under-mount full extension plus 25 mm overtravel, all steel ball bearing slide, steel finish, length to suit installation.
 - .1 Basis of Design Product.
 - .1 Richelieu Movento S 760H/766H Blumotion Slide complete-with Sliding Shelf Lock #WEBKIT123799.
- .8 Countertop Support Brackets (AP8.10): 1/4" thick x 2" wide powder coated carbon steel, max. 1800 lb. load capacity per pair, colour: Black.
 - .1 Basis of Design Products.
 - .1 Richelieu #640141890 Kolossus Concealed Bracket - Steel.

2.7 KEYING

- .1 Key cabinet locks to ANSI/BHMA A156.28, keyed alike by room/area or common function. Co-ordinate with the Division 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 division.
- .4 Do not leave keys in keyway or cabinet.

2.8 FABRICATION - GENERAL

- .1 Fabricate architectural woodwork in accordance with reviewed shop drawings and to standards specified for materials and workmanship in accordance with NAAWS unless otherwise noted.
- .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 Adhere laminate to core material in accordance with laminate manufacturer's instructions. Ensure core and laminate profiles coincide to provide continuous support and bond over entire surface. Ensure adjacent parts of continuous laminate work match in colour and pattern.
- .5 Use continuous lengths of laminate up to 3660 mm (12'-0"). No seams permitted in countertops unless indicated on plan.

- .6 Apply laminate backing sheet to non-exposed reverse side core of plastic laminate work. Exposed plywood or particleboard surfaces or edges are not acceptable.
- .7 Use PVC edging to cover exposed edge of core material except where indicated.
- .8 Shelving to cabinetwork to be adjustable unless otherwise indicated.
- .9 Shop assemble work for delivery to site in size easily handled and to ensure passage through building openings.
- .10 Millwork blind framing to be 19 x 64 mm wood members.
- .11 Provide intermediate base gables under floor cabinets at 610 mm on-centre maximum.
- .12 Shop install cabinet hardware.
- .13 Allow for scribing of cabinets fitting against walls.

2.9 PLASTIC LAMINATE FACED CASEWORK

- .1 Fabricate plastic laminate faced casework to “Premium Grade” standards for materials and workmanship in accordance with NAAWS and as follows:
 - .1 Top and Back Stretcher Rails: 19 mm thick softwood lumber for base unit top horizontal and back stretcher rails.
 - .2 Horizontal Back Support Rail: 19 mm thick particleboard, dado and glued to cabinet ends.
 - .3 Toe Space: 19 mm shop sanded exterior grade veneer core plywood with Type II adhesive, closed to cabinet bottom, 75 mm deep x height as detailed, reinforced with securing blocks.
 - .4 Lower Cabinet Bottoms (open and closed): 19 mm thick particleboard core, plastic laminate faced, dadoed and glued into cabinet ends and clamped under pressure during assembly.
 - .5 Upper and Lower Cabinet Backs (open and closed) 13 mm thick particleboard core, plastic laminate faced, recessed 19 mm and set into ends. Plastic laminate to match cabinet fronts and gables.
 - .6 Upper Cabinet Tops and Bottoms (open and closed): 19 mm thick particleboard core, plastic laminate faced. Plastic laminate on underside of upper cabinets to match cabinet fronts.
 - .7 Upper and Lower Cabinet Gables and End Gables (open and closed): 19 mm thick particleboard core, plastic laminate faced, 3 mm PVC exposed edges to match plastic laminate.
 - .8 Cabinet Doors and Drawer Fronts: 19 mm thick particleboard core, plastic laminate faced (both sides), 2 mm PVC all 4 edges to match colour of plastic laminate door/drawer face. Do not cut-out PVC edging to accommodate door hinges.
 - .9 Cabinet Drawer Box (front, back and sides): 13 mm thick particleboard core, plastic laminate faced, 13 mm edge below drawer bottom, dadoed, glued and clamped under pressure during assembly, 1 mm PVC all edges with colour to match drawer box. Glue drawer box to drawer front and bolt door pulls through both to ensure secure attachment.
 - .10 Cabinet Drawer Bottoms: 13 mm thick particleboard core, plastic laminate faced, captured 3 sides.

- .11 Fixed and Adjustable Shelving (open and closed): 25 mm thick particleboard core, plastic laminate faced (colour to match cabinet interior), 2 mm PVC exposed edges (all four edges of adjustable shelving and exposed edge of fixed shelving), PVC colour to match plastic laminate. Clear spans shelves 915 mm and over not allowed without intermediate support.
- .12 Cabinet Closure/Filler Panels: 19 mm thick particleboard core, plastic laminate faced, 1 mm PVC edge to match exposed plastic laminate door face.
- .13 Countertops and Backsplashes (typical).
 - .1 Solid Surfacing (SSM) Countertops and Backsplashes.
 - .1 Countertops and Backsplashes: 13 mm thick SSM.
 - .2 Laminate layers of SSM surfacing as detailed to create built-up edges and cutouts following procedures recommended by the manufacturer.
 - .3 Substrate: 25 mm thick moisture-resistant veneer core plywood substrate, plastic laminate on exposed and semi-exposed faces, with matching balancing sheet backer.
 - .2 Countertops: 25 mm thick shop sanded exterior grade veneer core plywood with Type II adhesive, plastic laminate faced with similar thickness plastic laminate backer sheet to non-exposed surfaces, solid hardwood edge as detailed.

2.10 PLASTIC LAMINATE FACED WINDOW SILLS

- .1 Fabricate to “Custom Grade” standards for materials and workmanship in accordance with NAAWS.
- .2 Typical Windows: fabricate from 25 mm shop sanded exterior grade veneer core plywood with Type II adhesive, plastic laminate faced with similar thickness plastic laminate backer sheet to non-exposed surfaces, 3 mm PVC edge on all exposed edges to match plastic laminate.
- .3 High Level Windows: same as above except plastic laminate self edge.

2.11 SOLID HARDWOOD FABRICATIONS - Commons Hardwood Work Surfaces, Change Room Benches and Coat Hook Mounting Plates, Wall Caps.

- .1 Fabricate from solid hardwood, to “Premium Grade” standards for materials and workmanship in accordance with NAAWS.
- .2 Shop finish as follows:
 - .1 Dulux System.
 - .1 Finish to be performed in shop.
 - .2 Sand with 180-220 grit sandpaper along wood grain until smooth. Remove all dust.
 - .3 Finish (3 coats): Dulux PWF420, VOC compliant, water-based satin polyurethane varnish.
 - .4 Sand lightly between each coat with 180-220 grit sandpaper along wood grain until smooth. Remove all dust.

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 in accordance with reviewed shop drawings and to “Premium Grade” standards for quality of workmanship, materials, installation and execution of the design intent in accordance with NAAWS.
- .2 Install architectural woodwork, plumb, level, true and straight with no distortions. Shim as required. Where plastic laminate faced casework abuts other finished work, scribe and cut to accurate fit.
- .3 Use draw bolts and splines in countertop joints. Maximum spacing 450 mm on-centre, 75 mm from edge. Make flush hairline joints.
- .4 Fit hardware accurately and securely in accordance with manufacturer's instructions. Adjust hardware so that doors and drawers operate smoothly without warp or bind.
- .5 Apply continuous bead of sealant where plastic laminate faced countertops and backsplash abut and adjacent wall finish.
- .6 Provide cutouts for inserts, grilles, electrical receptacle boxes, and other penetrations. Round internal corners, chamfer edges and seal exposed core.
- .7 Install door and drawer pulls to all upper and lower cabinets. Ensure bolts on drawer pulls are of sufficient length to pass through total thickness of drawer front and drawer box front.
- .8 Install glazing in accordance with Section 08 80 00.
- .9 Co-ordinate installation of sliding markerboard with Section 10 11 16.

3.3 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.

3.4 PROTECTION

- .1 Protect installed architectural woodwork and plastic laminate work from damage until project completion.

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.

1.2 REFERENCES

- .1 American Society for Testing and Materials (ASTM).
 - .1 ASTM D570-98(2018), Standard Test Method for Water Absorption of Plastics.
 - .2 ASTM D638-14, Standard Test Method for Tensile Properties of Plastics.
 - .3 ASTM D792-20, Standard Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement.
 - .4 ASTM E84-20, Standard Test Method for Surface Burning Characteristics of Building Materials.
 - .5 ASTM G21-15, Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.
- .2 National Electric Manufacturer's Association (NEMA).
 - .1 ANSI/NEMA LD 3-2005, High-Pressure Decorative Laminates (HPDL).

1.3 SYSTEM DESCRIPTION

- .1 Performance Requirements.
 - .1 Density: 1.73 g/cm³ to ASTM D792.
 - .2 Water Absorption (after 24 hours): 0.04% to ASTM D570.
 - .3 Tensile Strength: 31.1 MPa to ASTM D638.
 - .4 Rockwell Hardness (M Scale): 94 to ASTM D785.
 - .5 Fungi Resistance: no growth to ASTM G21.
 - .6 Cleanability/Stain Resistance: pass to NEMA LD3-3.4.
 - .7 Fire Resistance: Class A to ASTM E84.

1.4 SUBMITTALS

- .1 Shop Drawings.
 - .1 Submit shop drawings in accordance with Section 01 33 00.
 - .2 Indicate plans, sections, dimensions, seam locations, edge details, thermosetting requirements, fabrication details, attachment provisions, sizes of furring, blocking, including concealed blocking and co-ordination requirements with adjacent work.
 - .3 Deviations from drawings or this Section to be clearly noted on shop drawings.
- .2 Samples.
 - .1 Submit samples in accordance with Section 01 33 00.
 - .2 Submit 150 mm x 150 mm samples of solid surfacing material in each colour and finish specified. Provide sample c/w seam for representation of inconspicuous seam and built-up edge.

- .3 Closeout Submittals.
 - .1 Submit operation and maintenance data for incorporation into Operations and Maintenance Manual specified in Section 01 78 00.

1.5 QUALITY ASSURANCE

- .1 Qualifications.
 - .1 Fabrication company must be recognized as an approved fabricator by the solid surfacing manufacturer. Information confirming this criteria may be requested by the Contract Administrator.
 - .2 Fabrication company must employ skilled tradesmen recognized and trained as approved fabricators and installers by manufacturer, with minimum three (3) years successful experience on projects of similar size, requirements and complexity.
- .2 Mock-ups.
 - .1 Prepare mock-up of selected solid surfacing fabrication complete-with inconspicuous seam and built-up edge in accordance with Section 01 45 00.
 - .2 Locate mock-up on site in pre-determined location as part of final installation. Mock-up will be reviewed for quality of workmanship and overall appearance.
 - .3 Once approved, mock-up will set standard of acceptance for remaining installations.
 - .4 Do not proceed with solid surfacing installation until mock-up is complete and approved by the Contract Administrator.

1.6 DELIVERY, STORAGE AND HANDLING

- .1 Finished solid surfacing to be carefully packed and loaded for shipment using all reasonable care and precautions against damage during transit in accordance with manufacturer's printed instructions. No material to be used for blocking or packing which may cause staining or discolouration.
- .2 Transport in near vertical position with finished face toward finished face. Do not allow finished surfaces to rub during shipping and handling.
- .3 Deliver all material to site in manufacturer's original unopened packaging with labels clearly identifying product name and manufacturer.
- .4 Store materials in near vertical position, and in a dry enclosed area protected from exposure to moisture, construction activity, and direct sunlight in strict accordance with manufacturer's recommendations.
- .5 Handle all products with appropriate precautions and care as stated manufacturer's instructions to avoid chipping edges or damaging units in any way.
- .6 Cleaning and Waste Management in accordance with Section 01 74 00.
- .7 Construction Waste Management in accordance with Section 01 74 19.

1.7 WARRANTY

- .1 Manufacturer's Product Warranty: provide an extended warranty for Work of this Section for a period of 10 years from date of Total Performance of the Work. Manufacturer hereby warrants solid surface fabrications 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 Contract Administrator and the City, and at no expense to the City.

Part 2 Products

2.1 MANUFACTURERS

- .1 Basis of Design Products.
 - .1 Solid Surfacing Material (SSM1, SSM2).
 - .1 Aristech Avonite Solid Surface (Price Category #4) c/w Aristech Joint Adhesive.
 - .2 Dupont Corian Solid Surface (Price Category #4) c/w Corian Joint Adhesive.
 - .3 Formica Everform Solid Surface (Price Category #4) c/w Everform Joint Adhesive.
- .2 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes* of the *Bidding Procedures*.
- .3 Supply similar products from single manufacturer.

2.2 MATERIALS

- .1 Solid Surfacing Material (SSM1, SSM2).
 - .1 13 mm thick non-porous homogenous sheet material composed of polyester or acrylic polymer, aluminum trihydrate filler and pigment, 3 mm rounded edge profile, factory lazer-cut openings where indicated, gloss and matte finishes as indicated, 2 colours to be selected from manufacturer's entire selection.

2.3 ACCESSORIES

- .1 Mounting Adhesive: structural grade silicone or epoxy adhesive recommended by manufacturer for application and conditions of use.
- .2 Seam Adhesive: of type recommended by manufacturer for chemically bonding solid surfacing seams.
- .3 Joint Sealants: in accordance with Section 07 92 00.

2.4 FABRICATION

- .1 Fabricate all solid surfacing in shop to sizes and shapes indicated in accordance with reviewed shop drawings and manufacturer's printed instructions. Provide factory lazer-cut openings where indicated.
- .2 Form joints between components to create inconspicuous seams, using manufacturer's standard joint adhesive.
- .3 Where indicated, thermoform corners and edges or other objects to shapes and sizes indicated on drawings, prior to seaming and joining. Cut components larger than finished dimensions and sand edges to remove nicks and scratches. Heat entire component uniformly prior to forming. Ensure no blistering, whitening and cracking of components during forming.
- .4 Rout and finish component edges to a smooth, uniform finish. Factory rout all cutouts, then sand edges smooth. Repair or reject defective or inaccurate work.
- .5 Polish all exposed edges including cutouts exposed in finished work.

Part 3 Execution

3.1 EXAMINATION

- .1 Examine substrates and conditions, with fabricator present for compliance with requirements for installation tolerances and other conditions affecting performance of work. Proceed with installation only after unsatisfactory conditions have been corrected.
- .2 Verify actual site dimensions and location of adjacent materials prior to commencing work.
- .3 Verify that substrates supporting solid surfacing fabrications are plumb, level and flat to within 3 mm in 3 m and that all necessary supports and blocking are in place.

3.2 PREPARATION

- .1 Clean surfaces prior to installation and protect from scratches. Apply masking where necessary. Take necessary precautions to prevent dirt grit dust and debris from other trades from contacting the surface.

3.3 INSTALLATION

- .1 Install solid surfacing fabrications plumb, level, rigid, and scribed to adjacent finishes in accordance with reviewed shop drawings and manufacturer's printed instructions.
- .2 Form joint seams using manufacturer's recommended adhesive. Keep components and hands clean when making joints. Reinforce field joints as specified herein. Cut and finish component edges with clean, sharp returns.
- .3 Route radii and contours to template. Anchor securely to base component or other supports. Align adjacent components and form seams to comply with manufacturer's written recommendations using adhesive in colour to match work. Carefully dress joints smooth, remove surface scratches and clean entire surface.
- .4 Allow gaps for expansion as required when installed between walls or other fixed structure.
- .5 Apply sealant between walls and solid surfacing fabrications with colour matching joint sealant in accordance with Section 07 92 00.
- .6 Keep solid surfacing fabrications and hands clean during installation. Remove adhesives, sealants and other stains.
- .7 Horizontal surface: apply continuous bead of mounting adhesive around perimeter of structural substrate and supports.

3.4 CLEANING

- .1 Remove excess adhesive and sealant from visible surfaces.
- .2 Clean exposed surfaces in accordance with manufacturer's printed instructions.

3.5 PROTECTION

- .1 Provide protective coverings to prevent physical damage or staining following installation until completion of project.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 This section includes all labour and materials required to complete mock-up installation including component review and testing and quality control/quality assurance testing on thermal and moisture protection systems.

1.2 RELATED SECTIONS

- .1 Section 04 00 00 – Masonry
- .2 Section 07 11 13 – Bituminous Dampproofing
- .3 Section 07 11 19 – Sheet Dampproofing
- .4 Section 07 21 00 – Thermal Insulation
- .5 Section 07 26 00 – Air/Vapour Barrier Membrane
- .6 Section 07 26 13 – Polyethylene Sheet Vapour Barrier
- .7 Section 07 27 00 – Vapour Permeable Air Barrier Membrane - Self Adhesive
- .8 Section 07 41 13 – Metal Roof Panels
- .9 Section 07 42 13 – Metal Wall Panels
- .10 Section 07 52 00 – 2 Ply Mod Bit Membrane Roofing
- .11 Section 07 62 00 – Sheet Metal Flashing and Trim
- .12 Section 07 92 00 – Joint Sealants

1.3 MEASUREMENT AND PAYMENT

- .1 No measurement will be made under this section.
- .2 Building Envelope Testing; by Building Envelope Commissioning Authority, on behalf of The City.
- .3 Co-ordinate visual review and testing frequency and locations with Building Envelope Commissioning Authority to facilitate review of multiple distinct building envelope elements and components during the same visit.
- .4 Costs incurred for additional testing for items not meeting the specifications including costs for transportation and for required modifications to be the responsibility of the Contractor.

1.4 REFERENCES

- .1 American Society for Testing and Materials (ASTM):
 - .1 ASTM C1521-19(2020) Standard Practice for Evaluating Adhesion of Installed Weatherproofing Sealant Joints.
 - .2 ASTM D4541-17 Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers.

- .3 ASTM E1186-17 Standard Practices for Air Leakage Site Detection in Building Envelopes and Air Barrier Systems.

1.5 PRE-INSTALLATION CONFERENCE

- .1 Pre-Installation Conference in accordance with General Requirements.
- .2 Convene pre-installation conference minimum five (5) working days prior to beginning site installation of mock-up.
- .3 Establish date, time and location of conference and notify parties concerned minimum five (5) working days before conference.
- .4 Contractor, Contract Administrator, Commissioning Authority, Building Envelope Commissioning Authority, and installers involved in work to be in attendance.
- .5 Agenda for conference:
 - .1 Verify project requirements, design, and intent of design.
 - .2 Review installation and substrate conditions.
 - .3 Co-ordinate with subtrades.
 - .4 Review manufacturer's installation instructions and warranty requirements.
 - .5 Review compatibility of materials.

1.6 SUBMITTALS

- .1 Submittals in accordance with Section 01 33 00 Submittal Procedures.
- .2 Submit test results from testing agency for each specified test maximum one week following completion of testing.
- .3 The manufacturer for each component of the building envelope, including but not necessarily limited to all thermal and moisture protection components, shall provide written verification that the proposed material and systems will meet or exceed the requirements of the Contract Documents.
- .4 Product Data
 - .1 Provide product data for:
 - .1 Section 04 00 00 – Masonry
 - .2 Section 07 11 13 – Bituminous Dampproofing
 - .3 Section 07 11 19 – Sheet Dampproofing
 - .4 Section 07 21 00 – Thermal Insulation
 - .5 Section 07 26 00 – Air/Vapour Barrier Membrane
 - .6 Section 07 26 13 – Polyethylene Sheet Vapour Barrier
 - .7 Section 07 27 00 – Vapour Permeable Air Barrier Membrane – Self Adhesive
 - .8 Section 07 41 13 – Metal Roof Panels
 - .9 Section 07 42 13 – Metal Wall Panels
 - .10 Section 07 52 00 – 2 Ply Mod Bit Membrane Roofing

- .11 Section 07 62 00 – Sheet Metal Flashing and Trim
- .12 Section 07 92 00 – Joint Sealants
- .5 Shop Drawings
 - .1 Provide shop drawings for:
 - .1 Section 04 00 00 – Masonry
 - .2 Section 07 41 13 – Metal Roof Panels
 - .3 Section 07 42 13 – Metal Wall Panels
 - .4 Section 07 52 00 – 2 Ply Mod Bit Membrane Roofing
 - .5 Section 07 62 00 – Sheet Metal Flashing and Trim

1.7 QUALITY ASSURANCE

- .1 Notify the Contract Administrator, Commissioning Authority, Building Envelope Commissioning Authority, and the Testing Agency in writing of the construction and testing schedule prior to the start of work.
 - .1 On-site testing and reporting of the Contractor's work shall be carried out by the by the Building Envelope Commissioning Authority.
- .2 Field review/Testing frequency:
 - .1 On-Site Mock-Up Review and/or testing of thermal and moisture protection components:
 - .2 Review the mock-ups at completion milestones. Unless otherwise noted, mock-ups to be the first installation of the thermal and moisture protection components.
 - .3 Provide a minimum seventy-two (72) hours' notice for thermal and moisture protection components to be reviewed by Building Envelope Commissioning Authority.
- .3 On-Site Quality Assurance Review and/or Testing
 - .1 Visual review and testing of the installed thermal and moisture protection components may be periodically completed at the discretion of the Building Envelope Commissioning Authority.
 - .2 Provide a minimum seventy-two (72) hours' notice for thermal and moisture protection components to be reviewed by Building Envelope Commissioning Authority.

Part 2 Products

2.1 NOT USED

Part 3 Execution

3.1 MASONRY

- .1 Provide mock-ups of masonry at locations identified by the Building Envelope Commissioning Authority prior to full system installation. Mock-ups to be provided for each combination of masonry and substrate.
- .2 Visual review:
 - .1 Visual reviews shall be performed by the Building Envelope Commissioning Authority to determine general conformance with requirements of the Contract Documents.
 - .2 Frequency of visual reviews:
 - .1 Once during Mock-up.
 - .2 Randomly during remainder of installation at the discretion of the Building Envelope Commissioning Authority.

3.2 BITUMINOUS DAMPPROOFING

- .1 Provide a mock-up of the bituminous dampproofing at a location identified by the Building Envelope Commissioning Authority prior to full system installation.
- .2 Visual review:
 - .1 Visual reviews shall be performed by the Building Envelope Commissioning Authority to determine general conformance with requirements of the Contract Documents.
- .3 Frequency of visual reviews:
 - .1 Once during Mock-up.
 - .2 Randomly during remainder of installation at the discretion of the Building Envelope Commissioning Authority.

3.3 SHEET DAMPPROOFING

- .1 Provide a mock-up of the sheet dampproofing at a location identified by the Building Envelope Commissioning Authority prior to full system installation.
- .2 Visual review:
 - .1 Visual reviews shall be performed by the Building Envelope Commissioning Authority to determine general conformance with requirements of the Contract Documents.
- .3 Frequency of visual reviews:
 - .1 Once during Mock-up.
 - .2 Randomly during remainder of installation at the discretion of the Building Envelope Commissioning Authority.

3.4 THERMAL INSULATION

- .1 Provide mock-ups of thermal insulation at locations identified by the Building Envelope Commissioning Authority prior to full system installation. Mock-ups to be provided for each type of thermal insulation.
- .2 Visual review:
 - .1 Visual reviews shall be performed by the Building Envelope Commissioning Authority to determine general conformance with requirements of the Contract Documents.
- .3 Frequency of visual reviews:
 - .1 Once during Mock-up.
 - .2 Randomly during remainder of installation at the discretion of the Building Envelope Commissioning Authority.

3.5 AIR/VAPOUR BARRIER MEMBRANE

- .1 Provide mock-ups of the air barriers at locations identified by the Building Envelope Commissioning Authority prior to full system installation. Mock-ups to be provided for each combination of membrane and substrate.
- .2 Visual review:
 - .1 Visual reviews shall be performed by the Building Envelope Commissioning Authority to determine general conformance with requirements of the Contract Documents.
- .3 Frequency of visual reviews:
 - .1 Once during Mock-up.
 - .2 Randomly during remainder of installation at the discretion of the Building Envelope Commissioning Authority.
- .4 Adhesion testing:
 - .1 Adhesion testing shall be completed by the Building Envelope Commissioning Authority in accordance with ASTM D4541, using a 2.25" diameter disk.
 - .2 Standard of acceptance shall be the mean minus one standard deviation calculated from the mock-up and compared to manufacturer's requirements, but not less than 15 psi. In the event of a deficit, the manufacturer shall be consulted for direction.
 - .3 Pull tests shall be completed in sets of five per each substrate type, at the discretion of the Building Envelope Commissioning Authority.
 - .4 Frequency of testing:
 - .1 Once during Mock-up.
 - .2 Randomly during remainder of installation at the discretion of the Building Envelope Commissioning Authority.
- .5 Air- leakage testing:
 - .1 Air leakage testing shall be completed by the Building Envelope Commissioning Authority at membrane seams and overlaps and at the cladding support system anchorage penetrations in accordance with ASTM E1186.

- .2 Standard of acceptance is no observable air leakage.
- .3 Frequency of testing:
 - .1 Once during Mock-up.
 - .2 Randomly during remainder of installation at the discretion of the Building Envelope Commissioning Authority.

3.6 POLYETHYLENE SHEET VAPOUR BARRIER

- .1 Provide mock-ups of the polyethylene sheet vapour barrier at locations identified by the Building Envelope Commissioning Authority prior to full system installation. Mock-ups to be provided for each combination of membrane and substrate.
- .2 Visual review:
 - .1 Visual reviews shall be performed by the Building Envelope Commissioning Authority to determine general conformance with requirements of the Contract Documents.
 - .2 Frequency of visual reviews:
 - .1 Once during Mock-up.
 - .2 Randomly during remainder of installation at the discretion of the Building Envelope Commissioning Authority.

3.7 VAPOUR PERMEABLE AIR BARRIER MEMBRANE – SELF ADHESIVE

- .1 Provide mock-ups of the vapour permeable air barrier membrane – self adhesive at locations identified by the Building Envelope Commissioning Authority prior to full system installation. Mock-ups to be provided for each combination of membrane and substrate.
- .2 Visual review:
 - .1 Visual reviews shall be performed by the Building Envelope Commissioning Authority to determine general conformance with requirements of the Contract Documents.
 - .2 Frequency of visual reviews:
 - .1 Once during Mock-up.
 - .2 Randomly during remainder of installation at the discretion of the Building Envelope Commissioning Authority.

3.8 METAL ROOF PANELS

- .1 Provide a mock-up of the metal roof panels at a location identified by the Building Envelope Commissioning Authority prior to full system installation.
- .2 Visual review:
 - .1 Visual reviews shall be performed by the Building Envelope Commissioning Authority to determine general conformance with requirements of the Contract Documents.
 - .2 Frequency of visual reviews:
 - .1 Once during Mock-up.
 - .2 Randomly during remainder of installation at the discretion of the Building Envelope Commissioning Authority.

3.9 METAL WALL PANELS

- .1 Provide a mock-up of the metal wall panels at a location identified by the Building Envelope Commissioning Authority prior to full system installation.
- .2 Visual review:
 - .1 Visual reviews shall be performed by the Building Envelope Commissioning Authority to determine general conformance with requirements of the Contract Documents.
 - .2 Frequency of visual reviews:
 - .1 Once during Mock-up.
 - .2 Randomly during remainder of installation at the discretion of the Building Envelope Commissioning Authority.

3.10 2 PLY MOD BIT MEMBRANE ROOFING

- .1 Provide a mock-up of the 2-ply mod bit membrane roofing at a location identified by the Building Envelope Commissioning Authority prior to full system installation.
- .2 Visual review:
 - .1 Visual reviews shall be performed by the Building Envelope Commissioning Authority to determine general conformance with requirements of the Contract Documents.
 - .2 Frequency of visual reviews:
 - .1 Once during Mock-up.
 - .2 Randomly during remainder of installation at the discretion of the Building Envelope Commissioning Authority.
- .3 Air- leakage testing:
 - .1 Air leakage testing shall be completed by the Building Envelope Commissioning Authority at vapour barrier membrane seams and overlaps and at penetrations in accordance with ASTM E1186.
 - .2 Standard of acceptance is no observable air leakage at the penetrations.
 - .3 Frequency of testing:
 - .1 Once during Mock-up.
 - .2 Randomly during remainder of installation at the discretion of the Building Envelope Commissioning Authority.

3.11 SHEET METAL FLASHING AND TRIM

- .1 Provide a mock-up of the sheet metal flashing and trim at a location identified by the Building Envelope Commissioning Authority prior to full system installation.
- .2 Visual review:
 - .1 Visual reviews shall be performed by the Building Envelope Commissioning Authority to determine general conformance with requirements of the Contract Documents.
 - .2 Frequency of visual reviews:
 - .1 Once during Mock-up.

- .2 Randomly during remainder of installation at the discretion of the Building Envelope Commissioning Authority.

3.12 JOINT SEALANTS

- .1 Provide a mock-up of the joint sealants at a location identified by the Building Envelope Commissioning Authority prior to full system installation.
- .2 Visual review:
 - .1 Visual reviews shall be performed by the Building Envelope Commissioning Authority to determine general conformance with requirements of the Contract Documents.
 - .2 Frequency of visual reviews:
 - .1 Once during Mock-up.
 - .2 Randomly during remainder of installation at the discretion of the Building Envelope Commissioning Authority.
- .3 Adhesion testing:
 - .1 Adhesion testing on fully cured joints shall be completed by the Building Envelope Commissioning Authority in accordance with ASTM C1521, Destructive Procedure Method A.
 - .2 Adhesion testing on fully cured joints at dissimilar substrates shall be completed by the Building Envelope Commissioning Authority in accordance with ASTM C1521, Flap Procedure.
 - .3 Standard of acceptance shall be in accordance with manufacturer's published data and as follows:
 - .1 Silicone Sealants:
 - .1 Sealant should tear cohesively within itself or elongate the 1" gauge length the extent specified in the product manufacturer's technical literature before releasing from either substrate adhesively.
 - .2 Urethane Sealants:
 - .1 Sealant should tear cohesively within itself without bond loss.
 - .4 At this time, the joint will be reviewed for complete fill. The joint should not have voids, and joint dimensions should match those shown on the drawings.
 - .5 Frequency of testing:
 - .1 Once during Mock-up.
 - .2 Randomly during remainder of installation at the discretion of the Building Envelope Commissioning Authority.

3.13 ANALYSIS AND CORRECTIVE PROCEDURES

- .1 Repair all damages from testing.
- .2 Remediate non-conforming work identified during visual reviews and testing.

- .3 Do not cover any remediated work until reviewed by the Building Envelope Commissioning Authority, or until the Building Envelope Commissioning Authority has reviewed proof of remediation.
- .4 Re-testing of remediated work shall be at the discretion of the Building Envelope Commissioning Authority.
- .5 Costs for repairs, remediation of non-conforming work, and re-testing are the responsibility of the Contractor. No additional costs to be submitted to The City for repairs or testing.

3.14 REPORTING

- .1 Prepare reports in accordance with the specified test methods.
- .2 Reports to include modifications and repairs made to the test specimen.
- .3 Submit reports withing 5 working days following field observations and testing.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 03 30 00 – Cast-In-Place Concrete.

1.2 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 Asphalt's.
- .2 Canadian Standards Association (CSA).
 - .1 CAN/CSA A123.4-04 (R2018), Asphalt for Constructing Built-Up Roof Coverings and Waterproofing Systems.
- .3 Workplace Hazardous Materials Information System (WHMIS).

1.3 SUBMITTALS

- .1 Product Data.
 - .1 Submit product data in accordance with Section 01 33 00.
 - .2 Submit manufacturer's product specifications including technical data and installation instructions.

1.4 QUALITY ASSURANCE

- .1 Mock-ups.
 - .1 Co-ordinate with Section 07 08 00 for visual review and testing requirements.
 - .2 Mock-up critical bituminous dampproofing locations and connection details in accordance with Section 01 45 00.
 - .3 Prepare mock-up on site as part of initial installation. Mock-up to be reviewed for quality of workmanship, conformance with drawing details and requirements of this Section, and co-ordination with work of other Sections.
 - .4 Once approved, mock-up will set a standard of acceptance for remaining installations.
 - .5 Do not proceed with installation until mock-up is complete and reviewed by Contract Administrator.

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 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 20°C 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 Cleaning and Waste Management in accordance with Section 01 74 00.
- .7 Waste Management and Disposal in accordance with Section 01 74 19.

1.6 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 Comply with requirements of WHMIS regarding use, handling, storage, and disposal of asphalt, sealing compounds, primers and caulking materials.

Part 2 Products

2.1 MANUFACTURERS

- .1 Basis of Design Products.
 - .1 Asphalt Primer.
 - .1 Elsro #510 Asphalt Primer.
 - .2 Bakor 910-01 Asphalt Primer.
 - .3 Gibson Homans #6001 Asphalt Primer.
 - .4 Insulmastic 7501 Foundation/Roof Primer.
 - .2 Asphalt.
 - .1 Elsro #505 Fibrated Foundation Coating.
 - .2 Bakor 710-11 Foundation Coating.
 - .3 Gibson Homans #6125 Fibrated Foundation Coating.
 - .4 Insulmastic 7103 Fibrated Foundation Damproofing.
- .2 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes of the Bidding Procedures*.
- .3 Supply all products from single manufacturer.

2.2 MATERIALS

- .1 Asphalt Primer: in accordance with ASTM D41/D41M.
- .2 Asphalt: in accordance with ASTM D449/D449M.
- .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, and around penetrations through dampproofing with sealing compound applied in accordance with manufacturer's printed instructions.

3.3 APPLICATION

- .1 Apply primer continuous and uniform in accordance with manufacturer's instruction and applicable ASTM application standards.
- .2 Apply foundation coating in 2-coat application to entire exterior faces of grade beams.
- .3 Apply two (2) additional coats of foundation coating to vertical corners and construction joints for minimum width of 230 mm on each side, and all around and for 230 mm along pipes passing through grade beams.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 03 30 00 – Cast-In-Place Concrete.
- .2 Section 31 23 13 – Excavation, Trenching and Backfilling.
- .3 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(2020), Standard Test Method for Index Puncture Resistance of Geomembranes and Related Products.
 - .4 ASTM E84-20, Standard Test Method for Surface Burning Characteristics of Building Materials.
 - .5 ASTM E96/E96M-16, Standard Test Methods for Water Vapor Transmission of Materials.
 - .6 ASTM E154/E154M-08a(2019), Standard Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover.
 - .7 ASTM E1745-17, Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs.
 - .8 ASTM F1249-20, Standard Test Method for Water Vapor Transmission Rate Through Plastic Film and Sheeting Using a Modulated Infrared Sensor.
- .2 National Fire Protection Association (NFPA).
 - .1 NFPA 701-2019, Standard Methods of Fire Tests for Flame Propagation of Textiles and Films.

1.3 SUBMITTALS

- .1 Product Data.
 - .1 Submit product data in accordance with Section 01 33 00.
 - .2 Submit manufacturer's product specifications including technical data and installation instructions.

1.4 QUALITY ASSURANCE

- .1 Mock-ups.
 - .1 Co-ordinate with Section 07 08 00 for visual review and testing requirements.
 - .2 Mock-up critical sheet dampproofing locations and connection details in accordance with Section 01 45 00.
 - .3 Prepare mock-up on site as part of initial installation. Mock-up to be reviewed for quality of workmanship, conformance with drawing details and requirements of this Section, and co-ordination with work of other Sections.
 - .4 Once approved, mock-up will set a standard of acceptance for remaining installations.
 - .5 Do not proceed with installation until mock-up is complete and reviewed by Contract Administrator.

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 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.
- .4 Waste Management and Disposal in accordance with Section 01 74 19.

Part 2 Products

2.1 MANUFACTURERS

- .1 Basis of Design Products.
 - .1 Sheet Dampproofing Membrane (inaccessible void spaces).
 - .1 Layfield VaporFlex 15 Mil complete-with VaporFlex Tape.
 - .2 Stego Industries Stego Wrap 15-mil Class A Vapour Barrier complete-with Stego Tape.
 - .3 W.R. Meadows PERMINATOR 15 mil Underslab Vapour Barrier complete-with PERMINATOR Tape.
 - .2 Sheet Dampproofing Membrane (crawlspaces).
 - .1 Reef Industries Permalon Ply X-200 FR Fire-retardant Sheet Dampproofing Membrane complete-with Griffolyn Griff Tape FR.
- .2 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes* of the *Bidding Procedures*.
- .3 Supply all products from a single manufacturer.

2.2 MATERIALS

- .1 Sheet Dampproofing Membrane (inaccessible void spaces): 15 mil under-slab multi-layer plastic extrusion manufactured with polyolefin-based resin/chemical technology in accordance with ASTM E1745, water vapour permeance in accordance with ASTM F1249, tensile strength in accordance with ASTM E154, puncture resistance in accordance with ASTM D1709. Manufacturer's sealant, and purpose made low permeance tape constructed of high density polyethylene with pressure sensitive adhesive, minimum roll width 100 mm.
- .2 Sheet Dampproofing Membrane (crawlspaces): 14 mil 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. Manufacturer's sealant, and purpose made fire retardant pressure sensitive tape, minimum roll width 100 mm.

Part 3 Execution

3.1 EXAMINATION

- .1 Confirm that inaccessible void spaces and crawlspaces have 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 damproofing membrane on floors of inaccessible void spaces and crawlspaces on 50 mm leveling bed of sand/gravel as indicated in accordance with manufacturer's printed instructions. Cover sheet damproofing at inaccessible void spaces with 50 mm sand. Do not cover sheet damproofing (Permalon) at crawlspaces.
- .2 Lap edges of all sheet damproofing membrane 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 slit in the sheet damproofing membrane to fit around all concrete piles and mechanical and electrical penetrations. Then cover with second piece of same sheet damproofing membrane at these locations. Wrap around concrete piles and mechanical and electrical penetrations and secure with metal banding or sheathing tape as specified. Overlap bottom sheet and continuously tape all edges with sheathing tape as specified.
- .5 Seal punctures in sheet damproofing membrane. Use same sheet damproofing membrane at least 150 mm larger than puncture and continuously tape all edges with sheathing tape as specified.
- .6 Install additional strip of same sheet damproofing under precast concrete paver walkways in crawlspace.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 03 00 00 – Cast-In-Place Concrete.
- .2 Section 04 00 00 – Masonry.
- .3 Section 05 41 00 – Structural Metal Stud Framing.
- .4 Section 07 26 00 – Air/Vapour Barrier Membrane - Self Adhesive.
- .5 Section 07 27 00 – Vapour Permeable Air Barrier Membrane - Self Adhesive.
- .6 Section 07 42 13 – Metal Wall Panels.
- .7 Section 08 11 00 – Metal Doors and Frames.
- .8 Section 08 54 13 – Fiberglass Windows.
- .9 Section 09 22 16 – Non-Structural Metal Framing.
- .10 Section 09 29 00 – Gypsum Board.
- .11 Section 33 46 13 – Foundation Drainage Piping.

1.2 REFERENCES

- .1 American Society for Testing and Materials (ASTM).
 - .1 ASTM C167-18, Standard Test Methods for Thickness and Density of Blanket or Batt Thermal Insulations.
 - .2 ASTM C303-10(2016)e1, Standard Test Method for Dimensions and Density of Preformed Block and Board-Type Thermal Insulation.
 - .3 ASTM C423-17, Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.
 - .4 ASTM C518-17, Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
 - .5 ASTM C578-19, Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation.
 - .6 ASTM C612-14(2019), Standard Specification for Mineral Fiber Block and Board Thermal Insulation.
 - .7 ASTM C1104/C1104M-19, Standard Test Method for Determining the Water Vapor Sorption of Unfaced Mineral Fiber Insulation.
 - .8 ASTM D1621-16, Standard Test Method for Compressive Properties Of Rigid Cellular Plastics.
 - .9 ASTM D1622/D1622M-20, Standard Test Method for Apparent Density of Rigid Cellular Plastics.
 - .10 ASTM D4833/D4833M-07(2020), Standard Test Method for Index Puncture Resistance of Geomembranes and Related Products.
 - .11 ASTM E84-20, Standard Test Method for Surface Burning Characteristics of Building Materials.
 - .12 ASTM E96/E96M-16, Standard Test Methods for Water Vapor Transmission of Materials.
- .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 (R2019), 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 S770-15 (R2020), Standard Test Method for Determination of Long-Term Thermal Resistance of Closed-Cell Thermal Insulating Foams.

1.3 SUBMITTALS

- .1 Product Data.
 - .1 Submit product data in accordance with Section 01 33 00.
 - .2 Submit manufacturer's product specifications including technical data and installation instructions.
- .2 Samples.
 - .1 Submit samples in accordance with Section 01 33 00.
 - .2 Submit 200 mm x 200 mm sample of each type of insulation in thickness specified including fasteners as specified or proposed.

1.4 QUALITY ASSURANCE

- .1 Qualifications.
 - .1 Installation company to be an established firm with minimum five (5) years' experience in installing thermal insulation systems specified. If requested, submit list of minimum three (3) recently completed projects of similar size and complexity.
- .2 Mock-ups.
 - .1 Co-ordinate with Section 07 80 00 for visual review and testing requirements.
 - .2 Prepare mock-up of each insulation installation in accordance with Section 01 45 00.
 - .3 Prepare mock-up on site as part of final installation. Mock-up to be reviewed for quality of workmanship, conformance with drawing details requirements of this Section, and coordination with work of other Sections.
 - .4 Once approved, mock-ups will set standard of acceptance for remaining installations.
 - .5 Do not proceed with insulation installation until mock-up is complete and approved by the Contract Administrator.
- .3 Pre-Installation Meetings.
 - .1 Convene pre-installation meeting prior to commencement of the insulation work with insulation trade in attendance. Purpose of the meeting is to verify project requirements, substrate conditions, coordination with work of other Sections, and to review manufacturer's methods and procedures related to insulation 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. 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.
- .5 Waste Management and Disposal in accordance with Section 01 74 19.

Part 2 Products

2.1 MANUFACTURERS

- .1 Basis of Design Products.
 - .1 High Load Rigid Board Insulation - Adhesive Attached (grade beams).
 - .1 AMC Foam Technologies Styrobar HS-40 Expanded Polystyrene Insulation.
 - .2 Dow Styrofoam HIGHLOAD 40 Extruded Polystyrene Insulation.
 - .3 Quik-Therm SGI 40 Sub-Grade Expanded Polystyrene Insulation.
 - .4 Plasti-Fab PlastiSpan 40 Expanded Polystyrene Insulation.
 - .2 Drainage Board (grade beams).
 - .1 Bakor DB 2000 Drainage Composite Board.
 - .2 Grace Construction Products Hydroduct 200 Drainage Composite Board.
 - .3 Rigid Board Insulation - Loose Laid (extended horizontally below grade out from perimeter of grade beams).
 - .1 AMC Foam Technologies HALO Subterra 30 Expanded Polystyrene Insulation.
 - .2 Dow Styrofoam SM Extruded Polystyrene Insulation.
 - .3 Quik-Therm SGI 30 Sub-Grade Expanded Polystyrene Insulation.
 - .4 Semi-Rigid Mineral Wool Insulation - Mechanically Attached (outboard insulation on exterior walls above main floor).
 - .1 Rockwool Cavityrock Semi-Rigid Mineral Wool Insulation.
 - .5 Semi-Rigid Mineral Wool Insulation - Friction Fit (within exterior steel stud cavity).
 - .1 Rockwool Comfortbatt Semi-Rigid Mineral Wool Batt Insulation.
 - .6 Semi-Rigid Mineral Wool Acoustic Insulation (interior walls) - Friction Fit.
 - .1 Rockwool AFB evo™ Acoustical Fire Batt Mineral Wool Insulation.
 - .7 Two-Component, Low-Volume Foamed-In-Place Insulation.
 - .1 Froth-Pak as manufactured by Dow Polyurethane Systems.
 - .2 Handi-Foam as manufactured by Fomo Products Inc.
 - .3 Foamsulate as manufactured by Premium Spray Products.
 - .8 Mechanical Fasteners for Semi-Rigid Mineral Wool Insulation (to supplement masonry ties and thermal isolation clip system).
 - .1 Dekfast fastening system, #12 Hex screws with recessed steel hexagonal Dekfast plate.
 - .2 Duro-last fastening system, #12 Drill point screws with 75 mm square metal plate.
 - .9 Insulation Adhesive (tube application).
 - .1 LePage PL 300 Adhesive.
 - .2 Mulco 88 Adhesive.
 - .3 Insulmastic 7201 Adhesive.

- .2 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes of the Bidding Procedures*.
- .3 Supply similar products from a single manufacturer.

2.2 MATERIALS

- .1 High Load Rigid Board Insulation - Adhesive Attached (grade beams).
 - .1 Type 4 rigid cellular extruded polystyrene or Type 3 expanded polystyrene insulation to ASTM C518, ASTM C578, ASTM D1621, and CAN/ULC S701.1, Type 4 R-value nom 5.0 per 25 mm, Type 3 R-value nom 4.2 per 25 mm, compressive strength 275 kPa (40 psi), butt edge, CFC free and HCFC free, thickness as indicated.
- .2 Rigid Board Insulation - Loose Laid (extended horizontally below grade out from perimeter of grade beams).
 - .1 Type 4 rigid cellular extruded polystyrene or Type 3 expanded polystyrene insulation to ASTM C518, ASTM C578, ASTM D1621, and CAN/ULC S701, R-value nom 5.0 per 25 mm, compressive strength 207 kPa (30 psi), 600 mm width x 2400 mm length board sizes, square edge, CFC free and HCFC free, thickness as indicated.
- .3 Drainage Board (grade beams): to ASTM D1621, 11 mm thick, high impact polystyrene core with nonwoven polypropylene face both sides with puncture resistance to ASTM D4833/D4833M.
- .4 Semi-Rigid Mineral Wool Insulation - Mechanically Attached (outboard insulation on exterior walls above main floor).
 - .1 Non-combustible, lightweight, water repellent, semi-rigid mineral wool insulation board with rigid upper surface designed for exterior cavity wall and rainscreen applications to ASTM C518, ASTM C612, ASTM C1104/C1104M, CAN/ULC S102, and CAN/ULC S114, RSI 0.76/25 mm (R 4.3/inch), 610 mm width x 1220 mm length board sizes, thickness as indicated.
- .5 Semi-Rigid Mineral Wool Insulation - Friction Fit (within exterior steel stud cavity).
 - .1 Non-combustible, lightweight, semi-rigid mineral wool batt insulation board to ASTM C167, ASTM C518, CAN/ULC S102, and CAN/ULC S702.1, RSI 0.76/25 mm (R 4.3/inch), 610 mm width x 1220 mm length board sizes, thickness as indicated.
- .6 Semi-Rigid Mineral Wool Acoustic Insulation - Friction Fit (interior walls).
 - .1 Non-combustible, lightweight, formaldehyde free, mineral wool insulation board designed for superior fire resistance and acoustical performance to ASTM C167, ASTM C303, ASTM C423, CAN/ULC-S102, CAN/ULC S114, CAN/ULC S702.1, 413 mm width x 1220 mm length board sizes, thickness as indicated.
- .7 Foamed-In-Place Insulation: to C518 and D1622/D1622M, self-contained, factory pressurized, two-component polyurethane foam insulation.

2.3 ACCESSORIES

- .1 Mechanical Fasteners for Semi-Rigid Mineral Wool Insulation (to supplement masonry ties and thermal isolation clip system).
 - .1 Screw and plate fastening system consisting of minimum 50 mm diameter galvanized steel plate with self-drilling, high corrosive-resistant screws in accordance with manufacturer's printed installation instructions.

- .2 Fastening connection to be designed to withstand all combined applied loads including but not limited to pull-out and shear-loads, dead-loads, wind-loads, and wind driven rain-loads.
- .2 Masonry Ties complete-with Insulation Supports: in accordance with Section 04 00 00.
- .3 Thermal Isolation Clip System: in accordance with Section 07 42 13.

Part 3 Execution

3.1 EXAMINATION

- .1 Examine substrates and immediately inform the Contract Administrator in writing of defects.
- .2 Prior to commencement of work ensure substrates to receive insulation are firm, straight, smooth, dry, free of snow, ice or frost, and clean of dust and debris or other material detrimental to uniform bedding of the insulation.

3.2 INSTALLATION

- .1 High Load Rigid Board Insulation - Adhesive Attached (grade beams).
 - .1 Install high load rigid board insulation in accordance with manufacturer's printed installation instructions.
 - .2 Adhere high load insulation boards to face of grade beams as indicated with adhesive compatible with insulation boards.
 - .3 Apply adhesive in continuous 6 mm beads in a grid pattern to prevent air movement behind the insulation boards.
 - .4 Place boards in a method to maximize contact with bedding. Stagger side and end joints. Apply adhesive to butt edges and secure ends tight to adjacent boards.
 - .5 Use manufacturer's acceptable aluminum foil-faced tape to seal all board-to-board joints.
 - .6 Seal all openings and protrusions with foamed-in-place insulation.
 - .7 Co-ordinate installation of insulation with work of other trades.
 - .8 Do not cover insulation until it has been reviewed by the Contract Administrator.
- .2 Rigid Board Insulation - Loose Laid (extended horizontally below grade out from perimeter of grade beams).
 - .1 Extend rigid board insulation boards horizontal below grade out from perimeter of grade beams as indicated. Lay boards tight to one another and slope away from the building 20% minimum to direct water away from building.
 - .2 Place insulation boards on min. 50 mm thick course of weeping tile filter aggregate in accordance with section 33 46 13 to provide full support of the insulation boards. Place granular backfill as specified directly over the insulation boards.
- .3 Drainage Board (grade beams).
 - .1 Install drainage board to improve drainage and protect grade beam insulation prior to backfilling in accordance with manufacturer's printed instructions.
- .4 Semi-Rigid Mineral Wool Insulation - Mechanically Attached (outboard insulation on exterior walls above main floor).
 - .1 Install semi-rigid mineral wool insulation in accordance with CAN/ULC-S702.2 and manufacturer's printed installation instructions.

- .2 Install insulation to accommodate masonry ties specified in Section 04 00 00 and thermal isolation clip system specified in Section 07 42 13.
 - .3 Supplement masonry tie insulation supports and thermal isolation clip system with screw and plate fastening system. Fasteners to be spaced in accordance with manufacturer's printed instructions. Ensure all insulation boards are securely fastened and tight against and flush with the surface of the substrate.
 - .4 Install semi-rigid mineral wool insulation in single layer to maintain continuity of thermal protection to building elements and spaces. Bring each board into firm contact with adjacent boards. Do not compress insulation to fit into spaces.
 - .5 Fit insulation tightly around electrical boxes, pipes, ducts, door and window openings and other protrusions in or passing through insulation.
 - .6 Cut and trim insulation boards neatly to fit spaces. Use only insulation boards free from chipped or broken edges. Use largest possible dimensions to reduce number of joints.
 - .7 Co-ordinate installation of insulation with work of other trades.
 - .8 Do not cover insulation until it has been reviewed by the Contract Administrator.
- .5 Semi-Rigid Mineral Wool Insulation - Friction Fit (within exterior steel stud cavity).
- .1 Install semi-rigid mineral wool insulation in accordance with CAN/ULC-S702.2 and manufacturer's printed installation instructions.
 - .2 Install insulation to maintain continuity of thermal protection to building elements and spaces.
 - .3 Install insulation in exterior steel stud wall cavity. Run continuously from floor to underside floor/roof structure, over door and window openings, and around corners.
 - .4 Fit insulation closely around electrical boxes, plumbing and heating pipes, doors and window frames and other protrusions in or passing through insulation. Do not compress insulation to fit into spaces.
 - .5 Cut and trim insulation boards neatly to fit spaces. Use only insulation boards free from chipped or broken edges. Use largest possible dimensions to reduce number of joints.
 - .6 Do not cover insulation until it has been reviewed by the Contract Administrator.
- .6 Semi-Rigid Mineral Wool Acoustic Insulation - Friction Fit (interior walls).
- .1 Install semi-rigid mineral wool acoustic insulation in accordance with CAN/ULC-S702.2 and manufacturer's printed installation instructions.
 - .2 Install insulation to maintain continuity of acoustic and fire rating properties where required.
 - .3 Ensure insulation fills steel stud cavity. Run continuously from floor to underside floor/roof structure, over door and window openings, and around corners.
 - .4 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 insulation to fit into spaces.
 - .5 Ensure insulation is placed around cut openings in gypsum board, behind electrical receptacles, around plumbing, heating or structural items passing through and at abutting walls.
 - .6 Cut and trim insulation boards neatly to fit spaces. Use only insulation boards free from chipped or broken edges. Use largest possible dimensions to reduce number of joints.
 - .7 Do not cover insulation until it has been reviewed by the Contract Administrator.
- .7 Foamed-In-Place Insulation.
- .1 Apply foamed-in-place insulation in accordance with manufacturer's printed instructions.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 04 00 00 – Masonry.
- .2 Section 06 10 00 – Rough Carpentry.
- .3 Section 07 21 00 – Thermal Insulation.
- .4 Section 07 27 00 – Vapour Permeable Air Barrier Membrane - Self Adhesive.
- .5 Section 08 54 13 – Fiberglass Windows.
- .6 Section 09 29 00 – Gypsum Board.

1.2 REFERENCES

- .1 American Society for Testing and Materials (ASTM).
 - .1 ASTM A653/A653M-20, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by Hot-Dip Process.
 - .2 ASTM D4541-17, Standard Test Method for Pull Off Strength of Coatings Using Portable Adhesion Testers.
 - .3 ASTM D5147/D5147M-18, Standard Test Methods for Sampling and Testing Modified Bituminous Sheet Material.
 - .4 ASTM D6677-18, Standard Test Method for Evaluating Adhesion by Knife.
 - .5 ASTM D7234-19, Standard Test Method for Pull-Off Adhesion Strength of Coatings on Concrete Using Portable Pull-Off Adhesion Testers.
 - .6 ASTM E96/E96M-16, Standard Test Methods for Water Vapour Transmission of Materials.
 - .7 ASTM E283/E283M-19, Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Skylights, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
 - .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 by Uniform Static Air Pressure Difference.
 - .10 ASTM E1186-17, Standard Practices for Air Leakage Site Detection in Building Envelopes and Air Barrier Systems.
 - .11 ASTM E2178-13, Standard Test Method for Air Permeance of Building Materials.
- .2 National Building Code of Canada, 2020 (NBCC), complete with current Manitoba Building Code amendments (MBC).

1.3 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. Include manufacturer's technical data sheets.

1.4 QUALITY ASSURANCE

- .1 Qualifications.
 - .1 Installation of air/vapour barrier membrane to be by one trade only, approved and trained in installation procedures by the membrane manufacturer.
 - .2 Each applicator must be thoroughly trained and experienced in the installation of air/vapour barrier membrane specified. Applicators must perform or directly supervise all air/vapour barrier membrane work on the project.
 - .3 Assign one 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 a Building Envelope Commissioning Authority (BECxA) retained and paid for by the City.
- .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 air/vapour barrier membrane applicator will be expected to routinely inspect and test their work as work proceeds. The result of their testing and inspection efforts to be recorded in worksheets by the applicator. These worksheets are to be kept on site and be available for routine inspection by the City, Contract Administrator, and BECxA. A copy of the worksheets to be submitted to the Contract Administrator on a weekly basis. The cost of this requirement is to be borne by the air/vapour barrier membrane trade.
 - .2 The air/vapour barrier membrane applicator will pre-inspect/test all membranes and make all necessary repairs immediately prior to inspection and testing by BECxA who will document repairs made and approvals given.
 - .3 The applicator will co-operate with BECxA by making construction drawings and records available to BECxA, including the air/vapour barrier worksheets, and provide BECxA with other information as requested.
 - .4 Assist BECxA with the performance of their duties by providing access to scaffolding, swing stages, etc., and provide and pay for heating and hording if required in order for BECxA to perform inspections and testing.
- .4 Documentation.
 - .1 Maintain jobsite records including dates on which membrane was installed, wall areas covered on those dates, name of the applicator, the types and lot numbers of materials used, environmental and substrate conditions including at a minimum temperatures, humidity and cleanliness during installation, variations from drawings or specifications, and results of any pre-testing or inspections done by the applicator. The applicator's worksheets must identify all areas of substrate for which applicator has pre-tested application of air/vapour barrier membrane. Submit copy of these worksheets to the Contract Administrator on a weekly basis.
- .5 Mock-ups.
 - .1 Mock-up critical air/vapour barrier membrane locations and connection details in accordance with Section 01 45 00.

- .2 Prepare mock-up on site as part of final installation. Mock-up to be reviewed for quality of workmanship, conformance with drawing details and requirements of this Section, co-ordination with work of other Sections, and testing by BECxA.
- .3 Mock-up the following locations and connection details:
 - .1 Fiberglass faced gypsum board wall surfaces.
 - .2 Masonry wall surfaces.
 - .3 Masonry tie connections.
 - .4 Thru-wall penetrations.
 - .5 Roof/wall intersection.
 - .6 Tie-in between fiberglass window frames and air/vapour barrier membrane.
 - .7 Tie-in between curtain wall framing and vapour permeable air barrier membrane.
- .4 Once approved, mock-up will set standard of acceptance for remaining installations.
- .5 Do not proceed with air/vapour barrier membrane installation until mock-up is complete and approved by BECxA.
- .6 Pre-installation Meeting.
 - .1 Convene pre-installation meeting prior to commencement of the air/vapour barrier membrane installation work with roof trade, window trade, and air/vapour barrier membrane trade in attendance. Purpose of the meeting is to discuss the quality of workmanship expected, and to ensure that applicator is 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. BECxA will be in attendance to identify testing procedures that will be used on the project and to answer any questions.

1.5 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.
- .4 Waste Management and Disposal in accordance with Section 01 74 19.

1.6 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 frost or 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 materials in enclosed spaces without ventilation.

1.7 SEQUENCING

- .1 Co-ordinate work of this Section with all other applicable Sections to ensure continuity of the building envelope.

1.8 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 Total Performance of the Work. Manufacturer hereby warrants air/vapour barrier membrane free of manufacturing and material defects, and these or other observed defects and deficiencies will be repaired or replaced to the satisfaction of the Contract Administrator and the City, and at no expense to the City. Defects and deficiencies include, but are not limited to:
 - .1 Cohesive or adhesive failure of the system.
 - .2 Deficiencies resulting in crack-bridging failure of the system.
 - .3 Leakage as a result of any installation or material deficiency.
- .2 **Installation Contractor’s Warranty:** provide an extended warranty for Work of this Section for a period of two (2) years from date of Total Performance of the Work. Contractor hereby warrants that membrane work will maintain air/vapour 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 Contract Administrator 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 Henry 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 Membrane Thru-Wall Flashing.
 - .1 Henry Blueskin TWF Thru-Wall Flashing.
 - .3 Membrane Sealant.
 - .1 Henry 925 BES Sealant.
- .2 Substitutions: not permitted.
- .3 Supply all products from a single manufacturer.

2.2 MATERIALS

- .1 Air/Vapour Barrier Membrane and Membrane Flashing: 1 mm thick non-vapour permeable self-adhering membrane and membrane flashing consisting of an SBS rubberized asphalt compound laminated to a blue engineered thermoplastic film surface, 914 mm width, and having the following typical physical properties:
 - .1 Water Vapour Permeance: 0.08 Perms to ASTM E96/E96M.
 - .2 Air Permeance: <0.0002 cfm/ft² (0.0011 L/s.m.2) to ASTM E2178.
- .2 Membrane Thru-Wall Flashing: 1 mm thick non-vapour permeable self-adhering through-wall flashing consisting of an SBS rubberized asphalt compound integrally laminated to a yellow engineered thermoplastic film surface having the following typical physical properties:
 - .1 Water Vapour Permeance: 0.03 perms to ASTM E96/E96M.
 - .2 High Temperature Stability - Flow Resistance: Pass in accordance with ASTM D5147/D5147M.
 - .3 Tear Resistance: 45 lbs. MD to ASTM D1004.
 - .4 Low Application Temperature Limitation: -7°C.
- .3 Membrane Sealant: premium, one-part, low VOC, moisture cure, building envelope sealant for construction joints subject to dynamic joint movement.

2.3 ACCESSORIES

- .1 Primer: as recommended by the membrane manufacturer used to prime substrate to enhance the adhesion of the self-adhesive air/vapour barrier membrane.
- .2 Tapes: self-adhering type, maintaining a minimum thickness of 0.8 mm (30 mil), provided in rolls of dimensions 100 mm and 150 mm.
- .3 Galvanized Sheet Transition Strip: 20-gauge, continuous hot-dip Z275 zinc coated (galvanized) steel conforming to requirements of ASTM A653/A653M, regular spangle surface.

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 NBCC. 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 Contract Administrator, 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.
- .4 Roof assemblies including roof parapets must be watertight prior to commencing installation of wall membrane.

3.2 PREPARATION

- .1 Refer to manufacturer's printed literature for preparation requirements of substrates to receive air/vapour barrier membrane. Surfaces must be structurally sound and free of voids, loose aggregate, and sharp protrusions. Clean surfaces with a broom, vacuum, or compressed air to remove dust and debris.
- .2 Poor quality surfaces with excessive laitance to be shot blasted to provide a dense smooth surface free from contaminants. Use repair materials and methods that are acceptable to manufacturer of the air/vapour barrier membrane.
- .3 For applications onto new cast-in-place concrete or masonry surfaces, 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.
- .4 Apply primer over surfaces to receive air/vapour barrier membrane by means of roller or spray in accordance with manufacturer's printed instructions. Thoroughly dry primer before applying self-adhesive membrane.
- .5 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.
- .6 Cap and protect exposed back-up walls against wet weather conditions during and after application of the air/vapour barrier membrane.

3.3 INSTALLATION

- .1 Complete all preparatory work before commencing air/vapour barrier membrane installation. Ensure substrate is ready to receive membrane in accordance with manufacturer's installation guidelines and as specified in this Section.
- .2 Install adhesive/primer recommended by manufacturer in accordance with manufacturer's printed instructions. Install continuously and at rate recommended by manufacturer to ensure complete substrate coverage of air/vapour barrier membrane installation area.
 - .1 Allow adhesive/primer to cure to a tacky film prior to application of air/vapour barrier membrane.
 - .2 Primed areas not covered by end of day must be re-primed prior to installation of air/vapour barrier membrane.
- .3 Install galvanized sheet transition strip as detailed to support air/vapour barrier membranes across unsupported openings.
- .4 Detail work must be carefully carried out to ensure the air/vapour barrier membrane creates a continuous seal at all construction elements, and at junctures of different materials or construction types.

- .5 Install air/vapour barrier membrane vertically onto the primed surface by peeling back protective film on the underside and adhering the membrane to the surface. Apply hand pressure over the surface of the membrane in order to eliminate wrinkles and 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.
- .6 Where masonry anchors are already in place prior to the membrane installation, install the membrane vertically onto primed surface beginning from the bottom of the wall area and work in an upwards direction along the wall surface. 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. Neatly slit the membrane at each masonry tie. Press and adhere the membrane to the wall surface around each masonry tie, and seal all masonry ties at their contact with the membrane with membrane sealant.
- .7 Subsequent sheets applied above must overlap the sheet below minimum of 50 mm. End laps and vertical seams in the membrane to 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.
- .8 Double cover all inside and outside corners with initial strip of air/vapour barrier 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.
- .9 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.
- .10 Membrane Flashing/Sealant.
 - .1 Install membrane flashing complete-with primer at window openings and as detailed and in accordance with manufacturer's printed instructions.
 - .2 Refer to manufacturer's printed literature for preparation requirements of substrates to receive membrane flashing. Surfaces must be structurally sound and free of voids, loose aggregate, and sharp protrusions. Clean surfaces with a broom, vacuum, or compressed air to remove dust and debris.
 - .3 Install the membrane flashing 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 Install membrane flashing sealant along seams and as required to ensure continuous seal at all construction elements.
- .11 Membrane Thru-Wall Flashing.
 - .1 Install membrane thru-wall flashing under exterior masonry veneer bearing on shelf angles, at steel angles over openings, and at locations detailed on drawings.
 - .2 Install thru-wall flashing over metal drip flashings, and under weep hole courses and as indicated.

- .3 Install membrane thru-wall flashings through full thickness of exterior wythe horizontally across cavity and through insulation to terminate with a minimum 150 mm vertical leg against air/vapour barrier membrane.
- .4 Install membrane flashings to provide continuous waterproofing flashing in wall. Seal around all structural reinforcing penetrations with membrane sealant. Lap joints 150 mm and seal.
- .12 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.
- .13 At the end of each working day, if the wall area has been only partially covered, apply a bead of membrane sealant along the top edge of the membrane to prevent vertical drainage of precipitation from running in behind the membrane.
- .14 Before covering the membrane with the cavity insulation, inspect and repair as necessary any damaged areas. Cavity insulation to follow as closely as possible to the installation of the membrane.
- .15 Protect finished membrane from water runoff from adjoining building assemblies.

3.4 REPAIR

- .1 Patch and repair misaligned or inadequately lapped seams, tears, punctures or fishmouths to the satisfaction of BECxA and Contract Administrator.
- .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 membrane sealant.

3.5 FIELD QUALITY CONTROL

- .1 Commissioning (including site inspection and testing) of air/vapour barrier membrane installation will be carried out by a Building Envelope Commissioning Authority (BECxA) retained and paid for by the City.
- .2 Assist BECxA with the performance of their duties by providing access to aerial lifts, scaffolding, etc.
- .3 Testing procedures of air/vapour barrier mockup to include:
 - .1 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.
 - .2 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.
- .4 Once tested and approved by BECxA, 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.
- .5 Random field testing of air/vapour barrier membrane installation to include:
 - .1 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.

- .2 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.
- .6 Air/vapour barrier trade will be responsible to patch all adhesion test cuts following testing procedures.
- .7 Air/vapour barrier trade will be responsible for all re-testing costs associated with return visits by BECxA as a result of work that has failed inspection or testing procedures.

3.6 PROTECTION

- .1 Protect finished work from damage after installation.
- .2 Once approved by BECxA, cover membrane with building insulation as soon as possible protect the membranes from weather, excessively high temperatures, and damage by other trades.

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 08 54 13 – Fiberglass Windows.
- .5 Section 09 29 00 – Gypsum Board.

1.2 REFERENCES

- .1 American Society for Testing and Materials (ASTM).
 - .1 ASTM A653/A653M-20, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by Hot-Dip Process.
 - .2 ASTM D882-18, Standard Test Method for Tensile Properties of Thin Plastic Sheeting.
 - .3 ASTM D903-98(2017), Standard Test Method for Peel or Stripping Strength of Adhesive Bonds.
 - .4 ASTM D1004-13, Standard Test Method for Tear Resistance (Graves Tear) of Plastic Film and Sheeting.
 - .5 ASTM D4541-17, Standard Test Method for Pull Off Strength of Coatings Using Portable Adhesion Testers.
 - .6 ASTM D5147/D5147M-18, Standard Test Methods for Sampling and Testing Modified Bituminous Sheet Material.
 - .7 ASTM D6677-18, Standard Test Method for Evaluating Adhesion by Knife.
 - .8 ASTM D7234-19, Standard Test Method for Pull-Off Adhesion Strength of Coatings on Concrete Using Portable Pull-Off Adhesion Testers.
 - .9 ASTM E84-20, Standard Test Method for Surface Burning Characteristics of Building Materials.
 - .10 ASTM E96/E96M-16, Standard Test Methods for Water Vapour Transmission of Materials.
 - .11 ASTM E283/E283M-19, Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Skylights, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
 - .12 ASTM E330/E330M-14, Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.
 - .13 ASTM E331-00(2016), Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference.
 - .14 ASTM E1186-17, Standard Practices for Air Leakage Site Detection in Building Envelopes and Air Barrier Systems.
 - .15 ASTM E2178-13, Standard Test Method for Air Permeance of Building Materials.
- .2 National Building Code of Canada, 2020 (NBCC), complete with current Manitoba Building Code amendments (MBC).

1.3 SUBMITTALS

- .1 Shop Drawings.
 - .1 Submit shop drawings in accordance with Section 01 33 00.

- .2 Include vapour permeable air barrier membrane installation details at typical joints and junctions between assemblies, and at all penetrations through membrane. Include manufacturer's technical data sheets.

1.4 QUALITY ASSURANCE

- .1 Qualifications.
 - .1 Installation of vapour permeable air barrier membrane to be by one trade only, approved and trained in installation procedures by the membrane manufacturer.
 - .2 Each applicator must be thoroughly trained and experienced in the installation of vapour permeable air barrier membrane specified. Applicators must perform or directly supervise all vapour permeable air barrier membrane work on the project.
 - .3 Assign one applicator for this project who is to assume overall responsibility for installing and pre-testing all vapour permeable air barrier membrane on the project prior to inspection and testing by a Building Envelope Commissioning Authority (BECxA) retained and paid for by the City.
- .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 vapour permeable air barrier membrane applicator will be expected to routinely inspect and test their work as work proceeds. The result of their testing and inspection efforts to be recorded in worksheets by the applicator. These worksheets are to be kept on site and be available for routine inspection by the City, Contract Administrator, and BECxA. A copy of the worksheets to be submitted to the Contract Administrator on a weekly basis. The cost of this requirement is to be borne by the vapour permeable air barrier membrane trade.
 - .2 The vapour permeable air barrier membrane applicator will pre-inspect/test all membranes and make all necessary repairs immediately prior to inspection and testing by BECxA who will document repairs made and approvals given.
 - .3 The applicator will co-operate with BECxA by making construction drawings and records available, including the vapour permeable air barrier membrane worksheets, and providing other information as requested.
 - .4 Assist BECxA with the performance of their duties by providing access to scaffolding, swing stages, etc., and provide and pay for heating and hording if required in order for BECxA to perform inspections and testing.
- .4 Documentation.
 - .1 Maintain jobsite records including dates on which membrane was installed, wall areas covered on those dates, name of the applicator, the types and lot numbers of materials used, environmental and substrate conditions including at a minimum temperatures, humidity and cleanliness during installation, variations from drawings or specifications, and results of any pre-testing or inspections done by the applicator. The applicator's worksheets must identify all areas of substrate for which applicator has pre-tested application of vapour permeable air barrier membrane. Submit copy of these worksheets to the Contract Administrator on a weekly basis.

- .5 Mock-ups.
 - .1 Mock-up critical vapour permeable air barrier membrane locations and connection details in accordance with Section 01 45 00.
 - .2 Prepare mock-up on site as part of final installation. Mock-up to be reviewed for quality of workmanship, conformance with drawing details and requirements of this Section, co-ordination with work of other Sections, and testing by BECxA.
 - .3 Mock-up the following locations and connection details:
 - .1 Fiberglass faced gypsum board wall surfaces.
 - .2 Masonry tie connections.
 - .3 Thru-wall penetrations.
 - .4 Roof/wall intersection.
 - .5 Tie-in between fiberglass window frames and vapour permeable air barrier membrane.
 - .6 Tie-in between curtain wall framing and vapour permeable air barrier membrane.
 - .4 Once approved, mock-up will set standard of acceptance for remaining installations.
 - .5 Do not proceed with vapour permeable air barrier membrane installation until mock-up is complete and approved by BECxA.
- .6 Pre-installation Meeting.
 - .1 Convene pre-installation meeting prior to commencement of the vapour permeable air barrier membrane installation work with vapour permeable air barrier membrane trade in attendance. Purpose of the meeting is to discuss the quality of workmanship expected, and to ensure that applicator is 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. BECxA will be in attendance to identify testing procedures that will be used on the project and to answer any questions.

1.5 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.
- .4 Waste Management and Disposal in accordance with Section 01 74 19.

1.6 SITE CONDITIONS

- .1 Prior to installation, inspect areas to receive vapour permeable air barrier membrane to ensure surfaces are clean, dry, sound, smooth and continuous.
- .2 Apply adhesives/primers and vapour permeable air 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 frost or precipitation.

- .3 Control exterior environmental conditions (hording and heating) for vapour permeable air 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 materials in enclosed spaces without ventilation.

1.7 SEQUENCING

- .1 Co-ordinate work of this Section with all other applicable Sections to ensure continuity of the building envelope.

1.8 WARRANTY

- .1 **Manufacturer’s Product Warranty:** provide an extended warranty for Work of this Section for a period of 12 years from date of Total Performance of the Work. Manufacturer hereby warrants vapour permeable air barrier membrane free of manufacturing and material defects, and these or other observed defects and deficiencies will be repaired or replaced to the satisfaction of the Contract Administrator 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 Total Performance of the Work. Contractor hereby warrants that vapour permeable air barrier membrane will not lose adhesion or cohesion, and these or other observed defects and deficiencies will be repaired or replaced to the satisfaction of the Contract Administrator and the City, and at no expense to the City.

Part 2 Products

2.1 MANUFACTURERS

- .1 **Basis of Design Products.**
 - .1 Self-Adhered Vapour Permeable Air Barrier Membrane complete-with manufacturer recommended Adhesives/Primers, Flashings, and Sealants.
 - .1 Henry Blueskin VP160 Self-Adhered Water Resistive Air Barrier.
 - .2 Membrane Flashing.
 - .1 Henry Blueskin SA Flashing.
 - .3 Membrane Thru-Wall Flashing.
 - .1 Henry Blueskin TWF Thru-Wall Flashing.
 - .4 Membrane Sealant.
 - .1 Henry 925 BES Sealant.
- .2 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes* of the *Bidding Procedures*.
- .3 Supply all products from a single manufacturer.

2.2 MATERIALS

- .1 Self-Adhered Vapour Permeable Air Barrier Membrane: 0.58 mm thick (23 mils) self-adhering vapour permeable, water resistive air barrier consisting of a reinforced, modified polyolefin tri-laminate film surface and patented permeable adhesive technology with split-back poly-release film having the following typical physical properties:
 - .1 Water Vapour Permeance: 29 perms to ASTM E96/E96M.
 - .2 Air Leakage of Air Barrier Assemblies: Pass in accordance with ASTM E2357.

- .3 Air Permeance: Pass in accordance with ASTM E2178.
 - .4 Fastener Sealability: Pass in accordance with ASTM D1970.
 - .5 Dry Tensile Strength to ASTM D882.
 - .1 41 lbf /182N MD.
 - .2 29 lbf /129N CD.
 - .6 Surface Burning Characteristics to ASTM E84.
 - .1 Flame Spread: Class A.
 - .2 Smoke Development: Class A.
 - .7 Low Application Temperature Limitation: -7 degrees C.
- .2 Membrane Flashing: 1 mm thick non-vapour permeable self-adhering membrane flashing consisting of an SBS rubberized asphalt compound laminated to a blue engineered thermoplastic film surface having the following typical physical properties:
- .1 Water Vapour Permeance: 0.08 Perms to ASTM E96/E96M.
 - .2 Air Permeance: <0.0002 cfm/ft2 (0.0011 L/s.m.2) to ASTM E2178.
- .3 Membrane Thru-Wall Flashing: 1 mm thick non-vapour permeable self-adhering through-wall membrane flashing consisting of an SBS rubberized asphalt compound integrally laminated to a yellow engineered thermoplastic film surface, having the following typical physical properties:
- .1 Water Vapour Permeance: 0.03 perms to ASTM E96/E96M.
 - .2 High Temperature Stability - Flow Resistance: Pass in accordance with ASTM D5147/D5147M.
 - .3 Tear Resistance: 45 lbs. MD to ASTM D1004.
 - .4 Low Application Temperature Limitation: -7°C.
- .4 Membrane Sealant: premium, one-part, low VOC, moisture cure, building envelope sealant for construction joints subject to dynamic joint movement.

2.3 ACCESSORIES

- .1 Primer: as recommended by the membrane manufacturer used to prime substrate to enhance the adhesion of the self-adhesive vapour permeable air barrier membrane.

Tapes: self-adhering type, maintaining a minimum thickness of 0.8 mm (30 mil), provided in rolls of dimensions 100 mm and 150 mm.
- .2 Galvanized Sheet Transition Strip: 24-gauge, continuous hot-dip Z275 zinc coated (galvanized) steel conforming to requirements of ASTM A653/A653M, regular spangle surface.

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 adhesives/primers, sealants, flashings, tapes, etc. that are in direct contact with or form part of the vapour permeable air barrier membrane assembly 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 manufacturer of the vapour permeable air barrier membrane they contact.

Part 3 Execution

3.1 EXAMINATION

- .1 Prior to commencement of work, examine all areas to receive vapour permeable air barrier membrane.
- .2 Ensure that vapour permeable air barrier membrane is structurally supported in all areas including transition areas according to the requirements of the NBCC. 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 Contract Administrator, 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.
- .4 Roof assemblies including roof parapets must be watertight prior to commencing installation of wall membrane.

3.2 PREPARATION

- .1 Refer to manufacturer's printed literature for preparation requirements of substrates to receive vapour permeable air barrier membrane. Surfaces must be structurally sound and free of voids, loose aggregate, and sharp protrusions. Clean surfaces with a broom, vacuum, or compressed air to remove dust and debris.
- .2 Poor quality surfaces with excessive laitance to be shot blasted to provide a dense smooth surface free from contaminants. Use repair materials and methods that are acceptable to manufacturer of the vapour permeable air/vapour barrier membrane.
- .3 Apply primer over surfaces to receive vapour permeable air/vapour barrier membrane by means of roller or spray in accordance with manufacturer's printed instructions. Thoroughly dry primer before applying 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.
- .5 Cap and protect exposed back-up walls against wet weather conditions during and after application of the vapour permeable air/vapour barrier membrane.

3.3 INSTALLATION

- .1 Complete all preparatory work before commencing vapour permeable air barrier membrane installation. Ensure substrate is ready to receive membrane in accordance with manufacturer's installation guidelines and as specified in this Section.
- .2 Install adhesive/primer recommended by manufacturer in accordance with manufacturer's printed instructions. Install continuously and at rate recommended by manufacturer to ensure complete substrate coverage of vapour permeable air barrier membrane installation area.
 - .1 Allow adhesive/primer to cure to a tacky film prior to application of vapour permeable air barrier membrane.
 - .2 Primed areas not covered by end of day must be re-primed prior to installation of vapour permeable air barrier membrane.

- .3 Install galvanized sheet transition strip at wall deflection joints as detailed to support vapour permeable air barrier membranes across unsupported openings.
- .4 Detail work must be carefully carried out to ensure the vapour permeable air barrier membrane creates a continuous seal at all construction elements, and at junctures of different materials or construction types.
- .5 Install vapour permeable air barrier membrane vertically onto primed surface by peeling back protective film on the underside and adhering the membrane to the surface. Apply hand pressure over the surface of the membrane in order to eliminate wrinkles and to remove any trapped air bubbles beneath the membrane, followed by pressure with a hand roller over entire surface and laps to ensure perfect adhesion of the membrane to the surface.
- .6 Where masonry anchors are already in place prior to the membrane installation, install the membrane vertically onto primed surface beginning from the bottom of the wall area and work in an upwards direction along the wall surface. 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. Neatly slit the membrane at each masonry tie. Press and adhere the membrane to the wall surface around each masonry tie, and seal all masonry ties at their contact with the membrane with membrane sealant.
- .7 Subsequent sheets applied above must overlap the sheet below minimum of 50 mm. End laps and vertical seams in the membrane to maintain a minimum overlap of 75 mm. Stagger vertical joints minimum 300 mm. Apply pressure with a roller over the entire membrane surface to ensure perfect adhesion.
- .8 Double cover all inside and outside corners with initial strip of vapour permeable air barrier 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.
- .9 Membrane Flashing/Sealant.
 - .1 Install membrane flashing complete-with primer at window openings and as detailed and in accordance with manufacturer's printed instructions.
 - .2 Refer to manufacturer's printed literature for preparation requirements of substrates to receive membrane flashing. Surfaces must be structurally sound and free of voids and sharp protrusions. Clean surfaces with a broom, vacuum, or compressed air to remove dust and debris.
 - .3 Install the membrane flashing 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 Install membrane flashing sealant along seams and as required to ensure continuous seal at all construction elements.
- .10 Membrane Thru-Wall Flashing.
 - .1 Install membrane thru-wall flashing under exterior masonry veneer bearing on shelf angles, at steel angles over openings, and at locations detailed on drawings.
 - .2 Install thru-wall flashing over metal drip flashings, and under weep hole courses and as indicated.

- .3 Install membrane thru-wall flashings through full thickness of exterior wythe horizontally across cavity and through insulation to terminate with a minimum 150 mm vertical leg against vapour permeable air barrier membrane.
- .4 Install membrane flashings to provide continuous waterproofing flashing in wall. Seal around all structural reinforcing penetrations with membrane sealant. Lap joints 150 mm and seal.
- .11 Co-ordinate installation of the vapour permeable air barrier membrane with the roofing trade to ensure continuity of the wall vapour permeable air barrier membrane with the roofing system vapour barrier.
- .12 At the end of each working day, if the wall area has been only partially covered, apply a bead of membrane sealant along the top edge of the membrane to prevent vertical drainage of precipitation from running in behind the membrane.
- .13 Before covering the membrane with the cavity insulation, inspect and repair as necessary any damaged areas. Cavity insulation to follow as closely as possible to the installation of the membrane.
- .14 Protect finished membrane from water runoff from adjoining building assemblies.

3.4 REPAIR

- .1 Patch and repair misaligned or inadequately lapped seams, tears, punctures or fishmouths to the satisfaction of BECxA and Contract Administrator.
- .2 Patch defects by bonding an additional layer of vapour permeable air barrier membrane extending minimum 150 mm in all directions from defect and make air tight. Seal around its edges with membrane sealant.

3.5 FIELD QUALITY CONTROL

- .1 Commissioning (including site inspection and testing) of vapour permeable air barrier membrane installation will be carried out by a Building Envelope Commissioning Authority (BECxA) retained and paid for by the City.
- .2 Assist BECxA with the performance of their duties by providing access to aerial lifts, scaffolding, etc.
- .3 Testing procedures of vapour permeable air barrier membrane mockup to include:
 - .1 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.
 - .2 Air tightness testing in substantial conformance with the procedures found in ASTM E1186. If testing to method 4.2.7, ensure that the test surfactant is compatible with the membrane being tested.
- .4 Once tested and approved by BECxA, 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.
- .5 Random field testing of vapour permeable air 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. If testing to method 4.2.7, ensure that the test surfactant is compatible with the membrane being tested.
- .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.
- .6 Vapour permeable air barrier membrane trade will be responsible to patch all adhesion test cuts following testing procedures.
- .7 Vapour permeable air barrier membrane trade will be responsible for all re-testing costs associated with return visits by BECxA as a result of work that has failed inspection or testing procedures.

3.6 PROTECTION

- .1 Protect finished work from damage after installation.
- .2 Once approved by BECxA, cover membrane with building insulation as soon as possible protect the membranes from weather, excessively high temperatures, and damage by other trades.

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 27 00 – Vapour Permeable Air Barrier Membrane - Self Adhesive.
- .4 Section 07 42 13 – Metal Wall Panels.
- .5 Section 07 62 00 – Sheet Metal Flashing and Trim.
- .6 Section 07 92 00 – Joint Sealants.

1.2 REFERENCES

- .1 American Society for Testing and Materials (ASTM).
 - .1 ASTM A653/A653M-20, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - .2 ASTM D1187/D1187M-97(2018), Standard Specification for Asphalt-Base Emulsions for Use as Protective Coatings for Metal.
 - .3 ASTM D2244-16, Standard Practice for Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates.
 - .4 ASTM D4214-07(2015), Standard Test Methods for Evaluating the Degree of Chalking of Exterior Paint Films.
 - .5 ASTM D5796-20, Standard Test Method for Measurement of Dry Film Thickness of Thin Film Coil-Coated Systems by Destructive Means Using a Boring Device.
- .2 National Building Code of Canada 2020, complete with current Manitoba Building Code amendments (NBCC).

1.3 SYSTEM DESCRIPTION

- .1 Design Requirements.
 - .1 Design prefinished steel roof panel system, including its support and attachments to resist positive and negative wind loads in accordance with the requirements of the National Building Code of Canada, Climatic Information for Building Design for Place of Work.
 - .2 Maximum deflection not to exceed L/180 and exhibit no permanent deformation when subjected to these loads. Make allowance in panel design for movement within system caused by deflection in building structure.
 - .3 Design all parts of the metal roof panel assembly to accommodate thermal movement caused by temperature variations from -40°C to +40°C without causing deterioration of panels. Such variation in temperature not to cause buckling, stress on enclosed or adjoining materials or fasteners, or in any way impair performance or appearance of roof panel system.
 - .4 Design metal roof panel assembly to maintain the following erection tolerances:
 - .1 Maximum variation from plane: 20 mm/10 m.
 - .2 Maximum offset from true alignment between two adjacent members abutting end to end in line: 1 mm.

- .2 Performance Requirements.
 - .1 Thickness of metal and details of assembly and support to provide sufficient strength and stiffness to resist distortion of finished surface.
 - .2 Panel lines, breaks and angles to be sharp, true and surfaces free from warp or buckle. Exposed edges and ends of metal to be dressed smooth, free from sharp edges.
 - .3 Panel assembly to be fastened to building structure in manner which transmits all loads to main structure without exceeding capacity of any fastener.

1.4 SUBMITTALS

- .1 Shop Drawings.
 - .1 Submit shop drawings in accordance with Section 01 33 00.
 - .2 Submit shop drawings bearing the signature and stamp of qualified Professional Engineer registered in jurisdiction of Place of Work.
 - .3 Include metal roof panel material, gauge thickness, elevations, sections, dimensions, finishes, trims and closure pieces, and specific details for metal roof panel assembly specified.
- .2 Samples.
 - .1 Submit samples in accordance with Section 01 33 00.
 - .2 Submit sample of prefinished steel roof panels in specified thickness and colour c/w roof panel support clips.

1.5 QUALITY ASSURANCE

- .1 Qualifications.
 - .1 Skilled tradesmen 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 Mock-ups.
 - .1 Co-ordinate with Section 07 80 00 for visual review and testing requirements.
 - .2 Prepare mock-up of prefinished steel roof panels in accordance with Section 01 45 00.
 - .1 Mock-up to be full size panel located on site as part of final installation.
 - .2 Mock-up will be reviewed for conformance with drawing details, quality of workmanship, coordination with work of other Sections, and overall appearance.
 - .3 Once approved, mock-up will set standard of acceptance for remaining installations.

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 Section 01 74 00.

- .5 Waste Management and Disposal in accordance with Section 01 74 19.

1.7 WARRANTY

- .1 Manufacturer's Product Warranty: provide an extended warranty for Work of this Section from date of Total Performance of the Work in accordance with the term of warranty specified below. Manufacturer hereby warrants paint finish will have no evidence of cracking, flaking, checking, chalking, or colour change in accordance with ASTM D2244 and ASTM D4214, and these or other observed defects and deficiencies will be repaired or replaced to the satisfaction of the Contract Administrator and the City, and at no expense to the City.
 - .1 Prefinished Steel Roof Panels: 40 years against film integrity, 30 years against stringent colour fade and chalking.

Part 2 Products

2.1 MANUFACTURERS

- .1 Basis of Design.
 - .1 Prefinished Steel Panels – Maintenance Shed.
 - .1 Domtek Pro rib roof panels, SODTMetal_8456, 16 mm rib depth, 26-gauge complete-with seam tape in all standing seams, colour as specified below.
- .2 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes of the Bidding Procedures*.
- .3 Supply products from single manufacturer and from same production run.

2.2 MATERIALS

- .1 Prefinished Steel Standing Seam Roof Panels: 26-gauge, continuous hot-dip Z275 zinc coated (galvanized) steel conforming to requirements of ASTM A653/A653M, 38 mm high ribs x min. 406 mm panel width, factory or field roll formed in continuous lengths, c/w continuous seam tape in all standing seams, purpose made panel support clips and snow/ice stops, factory finished to ASTM D5796 with factory applied Valspar WeatherXL or Perspectra Plus Series paint coating, colour: QC 6072 Charcoal.
- .2 Sheet Metal Flashing and Trim: in accordance with Section 07 62 00.
- .3 Joint Sealants: in accordance with Section 07 92 00.
- .4 Touch-up Paint: as recommended by panel manufacturer.

2.3 COMPONENTS

- .1 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 insulation surface min. 10 mm for cross ventilation under panels.
- .2 Exposed Flashings at Prefinished Steel Roof Panels: closure trims, flashings, inside corners, outside corners, accessories, etc. of same material and finish as metal roof panel material, shop cut and brake formed to right angles, concealed corner braces as required, colours as indicated.
- .3 Bitumen Protective Coating: to ASTM D1187/D1187M.

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 Contract Administrator in writing of any defects or irregularities which would affect performance or appearance of work.

3.2 INSTALLATION

- .1 Roof Panel Support Clips.
 - .1 Install roof panel support clips plumb, level and true, in proper alignment, and anchored securely in place in accordance with reviewed shop drawings and manufacturer's printed instructions.
- .2 Prefinished Steel Roof Panels.
 - .1 Install roof panels plumb, level and true and in proper alignment and anchored securely in place in accordance with reviewed shop drawings and manufacturer's printed instructions.
 - .2 Install roof panels 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 roof panel system. Details of assembly and support to provide sufficient strength and stiffness to resist distortion of finished surface.
 - .3 Fasten panels 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.
 - .4 Fastening roof panels to support structure not to compromise performance of vapour permeable air barrier membrane specified in Section 07 27 00.
 - .5 Install inside and outside corners, closure panels, and flashings as indicated.
 - .6 Touch up any minor paint abrasions with factory provided matching paint.

3.3 CLEANING

- .1 Promptly clean all panel surfaces with dry wipe as installation progresses to remove all stains and marks caused during installation in accordance with recommendations of panel 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 04 00 00 – Masonry.
- .2 Section 06 10 00 – Rough Carpentry.
- .3 Section 07 21 00 – Thermal Insulation.
- .4 Section 07 26 00 – Air/Vapour Barrier Membrane - Self Adhesive.
- .5 Section 07 27 00 – Vapour Permeable Air Barrier Membrane - Self Adhesive.
- .6 Section 07 62 00 – Sheet Metal Flashing and Trim.
- .7 Section 07 92 00 – Joint Sealants.
- .8 Section 08 54 13 – Fiberglass Windows.

1.2 REFERENCES

- .1 American Architectural Manufacturers Association (AAMA).
 - .1 AAMA 2605-20, Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels.
- .2 American Society for Testing and Materials (ASTM).
 - .1 ASTM A653/A653M-20, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - .2 ASTM D1187/D1187M-97(2018), Standard Specification for Asphalt-Base Emulsions for Use as Protective Coatings for Metal.
 - .3 ASTM D2244-16, Standard Practice for Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates.
 - .4 ASTM D4214-07(2015), Standard Test Methods for Evaluating the Degree of Chalking of Exterior Paint Films.
 - .5 ASTM D5796-20, Standard Test Method for Measurement of Dry Film Thickness of Thin Film Coil-Coated Systems by Destructive Means Using a Boring Device.
 - .6 ASTM E84-20, Standard Test Method for Surface Burning Characteristics of Building Materials.
- .3 National Building Code of Canada, 2020 (NBCC), complete with current Manitoba Building Code amendments (MBC).
- .4 Underwriters' Laboratories of Canada (ULC).
 - .1 CAN/ULC S134-13-REV1, Standard Method of Fire Test of Exterior Wall Assemblies.

1.3 SYSTEM DESCRIPTION

- .1 Design Requirements.
 - .1 Design prefinished steel system, including its support and attachments to resist positive and negative wind loads in accordance with the requirements of the National Building Code of Canada, Climatic Information for Building Design for Place of Work.
 - .2 Maximum deflection not to exceed L/180 and exhibit no permanent deformation when subjected to these loads. Make allowance in panel design for movement within system caused by deflection in building structure.

- .3 Design all parts of the metal wall panel assembly to accommodate thermal movement caused by temperature variations from -40°C to +40°C without causing deterioration of panels. Such variation in temperature not to cause buckling, stress on enclosed or adjoining materials or fasteners, or in any way impair performance or appearance of wall panel system.
- .4 Design wall system to maintain the following erection tolerances:
 - .1 Maximum variation from plane: 20 mm/10 m.
 - .2 Maximum offset from true alignment between two adjacent members abutting end to end in line: 1 mm.
- .5 Sub system design to incorporate grid lock to eliminate rocking of thermal isolation clip system on wall structure.
- .2 Performance Requirements.
 - .1 Thickness of metal and details of assembly and support to provide sufficient strength and stiffness to resist distortion of finished surface.
 - .2 Panel lines, breaks and angles to be sharp, true and surfaces free from warp or buckle. Exposed edges and ends of metal to be dressed smooth, free from sharp edges.
 - .3 Panel assembly to be fastened to building structure in manner which transmits all loads to main structure without exceeding capacity of any fastener.

1.4 SUBMITTALS

- .1 Shop Drawings.
 - .1 Submit shop drawings in accordance with Section 01 33 00.
 - .2 Submit shop drawings bearing the signature and stamp of qualified Professional Engineer registered in jurisdiction of Place of Work.
 - .3 Include thermal isolation clip system layout, spacings and fastening methods c/w sub-girts for attachment of metal wall panels.
 - .4 Include metal wall material, gauge thickness, elevations, sections, dimensions, finishes, and attachment methods, type of fasteners, fastener spacing, and accommodation for thermal movement, trims and closure pieces, and specific details for each metal wall panel specified.
- .2 Samples.
 - .1 Submit samples in accordance with Section 01 33 00.
 - .2 Submit samples of prefinished steel wall panels, and prefinished aluminium composite wall panels in specified thickness and colour.

1.5 QUALITY ASSURANCE

- .1 Qualifications.
 - .1 Skilled tradesmen 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 Mock-ups.
 - .1 Co-ordinate with Section 07 80 00 for visual review and testing requirements.
 - .2 Prepare mock-up of prefinished steel wall panels in accordance with Section 01 45 00.
 - .1 Mock-ups to be full size panel located on site as part of final installation.
 - .2 Mock-ups will be reviewed for conformance with drawing details, quality of workmanship, coordination with work of other Sections, and overall appearance.

- .3 Once approved, mock-ups will set standard of acceptance for remaining installations.

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 Section 01 74 00.
- .5 Waste Management and Disposal in accordance with Section 01 74 19.

1.7 WARRANTY

- .1 Manufacturer's Product Warranty: provide an extended warranty for Work of this Section from date of Total Performance of the Work to term of warranty specified below. Manufacturer hereby warrants paint finish will have no evidence of cracking, flaking, checking, chalking, or colour change in accordance with ASTM D2244 and ASTM D4214, and these or other observed defects and deficiencies will be repaired or replaced to the satisfaction of the Contract Administrator and the City, and at no expense to the City.
 - .1 Prefinished Steel Wall Panels: 40 years against film integrity, 30 years against stringent colour fade and chalking.

Part 2 Products

2.1 MANUFACTURERS

- .1 Basis of Design Products.
 - .1 Corrugated Unfinished Galvanized Steel Wall Panels (below masonry veneer at grade).
 - .1 Agway Metals 7-175, 44 mm rib depth, 18 gauge.
 - .2 VicWest CL7040, 38 mm rib depth, 18 gauge.
 - .2 Prefinished Steel Wall Panels (P1, P2).
 - .1 VicWest AD300-SR (P1 without rib) and AD150 (P2) in combination as indicated, 40 mm rib depth, 22 gauge, colour as specified below.
 - .3 Prefinished Steel Wall Panels – Maintenance Shed (P3).
 - .1 Domtek Pro rib, SODTMetal_8455, 16 mm rib depth, 26 gauge, colour as specified below.
 - .4 Thermal Isolation Clip System.
 - .1 Cascadia Clip Fiberglass Thermal Spacer.
- .2 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes of the Bidding Procedures*.
- .3 Supply products from single manufacturer and from same production run.

2.2 MATERIALS

- .1 Corrugated Unfinished Galvanized Steel Wall Panels (below masonry veneer at grade): 18-gauge continuous hot-dip Z275 zinc coated (galvanized) steel conforming to requirements of ASTM A653/A653M, regular spangle surface, factory preformed to profile specified, unpainted galvanized finish.
- .2 Prefinished Steel Wall Panels (P1/P2/P3): 22-gauge continuous hot-dip Z275 zinc coated (galvanized) steel conforming to requirements of ASTM A653/A653M, factory finished to ASTM D5796 with factory applied Valspar WeatherXL or Perspectra Plus Series paint coating.
 - .1 Wall Panel Colours (P1/P2).
 - .1 Base Colour C2 - QC 6076 White White.
 - .2 Flashings to be QC 6076 White White, location dependent.
 - .2 Prefinished Steel Wall Panels – Maintenance Shed (P3).
 - .1 Base Colour to be Charcoal.
 - .2 Flashings and Trims to be Charcoal.
- .3 Touch-up Paint: as recommended by panel manufacturer.
- .4 Thermal Insulation: in accordance with Section 07 21 00.
- .5 Sheet Metal Flashing and Trim: in accordance with Section 07 62 00.
- .6 Joint Sealants: in accordance with Section 07 92 00.

2.3 COMPONENTS

- .1 Thermal Isolation Clip System: intermittently spaced, thermally broken clip system complete-with purpose made steel horizontal and vertical sub-girts designed for structural attachment of cladding to exterior wall assemblies, consisting of:
 - .1 Low-conductivity fiberglass thermal spacers fastened to substrate with stainless steel fasteners and designed to accept either vertical or horizontal factory pre-punched 18-gauge galvalume steel sub-girts.
- .2 Wall Panel Fasteners.
 - .1 Fasteners of size, type, quantity and length to meet load requirements of metal wall panel assembly in accordance with building code and all applicable local regulations, and to maintain weather-resistant installation.
- .3 Exposed Flashings at Prefinished Steel Wall Panels: closure trims, drip flashings, inside corners, outside corners, reveals as detailed, accessories, etc. of same material and finish as metal wall panel material, shop cut and brake formed to right angles, concealed corner braces as required, colours as indicated.
- .4 Bitumen Protective Coating: to ASTM D1187/D1187M.

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 the Contract Administrator in writing of any defects or irregularities which would affect performance or appearance of work.

3.2 INSTALLATION

- .1 Thermal Isolation Clip System.
 - .1 Install thermal isolation clip system complete-with purpose made sub-girts in proper alignment and anchored 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.
 - .2 Install sub-girts/furring channels plumb, level and true and in proper alignment and anchor securely in place to accommodate wall insulation and metal wall panels.
 - .3 Install wall insulation in accordance with Section 07 21 00.
- .2 Prefinished Steel Wall Panels.
 - .1 Install wall panels plumb, level and true and in proper alignment and anchored securely in place in accordance with reviewed shop drawings and manufacturer's printed instructions.
 - .2 Install wall panels 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 wall panel system. Details of assembly and support to provide sufficient strength and stiffness to resist distortion of finished surface.
 - .3 Fasten panel assemblies to subgirts 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.
 - .4 Fastening systems connecting wall panels to back-up walls and/or support structures not to compromise performance of air/vapour barrier membrane specified in Section 07 26 00 and vapour permeable air barrier membrane specified in Section 07 27 00 with respect to air leakage and water penetration.
 - .5 Install inside and outside corners, closure panels, and flashings as indicated or required.
 - .6 Install brake formed exposed trim and reveals as detailed.
 - .7 Touch up any minor paint abrasions with factory provided matching paint.

3.3 CLEANING

- .1 Promptly clean all panel surfaces with dry wipe as installation progresses to remove all stains and marks caused during installation in accordance with recommendations of panel 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 03 30 00 – Cast-In-Place Concrete.

1.2 REFERENCES

- .1 American Society for Testing and Materials (ASTM).
 - .1 ASTM A653/A653M-20, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by Hot-Dip Process.
 - .2 ASTM C423-17, Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.
 - .3 ASTM E84-23, Standard Test Method for Surface Burning Characteristics of Building Materials.
- .2 National Building Code of Canada, 2020 (NBCC), complete with current Manitoba Building Code amendments (MBC).

1.3 SYSTEM DESCRIPTION

- .1 Design Requirements.
 - .1 Design acoustic barrier panel system, including its support and attachments to resist positive and negative wind loads in accordance with the requirements of the National Building Code of Canada, Climatic Information for Building Design for Place of Work.
- .2 Performance Requirements.
 - .1 Acoustical performance of the panels shall be equal to or greater than the following in accordance with ASTM C423:

dB Noise Reduction

Octave Frequency (Hz)	63	125	250	500	1K	2K	4K	8K
Noise Reduction Coefficient	0.18	0.75	1.02	1.07	0.98	0.89	0.8	0.86
Transmission Loss (TL)	21	21	30	41	52	59	64	67

Vibro-Acoustics

Octave Band (Hz)	63	125	250	500	1K	2K	4K	8K
Absorption Coefficients	-	0.7	0.9	0.99	0.99	0.9	0.8	-
Transmission Loss (dB)	18	21	27	37	48	54	54	54

1.4 SUBMITTALS

- .1 Shop Drawings.
 - .1 Submit shop drawings in accordance with Section 01 33 00.
 - .2 Each drawing submission to bear the signature and stamp of a qualified professional Engineer licensed in the jurisdiction of the Place of the Work.
 - .3 Acoustic barrier panel system complete with steel reinforcing to be engineered to meet the requirements of National Building Code of Canada, Climatic Information for Building Design for at the Place of the Work.
 - .4 Provide product certificates signed by manufacturer of acoustic barrier panel system certifying that products comply with specified acoustical performance requirements specified.

- .5 Indicate panel layout, elevations, gauge of materials, weight loading, core thicknesses, finishes, field connection details, joints, method of anchorage, number of anchors, supports, reinforcement, details, and accessories.
- .6 Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length and type of each weld. Identify grinding, finish and profile of welds.
- .2 Closeout Submittals.
 - .1 Provide maintenance data for incorporation into Operation and Maintenance Manual specified in Section 01 78 00.

1.5 QUALITY ASSURANCE

- .1 Qualifications.
 - .1 Skilled tradespersons to be employed by specialty company recognized and trained as approved installer by manufacturer, normally engaged in this type of work with minimum five (5) years' extensive experience in installation of products specified on projects of equal or greater size and degree of complexity. Information confirming this criteria may be requested by Contract Administrator.
- .2 Regulatory Requirements.
 - .1 Metal panel materials including acoustical media to meet flame spread classification 15 and smoke development rating 5 when tested in accordance with ASTM E84.

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, level, firm, 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 in accordance with Section 01 74 00.
- .5 Waste Management and Disposal in accordance with Section 01 74 19.

Part 2 Products

2.1 MANUFACTURERS

- .1 Basis of Design Products.
 - .1 Acoustic Barrier Panel System.
 - .1 dB Noise Reduction Noise Control Enclosure System complete-with factory finished paint coating. www.dbnoisereduction.com
Vibro-Acoustics Acoustic Enclosure System, factory finished paint coating. www.vibro-acoustics.com
 - .2 Heavy Duty Spring Loaded Door Stops (each door).
 - .1 Grainger #1XMK7 Heavy Duty Spring Door Stop.

- .2 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes of the Bidding Procedures*.
- .3 Supply all products from single manufacturer.

2.2 MANUFACTURED UNITS

- .1 Barrier Wall Absorption Panels: to ASTM A653/A653M, 100 mm (4") thick tongue and groove, exterior sheet minimum 18-gauge, A40 galvanized steel, interior sheet minimum 22-gauge, A40 galvanized perforated steel, factory finished paint coating, colour to be selected from manufacturer's full colour selection, panels filled with fiberglass acoustic media.
- .2 Structural Support Steel: structural steel shall be provided by the acoustic barrier panel system manufacturer with maximum deflection of assembled panels L/180. Structural to structural steel connections shall be fully welded. Finish: galvanized finish to all structural steel members. Where structural steel is exposed to view on outside of enclosure, provide paint finish top coats with colour to match panels.
- .3 Acoustical Media: incombustible, acoustical quality, shot-free fiberglass insulation with long, resilient fibers bonded with a thermosetting resin. Fiberglass shall be packed with 15% compression during panel assembly. Media shall be bacteria and fungus resistant and conform to irregular surfaces. Media shall not cause or accelerate corrosion of aluminum or steel. Mineral wool will not be permitted as a substitute for fiberglass.
- .4 Access Doors: doors shall be provided as noted on the plans with the same construction as the acoustic panels, except that the interior sheet shall be solid. Doors shall be mounted in a 10-gauge, galvanized steel angle frame with a single "P" gasket. Double doors shall be equipped with a removeable mullion AHF40D. Hardware shall include two (2) cam-type Ventlok 310 latches, vandal resistant pulls, continuous stainless steel hinge, and custom built padlock hasps. Locking by the City.
- .5 Heavy Duty Spring Loaded Door Stops (each door): 648 mm (25-1/2") long zinc plated steel wrapped in vinyl (gray) lear resistant cover, draw bar spring on both ends to keep door from opening too far and to reduce stress on door hinges and closers.

Part 3 Execution

3.1 INSTALLATION

- .1 Install acoustic barrier panel system, including all clips, fasteners, joint fillers, trims, furring channels, flashings, etc. plumb, level and true, and in proper alignment and anchored securely in place in accordance with reviewed shop drawings and manufacturer's printed instructions.

3.2 CLEANING

- .1 Promptly clean all panel surfaces with dry wipe after removal of protective coating as installation progresses to remove all stains and marks caused during installation in accordance with recommendations of panel 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 04 00 00 – Masonry.
- .2 Section 05 31 00 – Steel Decking.
- .3 Section 05 41 00 – Structural Metal Stud Framing.
- .4 Section 06 10 00 – Rough Carpentry.
- .5 Section 07 26 00 – Air/Vapour Barrier Membrane - Self Adhesive.
- .6 Section 07 27 00 – Vapour Permeable Air Barrier Membrane - Self Adhesive.
- .7 Section 07 62 00 – Sheet Steel Flashing and Trim.
- .8 Division 22 – Plumbing.
- .9 Division 23 – Heating, Ventilating, and Air Conditioning (HVAC).
- .10 Division 26 – Electrical.

1.2 REFERENCES

- .1 American Society for Testing and Materials (ASTM).
 - .1 ASTM A653/A653M-20, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by Hot-Dip Process.
 - .2 ASTM C1177/C1177M-17, Standard Specification for Glass Matt Gypsum Substrate for Use as Sheathing.
 - .3 ASTM C1278-17, Standard Specification for Fiber-Reinforced Gypsum Panel.
 - .4 ASTM C1289-19, Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board.
 - .5 ASTM D1622-20, Standard Test Method for Apparent Density of Rigid Cellular Plastics.
 - .6 ASTM D2126-15, Standard Test Method for Response of Rigid Cellular Plastics to Thermal and Humid Aging.
 - .7 ASTM D6162/D6162M-16, Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using a Combination of Polyester and Glass Fiber Reinforcements.
 - .8 ASTM D6163/D6163M-16, Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using Glass Fiber Reinforcements.
 - .9 ASTM D6164/D6164M-16, Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using Polyester Reinforcements.
- .2 Canadian Standards Association (CSA).
 - .1 CAN/CSA-A123.21-20, Standard Test Method for the Dynamic Wind Uplift Resistance of Membrane-Roofing Systems.
 - .2 CSA A123.23-15 (R2020), Product Specification for Polymer-modified Bitumen Sheet, Prefabricated and Reinforced.
- .3 National Research Council Canada (NRCC).
 - .1 Wind-RCI Wind-Roof Calculator on Internet.
- .4 Underwriters Laboratories of Canada (ULC).
 - .1 CAN/ULC-S102-18, Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.

- .2 CAN/ULC-S107-19, Standard Methods of Fire Tests of Roof Coverings.
- .3 CAN/ULC-S114-18, Standard Method of Fire Tests for Determination of Non-Combustibility in Building Materials.
- .4 CAN/ULC-S704.1-17, Standard for Thermal Insulation, Polyurethane and Polyisocyanurate, Boards, Faced.
- .5 Canadian Roofing Contractors Association (CRCA).
 - .1 CRCA Roofing Specification Manual, 2012.
- .6 Roofing Contractors Association of Manitoba (RCAM).
- .7 Workplace Hazardous Materials Information System (WHMIS).

1.3 SUBMITTALS

- .1 Shop Drawings.
 - .1 Submit shop drawings in accordance with Section 01 33 00.
 - .2 Submit most current technical data sheets describing the materials' physical properties, and explanations about product installation, including installation techniques, restrictions, limitations and other manufacturer's recommendations.
 - .3 Submit screw and plate fastening pattern for fibreglass mat faced gypsum board sheathing specified as recommended by manufacturer to meet wind uplift resistance requirements specified below.
 - .4 Submit adhesive pattern (per board) for roof insulation and high density glass-mat cover board specified as recommended by manufacturer to meet wind uplift resistance requirements specified below.
 - .5 Submit control joint and sloped insulation layout design including roof crickets. Indicate sloped insulation type, quantity, max/min thicknesses, and percentage of slope. Indicate locations of roof top mechanical units, vents, hoods, etc, and coordinate with size and heights of roof curbs to ensure positive unrestricted drainage to roof drains.
 - .6 Submit Roof Protection Plan in accordance with manufacturer's recommendations.
 - .7 If applicable, submit cold weather construction procedures and methods of protection which will be initiated, provided and maintained when ambient temperature falls below 0°C to ensure proper application of the work, per the requirements of this Section.
- .2 Certifications.
 - .1 Submit documentation certifying that roofing system offered meets requirements of CAN/ULC-S107 Methods of Fire Tests of Roof Coverings, Class C.
 - .2 Submit NRCC Wind-RCI calculation for roof covering to confirm dynamic wind uplift resistance requirements in accordance with CAN/CSA-A123.21.
 - .1 Corner: 4.5 kPa (95 psf).
 - .2 Edge: 2.3 kPa (49 psf).
 - .3 Field: 1.8 kPa (37 psf).
- .3 Closeout Submittals.
 - .1 Maintenance Data: provide dated and executed copy of manufacturer's warranty, and name, address and phone number of nearest manufacturer's representative, for inclusion into Operations and Maintenance Manual specified in Section 01 78 00.

1.4 QUALITY ASSURANCE

- .1 Qualifications.
 - .1 Roofing Contractor: approved applicator by roofing materials manufacturer, member in good standing with RCAM and CRCA, minimum five (5) years' experience installing roof system specified and be able to provide evidence of having installed this type of roof system for each of those five (5) years if requested.
 - .2 Roofing Contractor to maintain at project site during entire project, a full time on-site Supervisor who has a minimum of three (3) years' experience in all phases of installation with the specified roofing system.
 - .3 Workmen: adequate number of skilled workmen recognized and trained as approved applicator by roofing materials manufacturer, with experience installing roof system specified and supervised at all times by at least one experienced roofing superintendent. Workmen must have in their possession, identification of training course taken for specified product.
 - .4 Roofing Contractor must strictly comply with the roofing material manufacturer's current specifications and details.
- .2 Pre-Installation Meetings.
 - .1 Convene pre-installation roofing start-up meeting prior to commencement of 2-ply modified bitumen roof installation work with the City, Roofing Contractor, Contract Administrator, Building Envelope Commissioning Authority (BECxA) retained and paid for by the City, Mechanical Contractor, and General Contractor in attendance.
 - .1 Coordinate height of all roof curbs to suit new mechanical roof top units.
 - .2 Coordinate final roof drain locations and heights, and sloped insulation cricket layouts to ensure positive roof drainage without water ponding and without compromising thickness and R-value of roof insulation.
 - .3 Discuss site storage and protection of roofing materials, and cold weather restrictions for roofing work.
 - .4 Discuss preconditioning of membrane rolls, primers, and adhesives prior to application.
 - .5 Discuss dynamic wind uplift resistance requirements for this project as specified in 1.3.2.2 above, and in accordance with CAN/CSA A123.21. Confirm fastening and adhesive patterns required for all materials.
 - .6 Discuss quality of workmanship expected, and ensure trades are fully aware of tie-in requirements as detailed and roof inspections that will be undertaken by BECxA to ensure that quality of workmanship is met.
 - .7 Review Roof Asset Management Plan (RAMP).
 - .2 Record minutes of meeting including items discussed, decisions or agreements made, and identification of unresolved issues. Distribute meeting minutes within 5 working days of meeting date to all attending parties.
- .3 Mock-ups.
 - .1 Mock-up full roofing assembly in accordance with Section 01 45 00. Locate mock-up on site as part of final installation.
 - .2 Stagger mock-up to exposed all layers of roofing assembly as specified.
 - .3 Mock-up will be critically reviewed for quality of workmanship including fastener and adhesive patterns to meet dynamic wind uplift resistance requirements.
 - .4 Once approved, mock-up will set standard of acceptance for remaining installations.
 - .5 Do not proceed with roofing installation until mock-up is complete and approved by BECxA.

1.5 DELIVERY, STORAGE, AND HANDLING

- .1 Delivery and Acceptance Requirements.
 - .1 Deliver all material to site in manufacturer's original unopened packaging with labels clearly identifying product name and manufacturer.
 - .2 Carefully unload in a manner to prevent damage.
- .2 Storage and Handling Requirements.
 - .1 Refer to Product MSDS for precautionary measures during storage and handling.
 - .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 Protect materials from damage by elements, weather and other activities on raised platforms and covered with breathable tarpaulins.
 - .4 Store rolls of membrane on end in upright position. Do not store in leaning position or on side of roll. Handle rolls with care to avoid crushing, puncturing or other damage. Ensure selvage edge is not damaged during handling and banding strips are removed before application of membrane. Do not use wet or damp membrane or flattened rolls.
 - .5 Keep pail goods and membrane materials dry and elevated from contact with moisture. Ensure pail goods have tight fitting lids when not in use.
 - .6 Handle all products with appropriate precautions and care as stated manufacturer's instructions.
 - .7 If applicable during cold weather, store liquid and adhesive materials, sealants, and primers at temperature not less than 5°C and remove for application with as little exposure to cold as possible. Remove only in quantities required for same day use.
 - .8 Store all solvent based material in a well ventilated area away from flames and sparks and keep protected from the elements.
 - .9 Remove and replace any material found to be exposed to moisture or damaged before installation of the roof system at roofing Contractor's expense.
 - .10 Ensure materials stored on roof stay within designated live load limits of roof construction. Provide ample bases under equipment and materials to distribute weight to conform to these live load limits. Do not store materials on, or transport materials across, completed roof areas.
 - .11 Do not expose insulation and roof sheathing to wet weather. Store and handle insulation to prevent broken edges and corners, punctures, indentations or other damage. Remove damaged insulation from site. Applied packaging must be removed from insulation to prevent accumulation of condensation.
 - .12 Protect sheet metal materials from bending and scratching.
 - .13 Do not store more than one (1) day's supply of materials on roof at any time. On roof, stack materials on pallets and completely cover with incombustible waterproof tarpaulin whenever work is interrupted, or when there is precipitation of any kind. Securely tie covering to pallets in such way as to be weather tight. Plastic covers and shrink wrap covers by manufacturers are not acceptable for site storage and be removed upon delivery to roof.
 - .14 Store combustible materials away from heat and open flames. Protect and store materials in dry, ventilated area away from welding flame, spark and from elements or harmful substance.
 - .15 Do not lift rigid insulation in slings which will damage edges. Remove damaged insulation and replace with new material at no cost to the City.
- .3 Cleaning and Waste Management in accordance with Section 01 74 00.

- .4 Waste Management and Disposal in accordance with Section 01 74 19.

1.6 SITE CONDITIONS

- .1 Temperature, Relative Humidity, Moisture Content.
 - .1 Do not install SBS modified bitumen membranes when air and substrate temperature remains below manufacturer's recommendations or when wind chill gives equivalent cooling effect. Temperature shall be considered to be the temperature minus half of the wind speed as recommended by the Canadian Roofing Contractors Association (CRCA).
 - .2 Install SBS modified bitumen membranes on dry substrate, free of snow and ice, use only dry materials and apply only during weather that will not introduce moisture into system.
- .2 Comply with requirements of WHMIS regarding use, handling, storage, and disposal of asphalt, bitumen membranes, sealing compounds, primers and caulking materials.

1.7 SEQUENCING

- .1 Ensure all rooftop penetrations are complete prior to commencing roof installation.
- .2 Schedule and coordinate roof installation as required to minimize rooftop traffic by other trades over completed areas of roof system in order to minimize damage to the new roof assembly.
- .3 Install all metalwork and flashings as the roof progresses in order to keep work spaces below dry and to prevent water intrusion into roof system.

1.8 WARRANTY

- .1 **Manufacturer's Product Warranty:** provide an extended warranty for Work of this Section for a period of 10 years (Soprema 10 year Mammoth Platinum SBS Warranty) from date of Total Performance of the Work. Membrane manufacturer hereby agrees to repair any leaks in the roofing membrane to restore the roofing system to a dry and watertight condition, to the extent that membrane manufacturing or installation defects caused water infiltration. The warranty must cover for the entire cost of the repair(s) during the entire warranty period at no expense to the City.
- .2 **Roofing Contractor's Warranty:** provide an extended warranty for Work of this Section for a period of five (5) years from date of Total Performance of the Work. Roofing Contractor to provide written and signed RCAM document certifying work of this Section against failure and leakage, and these or other observed workmanship defects and deficiencies will be repaired or replaced to the satisfaction of the Contract Administrator and the City, and at no expense to the City.
- .3 **Roof Asset Management Plan (RAMP):** Roofing Contractor to establish RAMP to ensure RCAM & Roof Manufacturer's Warranty terms are followed. Roofing Contractor to include annual warranty follow-up roof inspections complete-with reports for the term of their warranty (5 years).

Part 2 Products

2.1 MANUFACTURERS

- .1 Basis of Design Products.
 - .1 Soprema 2 Ply Modified Bituminous Roof Membrane System consisting of the following components:
 - .1 Fibreglass Mat Faced Gypsum Board Roof Sheathing (roof surface, curbs, and inside face of all parapets).
 - .1 CGC Securock Gypsum-Fiber Type X Roof Board.
 - .2 Georgia-Pacific DensDeck Fireguard Roof Board.
 - .2 Fasteners (for fibreglass mat faced gypsum board sheathing).
 - .1 Soprema Screws and Plates.
 - .3 Primer (for fibreglass mat faced gypsum board sheathing).
 - .1 Soprema Elastocol Stick H2O or Elastocol Stick.
 - .4 Torch-Applied Air/Vapour Barrier Membrane.
 - .1 Soprema Sopralene 180 SP 3.5.
 - .5 Roof Insulation.
 - .1 Base & Top Layer - Rigid Closed-Cell Extruded Polyisocyanurate Roof Insulation.
 - .1 Soprema Sopra-Iso Plus Insulation.
 - .2 Back-Slope/Crickets - Rigid Closed-Cell Extruded Polyisocyanurate Roof Insulation (tapered) as specified above.
 - .6 High Density Glass-Mat Cover Board.
 - .1 GCG Securock Glass-Mat Roof Board.
 - .2 Georgia-Pacific DensDeck Roof Board.
 - .7 Adhesive (for roof insulation and high density glass-mat cover board).
 - .1 Soprema Duotack.
 - .8 2 Ply Modified Bitumen Roof Membrane System.
 - .1 Roof Surface Membrane System.
 - .1 Torch-Applied Modified Bitumen Membrane Base Sheet Membrane.
 - .1 Soprema Sopraply Base 520.
 - .2 Torch-Applied Modified Bitumen Cap Sheet Membrane.
 - .1 Soprema Sopraply Traffic Cap.
 - .2 Membrane Flashing System (upstands, parapets, and curbs).
 - .1 Self-Adhesive Modified Bitumen Membrane Base Sheet Flashing Membrane.
 - .1 Soprema Sopraflash Flam Stick.
 - .2 Torch-Applied Modified Bitumen Cap Sheet Flashing Membrane.
 - .1 Soprema Sopraply Traffic Cap.
 - .3 Accessory Membranes.
 - .1 Reinforcement Membrane.
 - .1 Soprema Sopraflash Flam Stick.
 - .2 Cover Strip.
 - .1 Soprema Sopralap.
 - .3 Flexible Membrane for Expansion Joints.
 - .1 Soprema Soprajoint.

- .4 Cap Sheet Membrane on Interior Faces of all Scuppers.
 - .1 Soprema Sopraply Traffic Cap (colour to be selected by the Contract Administrator to complement colour of prefinished metal scuppers).
- .4 Complementary Waterproofing Products.
 - .1 Waterproofing Mastic.
 - .1 Soprema Sopramastic ALU.
 - .2 Pitch Pocket.
 - .1 Soprema Sopramastic Block.
 - .3 Waterproofing Sealant.
 - .1 Soprema Alsan Flashing.
- .9 Contrasting Colour Traffic Cap Sheet Walkway (where indicated over field surface).
 - .1 Soprema Sopraply Traffic Cap.
- .2 Vent Stack Flashings.
 - .1 Thaler Insulated Stack Jack Flashing.
- .3 Roof Protection Matting (where indicated).
 - .1 Refer to 2.2.14 below.
- .2 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes* of the *Bidding Procedures*.
- .3 Supply all similar products from single manufacturer.

2.2 MATERIALS

- .1 Fibreglass Mat Faced Gypsum Board Roof Sheathing (roof surface, upstands, curbs, and inside face of all parapets): to ASTM C1177/C1177M and ASTM D3273, 16 mm thick Type X fire-rated moisture and mould-resistant gypsum core with inorganic glass matt facing both side, ends square factory cut, noncombustible to ASTM C1278, ASTM E136, CAN/ULC-S102, and CAN/ULC-S114.
- .2 Fasteners (for fibreglass mat faced gypsum board sheathing): screws and plates of hardened carbon steel No. 14 Phillips head fasteners with anticorrosion coating complete-with 50 mm diameter, 20-guage, galvalume washers.
- .3 Primer (for fibreglass mat faced gypsum board sheathing): water based or solvent based primer designed to enhance the adhesion of torch-on membranes on porous surfaces such as DensDeck Roof Board.
- .4 Torch-Applied Air/Vapour Barrier Membrane: 3.5 mm thick composed of a proprietary formulation of elastomeric styrene-butadiene-styrene (SBS) polymer modified bitumen and reinforced with a tough, dimensionally stable non-woven polyester mat to ASTM D6164/D6164M. The topside is surfaced with fine mineral aggregate and underside is surfaced with polyolefin burn-off film to optimize heat welding.
- .5 Roof Insulation.
 - .1 Base & Top Layer - to ASTM D1622 and ASTM D2126, closed-cell polyisocyanurate foam core integrally laminated between two heavy coated-glass facers saturated with a coating that provides a smooth, consistent surface, free of loose fibres, RSI 1.06/25 mm (R6.0/inch) to ASTM C1289 and CAN/ULC S704.1, total insulating value as indicated, compressive strength 138 kPa (20 psi).

- .2 Back-Slope/Crickets Insulation (tapered): rigid closed-cell extruded polyisocyanurate roof insulation as specified above, max. 50 mm thick insulation layers, min. 4% roof slope.
- .6 Adhesive (for roof insulation and for high density glass-mat cover board): low-rise two-part urethane adhesive, highly elastomeric formulation which contains no solvents, allows complete cure in few minutes with no temperature restrictions.
- .7 High Density Glass-Mat Cover Board.
 - .1 Siliconized moisture and mold resistant gypsum core with high-performance fiberglass facer to ASTM C1177/C1177M and ASTM D3273, 1220 wide x 13 mm thick x maximum practical length, square edges.
- .8 2 Ply Modified Bituminous Roof Membrane System.
 - .1 Roof Membrane System (roof surface).
 - .1 Torch-Applied Base Sheet Membrane: 2.5 mm thick high performance base sheet membrane composed of SBS modified bitumen and a composite reinforcement to CSA A123.23. Both sides are covered with a thermofusible plastic film.
 - .2 Torch-Applied Cap Sheet Membrane: 4 mm thick high performance cap sheet membrane composed of SBS modified bitumen and a composite reinforcement, covered with coloured granules to CSA A123.23. The underface is covered with a thermofusible plastic film.
 - .2 Roof Membrane Flashing System (upstands, parapets, and curbs).
 - .1 Self-Adhesive Modified Bitumen Base Sheet Flashing Membrane: 2.5 mm thick Styrene-Butadiene-Styrene (SBS) modified bitumen reinforced with a glass mat reinforcement to CSA A123.23. The top surface is covered with a thermofusible plastic film the self-adhesive underface is covered with a silicone release film.
 - .2 Torch-Applied Cap Sheet Membrane: 4 mm thick high performance cap sheet membrane composed of SBS modified bitumen and a composite reinforcement, covered with coloured granules to CSA A123.23. The underface is covered with a thermofusible plastic film.
 - .3 Accessory Membranes.
 - .1 Reinforcement Membrane: roofing membrane with glass mat reinforced and SBS modified bitumen to CSA A123.23. Both faces covered with a thermofusible plastic film. The top face must be marked with three distinctive blue chalk lines to ensure proper roll alignment.
 - .2 Cover Strip: membrane strip 330 mm made of SBS modified bitumen and composite elastomeric bitumen reinforcement to CSA A123.23. Both faces covered with a plastic thermofusible film. Strip ensures water-tightness in the end laps.
 - .3 Flexible Membrane for Expansion Joints: waterproofing membrane manufactured by combining a polyester fabric with SBS modified bitumen and a root-repelling agent. The underface is covered with a thermofusible plastic film. The top face has an aluminum foil adhered to the centre of the membrane and is covered by a protective silicone paper to be removed during application. Nominal thickness is 4.0 mm. and width of 450 mm.
 - .4 Torch-Applied Modified Bitumen Cap Sheet Membrane on Interior Faces of all Scuppers: same as torch-applied modified bitumen cap sheet membrane specified above, except colour to be selected by the Contract Administrator to complement colour of prefinished metal scuppers.

- .4 Complementary Waterproofing Products.
 - .1 Waterproofing Mastic: made of synthetic rubbers, plasticized with bitumen and solvents, aluminum pigments added to provide greater resistance to UV.
 - .2 Pitch Pocket: prefabricated interlocking curbs, single component elastomeric polyurethane sealant, and fast setting solvent-free mastic that sets within minutes of application.
 - .3 Waterproofing Sealant: composed of a bitumen/polyurethane waterproofing mono-component and polyester reinforcements, designed to finish upstands and details.
- .9 Contrasting Colour Traffic Cap Sheet Walkway (where indicated over field surface): 4 mm thick high performance traffic cap sheet membrane composed of SBS modified bitumen and a composite reinforcement. The surface is protected by coloured granules and the underface is covered with a thermofusible plastic film. Colour to be selected from manufacturer's standard selection.
- .10 Galvanized Sheet Transition Strip: 20-gauge, continuous hot-dip Z275 zinc coated (galvanized) steel conforming to requirements of ASTM A653/A653M, regular spangle surface.
- .11 Galvanized Sheet Fastening Bar: 25 mm high x 18-gauge, continuous hot-dip Z275 zinc coated (galvanized) steel conforming to requirements of ASTM A653/A653M, regular spangle surface.
- .12 Vent Stack Flashings: CSA approved consisting of metal flashing sleeve with integral deck flange, premoulded urethane insulation liner, EPDM triple pressure grommet seal and EPDM base seal, to accommodate required vent size and mechanical or thermal movement.
- .13 Prefinished Metal Flashings: prefinished galvanized steel sheet in accordance with CRCA Roofing Specification Manual and Section 07 62 00.
- .14 Roof Protection Matting (where indicated): 19 mm thick recycled rubber mat used for protecting membranes at roof ladders as detailed. Hexagon-shaped embossing on top the surface, longitudinal grooves on underface to allow water drainage.

2.3 EQUIPMENT

- .1 Use torch types recommended by manufacturer of modified bitumen membranes.

Part 3 Execution

3.1 EXAMINATION

- .1 Surface examination and preparation must be completed in conformance with recommendations in materials manufacturer's Specifications Manual, particularly for fire safety precautions.
- .2 Before roofing work begins, Contractor, the City's representative and Roofing Contractor to inspect and approve roofing substrate conditions as well as upstands, curbs, and parapets, construction joints, plumbing vents, ventilation outlets and others. All unacceptable conditions to be repaired. The start of roofing work will mean roofing conditions are acceptable for work completion.
- .3 Prior to beginning of work ensure:
 - .1 Decks are firm, straight, smooth, dry, free of snow, ice or frost, and swept clean of dust and debris. Use of calcium or salt is forbidden for ice or snow removal.

- .2 Roof control joint curbs have been built.
- .3 Roof drains have been installed at proper elevations relative to finished roof surface.
- .4 Upstands, curbs and parapets have been installed to proper sizes and heights as detailed to accommodate new mechanical roof top units and equipment.
- .4 Do not begin any work before surfaces are smooth, dry, and free of ice, snow, and debris. No materials to be installed during rain or snowfall, and only during weather that will not introduce moisture into roofing system.

3.2 PREPARATION

- .1 Set up all safety rigging and hang tarps to protect walls and adjacent work where material hoisting is necessary.
- .2 Use warning signs and barriers. Maintain in good order until completion of work.
- .3 Dispose of rain water off roof and away from face of building until roof drains or hoppers installed and connected.
- .4 Protect existing and completed portions of roof from traffic and damage. Place plywood runways over work to enable movement of material and other traffic.
- .5 At end of each day's work or when stoppage occurs due to inclement weather, provide protection for completed work and materials out of storage.
- .6 Fire Protection.
 - .1 Prior to the start of work, conduct a site inspection to establish safe working practices and make sure that all procedures and proposed changes are approved to minimize the risk of fires.
 - .2 Respect safety measures in accordance with material manufacturer's printed instructions as well as local association recommendations.
 - .3 Never apply the torch directly to old and wood surfaces.
 - .4 Throughout roofing installation, maintain one pressure rechargeable fire extinguisher with hose and shut-off nozzle, ULC labeled for ABC class protection. Size 4.5 kg (10 lb.) on roof per torch applicator, within 6 m of torch applicator.
 - .5 At the end of each workday, use a heat detector gun to spot any smouldering or concealed fire. Maintain fire watch for 1 hour after each days roofing operations cease.

3.3 INSTALLATION

- .1 General.
 - .1 Prepare surfaces and install roofing elements on clean and dry surfaces, and in accordance with manufacturer's printed instructions and technical illustrations.
 - .2 Precondition membranes by fully unrolling and letting membranes relax sufficiently (min. 15 minutes) before installation no matter the outdoor temperature.
 - .3 Precondition membranes by fully unrolling prior to application for minimum 15 minutes (minimum 30 minutes in cold weather).
 - .4 Roofing work must be completed in a continuous fashion as surfaces are readied and weather conditions permit.
 - .5 Whenever membranes are torch-applied, a continuous and even bead of molten bitumen must be visible as the membrane is unrolled and torched.
 - .6 Ensure waterproofing conditions for roofs at all times, including protection during installation work by other trades and progressive protection as work is completed (e.g. vents, drains, etc.).

- .7 Complete all work required for waterproofing beneath equipment and bases. Use qualified trade persons as required.
- .2 Fibreglass Mat Faced Gypsum Board Roof Sheathing (roof surface, curbs, and inside face of all parapets).
 - .1 Mechanically fasten sheathing to steel deck with screw and plate fastening system at fastening pattern specified by sheathing manufacturer and to meet wind uplift resistance requirements specified in 1.3.2.2 above, and in accordance with CAN/CSA A123.21. Ensure sheathing is pulled firm with steel deck at each screw.
 - .2 Install sheathing with long edges bearing on and parallel to top flutes, so that edges are supported. Stagger roof board end joints minimum 150 mm.
 - .3 Mechanically fasten sheathing to upstands, curbs, and inside face of all parapets to accept roofing materials with screw and plate fastening system at fastening pattern specified by sheathing manufacturer.
- .3 Torch Applied Air/Vapour Barrier Membrane.
 - .1 Once fiberglass mat faced gypsum board sheathing is applied and no defects are apparent, proceed with air/vapour barrier membrane installation.
 - .2 Install galvanized sheet transition strip at roof parapets and where detailed to support transition of roof to wall air/vapour barrier membranes.
 - .3 Apply primer over fiberglass mat faced gypsum board sheathing in accordance with manufacturer's printed instructions.
 - .4 Torch weld roof air/vapour barrier membrane onto sheathing as recommended by membrane manufacturer. During application, simultaneously melt both designated contact surfaces so bead of bitumen is apparent as air barrier membrane unrolls. Avoid overheating.
 - .5 Stagger joints between air/vapour barrier membrane and sheathing 300 mm. Overlap air/vapour barrier membrane side laps 75 mm lengthwise following the reference line and end laps 150 mm. Stagger end laps by at least 300 mm. Cut off corners at end laps to be covered by next roll. Overlap surfaces must be granular-free or degranulated. Avoid the formation of wrinkles, voids, and fishmouths.
 - .6 Extend air/vapour barrier membrane over galvanized sheet transition strip and beyond edge of roof surface, and torch down exterior wall surface min. 150 mm to tie into self-adhesive wall air/vapour barrier membrane provided by Sections 07 26 00 and 07 27 00.
- .4 Roof Insulation.
 - .1 Adhere insulation boards in accordance with manufacturer's printed instructions and to meet wind uplift resistance requirements specified in 1.3.2.2 above and in accordance with CAN/CSA A123.21. Supplement adhesive with screw and plate fastening system if required at locations to meet wind uplift resistance requirements.
 - .2 Install field insulation in 2 layers. Install first layer in parallel rows, in firm contact with one another and cut tight to roof parapet/curbs (do not force into place), and with end joints staggered to adjacent rows. Install second layer with end and side joints staggered from first layer. Bring each board into firm contact with adjacent boards and cut tight to roof parapet/curbs (do not force into place). Install insulation promptly to avoid possibility of condensation beneath roof air/vapour barrier membrane.
 - .3 Install back-slope/crickets insulation (tapered) above field insulation in max 50 mm thick layers and at min. 4% roof slope to suit roof drain locations and heights. If job conditions do not allow the roof drains to be centred in the valley, adjust back-slope insulation and/or cricket layout to suit roof drain locations and heights.

- .4 Install 2400 mm x 2400 mm roof sumps at all roof drains in accordance with manufacturer's printed instructions.
- .5 Foam small gaps between roof insulation and roof parapets/curbs with compatible spray foam insulation. Spray foam to be applied to all layers of roof insulation, not just the top layer. Trim spray foam flush with top of each roof insulation layer. Batt insulation or slivers of roof insulation to fill the gaps is not acceptable.
- .6 Do not lay more insulation than can be covered on same day. Keep insulation dry at all times.
- .5 High Density Glass-Mat Cover Board.
 - .1 Adhere cover board to insulation in accordance with manufacturer's printed instructions and to meet wind uplift resistance requirements specified in 1.3.2.2 above, and in accordance with CAN/CSA A123.21. Supplement adhesive with screw and plate fastening system if required at locations to meet wind uplift resistance requirements.
 - .2 Stagger joints from insulation joints. Precisely butt panels edges and install as level to each other as possible.
- .6 2 Ply Modified Bituminous Roof Membrane System.
 - .1 Roof Membrane System (roof surface).
 - .1 Torch-Applied Modified Bitumen Base Sheet Membrane.
 - .1 Once cover board is installed and no defects are apparent, proceed with base sheet installation.
 - .2 Unroll base sheet at drain. Carefully align first side lap (parallel to roof edge). Let the membrane relax sufficiently before installation.
 - .3 Weld base sheet onto high density glass-mat cover board with torch recommended by membrane manufacturer. During application, simultaneously melt both designated contact surfaces so a bead of bitumen is apparent as base sheet unrolls.
 - .4 Overlap base sheet side laps by 75 mm and end laps by 150 mm. Cut off corners at end laps to be covered by next roll. Space end laps by min. 300 mm.
 - .5 Complete perfect welds between two base sheet membranes. Leave no zone unwelded. In cold weather, adjust welding time to obtain homogenous seam.
 - .6 Install galvanized sheet fastening bar along perimeter of all upstands, parapets, and curbs as detailed to continuously secure base sheet membrane. Fasten at 300 mm on-centre with galvanized fasteners.
 - .7 Once base sheet is installed, carefully check all overlapped joints. Avoid the formation of wrinkles, voids, and fishmouths.
 - .8 At conclusion of daily work, or in anticipation of inclement weather, seal exposed edges and make watertight.
 - .2 Torch-Applied Modified Bitumen Cap Sheet Membrane.
 - .1 Once base sheet is applied and no defects are apparent, proceed with cap sheet installation.
 - .2 Unroll cap sheet at drain. Carefully align first side lap (parallel to roof edge). Let the membrane relax sufficiently before installation.

- .3 Weld cap sheet onto base sheet with torch recommended by membrane manufacturer. During application, simultaneously melt both designated contact surfaces so a bead of bitumen is apparent as cap sheet unrolls. Make sure joints between the two layers are staggered by at least 300 mm. Avoid overheating.
 - .4 Overlap cap sheet side laps by 75 mm and end laps by 150 mm. Cut off corners at end laps to be covered by next roll. All overlap surfaces must be granular-free or degranulated.
 - .5 Complete perfect welds between two membranes. Leave no zone unwelded. In cold weather, adjust welding time to obtain homogenous seam.
 - .6 Once cap sheet is installed, carefully check all overlapped joints. Avoid the formation of wrinkles, voids, and fishmouths.
 - .7 At conclusion of daily work, or in anticipation of inclement weather, seal exposed edges and make watertight.
- .2 Membrane Flashing System (upstands, parapets, and curbs).
- .1 Self-Adhesive Modified Bitumen Base Sheet Flashing Membrane.
 - .1 Install base sheet flashing membrane along roof parapets, where roofing meets vertical surface, and at curbs for roof-mounted equipment in strict accordance with manufacturer's recommendations and details.
 - .2 Apply base sheet flashing only after primer coat is dry.
 - .3 Position the pre-cut membrane piece. Peel back 100 to 150 mm. of the silicone release paper to hold the membrane in place at the top of the parapet.
 - .4 Gradually peel back the remaining silicone release paper, pressing down on the membrane with an aluminum applicator to ensure good adhesion. Use the aluminum applicator to ensure a perfect transition between the upstand and the field surface. Smooth the entire membrane surface with a roller for full adhesion.
 - .5 Cut off corners at end laps to be covered by the next roll.
 - .6 Install a reinforcing gusset in all inside and outside corners.
 - .7 Once base sheet flashing is installed, carefully check all overlapped joints. Avoid the formation of wrinkles, voids, and fishmouths.
 - .8 Always seal overlaps at the end of the workday.
 - .2 Torch-Applied Modified Bitumen Cap Sheet Flashing Membrane (upstands, parapets, and curbs).
 - .1 Install cap sheet flashing membrane along roof parapets, where roofing meets vertical surface, and at curbs for roof-mounted equipment in strict accordance with manufacturer's recommendations and details.
 - .2 Install cap sheet flashing in 1000 mm widths. Install across top of parapet or curb, down vertical surfaces, and extend onto flat surface of roof minimum of 455 mm (150 mm beyond base sheet flashing). Overlap cap sheet side laps by 75 mm and staggered minimum of 100 mm from base sheet laps. At end laps, angle-cut the corners that will be covered by the following roll.

- .3 Torch weld cap sheet flashing directly onto base sheet flashing from bottom to top to soften both membranes and obtain homogenous sheet. Avoid overheating. Avoid the formation of wrinkles, voids, and fishmouths.
- .4 During installation, avoid excessive bitumen bleed-out at joints.
- .5 Always seal overlaps at the end of the workday.
- .6 Once cap sheet is installed, carefully check all overlapped joints. Avoid the formation of wrinkles, voids, and fishmouths.
- .3 Accessory Membranes.
 - .1 Install accessory membranes in accordance with manufacturer's written instructions and technical illustrations.
 - .2 Install thermofusible gussets at every angle and on inside and outside corners after installing the self-adhesive base sheet membrane.
 - .3 Install torch-applied modified bitumen cap sheet membrane on interior faces of all prefinished metal scuppers. Colour of cap sheet to be selected by the Contract Administrator to complement colour of prefinished metal scuppers.
- .4 Complementary Waterproofing Products.
 - .1 Install complementary waterproofing products in accordance with manufacturer's written instructions and technical illustrations.
- .7 Contrasting Colour Traffic Cap Sheet Walkway (where indicated over field surface).
 - .1 Following installation of cap sheet membrane over field surface, install contrasting colour traffic cap sheet walkway as indicated on roof plan at path of travel from roof access to roof top mechanical equipment, around all roof top mechanical equipment needing regular maintenance, at roof hatch locations, at roof access doors from mechanical rooms, and at top and bottom landings of all roof ladders.
 - .2 Weld traffic cap sheet walkway onto cap sheet membrane in accordance with manufacturer's printed instructions, and with torch recommended by membrane manufacturer. During application, melt designated contact surface so a bead of bitumen is apparent as traffic cap sheet unrolls. Avoid overheating.
 - .3 Overlap traffic cap sheet side laps by 75 mm and end laps by 150 mm. Cut off corners at end laps to be covered by next roll. All overlap surfaces must be granular-free or degranulated.
 - .4 Complete perfect welds between two membranes. Leave no zone unwelded. In cold weather, adjust welding time to obtain homogenous seam.
 - .5 Once traffic cap sheet is installed, carefully check all overlapped joints. Avoid the formation of wrinkles, voids, and fishmouths.
- .8 Prefinished Metal Flashing.
 - .1 Form flashings, roof drain pans, and other roof penetration flashings to profiles detailed, and in accordance with CRCA Roofing Specification Manual and Section 07 62 00.
 - .2 Install where indicated in accordance with CRCA Roofing Specification Manual.
- .9 Roof Penetrations.
 - .1 Install vent stack flashings in accordance with manufacturer's instructions and CRCA Roofing Specification Manual.
 - .2 Seal to membrane in accordance with manufacturer's recommendations and details.

- .3 Following installation of cap sheet membrane over field surface, install additional 1m x 1m piece of cap sheet membrane at each vertical roof penetration (including roof vent stacks, mechanical screen supports, etc.) as follows:
 - .1 Carefully precut hole in middle of 1m x 1m piece of cap sheet membrane (size of hole to match vertical roof penetration), and place over roof penetration. Torch to surface of cap sheet membrane ensuring perfect weld between the membranes. Seal around vertical roof penetration with waterproofing sealant as specified.
- .10 Roof Protection Matting (where indicated).
 - .1 Place roof protection matting with channel side down and channels parallel to roof slope.
 - .2 Adhere to cap sheet using adhesive recommended by manufacturer.

3.4 FIELD QUALITY CONTROL

- .1 Roof inspections will be carried out by a Building Envelope Commissioning Authority (BECxA) retained and paid for by the City.
- .2 Inspections will be performed at commencement of work as well as periodically throughout duration of work to review material installation.
- .3 Coordinate and assist BECxA with the performance of their duties by providing daily work schedule, and access to scaffolding, roof surfaces, on-site material storage, etc.
- .4 Presence of BECxA does not alleviate roofing trade of quality control obligations.
- .5 Provide workman on site with electronic thermometer and/or thermal imaging camera for minimum of one (1) hour each day after torching has been complete to check for hot areas.

3.5 CLEANING

- .1 Routinely clear roof of rubbish and other materials which may hinder roof installation, performance, or present a fire hazard.
- .2 Clean off drips and smears of bituminous material immediately.

3.6 PROTECTION / INSPECTION

- .1 Contractor to enforce the Roof Protection Plan and inform all trades what they need to do to conform to the plan. Contractor will be held liable for all costs to repair damage as a result of failure to enforce the Roof Protection Plan.
- .2 Roofing Contractor: at start of roofing system installation, institute appropriate procedures working with Contractor and Contract Administrator for surveillance and protection of completed roofing during remainder of construction period until project is turned over to the City.
- .3 Contractor/Roofing Contractor: at substantial completion, make final inspections of roofing system and complete all punch lists. Submit confirmation of completed punch lists to the Contract Administrator.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 04 00 00 – Masonry.
- .2 Section 06 10 00 – Rough Carpentry.
- .3 Section 07 41 13 – Metal Roof Panels.
- .4 Section 07 42 13 – Metal Wall Panels.
- .5 Section 07 52 00 – 2-Ply Modified Bituminous Membrane Roofing.
- .6 Section 07 92 00 – Joint Sealants.
- .7 Section 08 54 13 – Fiberglass Windows.

1.2 REFERENCES

- .1 American Society for Testing and Materials (ASTM).
 - .1 ASTM A653/A653M-20, 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(2020), Standard Test Method for Measurement of Dry-Film Thickness of Organic Coatings Using Micrometers.
 - .4 ASTM D1187/D1187M-97(2018), Standard Specification for Asphalt-Base Emulsions for Use as Protective Coatings for Metal.
 - .5 ASTM D5796-20, Standard Test Method for Measurement of Dry Film Thickness of Thin Film Coil-Coated Systems by Destructive Means Using a Boring Device.
- .2 Canadian Roofing Contractors Association (CRCA).
 - .1 CRCA Roofing Specification Manual, 2012.

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.
- .5 Waste Management and Disposal in accordance with Section 01 74 19.

Part 2 Products

2.1 MATERIALS

- .1 Galvanized Sheet Steel: 22-gauge, continuous hot-dip Z275 zinc coated (galvanized) steel conforming to requirements of ASTM A653/A653M, regular spangle surface.

- .2 Prefinished Sheet Steel: 22-gauge, continuous hot-dip Z275 zinc coated (galvanized) steel, conforming to requirements of ASTM A653/A653M factory finished to ASTM D5796 with factory applied Valspar WeatherXL or Baycoat Perspectra Plus Series paint coating.

2.2 ACCESSORIES

- .1 Cleats: of same material, and temper as sheet metal, minimum 50 mm wide.
- .2 Exposed Fasteners: stainless steel purpose made, head colour same as flashing.
- .3 Washers: of same material as sheet metal, 1 mm thick with rubber packings.
- .4 Touch-up Paint: as recommended by prefinished material manufacturer.
- .5 Bitumen Protective Coating: to ASTM D1187/D1187M.
- .6 Joint Sealants: in accordance with Section 07 92 00.

2.3 FABRICATION

- .1 Fabricate metal flashings including parapet cap flashings, thru-wall flashings, drip flashings, sill flashings, trims, closure 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. Miter 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 Scuppers and Downspouts.
 - .1 Scuppers: indicated size and profile, formed from 22-gauge, prefinished steel sheet, colour to be selected.
 - .2 Downspouts: indicated size and profile formed from 22-gauge, prefinished steel sheet. Downspouts to be closed (4-sided) upper portion as detailed and (3-sided) open lower portion, prefinished material on all exposed surfaces, colour to be selected.

Part 3 Execution

3.1 INSTALLATION

- .1 Flashings, Trims, and Scuppers.
 - .1 Install steel sheet metal flashings, trims, and scuppers as detailed. Install roof related flashings and trim in accordance with CRCA Specification Manual.
 - .2 Use concealed fastenings except where approved by the Contract Administrator before installation.
 - .3 Install steel sheet metal counterflashing 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 in contact with dissimilar materials.
- .2 Downspouts.
 - .1 Install downspouts as detailed.

- .2 Secure downspouts with straps at 1800 mm on-centre with minimum two (2) straps per downspout.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 04 00 00 – Masonry.
- .2 Section 06 10 00 – Rough Carpentry.
- .3 Section 09 22 16 – Non-Structural Metal Framing.
- .4 Section 09 29 00 – Gypsum Board.
- .5 Mechanical Specifications
- .6 Electrical Specifications.

1.2 REFERENCES

- .1 American Society for Testing and Materials (ASTM).
 - .1 ASTM C679-15(2022), Standard Test Method for Tack-Free Time of Elastomeric Sealants.
 - .2 ASTM D6904-03(2022), Standard Practice for Resistance to Wind Driven Rain for Exterior Coatings Applied on Masonry.
 - .3 ASTM E84-21a, Standard Test Method for Surface Burning Characteristics of Building Materials.
 - .4 ASTM E119-20, Standard Test Methods for Fire Tests of Building Construction and Materials.
 - .5 ASTM E595-15(2021), 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(2019), Standard Test Method for Fire-Resistive Joint Systems.
 - .8 ASTM E2174-20a, Standard Practice for On-Site Inspection of Installed Fire Stops.
 - .9 ASTM E2307-20, Standard Test Method for Determining Fire Resistance of Perimeter Fire Barrier Systems Using Intermediate-Scale, Multi-story Test Apparatus.
 - .10 ASTM E2393-20a, Standard Practice for On-Site Inspection of Installed Fire Resistive Joint Systems and Perimeter Fire Barriers.
 - .11 ASTM G21-15(2021)e1, Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.
- .2 Firestop Contractors International Association (FCIA).
 - .1 FCIA Manual of Practice (MOP) 7th Edition, 2018.
- .3 International Firestop Council (IFC).
 - .1 IFC 401 Inspection Manual for Firestopped through Penetrations, Joints, Perimeter Fire Barrier Systems, and Fire Rated Duct Enclosures Systems, 5th Edition, 2016.
 - .2 Recommended IFC Guidelines for Evaluating Firestop Systems Engineering Judgments, 2018.
- .4 National Building Code of Canada, 2020 (NBCC), complete with current Manitoba Building Code amendments (MBC).
- .5 National Fire Protection Association (NFPA).
 - .1 NFPA 101: Life Safety Code, 2021 Edition.

- .6 National Research Council Canada.
 - .1 Best Practice Guide on Fire Stops and Fire Blocks and their impact on Sound Transmission, June 2007.
- .7 Underwriters Laboratories (UL) / Underwriter’s Laboratories of Canada (ULC).
 - .1 CAN/ULC S101-14-Rev3, Standard Methods of Fire Endurance Tests of Building Construction and Materials.
 - .2 CAN/ULC S102-18-Rev1, Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.
 - .3 CAN/ULC S115-18, Standard Method of Fire Tests of Fire Stop Systems.
 - .4 ULC List of Equipment and Materials Firestop Systems and Components 2010 Edition.
 - .5 UL 1479-15, Standard for Fire Tests of Through-Penetration Firestops.

1.3 DEFINITIONS

- .1 Firestopping: 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 New and existing service penetrations for passage of duct, cable, cable tray, conduit, piping, electrical busways and raceways through new and existing 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 New and existing joints (gaps) between top of walls and ceilings or roof assemblies.
 - .4 New and existing wall-to-wall joints (gypsum board to concrete or concrete block walls or control/expansion joints for masonry, concrete or gypsum board).
 - .5 New and existing 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 Provide certification by manufacturer that products supplied are protected against mould growth in both the wet and dry stage.
- .6 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 five (5) years' experience with manufacturers' design systems. Provide proof of experience upon Contract Administrator'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 Contract Administrator'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 (2) years, and who is certified, licensed, or otherwise qualified by firestop manufacturer as having necessary experience, staff, and training to install manufacturer's products in accordance with specified requirements. Provide proof of membership and certification upon Contract Administrator'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 When installing non-preformed devices, 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
 - .3 Hilti Accredited Fire Stop Specialty 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 Contract Administrator 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 Contract Administrator prior to installation.
- .6 Verify on-site to Contract Administrator 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.
 - .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 Contract Administrator 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 in accordance with Section 01 74 00.
- .7 Waste Management and Disposal in accordance with Sections 01 74 19.

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 existing conditions and substrates before starting work. Correct unsatisfactory conditions before proceeding.
- .4 Weather conditions: Do not proceed with installation of firestop materials when temperatures exceed 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 Total 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 Contract Administrator 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 Total 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 Contract Administrator 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 D6904 with less than 1-hour tack free time as tested in accordance with ASTM C 679.

2.2 MANUFACTURERS

- .1 Basis of Design Products: subject to compliance with through penetration firestop systems and joint systems listed in ULC Fire Resistance Directory – Volume III or UL Products Certified for Canada (cUL) Directory, provide products of following manufacturers as identified below:
 - .1 AD Fire Protection Systems Inc.
 - .2 Hilti (Canada) Corporation.
 - .3 STI, Specified Technologies Inc., Spec Seal Firestop Products.
 - .4 Other manufacturers listed in ULC Fire Resistance Directory – Volume III or UL Products Certified for Canada (cUL) Directory.

2.3 MATERIALS

- .1 Accessories: provide components for each firestopping and smoke seal systems that are needed to install fill materials. Use only components specified by firestopping material manufacturer and approved by the qualified testing agency. Accessories include, but are not limited to, the following items:
 - .1 Permanent forming, damming and backing material.
 - .2 Temporary forming material.
- .2 Pre-formed firestop devices for use with non-combustible and combustible pipes (closed and open systems), conduit and/or cable bundles penetrating concrete floors and/or gypsum walls, the following products are the Basis of Design Hilti Tub Box Kit (CP 681) for use with tub installations.
 - .1 Hilti Cast-In Place Firestop Device (CP 680- P/PX) for use with combustible pipe
 - .2 Hilti Cast-In Place Firestop Device (CP 680-M) for use with noncombustible penetrants.
 - .3 Hilti Speed Sleeve (CP 653) for use with cable penetrations.
 - .4 Hilti Firestop Drop-In Device (CFS-DID) for use with noncombustible and combustible penetrants.
 - .5 Hilti Cast-in Firestop sleeve (CFS-CID MD P) and (CFS-CID MD M) for use with combustible and noncombustible pipes through metal deck.
- .3 Sealants or caulking materials for use with non-combustible items including steel pipe, copper pipe, rigid steel conduit and electrical metallic tubing (EMT), following products are the Basis of Design:
 - .1 Hilti FS-ONE MAX Intumescent Firestop Sealant.
 - .2 Hilti CFS-S SIL SL Self Leveling Firestop Sealant.
 - .3 Hilti CP660/CP 620 Fire Foam/CP660.
 - .4 Hilti CP 606 Flexible Firestop Sealant.
 - .5 Hilti Firestop Silicone Sealant Gun Grade (CFS-S SIL GG).
 - .6 Equivalent products listed in ULC Fire Resistance Directory – Volume III or UL Products Certified for Canada (cUL) Directory.
- .4 Sealants or caulking materials for use with sheet metal ducts, following products are the Basis of Design:
 - .1 Hilti Firestop Silicone Sealant Gun Grade (CFS-S SIL GG).
 - .2 Hilti CP 606 Flexible Firestop Sealant.
 - .3 Hilti FS-ONE MAX Intumescent Firestop Sealant.
 - .4 Hilti CFS-S SIL SL Self Leveling Firestop Sealant.
 - .5 Equivalent products listed in ULC Fire Resistance Directory – Volume III or UL Products Certified for Canada (cUL) Directory.
- .5 Sealants or sprays for use with fire-rated construction joints and other gaps, the following products are the Basis of Design:
 - .1 Hilti Firestop Joint Spray (CFS-SP WB).
 - .2 Hilti Firestop Silicone Joint Spray (CFS-SP SIL).
 - .3 Hilti Flexible Firestop Sealant (CP 606).
 - .4 Hilti Firestop Silicone Sealant Gun Grade (CFS-S SIL GG).
 - .5 Hilti Firestop Silicone Sealant Self Leveling (CFS-S SIL SL).
 - .6 Hilti Bottom of Wall sealant (CP 605).

- .6 Pre-formed materials for use with fire-rated construction joints and other gaps, the following products are the Basis of Design:
 - .1 Hilti Top Track Seal (CFS-TTS).
 - .2 Hilti Top Track Seal for Metal deck (CFS-TTS MD).
- .7 Pre-formed mineral wool designed to fit flutes of metal profile deck (as backer for spray material).
 - .1 Hilti CP 777 Speed Plugs.
 - .2 Hilti CP 767 Speed Strips.
- .8 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, following products are the Basis of Design:
 - .1 Hilti FS-ONE MAX Intumescent Firestop Sealant.
 - .2 Equivalent products listed in ULC Fire Resistance Directory – Volume III or UL Products Certified for Canada (cUL) Directory.
- .9 Foams, intumescent sealants, caulking or putty materials for use with flexible cable or cable bundles, following products are the Basis of Design:
 - .1 Hilti FS-ONE MAX Intumescent Firestop Sealant.
 - .2 Hilti CP 618 Firestop Putty Stick.
 - .3 Hilti CP660/ CP 620 Fire Foam.
 - .4 Hilti Firestop Silicone Sealant Gun Grade (CFS-S SIL GG).
 - .5 Hilti CP 606 Flexible Firestop Sealant.
 - .6 Hilti Firestop Silicone Sealant Self Leveling (CFS-S SIL SL)
 - .7 Equivalent products listed in ULC Fire Resistance Directory – Volume III or UL Products Certified for Canada (cUL) Directory.
- .10 Non curing, re-penetrable intumescent sealants, caulking or putty materials for use with flexible cable or cable bundles, following products are the Basis of Design:
 - .1 Hilti CP 618 Firestop Putty Stick.
 - .2 Hilti CFS-PL Firestop Plug.
 - .3 Equivalent products listed in ULC Fire Resistance Directory – Volume III or UL Products Certified for Canada (cUL) Directory.
- .11 Wall opening protective materials for use with cUL/ULC listed metallic and specified nonmetallic outlet boxes, following products are the Basis of Design:
 - .1 Hilti CP 617 Firestop Putty Pad.
 - .2 Hilti Firestop Putty Pad (CFS-P PA).
 - .3 Hilti Firestop Box Insert.
 - .4 Equivalent products listed in UL Products Certified for Canada (cUL) Directory.
- .12 Firestop collar or wrap devices attached to assembly around combustible plastic pipe (closed and open piping systems) tested to 50 Pa. differential, following products are the Basis of Design:
 - .1 Hilti CP 643N Firestop Collar.
 - .2 Hilti CP 648E/648S Wrap Strips.
 - .3 Equivalent products listed in ULC Fire Resistance Directory – Volume III or UL Products Certified for Canada (cUL) Directory.

- .13 Materials used for large size/complex penetrations made to accommodate cable trays, multiple steel and copper pipes, electrical busways in raceways, following products are the Basis of Design:
 - .1 Hilti FS 637 Firestop Mortar.
 - .2 Hilti CFS-BL Fire Block.
 - .3 Hilti CP 620/660 Fire Foam.
 - .4 Hilti CP 675-T Firestop Board.
 - .5 Equivalent products listed in ULC Fire Resistance Directory – Volume III or UL Products Certified for Canada (cUL) Directory.
- .14 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, following products are the Basis of Design:
 - .1 Hilti CFS-BL Fire Block.
 - .2 Hilti CP 675-T Firestop Board.
 - .3 Equivalent products listed in ULC Fire Resistance Directory – Volume III or UL Products Certified for Canada (cUL) Directory.
- .15 Sealants or caulking materials used for openings between structurally separate sections of wall and floors, following products are the Basis of Design:
 - .1 Hilti Firestop Joint Spray (CFS-SP WB)
 - .2 Hilti Flexible Firestop Sealant (CP 606)
 - .3 Hilti Firestop Silicone Sealant Gun Grade (CFS-S SIL GG)
 - .4 Hilti Firestop Silicone Sealant Self Leveling (CFS-S SIL SL)
 - .5 Equivalent products listed in ULC Fire Resistance Directory – Volume III or UL Products Certified for Canada (cUL) Directory.
- .16 For blank openings made in fire-rated wall or floor assemblies, where future penetration of pipes, conduits, or cables is expected, following products are the Basis of Design:
 - .1 Hilti CFS-BL Fire Block (for walls and floors).
 - .2 Hilti CFS-PL Firestop Plug (for walls and floors).
 - .3 Hilti CP 680 Cast-In Place Firestop Device (for floors only).
 - .4 Equivalent products listed in ULC Fire Resistance Directory – Volume III or UL Products Certified for Canada (cUL) Directory.
- .17 Re-penetrable, round cable management devices for use with new or existing cable bundles penetrating gypsum or masonry walls, the following products are the Basis of Design:
 - .1 Hilti Speed Sleeve (CP 653) with integrated smoke seal fabric membrane.
 - .2 Hilti Firestop Cable Collar (CFS-CC)
 - .3 Hilti Firestop Sleeve (CFS-SL SK).
 - .4 Hilti Retrofit Sleeve (CFS-SL RK) for use with existing cable bundles.
 - .5 Hilti Gangplate (CFS-SL GP) for use with multiple cable management devices.
 - .6 Hilti Gangplate Cap (CFS-SL GP CAP) for use at blank openings in gangplate for future penetrations.
 - .7 Equivalent products listed in ULC Fire Resistance Directory – Volume III or UL Products Certified for Canada (cUL) Directory.
- .18 For single or cable bundles up to 1” diameter penetrating gypsum, masonry, concrete walls or wood floor assemblies the following product is the Basis of Design:
 - .1 Hilti CFS-D Firestop Cable Disc.

- .19 Fire Barrier Insulation Block for expansion joints in fire-rated wall assemblies (wall to wall), mineral wool and the following product is the Basis of Design:
 - .1 Hilti CFS-S SIL.
- .20 Fire Barrier Insulation Block for expansion joints in fire-rated floor assemblies (floor to floor), mineral wool and the following product is the Basis of Design:
 - .1 Hilti CFS-S SIL.
- .21 Fire Barrier Insulation Block for expansion joints in fire-rated floor assemblies (floor to wall), mineral wool and the following product is the Basis of Design:
 - .1 Hilti CFS-S SIL.
- .22 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.
- .23 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.

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 affect 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 of New Fire Separations.
 - .1 Install firestopping to maintain the integrity of all new fire separations in new fire rated floors and walls whenever affected by the demolition and new 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 cm² (20 in²): 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 Contract Administrator, 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 E2174, "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 Contract Administrator 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 900m²;
 - .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. Contract Administrator 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 IDENTIFICATION AND DOCUMENTATION

- .1 The Contractor responsible for firestopping and smoke seals to supply documentation for each single application addressed. This documentation is to identify each penetration and joint location on the entire project.
- .2 Identify through-penetration firestopping with pressure sensitive, self-adhesive preprinted vinyl 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 -THROUGH PENETRATION FIRESTOP SYSTEM-DO NOT DISTURB. NOTIFY BUILDING MANAGEMENT OF ANY DAMAGE."
 - .2 Contractor's Name, address, and phone number.
 - .3 Through-Penetration firestop 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.
- .3 The Documentation Form for through penetrations is to include:
 - .1 A Sequential Location Number.
 - .2 The Project Name.
 - .3 Installers Name.
 - .4 Date of Installation.
 - .5 Detailed description of the penetrations location.
 - .6 Tested System or Engineered Judgment Number.
 - .7 Type of assembly penetrated.
 - .8 A detailed description of the size and type of penetrating item.
 - .9 Size of opening.
 - .10 Number of sides of assemblies addressed.
 - .11 Hourly rating to be achieved.
- .4 The Documentation Form for Construction Joints is to include:
 - .1 A Sequential Location Number.
 - .2 The Project Name.
 - .3 Installers Name.
 - .4 Date of Installation
 - .5 Detailed description of the Construction Joints location.
 - .6 Tested System or Engineered Judgment Number.
 - .7 Type of Construction Joint.
 - .8 The Width of the Joint.

- .9 The Lineal Footage of the Joint.
 - .10 Number of sides addressed.
 - .11 Hourly rating to be achieved.
- .5 Copies of these documents are to be provided to the general contractor at the completion of the project.

3.6 ADJUSTING AND CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 00.
 - .1 Leave Work area clean at end of each day.
 - .2 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 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00.
 - .1 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.
- .3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 19.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.7 SCHEDULE OF COMMON FIRESTOP SYSTEMS

- .1 Schedule of through penetration firestop systems. Basis of design: Hilti, Canada

CONCRETE FLOORS		
TYPE OF PENETRANT	F-RATING (HR)	BASIS OF DESIGN cUL SYSTEM
BLANK OPENINGS	1	F-A-0006, C-AJ-0055, C-AJ- 0070, C-A-J-0138
	2	F-A-0006, C-AJ-0055, C-AJ-0070, C-A-J-0138
	3	F-A-0006, C-AJ-0055, C-AJ-0086,
SINGLE METAL PIPES OR CONDUIT	1	C-AJ-1226, F-A-1028, F-A-1017
	2	C-AJ-1226, F-A-1028, F-A-1017
	3	C-AJ-1226, F-A-1017
	4	C-BJ -1037, C-BJ-1034, F-A-1091
SINGLE NON-METALLIC PIPE OR CONDUIT (I.E. PVC, CPVC, ABS, FRP, ENT)	1	F-A-2240, F-A-2025, CA-J-2078 , C-AJ-2035, CA-J-2022
	2	C-AJ-2035, C-AJ-2022,C-AJ-2021
	3	C-A-J-2012, C-AJ-2035-F-A-2012
	4	
SINGLE/CABLE BUNDLES	1	F-A-3007,C-AJ-3095,C-AJ-3180, C-AJ-3283
	2	F-A-3007,C-AJ-3095,C-AJ-3334, F-A-3060
	3	F-A-3007, C-AJ 3095, C-AJ-3285

CABLE TRAY	1	C-AJ-4034, C-AJ-4071
	2	C-AJ-4034, C-AJ-4071
	3	C-AJ-4034, C-AJ-4035
SINGLE INSULATED PIPES	1	F-A 5015, F-A 5017, C-AJ-5090, C-AJ-5091, C-AJ-5048
	2	F-A 5015, F-A 5017, C-AJ-5090, C-AJ-5090
	3	F-A 5016, C-AJ-5090, F-A-5018
	4	C-BJ-5006
ELECTRICAL BUSWAY	1	C-AJ-6006, C-AJ-6017, F-A-6002, C-AJ-6036
	2	C-AJ-6006, C-AJ-6017, F-A 6042, C-AJ-6036
	3	C-AJ-6006, C-AJ-6017
MECHANICAL DUCTWORK WITHOUT DAMPERS NON-INSULATED	1	C-AJ-7046, C-AJ-7051, C-AJ-7084
	2	C-AJ-7046, C-AJ-7051, C-AJ-7084
	3	C-AJ-7046, C-AJ-7051
MECHANICAL DUCTWORK WITHOUT DAMPERS INSULATED	2	C-A-J-7145
MIXED PENETRANTS	1	C-AJ 8099, C-AJ-8056, C-AJ-8143
	2	C-AJ-8099, C-AJ-8056, C-AJ-8143
	3	C-AJ-8099, C-AJ-8056
	4	C-AJ-8095

CONCRETE OR BLOCK WALLS		
TYPE OF PENETRANT	F-RATING (HR)	BASIS OF DESIGN cUL SYSTEM
BLANK OPENINGS	1	C-AJ-0055, C-AJ-0070
	2	C-AJ-0055, C-AJ-0070
	3	C-AJ-0055, C-AJ-0086
SINGLE METAL PIPES OR CONDUIT	1	C-AJ-1226, W-J-1067, W-J-1020
	2	C-AJ-1226, W-J-1067, W-J-1020, W-J-1248
	3	C-AJ-1226, W-J-1041, W-J-1068
	4	C-BJ-1034, C-BJ-1037, W-J-1041, W-J-1042, W-J-1068
SINGLE NON-METALLIC PIPE OR CONDUIT (I.E. PVC, CPVC, ABS, FRP, ENT)	1	C-AJ-2109C-AJ-2078, W-J-2332, C-AJ-2024, C-AJ-2035, C-AJ-2022
	2	C-AJ-2078, W-J-2332, C-AJ-2024, C-AJ-2035, C-AJ-2022
	3	CA-J-2035 C-J-2035 C-AJ-2024
	4	,
SINGLE/CABLE BUNDLES	1	W-J-3036, C-AJ-3095, C-AJ-3180, W-J-3060, W-J-3167
	2	W-J-3036, C-AJ-3095, C-AJ-3180, W-J-3060, W-J-3167, W-J-3189
	3	C-AJ-3095, C-AJ-3180, W-J-3167

	4	W-J-3050
CABLE TRAY	1	W-J-4027, C-AJ-4034, C-AJ-4071
	2	W-J-4027, C-AJ-4034, C-AJ-4071
	3	C-AJ-4034, C-AJ-4035
	4	W-J-8007
SINGLE INSULATED PIPES	1	C-AJ-5090, C-AJ-5091, C-AJ 5061, W-J-5042
	2	C-AJ-5090, C-AJ-5091, C-AJ-5061, W-J-5042
	3	C-AJ-5090, C-AJ-5061
	4	C-BJ-5006, W-J-5028
ELECTRICAL BUSWAY	1	C-AJ-6006, C-AJ-6017, C-AJ-6036
	2	C-AJ-6006, C-AJ-6017, C-AJ-6036
	3	C-AJ-6006, C-AJ-6017
MECHANICAL DUCTWORK WITHOUT DAMPERS NON-INSULATED	1	C-AJ-7046, C-AJ-7051, W-J-7021, W-J-7022
	2	C-AJ-7046, C-AJ-7051, W-J-7021, W-J-7022
	3	C-AJ-7046, C-AJ-7051
MECHANICAL DUCTWORK WITHOUT DAMPERS INSULATED	1	W-J-7029, W-J-7124
	2	W-J-7091, W-J-7112, W-J-7124
MIXED PENETRANTS	1	C-AJ 8099, C-AJ 8056, W-J 8007, C-AJ 8143
	2	C-AJ 8099, C-AJ 8056, W-J 8007, C-AJ 8143
	3	C-AJ 8041, C-AJ 8056, W-J 8007, C-AJ 8099
	4	C-AJ 8095, W-J 8007

GYPSUM WALLS		
TYPE OF PENETRANT	F-RATING (HR)	BASIS OF DESIGN cUL SYSTEM
METAL PIPES OR CONDUIT	1	W-L-1054, W-L-1058, W-L-1164, W-L-1506, W-L-1465
	2	W-L-1054, W-L-1058, W-L-1164, W-L-1506, W-L-1465
	4	W-L-1110, W-L-1111, W-L-1165
NON-METALLIC PIPE OR CONDUIT	1	W-L2028, W-L-2061, W-L-2020
	2	W-L-2028, W-L-2061, W-L-2020
	4	
SINGLE OR BUNDLED CABLES	1	W-L-3065, W-L-3111, W-L-3112, W-L-3334, W-L-3414, W-L-3396
	2	W-L-3065, W-L-3111, W-L-3112, W-L-3334, W-L-3414, W-L-3396
	3	W-L-3385, W-L-3277
	4	W-L-3139, W-L-3334
CABLE TRAY	1	W-L-4011, W-L-4060, W-L-4081
	2	W-L-4011, W-L-4060, W-L-4081
	4	W-L 8014
INSULATED PIPES	1	W-L-5028, W-L-5029, W-L-5047
	2	W-L-5028, W-L-5029, W-L-5047
	4	W-L-5073

NON-INSULATED MECHANICAL DUCTWORK WITHOUT DAMPERS	1	W-L-7040, W-L-7042, W-L-7155
	2	W-L-7040, W-L-7042, W-L-7155
INSULATED MECHANICAL DUCTWORK WITHOUT DAMPERS	1	W-L-7059, W-L-7153, W-L-7156, W-L-7151
	2	W-L-7059, W-L-7153, W-L-7156, W-L-7151
MIXED PENETRANTS	1	W-L-1095, W-L-8013
	2	W-L-1095, W-L-8013
	4	W-L-8014

.24 Schedule of joint firestop systems. Basis of design: Hilti Canada

Joint Type	F-Rating (Hr)	Hilti Basis of Design cUL System	
		Joint Width Less than or Equal to 2"	Joint Width Greater than 2" Less than or Equal to 6" ⁴
Concrete (Floor to Floor)	1	FF-D-1012, FF-D-1013 ¹	FF-D-1012, FF-D-1013
	2	FF-D-1012, FF-D-1013 ¹	FF-D-1012, FF-D-1013
	3	FF-D-1011, FF-D-1026 ¹	FF-D-1011, FF-D-1026
	4	FF-D-1047	FF-D-1125
Concrete (Edge of Floor Slab to Wall)	1	FW-D-1011, FW-D-1012, FW-D-1013	FW-D-1011, FW-D-1012, FW-D-1013, FW-D-1021
	2	FW-D-1011, FW-D-1012, FW-D-1013	FW-D-1011, FW-D-1012, FW-D-1013, FW-D-1021
	3	FW-D-1011	FW-D-1011, FW-D-1021
	4	FW-D-1047	FW-D-1092
Concrete or Block Wall to Flat Concrete Floor (Top-of-Wall)	1	N/A**	N/A**
	2	HW-D-0097 ¹	HW-D-1009, HW-D-1045
	3	HW-D-1008 ¹ , HW-D 0268	HW-D-1008
	4	HW-D-1042	HW-D-1103
Concrete or Block Wall to Concrete Over Fluted Metal Deck (Top-of- Wall)	1	HW-D-0098	N/A**
	2	HW-D-0080, HW-D-0081, HW-D-0098	HW-D-1037
	3	N/A**	N/A**
	4	HW-D-0294	N/A**
Gypsum Wall to Flat Concrete Floor (Top-of- Wall)	1	HW-D-0757, HW-D-0082, HW-D-0083, HW-D-0106, HW-D-0119	HW-D-1011, HW-D-1012, HW-1020
	2	HW-D-0757, HW-D-0082, HW-D-0083, HW-D-0106, HW-D-0119	HW-D-1011, HW-D-1012, HW-1020
	3	HW-D-0119	HW-D-1011

Gypsum Shaft Wall to (Top-of-Wall)	2	HW-D-0342 (FLAT CONCRETE) HW-D-0541, HW-D-0542 (CONCRETE OVER METAL DECK)	N/A**
Gypsum Shaft Wall to Concrete Floor (Bottom- of-Wall)	1	BW-S-0023	N/A**
	2	BW-S-0023	N/A**
Gypsum Wall to Concrete Floor (Bottom- of-Wall)	1	BW-S-0001, BW-S-0002	N/A**
	2	BW-S-0001, BW-S-0002,	N/A**
Gypsum Wall to Concrete Over Fluted Metal Deck (Top-of- Wall)	1	HW-D-0042*, HW-D- 0049*, HW-D-0087*, HW- D-0089*, HW-D-0045, HW-D-0046*, HW-D- 0076*, HW-D-0077*, HW- D-0154, HW-D-0184*, HW-D-0292, HW-D-0295, HW-D-538*	HWD-1011, HWD-1012, HW-1020
	2	HW-D-0042*, HW-D- 0049*, HW-D-0087*, HW- D-0089*, HW-D-0045, HW-D-0046*, HW-D- 0076*, HW-D-0077*, HW- D-0154, HW-D-0184*, HW-D-292, HW-D-0295, HW-D0538*	HW-D-1011, HW-D-1012, HW-D-1020
	3	HW-D-0292, HW-D-0295	HWD-1011, HWD-1012, HW-1020
	4	HW-D-0292, HW-D-0295	N/A**
Concrete (Wall to Wall)	2	WW-D-0017, WW-D-0082	WW-D-1080, WW-D- 1084
	3	WW-D-1011 ¹ , WW-D- 0032	WW-D-1011
	4	WW-D-1047	WW-D-1128
Gypsum to Concrete (Wall to Wall)	1	WW-D-0068	N/A**
	2	WW-D-0068	N/A**

.2 * SEE NOTE 3 ** CONTACT HILTI FOR CURRENT cUL-CLASSIFIED SYSTEM OR ENGINEERING JUDGMENT DRAWING: 1-800-363-4458

.3 NOTES:

- .1 Classified systems for 2" - 6" wide joints may be used for joints 2" wide and less.
- .2 Confirm that movement capabilities of the selected cUL system meets or exceeds the specified movement range of the particular joint.
- .3 Systems marked with asterik (*) are suitable for top-of-wall joints where the fluted metal deck has spray-on monokote mk-6/hy fireproofing.
- .4 Verify allowable joint width on specific cUL system drawing.

- .5 Contractor to submit all systems not shown in above schedule for Contract Administrator's approval prior to continuing work.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 04 00 00 – Masonry.
- .2 Section 06 40 00 – Architectural Woodwork.
- .3 Section 07 42 13 – Metal Wall Panels.
- .4 Section 07 62 00 – Sheet Metal Flashing and Trim.
- .5 Section 08 11 00 – Metal Doors and Frames.
- .6 Section 08 54 00 – Fiberglass Windows.
- .7 Section 09 29 00 – Gypsum Board.
- .8 Section 09 65 00 – Resilient Flooring.
- .9 Division 22 – Plumbing.
- .10 Division 26 – Electrical.

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 C717-19, Standard Terminology of Building Seals and Sealants.
 - .4 ASTM C834-17, Standard Specification for Latex Sealants.
 - .5 ASTM C919-19, Standard Practice for Use of Sealants in Acoustical Applications.
 - .6 ASTM C920-18, Standard Specification for Elastomeric Joint Sealant.
 - .7 ASTM C1193-16, Standard Guide for Use of Joint Sealants.
 - .8 ASTM C1248-18, Standard Test Method for Staining of Porous Substrate by Joint Sealants.
 - .9 ASTM C1253-14(2019), Standard Test Method for Determining Outgassing Potential of Sealant Backing.
 - .10 ASTM C1330-18, Standard Specification for Cylindrical Sealant Backing for Use with Cold Liquid-Applied Sealants.
 - .11 ASTM C1518-16, Standard Specification for Precured Elastomeric Silicone Joint Sealants.
 - .12 ASTM C1520-20, Standard Guide for Paintability of Latex Sealants.
 - .13 ASTM C1521-13, Evaluating Adhesion of Installed Weatherproofing Sealant Joints.
 - .14 ASTM D412-16, Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers - Tension.
 - .15 ASTM D624-00(2020), Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers.
 - .16 ASTM E90-09(2016), Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
- .2 Workplace Hazardous Materials Information System (WHMIS).

1.3 SUBMITTALS

- .1 Shop Drawings.
 - .1 Submit product data in accordance with Section 01 33 00.
 - .2 Include product literature of sealants, primers, joint filler material, and other related components by manufacturer's catalogue or product number.

1.4 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.
- .2 Mock-ups.
 - .1 Co-ordinate with Section 07 80 00 for visual review and testing requirements.
 - .2 Mock-up joint sealant installations at window openings and masonry veneer in accordance with Section 01 45 00.
 - .3 Prepare mock-up on site as part of initial installation. Mock-up will be reviewed for joint preparation, size, shape and depth of joint c/w back-up material, quality of workmanship, and co-ordination with work of other Sections.
 - .4 Once approved, mock-up will set a standard of acceptance for remaining installations.
 - .5 Do not proceed with joint sealant installation until mock-up is complete and reviewed by Contract Administrator.
- .3 Pre-installation Meeting.
 - .1 Convene pre-installation meeting prior to commencement of joint sealant installation. Purpose of meeting is to discuss substrate conditions, quality of workmanship expected, and to ensure Contractors are fully aware of mock-up required and testing procedures that will be undertaken on the work. Required attendance of parties directly affecting work of this Section include Contractor, Window Subcontractor, Masonry Subcontractor, and Contract Administrator.

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.
- .5 Waste Management and Disposal in accordance with Section 01 74 19.

1.6 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 Do not proceed with installation of joint sealants under following conditions:
 - .1 When ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer.
 - .2 When joint substrates are wet.
 - .3 Where joint widths are less than those allowed by joint sealant manufacturer for applications indicated.
 - .4 Until contaminants capable of interfering with adhesion are removed from joint substrates.

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 Total Performance of the Work. Manufacturer hereby warrants joint sealants to be free of manufacturing defects, and these or other observed defects and deficiencies will be repaired or replaced to the satisfaction of the Contract Administrator 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 five (5) years from date of Total 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 Contract Administrator and the City, and at no expense to the City.

Part 2 Products

2.1 MANUFACTURERS

- .1 **Basis of Design Products.**
 - .1 Exterior Silicone Sealant.
 - .1 DowSil 790 or 756 SMS Building Sealant.
 - .2 Tremco Spectrem 1 Silicone Sealant.
 - .2 Interior Mildew Resistant Silicone Sealant.
 - .1 DowSil 786 or CWS Silicone Sealant.
 - .2 GE SCS1700 Sanitary Sealant.
 - .3 Tremco Tremsil 200 Silicone Sealant.
 - .3 Interior Siliconized Acrylic Sealant.
 - .1 GE RCS20 Siliconized Acrylic Sealant.
 - .2 Tremco Tremflex 834 Siliconized Acrylic Latex Sealant.
 - .4 Interior Acoustic Sealant.
 - .1 BASF MasterSeal NP 520 Acoustic Sealant.
 - .2 GE RCS20 Acoustical Sealant.
 - .3 LePage PL Acousti-Seal Acoustic Sealant.
 - .4 Mono (R) Acoustic Sealant.
 - .5 Mulco Acoustik Soundproofing Sealant.
 - .6 Tremco Acoustical Sealant.
- .2 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes of the Bidding Procedures*.
- .3 Supply similar products from single manufacturer.

2.2 MATERIALS

- .1 Joint Sealants and Sealant Primers: as recommended by sealant manufacturer for use with their product on applicable substrates.
 - .1 Exterior Silicone Sealant: high-performance, single-component, ultra-low modulus silicone sealant to ASTM C920 and ASTM C1248.
 - .2 Interior Mildew Resistant Silicone Sealant: single-component, mildew resistant silicone sealant to ASTM C920, ASTM D412, and ASTM D624.
 - .3 Interior Siliconized Acrylic Sealant: single-component all-purpose siliconized acrylic sealant for interior joints in surfaces to be painted to ASTM C834 and ASTM C1520.
 - .4 Interior Acoustic Sealant: single-component, non-skinning, non-hardening synthetic rubber sealant for acoustical sealing of STC rated partitions where indicated to ASTM C919 and ASTM E90.
- .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/m³ density, or neoprene foam backer, size as recommended by manufacturer.
 - .5 Bond Breaker Tape.
 - .1 Self-adhesive, pressure sensitive tape mad from TFE-flouorocarbon (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.

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 Contract Administrator'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 Confirm primerless sealant adhesion prior to window installations.
- .7 Ensure joint surfaces are dry and frost free.
- .8 Verify that specified environmental conditions are ensured before commencing work.
- .9 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 INSTALLATION

- .1 Joint Sealants.
 - .1 Install joint sealants in accordance with reviewed shop drawings and manufacturer's printed instructions.
 - .2 Do not install sealants under conditions of precipitation or temperatures below 4°C. Use appropriate measures for protection and supplementary heating to ensure proper curing conditions in accordance with manufacturer's recommendations if application during inclement weather occurs.

- .3 All sealants have a temperature range for optimum handling which can vary considerably, and should be stored at a temperature within this range for at least 16 hours before use.
 - .4 Do not use sealant that has started to set in its container, exceeded shelf life or installation times as stated by the manufacturer.
 - .5 Mask edges of joint where irregular surface or sensitive joint border exists to provide neat joint.
 - .6 Apply sealant in continuous beads using gun with proper size nozzle.
 - .7 Use sufficient pressure to fill voids and joints solid. Superficial pointing with skin bead is not acceptable.
 - .8 Form surface of sealant with full bead, smooth, free from ridges, wrinkles, sags, air pockets, embedded impurities.
 - .9 Tool exposed surfaces before skinning begins to give slightly concave shape.
 - .10 Remove excess compound promptly as work progresses and upon completion.
 - .11 Install acoustical joint sealants at STC rated assemblies in accordance with Section 09 29 00.
- .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 FIELD QUALITY CONTROL

- .1 Field Adhesion Testing.
 - .1 Field adhesion testing will be performed by the Contract Administrator in the presence of and with the assistance of the Contractor in accordance with ASTM C1521. Testing to be completed throughout the course of the work. The purpose of the field adhesion testing is to help detect application problems such as improper cleaning, use of improper primer, poor primer application, or improper joint configuration.
- .2 Repair of Sealant at Field Adhesion Test Locations.
 - .1 Repair the sealant pulled from the test area by applying new sealant to the test area. Assuming good adhesion was obtained, use the same application procedure to repair the area as was used originally for the joint. Care should be taken to ensure that the original sealant surface area is clean and that the new sealant is in contact with the original sealant.
 - .2 Contractor shall carry costs associated with sealant testing and repair in their Bid including but not limited to access, labour, materials, etc.

3.6 CLEANING

- .1 Clean adjacent surfaces immediately and leave work neat and clean.
- .2 Remove excess and droppings, using recommended cleaners as work progresses.
- .3 Remove masking tape after initial set of sealant.

END OF SECTION

DOOR AND FRAME ABBREVIATIONS:

ABBREV	DOOR & FRAME TYPE	SPEC NO	ABBREV	DOOR OPERATIONS	SPEC NO
FRG	Fire Rated Glass	08 80 00	EP	Electrical Power (Refer to Electrical Drawings)	
HM	Hollow Metal Welded	08 11 00	SP	Soundproof Gasketting	08 71 01
HMI	Hollow Metal Welded Insulated	08 11 00			
IGU	Insulated Glass Unit	08 80 00			
OCCD-M	Overhead Coiling Counter Door - Motorized	08 33 23	ABBREV	DOOR & FRAME FINISHES	SPEC NO
OSD-M	Overhead Sectional Door - Motorized	08 36 13	P	Paint	09 90 00
SG	Sliding Gate	10 22 13	PF	Prefinished	
SRHM	Sound Retardant Hollow Metal	08 11 00	S	Steel	
WSV	Wood Solid Core Veneer Faced	08 14 00	SS	Stainless Steel	
ABBREV	DOOR PROTECTION	SPEC NO			
KP	Stainless Steel Kickplate	08 71 01			

TYPICAL NOTES:

1. Doors shall be 1000 mm wide unless otherwise noted.
2. Doors shall be 2150 mm high unless otherwise noted.
3. Doors shall be 45 mm thickness unless otherwise noted.
4. Door and frame type shall be hollow metal welded (HM) unless otherwise noted.
5. Doors and frames shall receive paint finish unless otherwise noted.
6. Doors shall be Style 1 unless otherwise noted.
7. Frames shall be Style 1 unless otherwise noted.
8. Install door frames 50 mm from adjacent perpendicular wall finish unless otherwise noted; for masonry walls install 100 mm.
9. Kickplates when indicated on one side of door to be on push side, unless otherwise noted.
10. Refer to drawings for specific details where interior hollow metal frames wrap around wall type and frame aligns with face of finish wall material.

REMARKS:

- R1 Glazing in door and/or sidelite assemblies to be Fire Rated Insulated Glass Units.
- R2 Refer to Project Manual Section 10 22 13 - Wire Mesh Partitions. Doors, frames and hardware by Wire Mesh Partition supplier/installer.
- R3 Refer to Project Manual Section 07 42 13.20 - Acoustic Barrier Panel System. Doors, frames and hardware by Acoustic Enclosure supplier/installer.
- R4 Provide overhead door security door contacts (674-OH) to accommodate for exterior door security system tie-in.

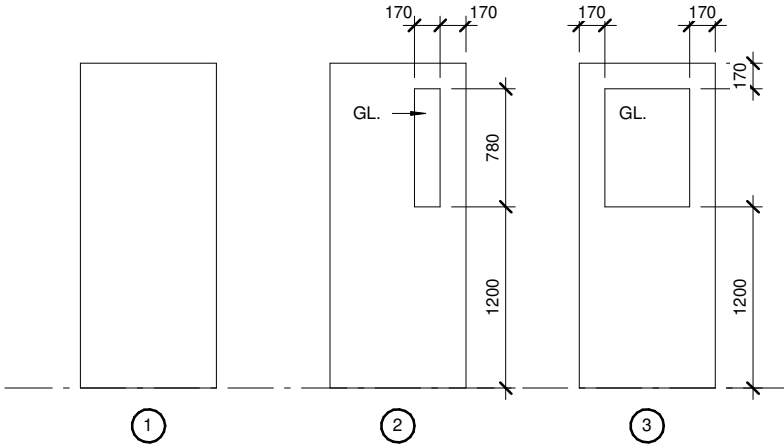
DOOR NO.	DOOR							FRAME				FIRE RATING	HDWE GROUP	REMARKS
	WIDTH	HEIGHT	THICK.	TYPE	FINISH	STYLE	PROT.	TYPE	FINISH	STYLE	PROT.			
T.O. MAIN FLOOR														
1:100	1100	2150	45	SRHM	P	2	KP	HM	P	1	-	-	73	SP, IGU
1:100.1	3100	3000		OSD-M	PF		-	S	P		-	-	70	EP, R4
1:100.2	1100	2150	45	HMI	P	2	KP	HMI	P	1	-	-	74	IGU
1:100A	1000	2150	45	HMI	P	2	KP	HMI	P	2A	-	-	37	SP, IGU
1:100B	1980	3000		SG	PF		-	S	PF	-	-	-	71	R2
1:100D	900/900	2150	45	HM	P	1	-	HM	P	1	-	-	-	R3
1:101	1000	2150	45	SRHM	P	2	KP	HM	P	2A	-	-	77	SP, IGU
1:101.1	1000	2150	45	SRHM	P	2	KP	HM	P	2A	-	45	77	SP, FRG, IGU, R1
1:102	1000/1000	2150	45	HMI	P	1	KP	HMI	P	1	-	-	69	
1:103	1100	2150	45	SRHM	P	2	KP	HM	P	1	-	45	78	SP, FRG, IGU, R1
1:103.1	1100	2150	45	HMI	P	2	KP	HMI	P	1	-	-	74	IGU
1:103.2	3100	3000	-	OSD-M	PF	-	-	S	P	-	-	-	70	EP, R4
1:103B	1000	2150	45	SRHM	P	2	KP	HM	P	2A	-	-	28	SP, IGU
1:103C	1980	3000		SG	PF		-	S	PF	-	-	-	71	R2
1:103D	850/850	2150	45	HM	P	1	KP	HM	P	1	-	-	69	
1:104	900	2150	45	HM	P	1	KP	HM	P	1	-	45	19	SP
1:106	1000	2150	45	SRHM	P	3	KP	HM	P	2B	-	-	73	SP, IGU
1:106.1	1000/1000	2150	45	HMI	P	2	KP	HMI	P	1	-	-	80	EP, IGU
1:106.2	4800	1685		OCCD-M	-		-	SS	SS	-	-	-	70	EP
1:106B	1000	2150	45	HM	P	1	KP	HM	P	1	-	0 (NRFS)	16	SP
1:106C	1000	2150	45	HM	P	1	KP	HM	P	1	-	-	50	
1:106D	1000	2150	45	HM	P	1	KP	HM	P	1	-	-	50	
1:106E	1000	2150	45	HM	P	3	KP	HM	P	3	-	-	28	SP, IGU
1:106G	1000/1000	2150	45	HM	P	3	KP	HM	P	1	-	-	79	SP, IGU
1:106K	1000	2150	45	HM	P	1	KP	HM	P	1	-	-	37	
1:106P	1000	2150	45	HM	P	1	KP	HM	P	1	-	-	37	
1:106Q	1000	2150	45	HM	P	1	KP	HM	P	1	-	-	32	
1:107	900	2150	45	WSV	ST	2	KP	HM	P	1	-	-	24	SP, IGU
1:107A	900	2150	45	WSV	ST	2	KP	HM	P	1	-	-	75	
1:107B	900	2150	45	WSV	ST	2	KP	HM	P	1	-	-	75	
T.O. MECH. MEZZANINE														
1M:02	1000/1000	2100	45	HMI	P	1	KP	HMI	P	1	-	-	56	
1M:03	1000	2150	45	HM	P	1	KP	HM	P	1	-	-	76	SP

DOOR STYLES

SCALE 1 : 50

NOTES:

1. ALL GLAZING (GL.) TO BE TEMPERED UNLESS OTHERWISE NOTED.
2. ALL GLAZING IN DOORS REQUIRING A FIRE-RATING TO BE FIRE-RATED GLAZING (FRG) UNLESS OTHERWISE NOTED. REFER TO DOOR SCHEDULE.
3. ALL GLAZING IN DOORS INDICATED AS SOUND RETARDANT TO BE INSULATED GLAZING UNITS (IGU) UNLESS OTHERWISE NOTED. REFER TO DOOR SCHEDULE.

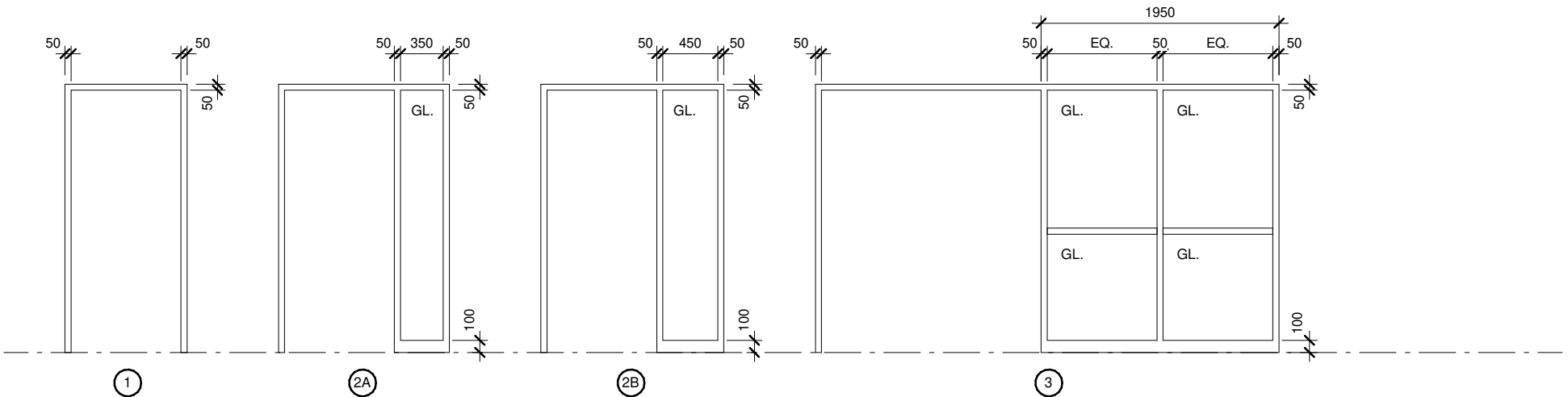


FRAME STYLES

SCALE 1 : 50

NOTES:

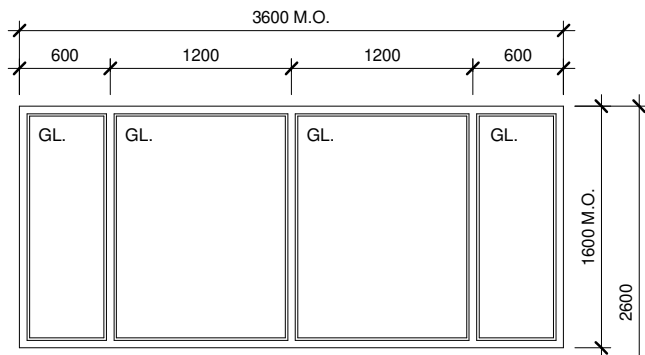
1. ALL FRAMES TO BE HOLLOW METAL (HM) UNLESS OTHERWISE NOTED.
2. REFER TO DOOR SCHEDULE 08 06 10 'REMARKS' & GLAZING SECTION 08 80 00 FOR GLAZING TYPES.
3. ALL GLAZING (GL.) TO BE SAFETY GLASS (SG) UNLESS OTHERWISE NOTED.
4. ALL GLAZING IN ASSEMBLIES REQUIRING A FIRE-RATING TO BE FIRE-RATED GLAZING (FRG) UNLESS OTHERWISE NOTED.
5. ALL GLAZING IN ASSEMBLIES INDICATED AS SOUND RETARDANT TO BE INSULATED GLAZING UNITS (IGU) UNLESS OTHERWISE NOTED.
6. ALL INTERIOR DOOR & WINDOW FRAMES WITHIN STEEL STUD/GYPSUM BOARD ASSEMBLIES ARE TO BE WRAP AROUND TYPE UNLESS OTHERWISE NOTED. REFER TO ARCHITECTURAL DRAWINGS FOR LOCATIONS OF SPECIAL CONDITIONS.



FRAME STYLES

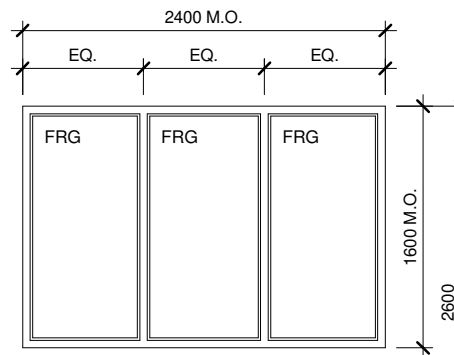
SCALE 1 : 50

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4. ALL GLAZING IN ASSEMBLIES INDICATED AS SOUND RETARDANT TO BE INSULATED GLAZING UNITS (IGU) UNLESS OTHERWISE NOTED.
5. ALL INTERIOR DOOR & WINDOW FRAMES WITHIN STEEL STUD/GYPSUM BOARD ASSEMBLIES ARE TO BE WRAP AROUND TYPE UNLESS OTHERWISE NOTED. REFER TO ARCHITECTURAL DRAWINGS FOR LOCATIONS OF SPECIAL CONDITIONS.



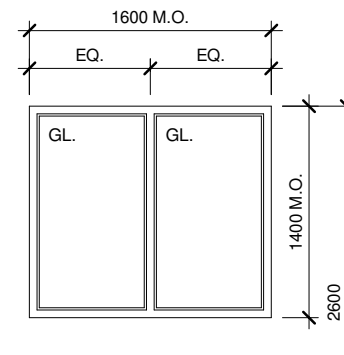
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DESIGN LAB 1:101



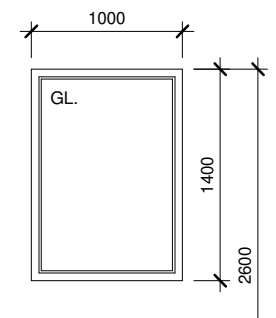
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MACHINING & WELDING TECHNOLOGY 1:103



⑥

CONST. & WOOD TECHNOLOGY 1:100



⑦

CULINARY ARTS 1:106 (x3)

Part 1 General

1.1 SECTION INCLUDES

- .1 This section includes labour and materials required to complete conformance testing and reporting of openings.

1.2 RELATED SECTIONS

- .1 Section 08 11 00 – Metal Doors and Frames
- .2 Section 08 54 13 – Fiberglass Windows
- .3 Section 08 80 00 – Glazing

1.3 MEASUREMENT AND PAYMENT

- .1 No measurement will be made under this section.
- .2 Building Envelope Testing; by Building Envelope Commissioning Authority, on behalf of the The City.
- .3 Co-ordinate visual review and testing frequency and locations with Building Envelope Commissioning Authority to facilitate review of multiple distinct building envelope elements and components during the same visit.
- .4 Costs incurred for additional testing for items not meeting the specifications including costs for transportation and for required modifications to be the responsibility of the Contractor.

1.4 REFERENCES

- .1 American Society for Testing and Materials (ASTM):
 - .1 ASTM E783-02(2018) Standard Test Method for Field Measurement of Air Leakage Through Installed Exterior Windows and Doors.
 - .2 ASTM E1105-15 Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform or Cyclic Static Air Pressure Difference.
 - .3 ASTM E1186-17 Standard Practices for Air Leakage Site Detection in Building Envelopes and Air Barrier Systems.
- .2 Canadian Standards Association (CSA International):
 - .1 AAMA/WDMA/CSA 101/I.S.2/A440-11, NAFS - North American Fenestration Standard/Specification for Windows, Doors, and Skylights.
 - .2 CSA A440SI-09 - Canadian Supplement to AAMA/WDMA/CSA 101/I.S.2/A440, NAFS - North American Fenestration Standard/Specification for Windows, Doors, and Skylights.

1.5 PRE-INSTALLATION CONFERENCE

- .1 Pre-work Conference in accordance with General Requirements.

- .2 Convene pre-work conference minimum five (5) working days prior to beginning site installation of mock-up.
- .3 Establish date, time and location of conference and notify parties concerned minimum five (5) working days before conference.
- .4 Construction Manager, Contract Administrator, Commissioning Authority, Building Envelope Commissioning Authority, and installers involved in work to be in attendance.
- .5 Agenda for conference:
 - .1 Verify project requirements, design, and intent of design.
 - .2 Review installation and substrate conditions.
 - .3 Co-ordinate with subtrades.
 - .4 Review manufacturer's installation instructions and warranty requirements.
 - .5 Review compatibility of materials.

1.6 SUBMITTALS

- .1 Submittals in accordance with Section 01 33 00 Submittal Procedures.
- .2 Submit test results from testing agency for each specified test, maximum one week following completion of testing.
- .3 The manufacturer for each component of the building envelope, including but not necessarily limited to all aluminum windows and associated adjacent wall assembly components, shall provide written verification that the proposed material and systems will meet or exceed the requirements of the Contract Documents.
- .4 Product Data
 - .1 Provide product data for:
 - .1 Section 08 11 00 – Metal Doors and Frames
 - .2 Section 08 54 13 – Fiberglass Windows
 - .3 Section 08 80 00 – Glazing
- .5 Shop Drawings
 - .1 Provide shop drawings for:
 - .1 Section 08 11 00 – Metal Doors and Frames
 - .2 Section 08 54 13 – Fiberglass Windows
 - .3 Section 08 80 00 – Glazing
- .6 Qualification Statements:
 - .1 Submit proof of Testing Agency qualifications for review and acceptance:
 - .1 Proof of ISO 17025:2005 accreditation.
 - .2 Minimum five projects completed in last five years demonstrating experience in air leakage testing and water penetration testing of glazed aluminum curtain walls and aluminum windows in accordance with standards specified in this section.

1.7 TESTING AGENCY

- .1 Testing Agency:
 - .1 Third-party accredited testing laboratory.
 - .2 Accredited to ISO 17025:2005, General requirements for the competence of testing and calibration laboratories.

1.8 QUALITY ASSURANCE

- .1 Notify the Contract Administrator, Commissioning Authority, Building Envelope Commissioning Authority, and the Testing Agency in writing of the construction and testing schedule prior to the start of work.
 - .1 On-site testing and reporting of the Contractor's work shall be carried out by the Testing Agency identified by the Building Envelope Commissioning Authority.
 - .1 Provide a minimum seventy-two (72) hours' notice for openings to be reviewed by Building Envelope Commissioning Authority.
- .2 Field review/Testing frequency:
 - .1 On-Site Mock-Up Review and/or testing of openings:
 - .1 Review the mock-ups at completion milestones. Unless otherwise noted, mock-ups to be the first installation of the openings including thermal and moisture protection components.
 - .2 Provide a minimum seventy-two (72) hours' notice for openings to be reviewed by Building Envelope Commissioning Authority.
 - .2 On-Site Quality Assurance Review and/or Testing
 - .1 Visual review and testing of the installed openings including thermal and moisture protection components may be periodically completed at the discretion of the Building Envelope Commissioning Authority.
Provide a minimum seventy-two (72) hours' notice for openings to be reviewed by Building Envelope Commissioning Authority.

Part 2 Products

2.1 NOT USED

Part 3 Execution

3.1 METAL DOORS AND FRAMES

- .1 Provide a mock-up of metal doors and frames at a location identified by the Building Envelope Commissioning Authority prior to full system installation.
- .2 Visual review:
 - .1 Visual reviews shall be performed by the Building Envelope Commissioning Authority to determine general conformance with requirements of the Contract Documents.

- .1 Frequency of visual reviews:
 - .1 Once during Mock-up.
 - .2 Randomly during remainder of installation at the discretion of the Building Envelope Commissioning Authority.

3.2 FIBERGLASS WINDOWS

- .1 Provide mock-ups of fiberglass windows at locations identified by the Building Envelope Commissioning Authority prior to full system installation.
 - .1 Include all detailing at head, jambs, mullions, and sill, including waterproofing, air sealing, sealants, flashings, and any other detailed assembly components.
- .2 Visual review:
 - .1 Visual reviews shall be performed by the Building Envelope Commissioning Authority to determine general conformance with requirements of the Contract Documents.
 - .1 Frequency of visual reviews:
 - .1 Once during Mock-up.
 - .2 Randomly during remainder of installation at the discretion of the Building Envelope Commissioning Authority.
- .3 Testing: Mock-Up and Functional Performance:
 - .1 Water leakage testing:
 - .1 Provide means for capture and disposal of water generated during the test.
 - .2 Water penetration testing under uniform or cyclic static air pressure difference:
 - .1 Conduct water penetration testing in accordance with:
 - .1 ASTM E1105.
 - .2 AAMA/WDMA/CSA 101/I.S.2/A440.
 - .3 CSA A440S1.
 - .3 Conduct water penetration testing as follows:
 - .1 Static pressure.
 - .2 Cyclic method.
 - .3 Include the rough opening.
 - .2 Quantitative air leakage testing:
 - .1 Air leakage testing under pressurization and depressurization:
 - .1 Conduct air leakage testing in accordance with:
 - .1 ASTM E783.
 - .2 AAMA/WDMA/CSA 101/I.S.2/A440.
 - .3 CSA A440S1.
 - .3 Qualitative air leakage testing:
 - .1 Air leakage testing under pressurization or depressurization:
 - .1 Conduct air leakage testing in accordance with:

- .1 ASTM E1186.
- .2 AAMA/WDMA/CSA 101/I.S.2/A440.
- .3 CSA A440S1.
- .4 Test pressure in accordance with:
 - .1 Section 08 62 00.
- .5 Frequency of Testing:
 - .1 One (1) during Mock-ups.
 - .2 Two (2) additional units randomly selected during remainder of installation.

3.3 ANALYSIS AND CORRECTIVE PROCEDURES

- .1 Repair all damages from testing.
- .2 Remediate non-conforming work identified during visual reviews and testing.
- .3 Do not cover any remediated work until reviewed by the Building Envelope Commissioning Authority, or until the Building Envelope Commissioning Authority has reviewed proof of remediation.
- .4 Re-testing of remediated work shall be at the discretion of the Building Envelope Commissioning Authority.
- .5 Costs for repairs, remediation of non-conforming work, and re-testing are the responsibility of the Contractor. No additional costs to be submitted to the The City for repairs or testing.

3.4 REPORTING

- .1 Prepare reports in accordance with the specified test methods.
- .2 Reports to include modifications and repairs made to the test specimen.
- .3 Submit reports withing 5 working days following field observations and testing.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 04 00 00 – Masonry.
- .2 Section 05 41 00 – Structural Metal Stud Framing.
- .3 Section 06 10 00 – Rough Carpentry.
- .4 Section 07 92 00 – Joint Sealants.
- .5 Section 08 06 10 – Door Schedule.
- .6 Section 08 14 00 – Wood Doors.
- .7 Section 08 71 00 – Door Hardware.
- .8 Section 08 80 00 – Glazing.
- .9 Section 09 22 16 – Non-Structural Metal Framing.
- .10 Section 09 29 00 – Gypsum Board.
- .11 Section 09 90 00 – Painting and Coating.

1.2 REFERENCES

- .1 American Society for Testing and Materials (ASTM).
 - .1 ASTM A653/A653M-20, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by Hot-Dip Process.
 - .2 ASTM A780/A780M-20, Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.
 - .3 ASTM E413-22, Classification For Rating Sound Insulation.
 - .4 ASTM F1554-18, Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength.
- .2 Canadian Standards Association (CSA).
 - .1 CSA G40.20-13/G40.21-13 (R2018), General Requirements for Rolled or Welded Structural Quality Steel/ Structural Quality Steel.
 - .2 CSA W59-18, Welded Steel Construction.
- .3 Canadian Steel Door Manufacturers Association (CSDMA).
 - .1 CSDMA, Recommended Specifications for Commercial Steel Doors and Frame Products, 2018.
 - .2 CSDMA, Recommended Dimensional Standards for Commercial Steel Doors and Frames, 2000.
 - .3 CSDMA, Canadian Fire Labeling Guide for Commercial Steel Doors and Frame Products, 2009.
 - .4 CSDMA, Guide Specifications for Installation and Storage of Hollow Metal Doors and Frames, 2012.
- .4 National Fire Protection Association (NFPA).
 - .1 NFPA 80, Standard for Fire Doors and Other Opening Protectives, 2019 Edition.
 - .2 NFPA 252, Standard Methods of Fire Tests of Door Assemblies, 2017 Edition.
- .5 Underwriters' Laboratories of Canada (ULC).

- .1 CAN/ULC S104-15 (R2020), Standard Method for Fire Tests of Door Assemblies.
- .2 CAN/ULC S105-16 (R2020), 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.
- .4 CAN/ULC S704.1-17, Standard for Thermal Insulation, Polyurethane and Polyisocyanurate Boards, Faced.

1.3 SUBMITTALS

- .1 Shop Drawings.
 - .1 Submit shop drawings in accordance with Section 01 33 00.
 - .2 Shop drawings to bear the signature and stamp of a qualified professional Engineer registered in the jurisdiction of the Place of the Work.
 - .3 Indicate each type of door, core material, steel thicknesses, mortises, reinforcements, arrangement of hardware, fire ratings, glazing, and finishes.
 - .4 Indicate each type frame material, steel thickness, reinforcements, location of anchors, fire ratings, and exposed fastenings and finishes.
 - .5 Include schedule identifying each unit, with door marks and numbers relating to numbering on drawings and in Door Schedule.

1.4 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.

1.5 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, 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 Section 01 74 00.
- .6 Waste Management and Disposal in accordance with Section 01 74 19.

Part 2 Products

2.1 MATERIALS

- .1 Hot Dipped Galvanized Steel Sheet: to ASTM A653/A653M, ZF75, 1.6 mm (16-gauge) 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 A653/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/m³ minimum sanded to required thickness.
 - .2 Insulated Core.
 - .1 Expanded polystyrene to CAN/ULC-S701.1, density 16 to 32 kg/m³.
 - .2 Polyurethane to CAN/ULC S704.1 rigid, modified poly/isocyanurate, closed cell board, density 32 kg/m³.
- .4 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).
- .5 Door Frame Adjustable Base Anchor: 1.6 mm (16-gauge) galvanized steel to ASTM A653/A653M, two spot welds per end, WHI and ULC approved.
- .6 Channel Spreaders: 1.6 mm (16-gauge) base steel thickness.
- .7 Guard Boxes: 0.8 mm (22-gauge) base steel thickness.
- .8 Hinge Reinforcing: 4.4 mm (7-gauge) base steel thickness.
- .9 Lock Reinforcing: 1.6 mm (16-gauge) base steel thickness.
- .10 Strike Reinforcing: 2.6 mm (12-gauge) base steel thickness.
- .11 Surface Applied Hardware Reinforcing: 2.6 mm (12-gauge) base steel thickness.
- .12 Fasteners: expansion bolts to ASTM F1554, galvanized.
- .13 Metallic Paste Filler: to manufacturer's standard.
- .14 Touch-up Primer: to ASTM A780/A780M.
- .15 Door Bumpers: single stud black rubber/neoprene type.
- .16 Joint Sealants: in accordance with Section 07 92 00.
- .17 Door Hardware: in accordance with Section 08 71 00.
- .18 Glazing: in accordance with Section 08 80 00.

2.2 FABRICATION

- .1 General.
 - .1 Fabricate steel doors and frames as detailed to Canadian Steel Door Manufacturers Association (CSDMA) specifications.

- .2 Fabricate doors and frames to profiles and maximum face sizes as indicated, reviewed 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 Build-in required hardware reinforcing and guard boxes.
 - .5 Attach ULC or WHI labels to required fire rated doors and frames as indicated.
 - .6 Manufacturer's nameplates on doors and frames are not permitted.
 - .7 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) Door Fabrication.
- .1 Fabricate hollow metal doors as follows. Refer to Section 08 06 10 Door Schedule for locations.
 - .1 Hollow Metal (HM): fabricate each face sheet from 16-gauge galvanized sheet steel with rigid honeycomb core laminated under pressure to face sheets.
 - .2 Hollow Metal Insulated (HMI): fabricate each face sheet from 16-gauge galvanized sheet steel with insulated polystyrene or polyurethane core laminated under pressure to face sheets.
 - .3 Sound Retardant Hollow Metal (SRHM): fabricate each face sheet from 16-gauge galvanized sheet steel with polystyrene core laminated under pressure to face sheets (STC 33 with sound seals and auto door bottom).
 - .2 Bevel hinge and lock door edges 3 mm in 50 mm. Square edges on hinge and/or lock stiles are not acceptable.
 - .3 Close door top with flush surface spot welded channel closure. Close door bottom with recessed spot welded channel closure. Weld channels to both face sheets to stiffen door laterally.
 - .4 Reinforce doors where required, for surface mounted hardware.
 - .5 Blank, reinforce, drill doors and tap for mortised, templated hardware and electronic hardware.
 - .6 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.
 - .7 Factory prepare holes 12.7 mm diameter and larger except mounting and through-bolt holes, on site, at time of hardware installation.
 - .8 Provide factory-applied touch-up primer at areas where zinc coating has been removed during fabrication.
 - .9 Provide fire labelled doors for those openings requiring fire protection ratings, as scheduled. Test such products in strict conformance with 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.
- .3 Hollow Metal (HM) Welded Frame Fabrication.
- .1 Fabricate hollow metal welded door frames as follows. Refer to Section 08 06 10 Door Schedule for locations.
 - .1 Hollow Metal (HM): 16-gauge galvanized steel, fully welded combination type construction in accordance with CSA W59.
 - .2 Accurately mitre or mechanically joint frame product and securely weld on inside of profile.

- .3 Cope accurately and securely weld butt joints of mullions. Grind welded joints and corners to flat plane, fill with metallic paste and sand to uniform smooth finish.
- .4 Grind welded joints and corners to flat plane, fill with metallic paste and sand to uniform smooth finish.
- .5 Fabricate sidelights to receive glazing indicated.
- .6 Fabricate custom corner section as detailed of same material and thickness as door frame. Site weld to adjacent frame, fill and sand smooth to receive paint finish.
- .7 Reinforce frames for surface mounted hardware.
- .8 Securely attach floor anchors to inside of each jamb profile.
- .9 Weld in two (2) temporary jamb spreaders per frame to maintain proper alignment during shipment.
- .10 Reinforce head of frames wider than 1200 mm.
- .11 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.
- .12 Protect strike and hinge reinforcements using steel guard boxes welded to frames.
- .13 Install three bumpers on strike jamb for single doors, plus two bumpers at head for double doors.
- .14 Conceal fastenings except where exposed fastenings are indicated.
- .15 Provide factory-applied touch-up primer at areas where zinc coating has been removed during fabrication.
- .16 Insulate exterior and sound retardant frame components with expanded polystyrene or polyurethane insulation.
- .17 Provide steel jamb anchors securely welded inside each jamb to frames in accordance with requirements of ULC or WHI. Custom anchors may be required where frame throats are unusually deep.
- .18 For power-assist door operators typically secured to door frame, provide additional reinforcing to support backside of mounting plate, consisting of minimum 6 mm thick aluminum plate the full height and width of the door operator.

Part 3 Execution

3.1 INSTALLATION

- .1 General.
 - .1 Install doors and frames in accordance with CSDMA Guide Specifications for Installation and Storage of Hollow Metal Doors and Frames.
 - .2 Install labeled steel fire rated doors and frames to NFPA 80 and NFPA 252 except where specified otherwise.
- .2 Frame Installation.
 - .1 During the setting of frame product, check and correct as necessary for opening width, opening height, square, alignment, twist and plumb, in accordance with CSDMA Recommended Dimensional Standards for Commercial Steel Doors and Frames.
 - .2 Frame Anchorage.
 - .1 Provide appropriate anchorages and connections to adjacent floor and wall construction.
 - .2 Install door frame adjustable base anchors as specified in accordance with manufacture's printed instructions.

- .3 Locate each wall anchor immediately above or below each hinge reinforcement on hinge jamb and directly opposite on strike jamb.
- .4 Provide two (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) with acoustic sealant to form airtight seal.
- .6 Install neoprene door bumpers in frames (following field painting of frames).
- .3 Door Installation.
 - .1 Install doors and hardware in accordance with reviewed shop drawings, hardware templates, 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 touch-up primer in accordance with ASTM A780/A780M.
 - .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 08 06 10 – Door Schedule.
- .2 Section 08 11 00 – Metal Doors and Frames.
- .3 Section 08 71 00 – Door Hardware.
- .4 Section 08 00 00 – Glazing.

1.2 REFERENCES

- .1 American National Standards Institute (ANSI)/National Particleboard Association (NPA).
 - .1 ANSI/NPA A208.1-2016, Particleboard.
- .2 American Society for Testing and Materials (ASTM).
 - .1 ASTM D5456-19, Standard Specification for Evaluation of Structural Composite Lumber Products.
 - .2 ASTM E90-09(2016), Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
 - .3 ASTM E413-16, Classification for Rating Sound Insulation.
- .3 Architectural Woodwork Manufacturers Association of Canada (AWMAC) / Woodwork Institute (WI).
 - .1 North American Architectural Woodwork Standards (NAAWS)- 4.0, 2021.
- .4 Canadian Standards Association (CSA).
 - .1 CSA O112.10-08 (R2017), Evaluation of Adhesives for Structural Wood Products (Limited Moisture Exposure).

1.3 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.
- .2 Samples.
 - .1 Submit samples in accordance with Section 01 33 00.
 - .2 Submit min 150 mm wide x 200 mm high corner sample of each wood door specified exposing core, stile, rail, edge detail, and face as specified c/w factory clear coat finish.

1.4 QUALITY ASSURANCE

- .1 Regulatory Requirements.
 - .1 Perform work to “Premium Grade” standards in accordance with Section 09 - Doors of NAAWS.

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, 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.
- .5 Waste Management and Disposal in accordance with Section 01 74 19.

1.6 WARRANTY

- .1 Manufacturer's Product Warranty: provide an extended warranty for Work of this Section from date of Total Performance of the Work. Manufacturer hereby warrants that wood 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 Contract Administrator and the City, and at no expense to the City.
 - .1 Wood Solid Core Veneer Faced Doors (WSV): lifetime.

Part 2 Products

2.1 MANUFACTURERS

- .1 Basis of Design Products.
 - .1 Wood Solid Core Veneer Faced Doors (WSV).
 - .1 Baillargeon Doors Inc. 8500-ME.
 - .2 Lynden Door LD2000 PC-5.
- .2 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes* of the *Bidding Procedures*.
- .3 Supply similar products from single manufacturer.

2.2 MANUFACTURED UNITS

- .1 Wood Solid Core Veneer Faced Doors (WSV).
 - .1 Construction: 5 ply, particleboard core, wood veneer faced, FSC Certified.
 - .2 Components.
 - .1 Solid Core: particleboard core LD-1, density of 449-513 kg/m³ (28-32 pcf) in accordance with ANSI/NAP A208.1, containing no added urea-formaldehyde resins.
 - .2 Stiles: 10 mm matching hardwood laminated to 22 mm structural composite lumber (SCL) in accordance with ASTM D5456.
 - .3 Rails: 150 mm (top and bottom) structural composite lumber (SCL).
 - .4 Face: 2 ply pre-manufactured door skins consisting of cross-banded hardwood veneer, grade "A", White Maple, plain sliced vertical grain, book matched in accordance with NAAWS, factory clear coat finish.
 - .5 Core to Edge Assembly: particleboard core bonded to stiles and rails, and sanded prior to application of veneer face to eliminate telegraphing.
 - .6 Adhesive: Type 1, containing no added urea-formaldehyde, cold pressing as recommended by door manufacturer in accordance with CSA O112.
 - .7 Edge Detail: Type "A" edge detail in accordance with NAAWS, factory clear coat finish (4 sides).

2.3 FABRICATION

- .1 Fabricate wood doors to “Premium Grade” standards in accordance with Section 09 - Doors of NAAWS.
- .2 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.
- .3 Comply with NAAWS for sanding and other preparations for factory finishing.
- .4 Prepare wood doors for hardware specified.

Part 3 Execution

3.1 INSTALLATION

- .1 Allow doors to become acclimatized to finished building heat and humidity before hanging.
- .2 Install doors to “Premium Grade” standards in accordance with Section 09 - Doors of NAAWS.
- .3 Install doors and hardware in accordance with reviewed shop drawings and 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.
- .4 Install glazing in doors where indicated in accordance with Section 08 80 00.

3.2 ADJUSTING

- .1 Adjust doors and hardware to operate smoothly, easily, and quietly, free from binding, warp, excessive deflections, distortion, and nonalignment.

3.3 SCHEDULES

- .1 Refer to Section 08 06 10.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 03 30 00 – Cast-In-Place Concrete.
- .2 Section 05 50 00 – Metal Fabrications.

1.2 REFERENCES

- .1 American Society for Testing and Materials (ASTM).
 - .1 ASTM A36/A36M-19, Standard Specification for Carbon Structural Steel.
 - .2 ASTM A506-16, Standard Specification for Alloy and Structural Alloy Steel, Sheet and Strip, Hot-Rolled and Cold-Rolled.
 - .3 ASTM A653/A653M-20, 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 and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric).
- .2 Canadian Standards Association (CSA).
 - .1 CSA S157-17/S157.1-17, Strength Design in Aluminum/Commentary on CSA S157-17, Strength Design in Aluminum.
 - .2 CSA W59.2-18, Welded Aluminum Construction.
- .3 Occupational Safety & Health Administration (OSHA).
 - .1 OSHA 29 CFR 1926.502(c) - Fall Protection Systems and Practices.

1.3 SYSTEM DESCRIPTION

- .1 Performance Requirements.
 - .1 Covers reinforced to support a minimum live load of 732 kg/m² (150 psf) 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.
- .5 Waste Management and Disposal in accordance with Section 01 74 19.

1.6 WARRANTY

- .1 Manufacturer's Product Warranty: provide an extended warranty for Work of this Section from date of Total Performance of the Work to the term of warranty specified. 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 Contract Administrator and the City, and at no expense to the City.
 - .1 Door: Five (5) years against defects in material and workmanship.
 - .2 Safety Post: Five (5) years against defects in material and workmanship.
 - .3 Fall Protection Grating: 25 years against defects in material and workmanship.

Part 2 Products

2.1 MANUFACTURERS

- .1 Basis of Design Products.
 - .1 Floor Door (FD) (762mm X 914mm).
 - .1 Door: Bilco Model T-3 Single Leaf Aluminum Floor Access Door (recessed to accept sheet flooring).
 - .2 Safety Post: Bilco, LadderUP Safety Post LU-1.
 - .3 Fall Protection Grating: Bilco, Fall Protection Grating System.
- .2 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes* of the *Bidding Procedures*.
- .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 SYSTEM COMPONENTS

- .1 Floor Door.
 - .1 Door.
 - .1 Door Leaf (FD): 6 mm thick aluminum smooth plate designed to receive thickness of resilient flooring specified in Section 09 65 00, and reinforced for a 732 kg/m² (150 psf) live load with maximum allowable deflection of 1/150th of span.
 - .2 Size: 762 mm x 914 mm.
 - .3 Frame: 6 mm extruded aluminum channel frame with built-in neoprene cushion and bend down anchor tabs around the perimeter.
 - .4 Hinges: cast steel cam-action hinges bolted to underside of frame and pilot on torsion bars for smooth, easy and controlled door operation throughout entire opening and closing.
 - .5 Operation: cylinder lock with keyway and panic lock for emergency egress. Provide Yale lock with Best cylinder core E12E72.
 - .6 Hold-Open Arm: automatic hold-open arm with vinyl grip handle to permit easy release and one-hand control of cover to its closed and latched position.
 - .2 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.
 - .3 Fall Protection Grating.
 - .1 Grating Panels: aluminum bar grating designed to meet OSHA 29 CFR 1926.502(c) requirements for fall protection, and finished with safety-yellow powder coat factory paint finish.
 - .2 Hold Open Feature: Type 316 stainless hold open device shall be provided to lock the cover in the fully open 90° position.
 - .3 Hardware: Type 316 stainless steel.

Part 3 Execution

3.1 INSTALLATION

- .1 Install floor access doors and safety components plumb, square, level and in proper alignment in accordance with reviewed shop drawings and manufacturer's printed installation instructions.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 04 00 00 – Masonry.
- .2 Section 05 12 23 – Structural Steel for Buildings.
- .3 Section 06 10 00 – Rough Carpentry.
- .4 Section 08 06 10 – Door Schedule.
- .5 Section 08 71 00 – Door Hardware.
- .6 Section 09 22 16 – Non-Structural Metal Framing.
- .7 Section 09 29 00 – Gypsum Board.
- .8 Division 26 – Electrical.
- .9 Division 28 – Electronic Safety and Security.

1.2 REFERENCES

- .1 American Society for Testing and Materials (ASTM).
 - .1 ASTM A653/A653M-20, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - .2 ASTM A666-15, Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
 - .3 ASTM B221M-13, Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric).
- .2 National Fire Protection Association (NFPA).
 - .1 NFPA 80, Standard for Fire Doors and Other Opening Protectives, 2019 Edition.
 - .2 NFPA 252, Standard Methods of Fire Tests of Door Assemblies, 2017 Edition.

1.3 SUBMITTALS

- .1 Shop Drawings.
 - .1 Submit shop drawings in accordance with Section 01 33 00.
 - .2 Include elevations, sections, and details indicating dimensions, materials including supporting steel, finishes, conditions for anchorage, required clearances, and support of each door.
- .2 Closeout Submittals.
 - .1 Provide operation and 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.
- .5 Waste Management and Disposal in accordance with Section 01 74 19.

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 Total Performance of the Work. Manufacturer hereby warrants overhead coiling 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 Contract Administrator and the City, and at no expense to the City.

Part 2 Products

2.1 MANUFACTURED UNITS

- .1 Basis of Design Products.
 - .1 Stainless Steel Overhead Coiling Counter Door (Culinary Arts).
 - .1 Cookson ESC10 Stainless Steel Motorized Counter Door, face of wall mounted.
 - .2 Overhead Door Series 651 Stainless Steel Motorized Counter Door, face of wall mounted.
- .2 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes* of the *Bidding Procedures*.
- .3 Provide all similar products from single manufacturer.

2.2 COMPONENTS

- .1 Stainless Steel Overhead Coiling Counter Door (Culinary Arts).
 - .1 Door Curtain: 22-gauge interlocking roll-formed Type 304 stainless steel flat-faced slats to ASTM A666 with No. 4 finish, and with endlock for curtain alignment, stainless steel tubular bottom bar with neoprene astragal.
 - .2 Bottom Bar/Locking: Type 304 stainless steel angle bottom bar c/w interior slide bolts.
 - .3 Guides: 12-gauge formed stainless steel shapes.
 - .4 Counterbalance: helical torsion spring type housed in a steel tube or pipe barrel, supporting the curtain with deflection limited to 0.8 mm per 305 mm of span. Counterbalance to adjustable by means of an adjusting tension wheel.
 - .5 Hood/Fascia: enclose counterbalance assembly with minimum 24-gauge SQUARE Type 304 stainless steel hood/fascia with No. 4 finish, provide intermediate support brackets as required.
 - .6 Electric Motor Operation: UL listed electric operator, size as recommended by manufacturer to move door in either direction complete-with electric sensing edge. The motor operator to be activated by a flush wall mounted push-button operated control station on interior room side consisting of open, close, and stop buttons.

Part 3 Execution

3.1 EXAMINATION

- .1 Examine surfaces and field conditions to which this work is to be performed and notify the Contract Administrator if conditions of surfaces exist which are detrimental to proper installation and timely completion of work.
- .2 Do not proceed with work until unsatisfactory conditions are corrected.

3.2 INSTALLATION

- .1 Install overhead coiling doors in accordance with reviewed shop drawings and manufacturer's printed instructions.
- .2 Perform installation using only factory approved and certified representatives of the door manufacturer.
- .3 Install door assemblies at locations shown in perfect alignment and elevation, plumb, level, straight and true.
- .4 Co-ordinate installation with adjacent work to ensure proper clearances for operation and maintenance.

3.3 ADJUSTING AND CLEANING

- .1 Test overhead coiling doors for proper operation. Lubricate and adjust door operating components to ensure smooth opening and closing of doors without binding or distortion.
- .2 Touch-up damaged coatings and finishes and repair minor damage.
- .3 Clean exposed surfaces using non-abrasive materials and methods recommended by manufacturer.

3.4 DEMONSTRATION

- .1 Demonstrate proper operation and maintenance procedures to the Division's representative in accordance with Section 01 79 00.

3.5 SCHEDULES

- .1 Refer to Section 08 06 10.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 04 00 00 – Masonry.
- .2 Section 05 50 00 – Metal Fabrications.
- .3 Section 08 06 10 – Door Schedule.

1.2 REFERENCES

- .1 American Society for Testing and Materials (ASTM).
 - .1 ASTM A123/A123M-17, Standard Specification for Zinc (Hot-Dip Galvanized) Coating on Iron and Steel Products.
 - .2 ASTM A229/A229M-18, Standard Specification for Steel Wire, Quenched and Tempered for Mechanical Springs.
 - .3 ASTM A653/A653M-20, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - .4 ASTM A780/A780M-09(2015), Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.
 - .5 ASTM A1008/A1008M-20, Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable.
- .2 Door and Access Systems Manufacturer's Association (DASMA).
 - .1 ANSI/DASMA 102-2011, Specifications for Sectional Doors.
- .3 National Building Code of Canada, 2020 (NBCC), complete with current Manitoba Building Code amendments (MBC).

1.3 SYSTEM DESCRIPTION

- .1 Design Requirements.
 - .1 Windload design in accordance with ANSI/DASMA 102 and as required by National Building Code.

1.4 SUBMITTAL

- .1 Product Data.
 - .1 Submit manufacturer's product data and installation instructions in accordance with Section 01 33 00.
 - .2 Include both published data and any specific data prepared for this project.
- .2 Shop Drawings.
 - .1 Submit shop drawings in accordance with Section 01 33 00.
 - .2 Include detailed plans, elevations, details of framing members, required clearances, sizes materials, operating mechanisms, glazing locations and details, service rating and electrical connections, hardware anchors, accessories, and relationship with adjacent work.
- .3 Closeout Submittals.
 - .1 Provide operation and maintenance data for incorporation into Operations and Maintenance Manual specified in Section 01 78 00.

1.5 QUALITY ASSURANCE

- .1 Qualifications.
 - .1 Manufacturer: sectional doors to be manufactured by a firm with minimum of five (5) year's experience in the fabrication of sectional doors.
 - .2 Installer: sectional doors to be installed by authorized representative of the manufacturer with minimum of five (5) year's experience in the installation of sectional doors.

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 Section 01 74 00.
- .5 Waste Management and Disposal in accordance with Section 01 74 19.

1.7 WARRANTY

- .1 Manufacturer's Product Warranty: provide an extended warranty for Work of this Section from date of Total Performance of the Work to term of warranty specified below. Manufacturer hereby warrants sectional door system to be free of defects in materials and workmanship, and these or other observed defects and deficiencies will be repaired or replaced to the satisfaction of the Contract Administrator and the City, and at no expense to the City.
 - .1 Sectional Door: minimum seven (7) year limited warranty against rust due to paint cracking, checking or peeling and against structural failure (rendering the door inoperable) of the door sections due to delaminating of polyurethane foam insulation from the steel skin of the door panel.
 - .2 Glazing: Five (5) years against window frame and glass cracking or major discolouration.
 - .3 Jackshaft Operator: Two (2) years against defects in material and workmanship.

Part 2 Products

2.1 MANUFACTURERS

- .1 Basis of Design Products.
 - .1 Insulated Sectional Steel Overhead Door (OSD).
 - .1 Overhead Door 592 Series Heavy-Duty Thermacore Insulated Sectional Steel Door complete-with Side-Mounted (Jackshaft) RSX Electric Operator.
 - .2 Richards-Wilcox T175 Thermatite Sectional Overhead Door complete-with Manaras Opera-SH Side-Mounted Jackshaft Electric Operator.
 - .3 Steel-Craft Therm-O-Dor TD134 Overhead Door complete-with Manaras Opera-GH Jackshaft Operator.
- .2 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes* of the *Bidding Procedures*.

- .3 Supply all similar products from a single manufacturer.

2.2 INSULATED SECTIONAL STEEL OVERHEAD DOORS

- .1 Sectional Door Assembly: minimum 28-gauge, thick roll formed of hot dipped galvanized stucco embossed steel skins to ASTM A1008/A1008M CS Z001 G40 zinc coating. Sections manufactured by a continuous foamed-in-place polyurethane lamination process resulting in a steel-polyurethane-steel sandwich type construction. Sections incorporate a mechanical interlock feature providing a positive mechanical lock on the exterior and interior skins, which also acts as a thermal break. Skins of sections ribbed for added strength and utilize ship-lap joints with continuous applied joint seal for weather-tight fit.
 - .1 Door Sizes: refer to Door Schedule.
 - .2 Panel Thickness: minimum 44 mm (1-3/4").
 - .3 Door Operation: electric jackshaft operator, HP to suit door size and weight.
 - .4 Thermal Values: minimum R16 value.
 - .5 End Caps: 16-gauge, hot-dipped galvanized steel.
 - .6 Glazing: three (3) 305 mm high x 610 mm long double pane insulating glass units with inner and outer panes of 6 mm clear tempered glass in high-impact polymer frames.
 - .7 Lock: Interior mounted spring-loaded side bolt lock.
 - .8 Track: 16-gauge, galvanized steel standard lift track.
 - .9 Weatherstripping: bottom of door to have U-shape all weather vinyl Durometer 65 seal designed to conform and seal at the floor surface. Steel vinyl side weather-strip installed on vertical jambs for an effective seal against the door. Top of door to have flexible type all weather vinyl Durometer 65 seal designed to conform and seat at the horizontal lintel. Between sections to have a continuous O-shape all weather vinyl Durometer 65 seal at joint.
- .2 Electric Door Operator: commercial electric jackshaft side-mounted operator to move door in either direction at not less than 200 mm and not more than 300 mm per second, HP to suit door size and weight.
 - .1 Electrical motors, controller units, relays and other electrical components to CSA and ULC approval.
 - .2 Rotary type limit switches for open and close position.
 - .3 Heavy-duty solenoid-actuated drum breaks.
 - .4 Adjustable slipping clutch.
 - .5 Controller units with integral motor reversing starter with time delay on reverse 1.5 seconds, 3 heater elements for overload protection, "OPEN-STOP-CLOSE" pushbutton station per door and control relays as applicable.
 - .6 Safety Devices.
 - .1 Non-contact photo-electric safety sensor system designed to sense an obstruction in the doorway and signal door operator to reverse to open.
 - .2 Electro pneumatic safety edge with reel cord.
 - .7 Manual Operation.
 - .1 Provide floor level disconnect device to allow for manual operation in event of power failure.
 - .2 Equip operator with the following:
 - .1 Built-in chain hoist for manual operation in event of power failure with electrical interlock switch to disconnect power to operator when in manual operation.

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

2.3 ACCESSORIES

- .1 Track: 76 mm heavy duty galvanized standard lift track as indicated.
- .2 Track Supports: 3 mm core thickness continuous galvanized steel angle track supports.
- .3 Torsion Spring Counter Balance: heavy duty Class II oil tempered steel torsion spring to ASTM A229/A229M with manufacturers standard brackets helically wound, rated for 10,000 cycles.
- .4 Pusher Springs: to initiate the closing from a fully open position.
- .5 Cable Drums and Spring Fittings: diecast high-strength aluminum.
- .6 Steel Shaft: solid or tubular steel engineered to suit door size and operation.
- .7 Rollers: 76 mm rollers to have 10 floating grease packed ball bearings in case hardened steel races.
- .8 Roller Brackets: adjustable, minimum 3 mm galvanized steel.
- .9 Hinges: 14-gauge, heavy duty galvanized steel.
- .10 Lift Cable: galvanized steel aircraft cable as recommended by manufacturer with a minimum safety factor of 7 to 1.
- .11 Track Guards: 6 mm thick x 1200 mm high formed galvanized steel.

2.4 FINISHES

- .1 Exposed Steel Door Faces, Rails and Stiles: two-coat baked-on polyester paint, colour: White exterior and interior skin.
- .2 Other Steel Components: galvanized in accordance with ASTM A653/A653M.
- .3 Touch-up Primer for Galvanized Steel Surfaces: in accordance with ASTM A780/A780M.

Part 3 Execution

3.1 INSTALLATION

- .1 Install doors and hardware in accordance with reviewed shop drawings and manufacturer's printed instructions. Rigidly support rail and operator and secure to supporting structure.
- .2 Install electric operator including electrical motors, controller units, pushbutton stations, relays and other electrical equipment required for door operation.

3.2 ADJUSTING AND CLEANING

- .1 Test sectional doors for proper operation. Lubricate and adjust door operating components to ensure smooth opening and closing of doors without binding or distortion.
- .2 Adjust weatherstripping to form a weathertight seal.
- .3 Touch-up damaged coatings and finishes and repair minor damage.

- .4 Clean exposed surfaces using non-abrasive materials and methods recommended by manufacturer.

3.3 DEMONSTRATION

- .1 Demonstrate proper operation and maintenance procedures to Division's representative in accordance with Section 01 79 00.

3.4 SCHEDULES

- .1 Refer to Section 08 06 10.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 04 00 00 – Masonry.
- .2 Section 05 41 00 – Structural Metal Stud Framing.
- .3 Section 06 10 00 – Rough Carpentry.
- .4 Section 07 26 00 – Air/Vapour Barrier Membrane - Self-Adhesive.
- .5 Section 07 27 00 – Vapour Permeable Air Barrier Membrane - Self-Adhesive.
- .6 Section 07 92 00 – Joint Sealants.
- .7 Section 08 80 00 – Glazing.
- .8 Section 09 29 00 – Gypsum Board.

1.2 REFERENCES

- .1 American Society for Testing and Materials (ASTM).
 - .1 ASTM E330/E330M-14, Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.
 - .2 ASTM E331-00(2016), Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference.
 - .3 ASTM E783-02(2018), Standard Test Method for Field Measurement of Air Leakage Through Installed Exterior Windows and Doors.
 - .4 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.
 - .5 ASTM E1186-17, Standard Practices for Air Leakage Site Detection in Building Envelopes and Air Barrier Systems.
 - .6 ASTM F588-17, Standard Test Methods for Measuring the Forced Entry Resistance of Window Assemblies, Excluding Glazing Impact.
 - .7 ASTM F2090-17, Standard Specification for Window Fall Prevention Devices With Emergency Escape (Egress) Release Mechanisms.
- .2 Canadian Standards Association (CSA).
 - .1 AAMA/WDMA/CSA 101/I.S.2/A440-17, NAFS - North American Fenestration Standard /Specification for Windows, Doors, and Skylights.
 - .2 CSA A440S1-17, Canadian Supplement to AAMA/WDMA/CSA 101/I.S.2/A440-11, NAFS - North American Fenestration Standard/Specification for Windows, Doors, and Skylights.
 - .3 CAN/CSA-A440.2-19/A440.3-19, Fenestration Energy Performance / User Guide to CSA A440.2-14, Fenestration Energy Performance.
 - .4 CAN/CSA-A440.4-19, Window, Door, and Skylight Installation.
- .3 American Architectural Manufacturer's Association (AAMA).
 - .1 AAMA 502-12, Voluntary Specification for Field Testing of Newly Installed Fenestration Products.
 - .2 AAMA 623-20, Voluntary Specification, Performance Requirements and Test Procedures for Organic Coatings on Fiber Reinforced Thermoset Profiles.

- .4 Insulating Glass Manufacturers Alliance (IGMA).
 - .1 TB-1200-83(16), Guidelines for Insulating Glass Dimensional Tolerances.
 - .2 TM-3000-90(16), North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use.
 - .3 TM-4000-02(07), Insulating Glass Manufacturing Quality Procedures.
- .5 National Building Code of Canada, 2020 (NBCC), complete with current Manitoba Building Code amendments (MBC).

1.3 SYSTEM DESCRIPTION

- .1 Design Requirements.
 - .1 Design and size window units and glazing to withstand wind loads, dead loads, and positive and negative live loads caused by pressure and suction of wind acting normal to plane of window glazing system in accordance with AAMA/WDMA/CSA 101/I.S.2/A440 NAFS, ASTM E330/E330M, IGMA TB-1200, IGMA TM-3000, IGMA TM-4000, and the National Building Code of Canada, Appendix C, Climatic and Seismic Information for Building Design in Canada, but not less than specified thickness and dimension.
- .2 Performance Requirements.
 - .1 Windows to meet or exceed AAMA/WDMA/CSA 101/I.S.2/A440 NAFS and Canadian Supplement classifications as follows:
 - .1 Minimum Performance Grade (PG).
 - .1 CW35.
 - .2 Minimum Positive and Negative Design Pressure (DP).
 - .1 1680 Pa.
 - .3 Water Penetration Resistance Test Pressure.
 - .1 330 Pa.
 - .4 Canadian Air Infiltration and Exfiltration Level.
 - .1 Fixed: Fixed
 - .2 Windows to meet Grade 20 in accordance with ASTM F588 for Forced Entry.

1.4 SUBMITTALS

- .1 Shop Drawings.
 - .1 Submit shop drawings in accordance with Section 01 33 00.
 - .2 Each drawing submission to bear the signature and stamp of a qualified professional Engineer registered in the jurisdiction of the Place of the Work.
 - .3 Indicate materials and details (including details of window installation in the wall assembly) in scale full size for head, jamb and sill, profiles of components, interior and exterior trim, elevations of units, anchorage details, fasteners, and caulking. Indicate location of manufacturer's nameplates.
 - .4 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.
 - .5 Fiberglass window system to be engineered to meet the requirements of the National Building Code of Canada, Appendix C, Climatic and Seismic Information for Building Design in Canada.

- .2 Test and Evaluation Reports.
 - .1 Submit manufacturer's test and evaluation reports in accordance with Section 01 33 00.
 - .2 Submit reports from approved independent testing laboratory, certifying windows comply to performance requirements of AAMA/WDMA/CSA 101/I.S.2/A440, NAFS and Canadian Supplement meeting or exceeding classifications noted in Performance Requirements listed in 1.3.2 above.
- .3 Samples.
 - .1 Submit samples in accordance with Section 01 33 00.
 - .2 Submit 305 mm x 305 mm corner sample of Insulating Glass Unit (IGU) specified clearly identifying manufacturer and product name for glass with low-e coatings, and high performance spacer.
- .4 Closeout Submittals.
 - .1 Provide operation and maintenance data for incorporation into Operation and Maintenance Manual specified in Section 01 78 00.

1.5 QUALITY ASSURANCE

- .1 Qualifications.
 - .1 Fabrication company must employ skilled tradesmen with minimum five (5) years' experience with fabrication and installation of fiberglass windows on projects of equal or greater size and degree of complexity.
- .2 Mock-ups.
 - .1 Mock-up fiberglass window installation on site as part of initial installation. Mock-up will be reviewed for rough opening condition, preparation, quality of window fabrication and installation including tie-in between window frame and vapour barrier film, sealant and flashing installation, and coordination with work of other Sections.
 - .2 Once approved, mock-up will set a standard of acceptance for remaining installations.
 - .3 Do not proceed with fiberglass window installation until mock-up is complete and reviewed by the Contract Administrator and BECxA.
- .3 Pre-installation Meeting.
 - .1 Convene pre-installation meeting prior to commencement of fiberglass window installation. Purpose of meeting is to discuss quality of workmanship expected, and to ensure that all Contractors are fully aware of mock-up required and testing procedures that will be undertaken on the work. Required attendance of parties directly affecting work of this Section include Contractor, Window Subcontractor, and Contract Administrator.

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 Section 01 74 00.

- .5 Waste Management and Disposal in accordance with Section 01 74 19.

1.7 SITE CONDITIONS

- .1 Ensure materials used are stored and installed to manufacturer specified temperature conditions.

1.8 WARRANTY

- .1 **Manufacturer's Product Warranty:** provide an extended warranty for Work of this Section from date of Total Performance of the Work to term of warranty. Manufacturer hereby warrants fiberglass windows 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 Contract Administrator and the City, and at no expense to the City.
 - .1 **Fiberglass Components:** minimum 20 years against defects in material and workmanship. The fiberglass is warranted not to corrode, peel, rot, rust, warp, bow, shrink, twist or blister.
 - .2 **Insulated Glass Units:** minimum 10 years against failure of the air seal due to defects in material or workmanship, or a significant obstruction of vision as a result of film formulation caused by dust or moisture in the leaked air space caused by the failure of hermetic seal.
 - .3 **Factory Paint Finish:** minimum five (5) years against not maintaining original colour characteristics.
 - .4 **Hardware and Weather Seals:** minimum 10 years against defects or malfunction.
- .2 **Installation Contractor's Warranty:** provide an extended warranty for Work of this Section for a period of two (2) years from date of Total 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 Contract Administrator and the City, and at no expense to the City.

Part 2 Products

2.1 MANUFACTURERS

- .1 **Basis of Design Products.**
 - .1 **Fiberglass Windows.**
 - .1 **Berdick 3500 Series Fiberglass Windows** (picture, awning, casement), factory paint finish as specified below, 83 mm (3-1/4") slim profile frame depth complete-with extruded aluminum panning/brick moulds, 2 window colours: Custom Off-White and Slate Grey (refer to drawings for locations),
 - .2 **Duxton FiberWall Series 328 Fiberglass Windows** (fixed, awning, casement), factory paint finish 83 mm (3-1/4") low profile frame depth complete-with extruded aluminum panning/brick moulds, 2 window colours: White and Charcoal (refer to drawings for locations).
 - .2 **Membrane Flashing.**
 - .1 **Bakor Blueskin SA Flashing** complete-with Aquatac or Hi-Tac Primer.
 - .3 **Membrane Flashing Sealant.**
 - .1 **Henry 925 BES Sealant.**

- .2 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes of the Bidding Procedures* and as follows:
 - .1 Submit test and evaluation reports from approved independent testing laboratory, certifying windows comply to performance requirements listed in item 1.3.
- .3 Supply products from single manufacturer.

2.2 COMPONENTS

- .1 Frame and Sash Profile: to AAMA/WDMA/CSA 101/I.S.2/A440, made from pultruded fiberglass consisting of 65 to 85% glass fibres and 15 to 35% resin, and having a wall thickness of 2.28 mm (0.090”), main frame depth of 83 mm (3-1/4”) insulated with expanded polystyrene (EPS Type 1) insulation, factory paint finish as specified.
- .2 Glazing Stop: insulating glass units held in place by a removable interior fiberglass glass stop complete-with double sided foam tape on the exterior and thermoplastic rubber on the interior to assist in securing the glass. The glazing cavity face drained to the exterior through injection moulded drain caps. The glazing cavity also face vented to the exterior through two 1.5 mm (1/16”) vent holes.
- .3 Factory Paint Finish: all fiberglass sections coated with a high performance two-component polyurethane enamel finish in accordance with AAMA 623. Total dry-film thickness on exposed surfaces minimum 20 microns (.8 mil) total film thickness.
- .4 Insect Screen: roll-formed aluminum frame with friction fit corner keys. Secure screen mesh fiberglass to screen frame with spline. Mount screens on interior in manner that permits removal.
- .5 Prefinished Extruded Aluminum Panning/Brickmould: made from extruded 1 mm (0.040”) thick aluminum, factory paint finish to match window framing.
- .6 Interior Jamb Extensions (at CMU where indicated): made from 2.28 mm (0.090”) thick pultruded fiberglass to match window framing, factory paint finish to match window framing.
- .7 Membrane Flashing: 1 mm thick self-adhering membrane consisting of an SBS rubberized asphalt compound laminated on a blue polyethylene film.
 - .1 Water Vapour Permeance: 0.08 Perms to ASTM E96/E95M.
 - .2 Air Permeance: <0.0002 cfm/ft2 (0.0011 L/s.m.2) to ASTM E2178.
 - .3 Primer: as specified.
- .8 Membrane Flashing Sealant: premium, one-part, low VOC, moisture cure, building envelope sealant for construction joints subject to dynamic joint movement.
- .9 Air/Vapour Barrier Membrane - Self-Adhesive: in accordance with Section 07 26 00.
- .10 Vapour Permeable Air Barrier Membrane - Self-Adhesive: in accordance with Section 07 27 00.
- .11 Joint Sealants: in accordance with Section 07 92 00.
- .12 Insulating Glass Units (IGU): in accordance with Section 08 80 00.

2.3 FABRICATION

- .1 General.
 - .1 Fabricate fiberglass window components with minimum clearances and shim spacing around perimeter of assembly. Tolerances to CSA A440. Account for dynamic movement of perimeter seal and installation requirements.
 - .2 Fabricate units square, plumb and free from distortion, waves, twists, buckles or other defects detrimental to performance or appearance.
 - .3 Accurately machine, assemble, and seal all joints to provide neat, flush, hairline, and weathertight joints.
 - .4 Brace frames to maintain squareness and rigidity during shipment and installation.
 - .5 Prepare components to receive anchor devices and accessories. Arrange fasteners and attachments to conceal from view.
 - .6 Incorporate continuous silicone “heal bead” (all 4 sides) to seal edge of glass unit to fiberglass frame.
 - .7 Seal cam locks and roto gears from water penetration.
 - .8 Fabricate system components with minimum clearances and shim spacing around perimeter of assembly, yet enabling installation and dynamic movement of perimeter seal.
 - .9 Make allowance for anticipated deflection of structure to ensure that structural loads are not transmitted to window framing.
 - .10 Units to be assembled with specified insulating glass, hardware, insect screens, and prefinished aluminum panning/brickmoulds.
 - .11 Visible manufacturer's identification labels not permitted.
- .2 Fabrication Tolerances.
 - .1 Coordinate fabrication tolerance of insulating glass units (IGU) to be installed in fiberglass window framing, with glazing manufacturer to ensure proper fit and adequate seal between IGU and window framing.

Part 3 Execution

3.1 EXAMINATION

- .1 Prior to installation, verify that openings are plumb, square and of proper dimensions. Report any framing deficiencies or other unsuitable conditions in writing to Contract Administrator.
- .2 Upon commencement of installation implies acceptance of existing conditions.

3.2 INSTALLATION

- .1 The installation of the fiberglass windows must be by the fiberglass window Subcontractor's own forces, or by a highly skilled independent installation Contractor employed by the fiberglass window Subcontractor. The fiberglass window Subcontractor shall assume overall responsibility for the installation of the windows in accordance with, reviewed shop drawings, manufacturer's printed instructions, and CAN/CSA A440.4.
- .2 Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities. Set all components level, square, plumb, at proper elevations and in alignment with other work.

- .3 Make allowance for deflection of structure to ensure that structural loads are not transmitted to fiberglass windows.
- .4 Membrane Flashing/Sealant.
 - .1 Install membrane flashing c/w primer at window openings as detailed and in accordance with manufacturer's printed instructions.
 - .2 Refer to manufacturer's printed literature for preparation requirements of substrates to receive membrane flashing. Surfaces must be structurally sound and free of voids, loose aggregate, and sharp protrusions. Clean surfaces with a broom, vacuum, or compressed air to remove dust and debris.
 - .3 Install the membrane flashing 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 Install membrane flashing sealant along seams and as required to ensure continuous seal at all construction elements.
- .5 Prefinished Metal Flashings/Trims.
 - .1 Install prefinished metal drip flashings, and trims plumb, level, and true and in proper alignment and anchored securely in place as detailed and in accordance with reviewed shop drawings.
 - .2 Apply isolation coating to surfaces in contact with dissimilar materials.
- .6 Erect and secure window units in prepared openings, plumb and square and free from warp, twist, bow or superimposed loads.
- .7 Secure work adequately and accurately to structure in required position, in manner not restricting thermal and wind movement of windows.
- .8 All anchors and fasteners must be concealed. Exposed heads of fasteners not permitted.
- .9 Ensure continuity of air/vapour barrier with adjacent wall construction.
- .10 Install low volume expansion closed-cell polyurethane foam insulation in shim space around perimeter of fiberglass window framing to maintain continuity of thermal barrier. Provide sealant joints supported by closed cell backer rods as shown on drawings to provide air and water barrier continuity.

3.3 FIELD QUALITY CONTROL

- .1 Co-ordinate with section 08 08 00 for visual review and testing requirements
- .2 Commissioning (including site inspection and testing) of fiberglass window installation will be carried out by a Building Envelope Commissioning Authority (BECxA) retained and paid for by the City.
- .3 Assist BECxA with the performance of their duties by providing access to aerial lifts, scaffolding, etc.
- .4 Testing procedures of Fibreglass Window Mock-ups.
 - .1 Mock-up to consist of detailed review of initial window installation, including but not limited to rough opening preparation, window installation, and detailing.

- .2 Quantitative air leakage testing of the window mock-up will be performed in general accordance with AAMA 502 and ASTM E783. Air leakage rate of tested window must fall within the performance requirements identified in item 1.3.
- .3 Qualitative air leakage (smoke) testing of the window mock-up will be performed in general accordance with ASTM E1186. In the event of FAIL, Contractor shall engage BECxA to confirm point of failure, window and/or rough opening.
- .4 Following quantitative air leakage and qualitative air leakage (smoke) testing, wind-driven rain testing on the window mock-up will be performed in accordance with ASTM E1105. Failure will be defined by any visible water penetration when tested to water penetration resistance test pressure identified in item 1.3.
- .5 Window manufacturer and/or window installation Contractor will be responsible for all re-testing costs associated with return visits by BECxA as a result of window mock-up that has failed inspection or testing procedures.
- .5 Once tested and approved by BECxA, mock-up will set a standard of acceptance for all other installations. Following this, review and testing will be performed at random windows installations.
- .6 Random field testing of fiberglass window installations to include:
 - .1 A minimum of 8 additional random windows will be tested in general accordance with AAMA 502 for water resistance (ASTM E1105) and either quantitative air leakage (ASTM E783) or qualitative air leakage (E1186) as determined by BECxA.
 - .2 Window manufacturer and/or window installation Contractor will be responsible for all re-testing costs associated with return visits by BECxA as a result of random field testing that has failed inspection or testing procedures.
 - .3 In the event of a failure, the window manufacturer and/or window installation Contractor is not only responsible for the cost of re-testing the failed window, but also the cost of testing an additional window at the discretion of the BECxA.

3.4 ADJUSTING

- .1 Adjust operating sash to work freely and with all hardware functioning properly.

3.5 CLEANING

- .1 Clean exposed surfaces using manufacturer recommended materials and methods. Remove labels and visible markings.

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 33 33 – Overhead Coiling Doors.

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 A156.4-2019, Door Controls - Closers.
 - .5 ANSI/BHMA A156.5-2020, Cylinders and Input Devices for Locks.
 - .6 ANSI/BHMA A156.6-2015, Architectural Door Trim.
 - .7 ANSI/BHMA A156.7-2016, 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, Series 1000.
 - .10 ANSI/BHMA A156.16-2018, Auxilary Hardware.
 - .11 ANSI/BHMA A156.18-2016, Materials and Finishes.
 - .12 ANSI/BHMA A156.21-2019, Thresholds.
 - .13 ANSI/BHMA A156.22-2017, Door Gasketing and Edge Seal Systems.
 - .14 ANSI/BHMA A156.28-2018, Recommended Practices for Mechanical Keying Systems.
 - .15 ANSI/BHMA A156.115-2016, Hardware Preparation in Steel Doors and Frames.
- .2 Canadian Steel Door and Frame Manufacturers' Association (CSDFMA).
 - .1 CSDFMA Canadian Metric Guide for Steel Doors and Frames (Modular Construction) standard hardware location dimensions.

1.3 SUBMITTALS

- .1 Shop Drawings.
 - .1 Submit hardware and keying 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 or pair of doors.
- .2 Samples.
 - .1 If requested by the Contract Administrator, submit samples of hardware specified 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 each type of door hardware for incorporation into Operation and Maintenance Manual specified in Section 01 78 00.
 - .2 Supply two (2) sets of wrenches for hardware adjustment.

1.4 QUALITY ASSURANCE

- .1 Qualifications.
 - .1 Install products specified in this Section by manufacturers' certified installers.
 - .2 Submit proof of installer's certification with Shop Drawings.
- .2 Regulatory Requirements.
 - .1 Hardware for doors in fire separations and exit doors certified by Canadian Certification Organization accredited by Standards Council of Canada.

1.5 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 as per manufacturer's recommendations. Remove only in quantities required for same day use.
- .4 Cleaning and Waste Management in accordance with Section 01 74 00.
- .5 Waste Management and Disposal in accordance with Section 01 74 19.

Part 2 Products

2.1 MANUFACTURERS

- .1 Basis of Design Products.
 - .1 Door hardware sets specified in Schedule following this Section.
- .2 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes of the Bidding Procedures*.
- .3 Supply similar products from single manufacturer.

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 Contractor to provide cores. Keying to be performed by Noble Locksmith.
- .2 Keying to be under new Grand Master Key System as supplied by Schlage to be compatible with Primus Keyway (through Noble Locksmith). Prepare detailed keying schedule in conjunction with the Division's requirements and submit with shop drawings for Division review.
- .3 Supply three (3) keys per individual key group or lock. Supply five (5) of each Master Key required. Supply three (3) Grand Master Keys. All keys to be stamped "Do Not Duplicate".

- .4 Hardware supplier to furnish required number of temporary construction cores and keys to General Contractor for security purposes during construction. General Contractors shall maintain strict control over construction cores and keys.
- .5 All keys, permanent cylinder cores, and key records are to be sent directly to the Division for the Division's installation.
- .6 Stamp all keys and sides of cylinders with visual key code.
- .7 Replace all construction keyed locks with the Division present and turn over keys to the Division.

Part 3 Execution

3.1 INSTALLATION

- .1 Installation of door hardware is responsibility of door hardware supplier.
- .2 Supply related Sections 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 4 hinges.
- .7 Locked outswing doors to have NRP hinges.
- .8 Except for levers, install locks and latchsets with 127 mm backset unless otherwise indicated.
- .9 When used in hollow metal doors, 127 mm backset must include reinforcing sleeve.
- .10 When applied to mineral core doors, install door closers with through bolts.
- .11 Provide adapter plates to door closers where door or frame conditions require.
- .12 Install kickplates on one side of door unless otherwise specified. Install steel kickplates with oval head countersunk screws.
- .13 Drill protection plates for other hardware as required.

3.2 FIELD QUALITY CONTROL

- .1 Hardware may be inspected by hardware Contract Administrator 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 DEMONSTRATION

- .1 Brief maintenance personnel regarding proper operation and care of hardware in accordance with Section 01 79 00. Demonstrate the following:
 - .1 Proper care, lubrication, adjustment, cleaning, and general maintenance of hardware.
 - .2 Use, application and storage of wrenches for door closers, locksets and fire exit hardware.

3.5 CLEANING

- .1 Clean hardware after installation with damp rag and approved non-abrasive cleaner, and polish hardware in accordance with manufacturer's instructions.

3.6 HARDWARE SCHEDULE

- .1 Refer to Hardware Groups following this Section.

END OF SECTION

Hardware Group No. 01 (not used).
Hardware Group No. 02 (not used).
Hardware Group No. 03 (not used).
Hardware Group No. 04 (not used).
Hardware Group No. 05 (not used).
Hardware Group No. 06 (not used).
Hardware Group No. 07 (not used).
Hardware Group No. 08 (not used).
Hardware Group No. 09 (not used).
Hardware Group No. 10 (not used).
Hardware Group No. 11 (not used).
Hardware Group No. 12 (not used).
Hardware Group No. 13 (not used).
Hardware Group No. 14 (not used).
Hardware Group No. 15 (not used)

Hardware Group No. 16

For use on Door #(s):

1:106B

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 114X114MM	652	IVE
1	EA	STOREROOM LOCK	ND80PD RHO "0" BITTED	626	SCH
1	EA	SURFACE CLOSER	4040XP DEL	689	LCN
1	EA	KICK PLATE	8400 255MM X 40MM LDW B-CS	630	IVE
1	EA	WALL STOP	WS401/402CVX	626	IVE
1	EA	HEAD SEAL	429AA X DOOR WIDTH	628	ZER
2	EA	JAMB SEAL	429AA X DOOR HEIGHT	628	ZER

FREE EGRESS AT ALL TIMES, EXTERIOR LEVER LOCKED AT ALL TIMES,
KEY RETRACTS LATCH, INSIDE LEVER RETRACTS LATCH.
SELF-CLOSING C/W SMOKE SEAL

Hardware Group No. 17 (not used).

Hardware Group No. 18 (not used).

Hardware Group No. 19

For use on Door #(s):

1:104

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 114X114MM NRP	652	IVE
1	EA	STOREROOM LOCK	ND80PD RHO "0" BITTED	626	SCH
1	EA	SURFACE CLOSER	4040XP CUSH	689	LCN
1	EA	KICK PLATE	8400 255MM X 40MM LDW B-CS	630	IVE
1	EA	HEAD SEAL	429AA X DOOR WIDTH	628	ZER
2	EA	JAMB SEAL	429AA X DOOR HEIGHT	628	ZER
1	EA	DOOR BOTTOM	355AA	AA	ZER

FREE EGRESS AT ALL TIMES, EXTERIOR LEVER LOCKED AT ALL TIMES,
KEY RETRACTS LATCH, INSIDE LEVER RETRACTS LATCH.
SELF-CLOSING C/W SMOKE SEAL.

Hardware Group No. 20 (not used).

Hardware Group No. 21 (not used).

Hardware Group No. 22 (not used).

Hardware Group No. 23 (not used).

Hardware Group No. 24

1:107

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 114X114MM	652	IVE
1	EA	CLASSROOM SECURITY	ND75PD RHO XN12-035 "0" BITTED	626	SCH
1	EA	KICK PLATE	8400 255MM X 40MM LDW B-CS	630	IVE
1	EA	WALL STOP	WS401/402CVX	626	IVE
1	EA	HEAD SEAL	429AA X DOOR WIDTH	628	ZER
2	EA	JAMB SEAL	429AA X DOOR HEIGHT	628	ZER
1	EA	DOOR BOTTOM	350AA	AA	ZER

FREE EGRESS AT ALL TIMES, EXTERIOR LEVER LOCKED / UNLOCKED BY KEY EITHER SIDE,
LATCH RETRACTED BY ROTATING LEVER.

Hardware Group No. 25 (not used).

Hardware Group No. 26 (not used).

Hardware Group No. 27 (not used).

Hardware Group No. 28

For use on Door #(s):

1:103B 1:106E

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 114X114MM	652	IVE
1	EA	OFFICE LOCK	ND50PD RHO "0" BITTED	626	SCH
1	EA	KICK PLATE	8400 255MM X 40MM LDW B-CS	630	IVE
1	EA	WALL STOP	WS401/402CCV	626	IVE
1	EA	HEAD SEAL	429AA X DOOR WIDTH	628	ZER
2	EA	JAMB SEAL	429AA X DOOR HEIGHT	628	ZER
1	EA	DOOR BOTTOM	355AA	AA	ZER

FREE EGRESS AT ALL TIMES, EXTERIOR LEVER LOCKED BY PUSH BUTTON ON INSIDE LEVER,
KEY IN OUTSIDE LEVER UNLOCKS.
LATCH RETRACTED BY ROTATING LEVER.

Hardware Group No. 29 (not used).

Hardware Group No. 30 (not used).

Hardware Group No. 31 (not used).

Hardware Group No. 32

For use on Door #(s):

1:106Q

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 114X114MM	652	IVE
1	EA	CLASSROOM LOCK	ND70PD RHO "0" BITTED	626	SCH
1	EA	SURFACE CLOSER	4040XP REG	689	LCN
1	EA	KICK PLATE	8400 255MM X 40MM LDW B-CS	630	IVE
1	EA	OH STOP	100S	630	GLY
3	EA	SILENCER	SR64	GRY	IVE

FREE EGRESS AT ALL TIMES, EXTERIOR LEVER LOCKED / UNLOCKED BY KEY IN OUTSIDE
LEVER.
LATCH RETRACTED BY ROTATING LEVER.

Hardware Group No. 34 (not used).

Hardware Group No. 35 (not used).

Hardware Group No. 36 (not used).

Hardware Group No. 37

For use on Door #(s):

1:106K 1:106P 1:100A

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 114X114MM	652	IVE
1	EA	CLASSROOM LOCK	ND70PD RHO "0" BITTED	626	SCH
1	EA	OH STOP	100S	630	GLY
1	EA	KICK PLATE	8400 255MM X 40MM LDW B-CS	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

Hardware Group No. 38 (not used).

Hardware Group No. 39 (not used).

Hardware Group No. 40 (not used).

Hardware Group No. 41 (not used).

Hardware Group No. 42 (not used).

Hardware Group No. 43 (not used).

Hardware Group No. 44 (not used).

Hardware Group No. 45 (not used).

Hardware Group No. 46 (not used).

Hardware Group No. 47 (not used).

Hardware Group No. 48 (not used).

Hardware Group No. 49 (not used).

Hardware Group No. 50

For use on Door #(s):

1:106C 1:106D

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 114X114MM	652	IVE
1	EA	CYL X TURN DEAD LOCK	L9460P 06A L583-363 L283-722 XL11-886 "0" BITTED	626	SCH
1	EA	SURFACE CLOSER	4040XP DEL	689	LCN
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

Hardware Group No. 51 (not used).
Hardware Group No. 52 (not used).
Hardware Group No. 53 (not used).
Hardware Group No. 54 (not used).
Hardware Group No. 55 (not used).

Hardware Group No. 56

For use on Door #(s):

1M:02

Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HINGE	5BB1 127X114MM NRP	626	IVE
2	EA	SURFACE BOLT	SB453 203MM TB	604	IVE
1	EA	PASSAGE SET	ND10S RHO	626	SCH
1	EA	CYL ONLY DEADBOLT	B664P "0" BITTED	626	SCH
2	EA	OH STOP	90S	630	GLY
2	EA	KICK PLATE	8400 255MM X 25MM LDW B-CS	630	IVE
1	EA	HEAD SEAL	429AA X DOOR WIDTH	628	ZER
2	EA	JAMB SEAL	429AA X DOOR HEIGHT	628	ZER
1	EA	DOOR SWEEP	39A X DR W	AL	ZER
1	EA	ASTRAGAL	43SP	SP	ZER
1	EA	THRESHOLD	623A-223	A	ZER
2	EA	DOOR CONTACT	679-05 TO SUIT DOOR MATERIAL	BLK	SCE

Hardware Group No. 57 (not used).
Hardware Group No. 58 (not used).
Hardware Group No. 59 (not used).
Hardware Group No. 60 (not used).
Hardware Group No. 61 (not used).
Hardware Group No. 62 (not used).
Hardware Group No. 63 (not used).
Hardware Group No. 64 (not used).
Hardware Group No. 65 (not used).
Hardware Group No. 66 (not used).
Hardware Group No. 67 (not used).
Hardware Group No. 68 (not used).

Hardware Group No. 69

For use on Door #(s):

1:102 1:103D

Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HINGE	5BB1HW 127X114MM	652	IVE
2	EA	MANUAL FLUSH BOLT	FB458	626	IVE
1	EA	DUST PROOF STRIKE	DP1	626	IVE
1	EA	CLASSROOM DEAD LOCK	L463T	626	SCH
1	EA	PRIMUS CORE	20-740 "0" BITTED	626	SCH
2	EA	PUSH PLATE	8200 150X405MM	630	IVE
2	EA	FLUSH PULL	955	626	IVE
2	EA	SURFACE CLOSER	4040XP SHCUSH TBWMS	689	LCN
2	EA	KICK PLATE	8400 915MM X 25MM LDW B-CS	630	IVE
1	EA	HEAD SEAL	429AA X DOOR WIDTH	628	ZER
2	EA	JAMB SEAL	429AA X DOOR HEIGHT	628	ZER
2	EA	DOOR SWEEP	39A X DR W	AL	ZER
1	EA	THRESHOLD	623A-223	A	ZER
2	EA	DOOR CONTACT	679-05 TO SUIT DOOR MATERIAL	BLK	SCE

Hardware Group No. 70

For use on Door #(s):

1:100.1 1:103.2 1:106.2

Provide each RU door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1			HARDWARE BY DOOR MANUFACTURER		

Hardware Group No. 71

For use on Door #(s):

1:100B 1:103C

Provide each SL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1			HARDWARE BY DOOR MANUFACTURER		

Hardware Group No. 72 (not used).

Hardware Group No. 73

For use on Door #(s):

1:100 1:106

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 114X114MM NRP	626	IVE
1	EA	CLASSROOM SECURITY	ND75PD RHO XN12-035 "0" BITTED	626	SCH
1	EA	SURFACE CLOSER	4040XP EDA	689	LCN
1	EA	KICK PLATE	8400 255MM X 40MM LDW B-CS	630	IVE
1	EA	WALL STOP	WS401/402CVX	626	IVE
1	EA	HEAD SEAL	429AA X DOOR WIDTH	628	ZER
2	EA	JAMB SEAL	429AA X DOOR HEIGHT	628	ZER
1	EA	DOOR BOTTOM	355AA	AA	ZER

Hardware Group No. 74

For use on Door #(s):

1:100.2 1:103.1

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 127X114MM NRP	626	IVE
1	EA	PANIC HARDWARE	LD-98-EO-299	626	VON
1	EA	MORTISE CYLINDER	20-001 114 XQ11-949 "0" BITTED	626	SCH
1	EA	DOOR PULL	VR810 DT	630	IVE
1	EA	SURFACE CLOSER	4040XP SCUSH	689	LCN
1	EA	KICK PLATE	8400 255MM X 40MM LDW B-CS	630	IVE
1	EA	HEAD SEAL	429AA X DOOR WIDTH	628	ZER
2	EA	JAMB SEAL	429AA X DOOR HEIGHT	628	ZER
1	EA	DOOR SWEEP	39A X DR W	AL	ZER
1	EA	THRESHOLD	623A-223	A	ZER
1	EA	DOOR CONTACT	679-05 TO SUIT DOOR MATERIAL	NLK	SCE

EXIT ONLY

Hardware Group No. 75

For use on Door #(s):

1:107A 1:107B

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 114X114MM	652	IVE
1	EA	PASSAGE SET	ND10S RHO	626	SCH
1	EA	OH STOP	100S	630	GLY
1	EA	KICK PLATE	8400 255MM X 40MM LDW B-CS	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

Hardware Group No. 76

For use on Door #(s):

1M:03

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 127X114MM	652	IVE
1	EA	PASSAGE SET	ND10S RHO	626	SCH
1	EA	KICK PLATE	8400 255MM X 40MM LDW B-CS	630	IVE
1	EA	OH STOP	90S	630	GLY
1	EA	HEAD SEAL	429AA X DOOR WIDTH	628	ZER
2	EA	JAMB SEAL	429AA X DOOR HEIGHT	628	ZER
1	EA	DOOR BOTTOM	355AA	AA	ZER

Hardware Group No. 77

For use on Door #(s):

1:101.1 1:101

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 127X114MM	652	IVE
1	EA	CLASSROOM LOCK	ND70PD RHO "0" BITTED	626	SCH
1	EA	SURFACE CLOSER	4040XP EDA	689	LCN
1	EA	KICK PLATE	8400 255MM X 40MM LDW B-CS	630	IVE
1	EA	WALL STOP	WS401/402CVX	626	IVE
1	EA	HEAD SEAL	429AA X DOOR WIDTH	628	ZER
2	EA	JAMB SEAL	429AA X DOOR HEIGHT	628	ZER
1	EA	DOOR BOTTOM	355AA	AA	ZER

Hardware Group No. 78

For use on Door #(s):

1:103

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 127X114MM	652	IVE
1	EA	CLASSROOM SECURITY	ND75PD RHO XN12-035 "0" BITTED	626	SCH
1	EA	SURFACE CLOSER	4040XP DEL EDA	689	LCN
1	EA	KICK PLATE	8400 255MM X 40MM LDW B-CS	630	IVE
1	EA	WALL STOP	WS401/402CVX	626	IVE
1	EA	HEAD SEAL	429AA X DOOR WIDTH	628	ZER
2	EA	JAMB SEAL	429AA X DOOR HEIGHT	628	ZER
1	EA	DOOR BOTTOM	355AA	AA	ZER

Hardware Group No. 79

For use on Door #(s):

1:106G

Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HINGE	5BB1HW 114X114MM	652	IVE
1	EA	SURFACE BOLT	SB453 203MM TB	604	IVE
1	EA	CLASSROOM DEAD LOCK	L463P "0" BITTED	626	SCH
2	EA	DOOR PULL, 1" ROUND	8103HD 255MM STD	630	IVE
2	EA	PUSH PLATE	8200 150X405MM	630	IVE
2	EA	SURFACE CLOSER	4040XP HEDA	689	LCN
2	EA	KICK PLATE	8400 915MM X 25MM LDW B-CS	630	IVE
1	EA	HEAD SEAL	429AA X DOOR WIDTH	628	ZER
2	EA	JAMB SEAL	429AA X DOOR HEIGHT	628	ZER
1	EA	MEETING STILE	328AA (2X DR H)	AA	ZER

Hardware Group No. 080

For use on Door #(s):

1:106.1

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HINGE	3CB1HW 127X114MM NRP	630	IVE
2	EA	ELECTRIC HINGE	5BB1HW 127X114MM CON TW4	652	IVE
1	EA	KEYED REMOVABLE MULLION	KR4954	689	VON
1	EA	ELEC PANIC HARDWARE	LX-RX-QEL-98-DT-4'-CON 24 VDC	626	VON
1	EA	ELEC PANIC HARDWARE	LX-RX-QEL-98-NL-4'-CON 24 VDC	626	VON
1	EA	RIM CYLINDER	1E72	626	BES
1	EA	MORTISE CYLINDER	1E74 - KEY SWITCH	626	BES
2	EA	OH STOP	100S	630	GLY
2	EA	SURFACE CLOSER	4040XP EDA	689	LCN
2	EA	KICK PLATE	8400 254MM X 40MM LDW B-CS	630	IVE
2	EA	JAMB GASKET	429AA X DOOR HEIGHT	628	ZER
2	EA	HEAD GASKETING	429AA X DOOR WIDTH Install prior to mounting soffit hardware	628	ZER
2	EA	DOOR SWEEP	39A X DOOR WIDTH	A	ZER
2	EA	MEETING STILE	8192AA X DR HT	AA	ZER
1	EA	THRESHOLD T/B	626A-223 X OPENING WIDTH	A	ZER
2	EA	WIRE HARNESS	CON-____(SIZE TO SUIT)		SCH
2	EA	WIRE HARNESS	CON-6W		SCH
1	EA	KEY SWITCH	653-1415 NS L2 ATS 12/24 VDC CONTROLS LATCH RETRACTION ON EXIT DEVICE	630	SCE
2	EA	DOOR CONTACT	679-05 TO SUIT DOOR MATERIAL	BLK	SCE
1	EA	POWER SUPPLY	PS904 900-4RL KL900 120/240 VAC	LGR	SCE

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 06 40 00 – Architectural Woodwork.
- .2 Section 08 06 00 – Door Schedule.
- .3 Section 08 11 00 – Metal Doors and Frames.
- .4 Section 08 14 00 – Wood Doors.
- .5 Section 08 54 13 – Fiberglass Windows.

1.2 REFERENCES

- .1 American Architectural Manufacturer's Association (AAMA).
 - .1 AAMA 501.1-17, Standard Test Method for Water Penetration of Windows, Curtain Walls and Doors Using Dynamic Pressure.
- .2 American National Standards Institute (ANSI).
 - .1 ANSI Z97.1-2015 (R2020), Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test.
- .3 American Society for Testing and Materials (ASTM).
 - .1 ASTM C542-05(2017), Standard Specification for Lock-Strip Gaskets.
 - .2 ASTM C1036-16, Standard Specification for Flat Glass.
 - .3 ASTM C1048-18, Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass.
 - .4 ASTM C1172-19, Standard Specification for Laminated Architectural Flat Glass.
 - .5 ASTM C1503-18, Standard Specification for Silvered Flat Glass Mirror.
 - .6 ASTM D2240-15e1, Standard Test Method for Rubber Property - Durometer Hardness.
 - .7 ASTM E119-20, Standard Test Methods for Fire Tests of Building Construction and Materials.
 - .8 ASTM E283/E283M-19, Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
 - .9 ASTM E330/E330M-14, Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.
 - .10 ASTM E331-00(2016), Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference.
 - .11 ASTM E547-00(2016), Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Cyclic Static Air Pressure Difference.
 - .12 ASTM E783-02(2018), Standard Test Method for Field Measurement of Air Leakage Through Installed Exterior Windows and Doors.
 - .13 ASTM E1186-17, Standard Practices for Air Leakage Site Detection in Building Envelopes and Air Barrier Systems.
 - .14 ASTM E2190-19, Standard Specification for Insulating Glass Unit Performance and Evaluation.
- .4 Canadian General Standards Board (CGSB).
 - .1 CAN/CGSB-12.1-2017, Safety Glazing.
 - .2 CAN/CGSB-12.3-M91 (R2017), Flat, Clear Float Glass.

- .3 CAN/CGSB 12.8-2017, Insulating Glass Units.
- .5 Canadian Standards Association (CSA).
 - .1 AAMA/WDMA/CSA 101/I.S.2/A440-17, NAFS - North American Fenestration Standard /Specification for Windows, Doors, and Skylights.
 - .2 CSA A440.2-19/A440.3-19, Fenestration Energy Performance/User Guide to CSA A440.2-19, Fenestration Energy Performance.
 - .3 CSA A440.4-19, Window, Door and Skylight Installation.
 - .4 CSA A460-19, Bird-Friendly Building Design.
- .6 Consumer Product Safety Commission (CPSC).
 - .1 CPSC 16 CFR 1201 - Safety Standard for Architectural Glazing Materials, 2012.
- .7 Insulating Glass Manufacturers Alliance (IGMA).
 - .1 TB-1200-83(16), Guidelines for Commercial Insulating Glass Dimensional Tolerances.
 - .2 TM-3000-90(16), North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use.
 - .3 TM-4000-02(07), Insulating Glass Manufacturing Quality Procedures.
- .8 National Building Code of Canada, 2020 (NBCC), complete with current Manitoba Building Code amendments (MBC).
- .9 Underwriters' Laboratories of Canada (ULC).
 - .1 CAN/ULC S101-14, Standard Methods of Fire Endurance Tests of Building Construction and Materials.
 - .2 CAN/ULC S104-15, Standard Method for Fire Tests of Door Assemblies.
 - .3 CAN/ULC S105-16, Standard Specification for Fire Door Frames Meeting the Performance Required by CAN/ULC S104.

1.3 SYSTEM DESCRIPTION

- .1 Design Requirements.
 - .1 Design and size insulating glazing units to withstand wind loads, dead loads, and positive and negative live loads caused by pressure and suction of wind acting normal to plane of window glazing system in accordance with ASTM E330/E330M, IGMA TB-1200, IGMA TM-3000, IGMA TM-4000, and the 2010 National Building Code of Canada, Appendix C, Climatic and Seismic Information for Building Design in Canada, but not less than thickness specified in this Section.

1.4 SUBMITTALS

- .1 Shop Drawings.
 - .1 Submit shop drawings in accordance with Section 01 33 00.
 - .2 Include manufacturer's printed product literature, specifications and data sheets.
 - .3 Provide elevation of typical curtain wall glazing unit indicating ceramic frit or acid etch bird friendly dot pattern/size and colour, and spacing relative to aluminum framing members.
 - .4 Indicate dimensional tolerances of insulating glass units (IGU) in accordance with IGMA TB-1200 to be installed in fiberglass windows and glazed aluminum curtain walls specified in Section 08 54 13.

- .2 Samples.
 - .1 Submit samples in accordance with Section 01 33 00.
 - .2 Submit 305 mm x 305 mm corner sample of each Insulating Glass Unit (IGU) specified clearly identifying manufacturer and product name for tinted tempered ceramic frit or acid etch bird friendly glass, laminated glass, low-e glass, and high performance spacer.
 - .3 Submit 305 mm x 305 mm sample of Fire-Rated/Impact Safety-Rated Glass (FRG) specified clearly identifying manufacturer and product name.
 - .4 Submit 305 mm x 305 mm sample of Factory Back-Painted Spandrel Glass (SP) specified clearly identifying manufacturer and product name.
- .3 Test Reports.
 - .1 Submit certified test reports showing compliance with specified performance characteristics and physical properties.
- .4 Certificates.
 - .1 Submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria, and physical requirements.
- .5 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.
- .5 Waste Management and Disposal in accordance with Section 01 74 19.

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 Manufacturer's Product Warranty: provide an extended warranty for Work of this Section from date of Total Performance of the Work to term of warranty specified below, and these or other observed defects and deficiencies to be repaired or replaced to the satisfaction of the Contract Administrator and the City, and at no expense to the City.
 - .1 Fire-Rated/Impact Safety-Rated Glass: Five (5) years against manufacturing defects resulting in material obstruction through the glass area and/or edge separation and changes in properties of the interlayer.

- .2 Insulating Glass Units (IGU): 10 years against failure of seal, cracking of coatings, and deposits on interior surfaces of glass detrimental to vision including dust, moisture or film.

Part 2 Products

2.1 MANUFACTURERS

- .1 Basis of Design Products.
 - .1 Tinted Glass.
 - .1 Vitro Solargray Tempered.
or
 - .2 Vitro Solarbronze Tempered.
 - .2 Low Emissivity Coatings.
 - .1 Cardinal LoE 272.
 - .2 Guardian SunGuard SN 68.
 - .3 Vitro Solarban 60.
 - .3 High Performance Spacer.
 - .1 Cardinal SS XL Edge Spacer.
 - .2 GED Interceptor Ultra Super Spacer.
 - .3 Quanex Premium Plus Super Spacer.
 - .4 Fire-Rated /Impact Safety-Rated Glass (FRG).
 - .1 Safti First SuperLite II-XL 45 Fire Resistive Glazing.
 - .2 TGP FireLite Plus Fire-Rated Laminated Impact Resistant Glazing.
- .2 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes* of the *Bidding Procedures*.
- .3 Supply all similar products from a single manufacturer.

2.2 MATERIALS

- .1 Clear Annealed Float Glass: to ASTM C1036 and CAN/CGSB-12.3, Type 1, Class 1 (clear), thickness as indicated.
- .2 Tinted Tempered Glass: to ASTM C1048, ANSI Z97.1, and CAN/CGSB 12.1, Type 1, Class 2 (tinted), thickness as indicated.
- .3 Clear Tempered Safety Glass (SG): to ASTM C1048, ANSI Z97.1, and CAN/CGSB-12.1, 6 mm, 10 mm, and 13 mm thick, Type 1, Class 1 (clear), clean-cut (with minimum serration, hackle, etc.), ground and polished edges where exposed.
- .4 Fire-Rated/Impact Safety-Rated Glass (FRG).
 - .1 19 mm thick fire-rated impact resistant glazing comprised of an inboard and outboard lite of clear tempered glass protecting a clear, fire resistive intumescent interlayer to ASTM E119, CAN/ULC S101, and CPSC 16 CFR 1201 Cat. I and II.
or
 - .2 8 mm thick premium grade ceramic fire-rated laminated impact resistant clear and wireless glazing material to CAN/ULC S104, ANSI Z97.1, and CPSC 16 CFR 1201 Cat. I and II.

- .5 Laminated Glass (LG): to ASTM C1172 and CAN/CGSB-12.1, Type 1 (laminated), 6 mm overall thickness consisting of 3 mm tempered glass each side of 0.060" thick clear polyvinyl butyral (PVB) interlayer.
- .6 Insulating Glass Units (IGU) Basis of Design (refer to paragraph 1.3): to ASTM E2190, CAN/CGSB-12.8, IGMA TB-1200, IGMA TM-3000, and IGMA TM-4000, consisting of two and three lites of glass as indicated separated by a high performance window spacer and air space which is hermetically sealed by an organic compound and kept continually dehydrated by a specially formulated desiccant material inside the spacer. Glass thickness to comply with National Building Code of Canada, Appendix C, Climatic and Seismic Information for Building Design in Canada.
 - .1 IGU1 - Triple Glazing (fiberglass windows typical): 36 mm triple pane insulating glass units – exterior pane 5 mm annealed with low-e (surface #2), mid pane 5 mm annealed, interior pane 5 mm annealed with low-e (surface #5), sealed with high performance spacer, argon filled (both cavities).
 - .2 IGU4 - Double Glazing (exterior HM doors/frames, exterior aluminum doors only): 25 mm double pane insulating glass unit – exterior pane 6 mm laminated, interior pane 6 mm laminated, sealed with high performance spacer, argon filled.
 - .3 IGU5 - Double Glazing (interior doors/frames requiring acoustic enhancement): 25 mm double pane insulating glass unit – corridor pane 6 mm tempered, room side pane 6 mm laminated, sealed with high performance spacer, argon filled.
- .7 Insulated Glass Units - Fire-Rated (IGU-FRG): 25 mm double pane, fire-rated, insulating glass unit – exterior pane 6 mm clear safety glass (SG), 8 mm clear fire-rated glass (FRG), complete-with 12 mm argon gas filled air space and stainless steel air spacer.

2.3 ACCESSORIES

- .1 Glazing Tape: Tremco VISIONstrip® precision-extruded glazing seal consisting of an EPDM rubber extrusion to ASTM D2240, positioned at the sightline with a 100% solids, highly adhesive, cross-linked performed butyl sealant bonded below the rubber extrusion. A single component profile achieving a positive-wet seal between the metal and glass surfaces while providing a clean gasket appearance at the sightline, designed for use in compression glazing systems.
- .2 Glazing Splines: extruded 70 durometer dense EPDM wedge profiles to ASTM D2240, designed for use in compression glazing systems.
- .3 Setting Blocks: neoprene, 80 - 90 Shore "A" durometer hardness to ASTM D2240, minimum 100 mm long 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 Primer-sealers and Cleaners: to glass manufacturer's standard.

2.4 FABRICATION

- .1 Fabricate insulating glass units (IGU) in accordance with IGMA TB-1200, IGMA TM-3000, and IGMA TM-4000.

- .2 Co-ordinate with Section 08 11 00 and 08 54 13, the dimensional tolerances of insulating glass units (IGU) to be installed in fiberglass windows and glazed aluminum curtain walls in accordance with IGMA TB-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 Remove and replace single pane glass, mirror, IGU that is broken, chipped, cracked or damaged in any way.

3.2 INSTALLATION

- .1 Install glazing in accordance with reviewed shop drawings and manufacturer's printed handling and installation instructions.
- .2 Exterior Wet/Dry Method (preformed tape and sealant).
 - .1 Perform work in accordance with IGMA and for glazing installation methods.
 - .2 Cut VISIONstrip glazing tape to length and set against permanent stops 6 mm below sight line in accordance with manufacturer's instructions. Seal corners by butting glazing tape and sealing junctions with sealant.
 - .3 Apply heal bead of sealant along intersection of permanent stop with frame ensuring full perimeter seal between glass and frame to complete continuity of air and vapour seal.
 - .4 Place setting blocks at 1/4 points, with edge block maximum 150 mm from corners.
 - .5 Rest glazing on setting blocks and push against VISIONstrip with sufficient pressure to attain full contact at perimeter of glass unit to render the glazing system weather-tight.
 - .6 Cut glazing spline to length and install on glazing in accordance with manufacturer's instructions. Seal corners by butting spline and sealing junctions with sealant.
 - .7 Apply continuous heal bead of sealant to seal edge of glass unit to frame to complete continuity of air and vapour seal.
 - .8 Install removable stops without displacing glazing spline. Exert pressure for full continuous contact.
- .3 Exterior Dry Method (preformed glazing).
 - .1 Perform work in accordance with IGMA and for glazing installation methods.
 - .2 Cut glazing tape to length and 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.
- .4 Interior Dry Method (tape and tape).
 - .1 Perform work in accordance with IGMA and for glazing installation methods.

- .2 Cut glazing tape to length and set against permanent stop, projecting 1.6 mm above sight line.
- .3 Place setting blocks as per manufacturer's instructions.
- .4 Rest glazing on setting blocks and push against tape for full contact at perimeter of light or unit.
- .5 Place glazing tape on free perimeter of glazing in same manner as noted above.
- .6 Install removable stop without displacement of tape. Exert pressure on tape for full continuous contact.
- .7 Knife trim protruding tape. Do not cut or abrade tempered glass.

3.3 CLEANING

- .1 Clean glass and mirrors using approved non-abrasive cleaner in accordance with manufacturer's printed instructions.

3.4 SCHEDULES

- .1 Refer to Section 08 06 10.

END OF SECTION

ROOM FINISH ABBREVIATIONS:

ABBREV	MATERIAL	SPEC NO	ABBREV	MATERIAL	SPEC NO
C	Concrete	03 30 00	P	Paint	09 90 00
CT	Ceramic Tile	09 31 00	PT	Porcelain Tile	09 31 00
CSH	Concrete Sealer with Hardener	03 35 00	PF	Prefinished	-
CMU	Concrete Masonry Unit	04 00 00	R	Rubber-Coved Base	09 65 00
EP	Epoxy Paint	09 90 00	REF	Resinous Flooring (with integral cove base)	09 67 23
GB	Gypsum Board	09 29 00	SC	Self-Coved Base	09 65 00
GL	Glazing	-	VS	Vinyl Sheet	09 65 00
IMP	Insulated Metal Panel	07 42 13			

TYPICAL NOTES:

1. All sub-floor material to be concrete unless otherwise noted.
2. All measurements indicated are millimeters and are indicated as height above floor finish (AFF), unless otherwise noted.
3. Refer to reflected ceiling plans for ceiling types and finishes.
4. All GB ceilings and bulkheads to be painted P1 unless otherwise noted.
5. All exposed structure, conduit, sprinkler lines and HVAC to be painted to match adjacent ceiling colour in gloss level G2 unless otherwise noted as ESU (Exposed Structure-Unfinished) on Reflected Ceiling Plan.
6. All GB ceilings and bulkheads to be painted gloss level G2 unless otherwise noted. All ceilings in rooms noted to receive EP wall finish to receive EP ceiling finish in G3 gloss level.
7. Refer to section 09 90 00 Project Manual for typical paint gloss levels.
8. Where two wall materials are indicated, first is lower, second is upper (i.e. RV/P)
9. Distribution of paint gloss application in various locations to be confirmed during construction.
10. Contractor to submit finished samples as specified for all hardwood, hardwood veneer paneling, etc. for design consultants approval.
11. All welding seams to be multicoloured to match field colour, unless otherwise noted.
12. Floor finishes to transition at centerline of door unless otherwise noted.
13. All metal stair railings, stringers etc to receive paint finish, colour P#, G5 gloss level.
14. Flooring pattern to continue below open millwork where exposed (typ.).
15. Refer to interior elevations for clarification of material distribution where multiple finishes are listed. Where multiple paint colours are noted for one elevation, refer to Paint Distribution Plans for clarification of application/transitions.
16. Where vinyl sheet (VS) transitions to REF, feather substrate to align materials. Typical all locations.
17. All plywood backboards to be painted with fire retardent paint behind all electrical panels. Refer to Electrical drawings.

REMARKS:

- R1 Refer to elevations for CT patterning and extent of finish.
- R2 Concrete sub-floor with brushed/broom finish and applied CSH.
- R3 Provide paint finish P# (both sides) to interior hollow metal window frame.
- R4 Remove x rubber base. Install new continuous wall base and infill VS flooring to suit new openings for addition. Match existing. Paint all walls affected by demolition/new construction as noted.
- R5 Millwork to receive SC base.

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		

T.O. MAIN FLOOR

1:001	EXISTING VESTIBULE	X	X	X	X	X	X	X	X	X	X	X	X		
1:002	EXISTING CORRIDOR	XC	VS1, XVS1	CMU	R, XR	XCMU	X	XCMU	X	-	-	XCMU	P		R4
1:003A	EXISTING ATRIUM	X	X	X	X	-	-	X	X	-	-	X	X		
1:003C	EXISTING KITCHENETTE	X	X	X	X	X	X	X	X	X	X	X	X		
1:003D	KITCHENETTE STORAGE	XC	XREF2	GB, XGB	SC, XSC	GB	EP	XGB	EP	XGB	EP	XGB	EP		
1:035	COMMONS	X	X	X	X	-	-	X	X	X	X	X	X		
1:090	EXISTING CORRIDOR	XC	XVS1, VS1	XCMU	R, XR	XCMU	X, P, X	-	-	XCMU	X	XCMU	P		R4, R3
1:090A	ALCOVE	C	VS1	CMU	R	CMU	P	CMU	P	-	-	CMU	P		
1:099	EXISTING VESTIBULE	XC	X	XCMU	X	XCMU	P	XCMU	P	XCMU	P	XCMU	P		R3
1:100	CONST. & WOOD TECHNOLOGY	C	CSH	CMU	R	CMU	P	CMU	P	CMU	P	CMU	P		R2
1:100A	PRINT ROOM	C	CSH	CMU	R	CMU	P	CMU	P	CMU	P	CMU	P		R2
1:100B	STORAGE ROOM	C	CSH	CMU	R	CMU	P	CMU	P	CMU	P	CMU	P		R2
1:100D	DUST COLLECTOR ENCLOSURE	C	-	IMP	-	IMP	PF	IMP	PF	IMP	PF	IMP	PF		
1:101	DESIGN LAB	C	CSH	CMU	R	CMU	P	CMU	P	CMU	P	CMU	P		R2
1:102	EXTERIOR STORAGE	C	CSH	CMU	R	CMU	P	CMU	P	CMU	P	CMU	P		R2
1:103	MACHINING & WELDING TECHNOLOGY	C	CSH	CMU	R	CMU	P	CMU	P	XCMU	P	CMU	P		R2
1:103A	LOCKER ROOM	C	CSH	CMU	R	CMU	P	CMU	P	CMU	P	CMU	P		R2
1:103B	OFFICE	C	CSH	CMU	R	CMU	P	CMU	P	CMU	P	CMU	P		R2
1:103C	STORAGE ROOM	C	CSH	CMU	R	CMU	P	CMU	P	CMU	P	CMU	P		R2
1:103D	TANK STORAGE	C	-	-	-	CMU	-	CMU	-	CMU	-	CMU	-		
1:104	STAIR 5	C	CSH	CMU	R	CMU	CSH	CMU	CSH	CMU	CSH	CMU	CSH		R2
1:106	CULINARY ARTS	C	REF1	GB	SC	GB	EP	GB	EP	GB	EP	GB	EP		
1:106A	CHANGEROOM	C	REF2	2	SC	GB	EP	GB	EP	GB	EP	GB	EP		R5
1:106B	JAN. / MOP ROOM	C	REF2	GB	SC	GB	EP	GB	EP	GB	EP	GB	EP		
1:106C	W/C	C	REF2	GB	SC	GB	EP	GB	EP	GB	EP	GB	EP		
1:106D	W/C	C	REF2	GB	SC	GB	EP	GB	EP	GB	EP	GB	EP		
1:106E	OFFICE	C	REF2	GB	SC	GB	P	GL, GB	-, P	GB	P	GB	P		
1:106F	DISH WASHING AREA	C	REF1	GB	SC	GB	EP	GB	EP	GB	EP	GB	EP		
1:106G	BAKING CLASSROOM	C	REF1	GB	SC	GB	EP	GB	EP	GB	EP	GB	EP		
1:106H	WALK-IN COOLER	C	REF1	GB	SC	-	-	GB	EP	-	-	GB	EP		
1:106J	WALK-IN FREEZER	C	-	GB	-	-	-	GB	EP	GB	EP	GB	EP		
1:106K	BAKERY STORAGE	C	REF1	GB	SC	GB	EP	GB	EP	GB	EP	GB	EP		
1:106L	CORRIDOR	C	REF1	GB	SC	GB	EP	GB	EP	GB	EP	GB	EP		
1:106M	WALK-IN COOLER	C	REF1	GB	SC	-	-	GB	EP	GB	EP	GB	EP		
1:106N	WALK-IN FREEZER	C	-	GB	-	GB	EP	GB	EP	-	-	-	-		R5
1:106P	CULINARY ARTS STORAGE	C	REF1	GB	SC	GB	EP	GB	EP	GB	EP	GB	EP		
1:106Q	LAUNDRY	C	REF1	GB	SC	GB	EP	GB	EP	GB	EP	GB	EP		
1:107	FOOD & NUTRITION	C	REF2	GB	SC	GB	EP	GB	EP	GB	EP	GB	EP		R1
1:107A	DRY STORAGE	C	REF2	GB	SC	GB	EP	GB	EP	GB	EP	GB	EP		R5
1:107B	LAUNDRY	XC	XREF2	GB, XGB	SC, XSC	XGB	EP	XGB	EP	GB	EP	XGB	EP		R5

T.O. MECH. MEZZANINE

1M:02	MECH. MEZZ.	C	EFP	C	-	CMU/GB	P	CMU/GB	P	CMU/GB	P	CMU/GB	P		
1M:03	SERVICE ROOM	C	EFP	GB	R	GB	P	GB	P	GB	P	GB	P		

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 04 00 00 – Masonry.
- .2 Section 06 10 00 – Rough Carpentry.
- .3 Section 07 21 00 – Thermal Insulation.
- .4 Section 07 92 00 – Joint Sealants.
- .5 Section 08 11 00 – Metal Doors and Frames.
- .6 Section 09 29 00 – Gypsum Board.

1.2 REFERENCES

- .1 American Society for Testing and Materials (ASTM).
 - .1 ASTM A653/A653M-20, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by Hot-Dip Process.
 - .2 ASTM C645-18, Standard Specification for Nonstructural Steel Framing Members.
 - .3 ASTM C754-20, Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products.
 - .4 ASTM C840-20, Standard Specification for Application and Finishing of Gypsum Board.
 - .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.
- .2 Underwriters Laboratories of Canada (ULC).
 - .1 CAN/ULC S101-14, Standard Methods of Fire Endurance Tests of Building Construction and Materials.
- .3 Canadian Sheet Steel Building Institute (CSSBI).
 - .1 CSSBI S18-2019, Guide Specification for Non-loadbearing Steel Framing.

1.3 QUALITY ASSURANCE

- .1 Stud Height Limitations: to be in accordance with ASTM C645 and ASTM C754 “Limiting Height Table” for stud width and spacing used, and CAN/ULC S101 when steel studs are used as part of a fire rated assembly.

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.
- .5 Waste Management and Disposal in accordance with Section 01 74 19.

Part 2 Products

2.1 MANUFACTURERS

- .1 Basis of Design Products.
 - .1 Slotted Track.
 - .1 Dietrich Metal Framing Canada SLP-TRK.
- .2 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes* of the *Bidding Procedures*.
- .3 Supply all similar products from single manufacturer.

2.2 MATERIALS

- .1 Steel Stud Framing for Screw Attachment of Gypsum Board: to be roll formed from 0.49 mm (25-gauge), 0.91 mm (20-gauge), 1.22 mm (18-gauge) thick, and other gauge designations as indicated, cold formed steel with hot dipped galvanized coating.
- .2 Stud Widths: 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 and gauge as studs and sized to suit stud. Leg length of bottom track to be minimum 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 Screws.
- .7 Resilient Channels (to reduce air-borne sound transmission where indicated): 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 Acoustic Insulation: in accordance with Section 07 21 00.
- .10 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 ASTM C645, ASTM C754, and CSSBI S18 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 studs to underside of floor/roof 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 406 mm on centre maximum and maximum 50 mm from abutting walls and each side of corners and openings.
- .6 Install steel stud framing 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 floor/roof 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 1.2 mm (18-gauge) doubled (boxed) studs at jambs and heads of all door openings. Fasten studs together to act as single structural unit. Extend doubled (boxed) studs each side of door opening to underside of floor/roof structure above.
- .10 Install minimum 0.91 mm (20-gauge) steel studs where partition is finished with moisture resistant gypsum board, abuse-resistant gypsum board, and tile backerboard where indicated.
- .11 Install steel door frames (supplied by others) into steel stud partitions in accordance with requirements of section 08 11 00. Screw-fix frame anchor clips to jamb, header, and/or sill members. Fixing to be adequate to prevent movement of frame relative to steel stud framing.
- .12 Install steel stud framing between studs for attachment of electrical receptacles and other mechanical and/or electrical systems.
- .13 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.
- .14 Install resilient and furring channels where indicated. Start rows of channel 50 mm up from floor and within 152 mm from ceiling. Space rows at maximum 406 mm on centre maximum. Locate splices over framing and secure channel ends to framing.
- .15 Install acoustical sealant under tracks around perimeter of sound control partitions indicated.
- .16 Provide additional framing and solid wood blocking to support wall mounted millwork and fixtures, door stops, washroom accessories, etc. where indicated.
- .17 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 SECTIONS

- .1 Section 04 00 00 – Masonry.
- .2 Section 05 41 00 – Structural Metal Stud Framing.
- .3 Section 06 10 00 – Rough Carpentry.
- .4 Section 06 40 00 – Architectural Woodwork.
- .5 Section 07 21 00 – Thermal Insulation.
- .6 Section 07 26 00 – Air/Vapour Barrier Membrane - Self Adhesive.
- .7 Section 07 27 00 – Vapour Permeable Air Barrier Membrane - Self Adhesive.
- .8 Section 07 84 00 – Firestopping and Smoke Seals.
- .9 Section 07 92 00 – Joint Sealants.
- .10 Section 08 11 00 – Metal Doors and Frames.
- .11 Section 08 54 13 – Fiberglass Windows.
- .12 Section 09 06 00 – Room Finish Schedule.
- .13 Section 09 22 16 – Non-Structural Metal Framing.
- .14 Section 09 31 00 – Tiling.
- .15 Section 09 51 00 – Acoustical Ceilings.
- .16 Section 09 65 00 – Resilient Flooring.
- .17 Section 09 90 00 – Painting and Coating.

1.2 REFERENCES

- .1 American Society for Testing and Materials (ASTM).
 - .1 ASTM A641/A641M-19, Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire.
 - .2 ASTM A653/A653M-20, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by Hot-Dip Process.
 - .3 ASTM C475/C475M-17, Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board.
 - .4 ASTM C635/C635M-17, Standard Specification for Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings.
 - .5 ASTM C645-18, Standard Specification for Nonstructural Steel Framing Members.
 - .6 ASTM C754-20, Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products.
 - .7 ASTM C840-20, Standard Specification for Application and Finishing of Gypsum Board.
 - .8 ASTM C919-19, Standard Practice for Use of Sealants in Acoustical Applications.
 - .9 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.

- .10 ASTM C1002-20, Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.
- .11 ASTM C1047-14a(2019), Standard Specifications for Accessories for Gypsum Wallboard and Gypsum Veneer Base.
- .12 ASTM C1177/C1177M-17, Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing.
- .13 ASTM C1178/C1178M-18, Standard Specification for Coated Glass Mat Water-Resistant Gypsum Backing Panel.
- .14 ASTM C1193-16, Standard Guide for Use of Joint Sealants.
- .15 ASTM C1278/C1278M-17, Standard Specification for Fiber-Reinforced Gypsum Panel.
- .16 ASTM C1280-18, Standard Specification for Application of Exterior Gypsum Panel Products for Use as Sheathing.
- .17 ASTM C1396/C1396M-17, Standard Specification for Gypsum Board.
- .18 ASTM C1629/C1629M-19, Standard Classification for Abuse-Resistant Nondecorated Interior Gypsum Panel Products and Fiber-Reinforced Cement Panels.
- .19 ASTM C1658/C1658M-19e1, Standard Specification for Glass Mat Gypsum Panels.
- .20 ASTM D1667-17, Standard Specification for Flexible Cellular Materials—Poly (Vinyl Chloride) Foam (Closed-Cell).
- .21 ASTM D1784-20, Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds.
- .22 ASTM D3273-16, Standard Test Method for Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber.
- .23 ASTM D3678-19, Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Interior-Profile Extrusions.
- .24 ASTM E84-20, Standard Test Method for Surface Burning Characteristics of Building Materials.
- .25 ASTM E136-19a, Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750°C.
- .2 Gypsum Association (GA).
 - .1 GA 214-2015, Recommended Levels of Finish Gypsum Board, Glass Mat & Fiber-Reinforced Gypsum Panels.
 - .2 GA 216-2018, Application and Finishing of Gypsum Panel Products.
 - .3 GA 253-2018, Application of Gypsum Sheathing.
- .3 Underwriters Laboratories of Canada (ULC).
 - .1 CAN/ULC S102-18, Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.

1.3 SUBMITTALS

- .1 Shop Drawings.
 - .1 Submit shop drawings for non fire-rated and fire-rated suspended gypsum board ceiling systems 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, support at light fixtures, air diffusers, and other devices indicated, and perimeter trim specified.

1.4 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 Deliver all material to site in manufacturer's original unopened packaging and containers with labels clearly identifying product name and manufacturer.
- .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.
- .5 Waste Management and Disposal in accordance with Section 01 74 19.

1.5 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 MANUFACTURERS

- .1 Basis of Design Products.
 - .1 Exterior Fibreglass-Faced Gypsum Board Sheathing.
 - .1 CertainTeed GlasRoc High Performance Glass Fiber Reinforced Exterior Sheathing.
 - .2 CGC Securock Glass-Mat Sheathing.
 - .3 Georgia-Pacific DensGlass Gold Exterior Sheathing.
 - .2 Fire-Rated Moisture/Mould-Resistant Gypsum Board (where indicated).
 - .1 CertainTeed M2Tech Type X Moisture & Mold Resistant Gypsum Board.
 - .2 CGC SheetRoc Mold Tough Type X Gypsum Board.
 - .3 Georgia-Pacific ToughRock Type X Mold-Guard Gypsum Board.
 - .3 Fire-Rated Tile Backerboard (where indicated).
 - .1 CertainTeed Diamondback Tile Backer Type X.
 - .2 CGC Durock Tile Backerboard Type X.
 - .3 Georgia-Pacific DensShield Fireguard Tile Backer Type X.
 - .4 Fire-Rated Very High Impact (VHI) Gypsum Board (where indicated).
 - .1 CGC Sheetrock Mold Tough VHI Firecode X Abuse-Resistant Gypsum Board c/w manufacturer recommended joint tape and setting-type joint compound.
 - .5 Gypsum Board Suspension System.
 - .1 Armstrong Drywall Grid System.
 - .2 CertainTeed Drywall Suspension System.
 - .3 CGC Drywall Suspension System.
 - .6 PVC Gypsum Board Trims.
 - .1 Trim-Tex No. 093V Expansion Bead (control joint).

- .2 Trim-Tex No. AS5150 (6 mm x 6 mm) Reveal Bead.
- .3 Trim-Tex No. 9050 (1/2") Archway Tear Away L Bead.
- .7 High Density Closed Cell Neoprene Gasketing (at Trim-Tex No. 9050 Archway Tear Away L Bead).
 - .1 TCH 556-NP1212900 (1/2") www.tchweb.com
- .2 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes* of the *Bidding Procedures*.
- .3 Supply all similar products from single manufacturer.

2.2 MATERIALS

- .1 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.
- .2 All Interior Gypsum Board (unless otherwise indicated): to ASTM C1396/C1396M and ASTM E136, 16 mm thick Type X fire-rated, 1220 mm wide x maximum practical length, ends square factory cut, edges tapered.
- .3 Fire-Rated Moisture/Mould-Resistant Gypsum Board (where indicated): to ASTM C1396/C1396M and ASTM D3273, 16 mm thick Type X fire-rated moisture-resistant treated gypsum core with moisture and mould-resistant treated paper facings on the front, back, and long edges, 1220 mm wide x maximum practical length, ends square factory cut, edges tapered.
- .4 Fire-rated Tile Backerboard (where indicated): to ASTM C1178/C1178M, ASTM C1278/C1278M, and ASTM D3273, 16 mm thick Type X fire-rated 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.
- .5 Fire-Rated Very High Impact (VHI) Gypsum Board (all wall and bulkhead surfaces except behind ceramic tile): to ASTM C1396/C1396M, ASTM C1629/C1629M, and ASTM E136, 16 mm thick Type X fire-rated very high impact-resistant (VHI) paper-faced panels with moisture and mould resistance, 1220 mm wide x maximum practical length, ends square factory cut, edges tapered.

2.3 COMPONENTS

- .1 Gypsum Board Suspension System.
 - .1 Heavy-duty gypsum board suspension system to ASTM C635/C635M, ASTM C645 and ASTM C754 consisting of commercial quality cold rolled hot-dipped galvanized steel straight main and cross tees and perimeter angle mouldings that join together to support screw attached interior gypsum board panels and independently supported light fixtures, air diffusers, and other devices indicated.
 - .2 Suspension system to include 41 mm high x 38 mm wide knurled face main and cross tees, and perimeter angle mouldings, hanger wire, and accessories.
 - .3 Hanger Wire: to 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 diameter strength.
 - .4 Where applicable, installed systems must conform to Underwriter's Laboratories, Inc. (UL) Fire Resistance Design.
 - .5 Maximum deflection of L/360 of distance between supports.

2.4 ACCESSORIES

- .1 Fasteners for Exterior Fibreglass-Faced Gypsum Board Sheathing: to ASTM C1280.
- .2 Fasteners for Gypsum Board Sheathing: to ASTM C954 and ASTM C1002.
- .3 Joint Tape: to ASTM C475/C475M, 51 mm wide, high strength, coated, alkali-resistant, glass fiber reinforcing tape.
- .4 Joint Compound: to ASTM C475/C475M, asbestos-free, mould-resistant.
- .5 Metal Corner Beads: roll formed from 0.40 mm (28 ga.) thick cold formed galvanized steel, beading angle, flange length as required.
- .6 Metal Casing Beads: roll formed from 0.40 mm (28 ga.) thick cold formed galvanized steel, type "L", "J" or "Z" as required, beading angle or casing with one side knurled for joint filling.
- .7 Paper Faced Metal Corner and Casing Beads: roll formed flanges from 0.40 mm (28 ga.) thick cold formed galvanized steel laminated to exposed paper tape.
- .8 PVC Gypsum Board Expansion Bead (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.
- .9 PVC Gypsum Board Reveal Bead: co-extruded flexible PVC to ASTM C1047, ASTM D3678 Class 2, and ASTM D1784, 6 mm x 6 mm reveal, Class A rating for flame spread and smoke developed when tested under ASTM E84.
- .10 PVC Archway Tear Away L Bead: co-extruded flexible PVC to ASTM C1047, ASTM D3678 Class 2, and ASTM D1784, used to finish round edge of gypsum board at round steel and concrete columns, Class A rating for flame spread and smoke developed when tested under ASTM E84.
- .11 High Density Closed Cell Neoprene Gasketing (at Trim-Tex No. 9050 Archway Tear Away L Bead): black high density closed cell neoprene to ASTM D1667 with one side pressure sensitive adhesive, flexible with no distortion, used to fill 13 mm gap at round edge of gypsum board at round steel and concrete columns.
- .12 Access Doors (to mechanical and electrical systems): in accordance with Mechanical and Electrical Divisions.
- .13 Thermal and Acoustic Insulation: in accordance with Section 07 21 00.
- .14 Joint Sealants: in accordance with Section 07 92 00.

Part 3 Execution

3.1 INSTALLATION

- .1 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 o.c. at perimeter and 200 mm o.c. 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.
- .2 Interior Fire-Rated Gypsum Board.
- .1 Install interior fire-rated gypsum board in accordance with ASTM C840, GA 216, and GA 253, and manufacture's printed instructions.
 - .2 Do not apply gypsum board until blocking, electrical and mechanical work are complete and approved.
 - .3 Apply single and double layer gypsum board to wood or metal furring or framing using screw fasteners. Spacing and length of fasteners in accordance with manufacturer's printed instructions, and to obtain required fire rated assemblies.
 - .4 Install fire-rated moisture/mould-resistant gypsum board, tile backerboard, and VHI gypsum board where indicated.
- .3 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 latex acrylic sealant continuously around periphery of each face of partitioning to seal gypsum board/structure junction where partitions abut fixed building components. In addition, seal full perimeter of cut-outs around electrical boxes and ducts in partitions with latex acrylic sealant.
 - .4 Install access doors to electrical and mechanical fixtures specified in respective sections. Rigidly secure access door frames to furring or framing systems.
- .4 Gypsum Board Control Joints.
- .1 Construct gypsum board 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 o.c. horizontally and vertically on walls and ceilings unless otherwise indicated.
 - .3 Install control joints straight and true.
- .5 Acoustic Joint Sealants at STC Rated Assemblies.
- .1 Seal STC rated assemblies with a continuous bead of acoustic joint sealant along perimeters at both faces of partition, through head-of-wall and bottom-of-wall joints and openings, behind control joints, and at mechanical and electrical duct, piping, conduit, and other penetrations into and through partitions.
 - .2 Comply with ASTM C919, ASTM C1193, and manufacturer's printed recommendations for closing off sound-flanking paths around or through assemblies, including sealing partitions to underside of floor/roof structure above acoustical ceilings.
 - .3 Acoustic sealant to maintain STC ratings at non fire-rated and fire-rated partitions as indicated on the drawings.
 - .4 Install acoustic sealant, free of air pockets, embedded foreign matter, sags, and ridges.
 - .5 Tooling of Nonsag Sealants: immediately after sealant application and before skinning or curing begins, tool sealants to form smooth, uniform beads to eliminate air pockets and to ensure contact and adhesion of sealant with sides of joint.
 - .1 Remove excess acoustic sealant from surfaces adjacent to joint.

- .2 Use tooling agents approved by sealant manufacturer that do not discolour sealants or adjacent surfaces.
- .3 Provide concave joint configuration in accordance with ASTM C1193.

3.2 CONSTRUCTION

- .1 Gypsum Board Finish Levels: to GA 214 and GA 216 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.
- .2 Taping and Filling.
 - .1 Finish corner beads, control joints and trim as required with two coats of joint compound and one coat of taping compound, feathered out onto panel faces.
 - .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 At locations to receive tile in accordance with Sections 09 31 00, use wet mastic or modified thin-set mortar instead of joint compound.
- .3 Suspended Gypsum Board Ceilings.
 - .1 Install gypsum board suspension system in accordance with manufacturer's printed instructions, and to comply with requirements of fire-resistance-rated assemblies where indicated.
 - .2 Secure hanger wires to upper structural elements and space hangers so that each hanger wire supports a maximum of 1.48 m² (16 ft²).
 - .3 Support light fixtures, air diffusers, and other devices indicated by providing additional suspension grid and hanger wire within 150 mm of each corner and at maximum 600 mm around perimeter of fixture.
 - .4 Install work level to tolerance of 1:1200.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 03 30 00 – Cast-In-Place Concrete.
- .2 Section 04 00 00 – Masonry.
- .3 Section 07 92 00 – Joint Sealants.
- .4 Section 09 06 00 – Room Finish Schedule.
- .5 Section 09 29 00 – Gypsum Board.

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 E96/E96M-16, Standard Test Methods for Water Vapor Transmission of Materials.
- .2 American National Standards Institute (ANSI).
 - .1 ANSI A108/A118/A136.1-2020, Specifications for the Installation of Ceramic Tile.
 - .2 ANSI A137.1-2019, American National Standards Specifications for Ceramic Tile.
- .3 Terrazzo Tile and Marble Association of Canada (TTMAC).
 - .1 Specification Guide 09 30 00 Tile Installation Manual 2019-2021.
- .4 Workplace Hazardous Materials Information System (WHMIS).

1.3 SUBMITTALS

- .1 Samples.
 - .1 Submit samples in accordance with Section 01 33 00.
 - .2 Submit 300 x 300 mm sample panels of each colour, texture, size, and pattern of tile for final approval prior to ordering. Adhere tile samples to 19 mm thick plywood and grout joints to represent project installation.
- .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 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.
- .2 Mock-ups.
 - .1 Prepare mock-up of thin-set tiling installation at shower floors in accordance with Section 01 45 00.

- .2 Locate mock-up on site as part of final installation including tile base and transition strip between thin-set tiling and adjacent flooring material. Mock-up will be reviewed for quality workmanship, tile pattern, grout colour, and overall appearance.
- .3 Once approved, mock-up will set standard of acceptance for remaining installations.
- .4 Do not proceed with thin-set tiling installation until mock-up area is complete and approved by Contract Administrator.

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 Section 01 74 00.
- .5 Waste Management and Disposal in accordance with Section 01 74 19.

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 Total Performance of the Work. Manufacturer hereby warrants waterproof membrane to be free from manufacturing defects and will not rot, deteriorate or break down, and these or other observed defects and deficiencies will be repaired or replaced to the satisfaction of the Contract Administrator and the City, and at no expense to the City.

1.7 MAINTENANCE

- .1 Comply with requirements of Section 01 78 00.
- .2 Provide maintenance materials as follows:
 - .1 Supply quantity of full-size tiles equal to 5% of amount installed for each type of tile. Provide mortar, adhesive and grout of quantity sufficient to install maintenance materials.
 - .2 Maintenance materials to be from same production run as installed materials.

Part 2 Products

2.1 MANUFACTURERS

- .1 Basis of Design Products.
 - .1 Glazed Ceramic Wall Tile (CT1).
 - .1 Olympia Tile Colour & Dimension Collection, 4" x16" x 1/4" thick.
 - .1 CT1 (field colour): Matte finish, colour to be selected from manufacturer's entire selection.
 - .2 CT2, CT3, CT4 (accents): Bright (gloss) finish, colour to be selected from manufacturer's entire selection.
 - .2 Stainless Steel Transition Strip (PT1 tile to resilient flooring).
 - .1 Schluter SCHIENE E60 (stainless steel).

- .3 Stainless Steel Finishing and Edge Protection (all CT1 outside corners, and vertical & horizontal locations where tiles edges are exposed).
 - .1 Schluter QUADEC (stainless steel) c/w matching connectors as required.
- .2 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes* of the *Bidding Procedures*.
- .3 Supply similar products from single manufacturer.

2.2 MATERIALS

- .1 Glazed Ceramic Wall Tile (CT1): to ANSI A137.1, surface finish as indicated, square edge tiles, size and colour as indicated.
- .2 Epoxy Mortar and Grout: premium-grade, water cleanable, non-sag 100% solids epoxy grout to ANSI A108/A118/A136.1 that offers colour uniformity, durability and stain resistance with extraordinary ease of use, inhibits the growth of stain-causing mold and mildew in substrates with Microban® antimicrobial product protection, Greenguard certified, colour to be selected from manufacturer's entire selection.
- .3 Stainless Steel Transition Strip (PT1 tile to resilient flooring): stainless steel profile consisting of a trapezoid-perforated anchoring leg which is secured beneath the thin-set tiling, and a sloped vertical wall section that transfers point loads to the substrate and surface covering while protecting the flooring edge from damage.
 - .1 Flooring trade to review profile specified and advise the Contract Administrator if change of profile is recommended to suit flooring materials selected for the project.
- .4 Stainless Steel Finishing and Edge Protection (CT1 outside corners, and vertical & horizontal locations): 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.
- .5 Water: potable, clean, and free of chemicals and contaminants detrimental to adhesive or grout mixes.
- .6 Joint Sealants: in accordance with Section 07 92 00.

Part 3 Execution

3.1 PREPARATION

- .1 Ensure surfaces are plumb, level, smooth and dry, free of irregularities or loose material that would prevent adhesion, and meet all requirements listed in TTMAC Tile Specification Guide and ANSI A108/A118/A136.1.
- .2 Work penetrating substrate to be completed before installing waterproofing and tile.
- .3 Protect surrounding work from damage or disfiguration. Vacuum clean and damp clean surfaces.

3.2 INSTALLATION

- .1 Install all thin-set tiling materials and accessories in accordance with TTMAC Tile Specification Guide, ANSI A108/A118/A136.1, and manufacturer's printed instructions.

- .2 Lay out all tile work 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. Do not interrupt tile pattern through openings.
- .3 Align all joints to give straight grout lines parallel to walls. Make internal angles square and external angles square.
- .4 Place edge strips at exposed tile edges unless otherwise indicated.
- .5 Mix and proportion pre-mix setting bed and grout materials in accordance with manufacturer's printed instructions. Follow tile and grout manufacturer's printed procedures and precautions for setting and grouting all tiling specified.
 - .1 Grout Preparation.
 - .1 Ensure setting materials are adequately cured prior to grouting.
 - .2 Remove space and rake out high ridges of setting material from tile joints prior to grouting to ensure uniform grout thickness.
 - .3 Joints must be free and clear of dirt, dust and other foreign matter.
 - .4 Do a test patch to see if pre-sealing of tile is required to avoid staining.
 - .2 Grout Application.
 - .1 Install grout to manufacturer's instructions.
 - .2 Store grout at 20 degrees Celsius for 12 hours prior to use.
 - .3 For vertical application, where grout may slump, mix in part or all of the extra silica sand provided to produce the desired working consistency.
 - .4 Within 1 hour after application of grout, clean surface with cheesecloth or a cleaning pad and cool clean water.
 - .5 Do not allow wash water to run into un-grouted tile joints.
 - .6 Avoid leaving excess water on the surface of grout joints during clean-up as this can affect grout's cure.
 - .7 Make wall tile joints 3 mm wide for epoxy grout (1.5 mm wide for polymer modified grout with optimizer additive). Grout to be filled to industry standards, flush with glazed edge of wall tile.
 - .8 Make floor tile joints 3 mm wide. Grout to be filled to industry standards, flush with edge of porcelain floor tile.
- .6 Cut and fit tile tight to penetrations through tile, around corners, fittings, 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 Place tile joints uniform in width, subject to variance in tolerance allowed in tile size. Make joints watertight, without voids, cracks, excess mortar or grout.
- .8 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.
- .9 When appropriate, mix tiles from several boxes prior to installation to assure that colour variations from tile to tile are evenly distributed throughout field.
- .10 Apply sealant to junction of tile and dissimilar materials and junction of dissimilar planes.

- .11 Clean all surfaces after completion of grouting and remove any grout haze.

3.3 PROTECTION

- .1 Protect floor and wall tiles from impact, vibration, heavy hammering on adjacent surfaces for at least 14 calendar days after installation.

3.4 SCHEDULES

- .1 Refer to Section 09 06 00.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 04 00 00 – Masonry.
- .2 Section 06 10 00 – Rough Carpentry.
- .3 Section 09 22 16 – Non-Structural Metal Framing.
- .4 Section 09 29 00 – Gypsum Board.
- .5 Section 09 90 00 – Painting and Coating.

1.2 REFERENCES

- .1 American Society for Testing and Materials (ASTM).
 - .1 ASTM A641/A641M-19, Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire.
 - .2 ASTM A653/A653M-20, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - .3 ASTM 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-19, 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 E84-20, Standard Test Method for Surface Burning Characteristics of Building Materials.
 - .11 ASTM E1264-19, 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)e1, 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-S102-18, 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/C635M deflection test.

1.4 SUBMITTALS

- .1 Shop Drawings.
 - .1 Submit shop drawings for each acoustical ceiling system specified 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, acoustic unit support at ceiling fixture, and perimeter trim specified.
- .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 suspension system including main runner and cross tee, wall molding, and perimeter trim specified.
- .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 Regulatory Requirements.
 - .1 Provide acoustical ceiling systems and acoustical panel systems to meet ASTM E84 and CAN/ULC S102 Flame Spread Rating 25 or less, and Smoke Developed Classification 50 or less.
 - .2 Materials provided shall be identical to materials tested.

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 Section 01 74 00.
- .5 Waste Management and Disposal in accordance with Section 01 74 19.

1.7 SITE CONDITIONS

- .1 Ensure painting of wall surfaces is dry before commencement of ceiling 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 from date of Total Performance of the Work to term of warranty specified below. Manufacturer hereby warrants acoustical ceilings and painted grid system 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 Contract Administrator and the City, and at no expense to the City.
 - .1 Acoustical Ceiling Tile System (ACS1A and ACS2): 30 years against manufacturing and material defects including rusting and visible sag.

1.10 MAINTENANCE

- .1 Comply with requirements of Section 01 78 00.
- .2 Provide maintenance materials as follows:
 - .1 Acoustical Ceiling Units (ACS1A and ACS2): 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 Acoustical Ceiling Tile System.
 - .1 Acoustical Ceiling Tile System (ACS1A).
 - .1 Suspension System.
 - .1 Armstrong Prelude XL (15/16").
 - .2 Acoustic Units.
 - .1 Armstrong Fine Fissured High NRC #1755.
 - .2 Acoustical Ceiling Tile System (ACS2).
 - .1 Suspension System.
 - .1 Armstrong Prelude XL (15/16").
 - .2 Acoustic Units.
 - .1 Armstrong Clean Room VL #870.
 - .2 Wall Moldings.
 - .1 Armstrong #7871 Hemmed Shadow Molding (typical throughout).
- .2 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes* of the *Bidding Procedures*.

- .3 Supply similar products from single manufacturer (Note: ACS1A and ACS2 to be supplied from same manufacturer).

2.2 MATERIALS

- .1 Acoustical Ceiling Tile System (ACS1A, ACS2).
 - .1 Non-Rated Suspension System.
 - .1 All main beams, cross tees, and angle moldings: commercial quality cold rolled 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: Intermediate Duty to ASTM C635/C635M, colour: White.
 - .2 Structural Classification (rooms containing ceiling barrel diffusers): Heavy Duty to ASTM C635/C635M, colour: White.
 - .2 Acoustical Ceiling Units.
 - .1 Acoustic Units (ACS1A).
 - .1 Classification: Type III, Form 2, Pattern C E to ASTM E1264.
 - .2 Surface Texture: medium texture.
 - .3 Composition: wet-formed mineral fibre.
 - .4 Surface Finish: factory-applied latex paint.
 - .5 Noise Reduction Coefficient (NRC): 0.75 to ASTM C423.
 - .6 Ceiling Attenuation Class (CAC): 35 to ASTM E1414/E1414M.
 - .7 Sound Absorption Coefficient: 0.86 at 500Hz.
 - .8 Light Reflectance (LR): 0.86 to ASTM E1477.
 - .9 Edge Type: square lay-in.
 - .10 Colour: white.
 - .11 Size: 2'-0" x 4'-0" x 7/8" thick.
 - .12 Shape: flat.
 - .13 Fire Resistance: to ASTM E84 and CAN/ULC S102 surface burning characteristics. Flame Spread Index 25 or less, Smoke Developed Index 50 or less (UL labeled).
 - .14 Antimicrobial Treatment: guaranteed resistance against growth of mold/mildew and bacteria to ASTM D3273.
 - .15 Dimensional Stability: standard resistance to sagging in high humidity conditions up to, but not including standing water and outdoor applications.
 - .2 Acoustic Units (ACS2).
 - .1 Classification: Type IV, Form 2, Pattern E to ASTM E1264.
 - .2 Surface Texture: smooth texture.
 - .3 Composition: wet-formed mineral fibre.
 - .4 Surface Finish: vinyl-faced membrane.
 - .5 Noise Reduction Coefficient (NRC): N/A.
 - .6 Ceiling Attenuation Class (CAC): 40 to ASTM E1414/E1414M.
 - .7 Light Reflectance (LR): 0.80 to ASTM E1477.
 - .8 Edge Type: square lay-in.
 - .9 Colour: white.
 - .10 Size: 2'-0" x 4'-0" x 5/8" thick.
 - .11 Shape: flat.

- .12 Fire Resistance: to ASTM E84 and CAN/ULC S102 surface burning characteristics. Flame Spread Index 25 or less, Smoke Developed Index 50 or less (UL labeled).
- .13 Durability: washability to ASTM D4828, scratch resistance to Hess Rake Test, soil resistance to Simulated Supply Air Diffuser Soiling Test, water repellency.
- .14 Scrubbability: to ASTM D2486, withstands up to 150 scrub cycles using a scrubbability tester.
- .15 Antimicrobial Treatment: guaranteed resistance against growth of mold/mildew and bacteria to ASTM D3273.
- .16 Dimensional Stability: standard resistance to sagging in high humidity conditions up to, but not including standing water and outdoor applications.

2.3 ACCESSORIES

- .1 Shadow Molding: manufacturer's standard commercial quality hot-dipped galvanized steel to ASTM A653/A653M with profile shaped to form 3/4" x 3/4" reveal at perpendicular surface. Exposed surfaces pre-finished galvanized steel in baked polyester paint to match suspension system.
- .2 Attachment Devices: size for 5 times design load indicated in ASTM C635/C635M, Table 1, Direct Hung unless otherwise indicated.
- .3 Hanger Wire: 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 diameter strength.

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 the Contract Administrator.
- .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 systems, acoustical panels, perimeter moldings, and painted grid system in accordance with reviewed shop drawings, manufacturer's printed instructions, and ASTM C636/C636M.
- .2 Install extruded aluminum perimeter trim in accordance with reviewed shop drawings, manufacturer's printed instructions, and ASTM C636/C636M.

- .3 Install intermediate duty suspension system with main runners on 1220 mm centers and cross tees every 610 mm. Install 12-guage wire hanger at 1220 mm on-centre along each main runner and within 150 mm of ends. All wire hangers are to be attached to an industry standard connecting device meeting recommended loading requirements (i.e., inserts, screw eyes, etc.). Install hanger wires plumb and straight spaced. Provide unistrut channels were indicated to avoid conflicts with overhead ductwork or other services.
- .4 Install angle and shadow moldings at intersection of suspended ceiling, vertical surfaces, and lay-in diffusers. Miter corners where wall moldings intersect or install corner caps.
- .5 Install acoustical ceiling 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 angle moldings.

3.4 ADJUSTING AND CLEANING

- .1 Replace damaged and broken panels.
- .2 Clean exposed surfaces of acoustical ceiling, including trim, edge and shadow moldings, 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 03 00 00 – Cast-In-Place Concrete.
- .2 Section 04 00 00 – Masonry.
- .3 Section 06 40 00 – Architectural Woodwork.
- .4 Section 07 92 00 – Joint Sealants.
- .5 Section 09 06 00 – Room Finish Schedule.
- .6 Section 09 29 00 – Gypsum Board.
- .7 Section 09 31 00 – Tiling.

1.2 REFERENCES

- .1 American Society for Testing and Materials (ASTM).
 - .1 ASTM C109/C109M-20b, Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or [50-mm] Cube Specimens).
 - .2 ASTM D412-16, Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers - Tension.
 - .3 ASTM D2047-17, Standard Test Method for Static Coefficient of Friction of Polish-Coated Flooring Surfaces as Measured by the James Machine.
 - .4 ASTM E84-20, Standard Test Method for Surface Burning Characteristics of Building Materials.
 - .5 ASTM E492-09(2016)e1, Standard Test Method for Laboratory Measurement of Impact Sound Transmission Through Floor-Ceiling Assemblies Using the Tapping Machine.
 - .6 ASTM F710-19e1, Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring.
 - .7 ASTM F1303-04(2014), Standard Specification for Sheet Vinyl Floor Covering with Backing.
 - .8 ASTM F1344-15, Standard Specification for Rubber Floor Tile.
 - .9 ASTM F1516-13(2018), Standard Practice for Sealing Seams of Resilient Flooring Products by the Heat Weld Method (when Recommended).
 - .10 ASTM F1861-16, Standard Specification for Resilient Wall Base.
 - .11 ASTM F1869-16a, Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.
 - .12 ASTM F1913-19, Standard Specification for Vinyl Sheet Floor Covering Without Backing.
 - .13 ASTM F2169-15(2020), Standard Specification for Resilient Stair Treads.
 - .14 ASTM F2170-19a, Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes.
 - .15 ASTM F2659-10(2015), Standard Guide for Preliminary Evaluation of Comparative Moisture Condition of Concrete, Gypsum Cement and Other Floor Slabs and Screeds Using a Non-Destructive Electronic Moisture Meter.
 - .16 ASTM F3191-16, Standard Practice for Field Determination of Substrate Water Absorption (Porosity) for Substrates to Receive Resilient Flooring.
- .2 Canadian Standards Association (CSA).
 - .1 CSA B651-18, Accessible Design for the Built Environment.

- .3 American Concrete Institute (ACI).
 - .1 ACI 302.2R-06, Guide for Concrete Slabs that Receive Moisture-Sensitive Flooring Materials.
- .4 South Coast Air Quality Management District (SCAQMD).
 - .1 Rule 1168 - Adhesive and Sealant Applications, 2017.
- .5 Underwriters Laboratories of Canada (ULC).
 - .1 CAN/ULC S101-14, Standard Methods of Fire Endurance Tests of Building Construction and Materials.
 - .2 CAN/ULC S102-18, Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.
 - .3 CAN/ULC S102.2-18, Standard Method of Test for Surface Burning Characteristics of Flooring, Floor Coverings, and Miscellaneous Materials and Assemblies.
- .6 National Floor Covering Association of Canada (NFCA).
 - .1 NFCA Floor Covering Reference Manual.
- .7 Workplace Hazardous Materials Information System (WHMIS).

1.3 SYSTEM DESCRIPTION

- .1 Performance Requirements.
 - .1 The VOC content of the adhesives, sealants, and sealant primers used must be less than the VOC content limits of the South Coast Air Quality Management District (SCAQMD) Rule #1168.

1.4 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 self-cove forming details at inside and outside corners.
 - .3 Submit WHMIS MSDS - Material Safety Data Sheets acceptable to Labour Canada and Health and Welfare Canada for resilient flooring adhesive. Indicate VOC content.
- .2 Samples.
 - .1 Submit samples in accordance with Section 01 33 00.
 - .2 Submit 300 x 300 mm sample of each type of resilient flooring specified for final approval prior to ordering.
- .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 Qualifications.
 - .1 Skilled tradespersons 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 Mock-ups.
 - .1 Resilient Flooring.
 - .1 Prepare mock-up of each resilient flooring installation in accordance with Section 01 45 00.
 - .2 Mock-up to include heatweld seaming, typical self-cove base, self-cove base at bullnosed concrete block, and transition strip to adjacent flooring material.
 - .3 Locate mock-up on site as part of final installation. Mock-up will be reviewed for quality of workmanship, seam welding, and overall appearance.
 - .4 Once approved, mock-up will set standard of acceptance for remaining installations.
 - .3 Pre-Installation Meetings.
 - .1 Convene pre-installation meeting prior to commencement cast-in-place concrete work with concrete trade and Contract Administrator in attendance. Discuss the following:
 - .1 Floor flatness requirements.
 - .2 Convene pre-installation meeting prior to commencement of resilient flooring installation work with resilient flooring trade and Contract Administrator in attendance. Discuss the following:
 - .1 Floor moisture, pH and bond test results.
 - .2 Facility room temperatures/HVAC requirements.
 - .3 Floor flatness.
 - .4 Mock-up requirements.
 - .5 Installation and application procedure for all products specified including floor preparation, adhesive application, seaming methods, self-cove base (inside/outside corners), rubber base, tactile warning stud layout and installation, transitions to adjacent flooring materials, co-ordination with work by others, protection of finished work, etc.
 - .6 Quality of workmanship expected.

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 in upright position, not in leaning position or on side of roll.
- .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.
- .5 Waste Management and Disposal in accordance with Section 01 74 19.

1.7 SITE CONDITIONS

- .1 Moisture content of the concrete subfloor must not exceed requirements of ASTM F1869, ASTM F2170, and ACI 302.2R for work of this Section. The concrete subfloor must be sufficiently cured, and not exhibit negative alkalinity carbonization or dusting.
- .2 Confirm floor flatness requirements specified in Section 03 30 00 have been met. Do not begin resilient flooring installation until deficiencies if any have been corrected.

- .3 Concrete subfloor to be free of foreign materials, and turned over to the flooring installer broom clean.
- .4 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of hazardous materials.
- .5 Maintain air temperature and structural base temperature at flooring installation area is above 20°C, and relative humidity between 35% and 55% for 48 hours before, during and 48 hours after installation.
- .6 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.

1.8 WARRANTY

- .1 Manufacturer's Product Warranty: provide an extended warranty for Work of this Section from date of Total Performance of the Work to term of warranty specified below. Manufacturer hereby warrants resilient flooring against excessive wear, and 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 Contract Administrator and the City, and at no expense to the City.
 - .1 Vinyl Sheet (VS1).
 - .1 5 years against manufacturing and material defects.

1.9 MAINTENANCE

- .1 Comply with requirements of Section 01 78 00.
- .2 Provide maintenance materials as follows:
 - .1 Resilient Flooring (VS1): 5% of floor area for each type, colour and pattern of resilient flooring installed. Sheet material to be supplied in one continuous length.
 - .2 Rubber Base (R): 5% of total length for each type and colour of rubber base installed. Rubber base material to be supplied in one continuous length.
 - .3 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 Vinyl Sheet (VS1).
 - .1 Johnsonite Tarkett iQ Optima.
 - .2 Rubber Base (R).
 - .1 Johnsonite Rubber Wall Base.
 - .3 Rubber Transition Strip (VS1 to concrete).
 - .1 Johnsonite SSR-XX-B Reducer.
 - .4 Rubber Transition Strip (VS1 to resinous flooring).
 - .1 Johnsonite CRS-XX-B Reducer.

- .5 PVC Cove Cap.
 - .1 Johnsonite SCC-XX-A Rounded Cove Cap.
- .6 Cement Based Patching and Skimcoating Compound.
 - .1 Mapei Planipatch® Fast-Setting, Polymer-Modified Cement-Based Patching and Skimcoating Compound.
- .2 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes* of the *Bidding Procedures*.
- .3 Supply similar products from single manufacturer and from same dye lot or production run.

2.2 MATERIALS

- .1 Vinyl Sheet (VS1): 2 mm total thickness, homogeneous single layered sheet vinyl flooring in accordance with ASTM F1913, polyurethane (PUR) reinforced wear layer, 2 m wide rolls, heat welded seams, multi-colours to be selected from manufacturer's entire selection, c/w self-cove base.
- .2 Rubber Base (R): Type TP Thermoplastic Rubber, Group 1 (solid) to ASTM F1861, 100 mm high, standard toe (cove base) profile, 3 mm thick, continuous lengths, no preformed inside or outside corners, colour to be selected from manufacturer's entire selection.

2.3 ACCESSORIES

- .1 Cement Based Patching Compound: ultra fast-drying, self-curing, polymer-modified cement-based patching compound for filling minor voids, holes, cracks, and depressions in concrete prior to the installation of resilient flooring.
- .2 Welding Rods: manufacturer's standard, multi-coloured to match resilient sheet flooring unless otherwise indicated.
- .3 Primers and Adhesives: water-resistant type recommended by flooring manufacturer for use with their product on applicable substrates as well as cement based patching and skimcoating compound.
 - .1 Primer, Vinyl Sheet Adhesive, Rubber Base Adhesive.
 - .1 VOC Content: comply with Rule 1168 of South Coast Air Quality Management District (SCAQMD).
- .4 Cove Former: minimum 19 mm radius vinyl as recommended by manufacturer for use with their product.
- .5 PVC Cove Cap: manufacturer's standard PVC rounded cove cap, colour to be selected from manufacturer's entire selection.
- .6 Rubber Transition Strip: transitional moulding to create a gradual transition between flooring of varying heights.
 - .1 Flooring trade to review profiles specified and advise Contract Administrator if change of profile is recommended to suit flooring materials selected for the project.
- .7 Stainless Steel Transition Strip (resilient flooring to tiling): in accordance with Section 09 31 00.
- .8 Joint Sealants: in accordance with Section 07 92 00.

Part 3 Execution

3.1 EXAMINATION

- .1 Installation of resilient flooring not to be carried out sooner than the specified curing time of concrete subfloor (normal density concrete curing time is approximately 28 calendar days for development of design strength). Report any discrepancies in writing to Contractor and Contract Administrator. Do not proceed until conditions are acceptable for proper installation.
- .2 Smooth flat concrete finish with a tolerance of 3.9 mm (3/16") in 3048 mm (10') in accordance with ASTM F710 to be provided by Section 03 30 00 prior to installation of resilient flooring. Report any discrepancies in writing to Contractor and Contract Administrator. Do not proceed until conditions are acceptable for proper installation.
- .3 Commencement of installation implies acceptance of all conditions noted above.

3.2 PREPARATION

- .1 Prepare concrete substrate for installation of products specified in this Section in accordance with NFCA Floor Covering Reference Manual, ASTM F710, and resilient flooring manufacturer's printed substrate preparation guidelines to ensure proper adhesion of resilient flooring specified. Verify that substrates are dry and free of sealers, curing compounds and other additives. Remove coatings and other substances that are incompatible with adhesives using mechanical methods recommended by manufacturer.
- .2 Further to the floor flatness responsibilities of Section 03 30 00, remove minor sub floor ridges, bumps, or roughness in accordance with NFCA Floor Covering Reference Manual and ASTM F710 that would telegraph through resilient flooring materials and affect installation.
- .3 Further to the floor flatness responsibilities of Section 03 30 00, fill minor low spots and surface irregularities, cracks, and joints in concrete floor surfaces with cement-based patching compound as specified and recommended by resilient flooring manufacturer and in accordance with ASTM F710 prior to commencement of installation of flooring materials. Thickness of patching compound 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.
- .4 Fill all saw-cuts in concrete floors and toppings with cement based patching and skimcoating compound specified or as recommended by resilient flooring manufacturer prior to installation of resilient flooring materials and in accordance with ASTM F710. Patching and skimcoating compound shall be moisture, mildew, and alkali-resilient, and shall provide a minimum 3,000 psi compressive strength after 28 days when tested in accordance with ASTM C109/C109M. Steel trowel and float to leave smooth, flat, hard surface. Prohibit traffic until patching and skimcoating compound is cured and dry.
- .5 Moisture Testing: in accordance with ASTM F710, ASTM F2659 and ASTM F3191, perform relative humidity test to ASTM F2170 and proceed with installation only after substrates have maximum relative humidity of 75%, or perform calcium chloride test to ASTM F1869 and proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb/1000 ft² in 24 hours.
- .6 Alkalinity Testing: perform pH testing to ASTM F710. Proceed with installation only if pH readings are between 7.0 and 8.5.

- .7 All floors to be clean, dry, smooth, level, structurally sound and free from moisture, alkali, dust, solvents, paint, wax, oil, grease, sealing compounds and other contaminants that may prevent the resilient floor adhesive from bonding.
- .8 Materials used in sub-floor preparation to be as recommended by resilient flooring manufacturer, and chemically and physically compatible with resilient flooring products specified to ensure proper adhesion.
- .9 Store materials on end or as recommended by manufacturer in designated areas ready for installation and allow to acclimatize at min 20°C temperature for at least 48 hours prior to installation.
- .10 Vacuum all areas to be covered with resilient flooring immediately prior to spreading adhesive.
- .11 Perform bond testing to determine compatibility of resilient flooring to the substrate. Prime concrete as required to resilient flooring manufacturer's printed instructions.
- .12 At locations to receive self-coved base confirm that gypsum board walls terminate no more than 6 mm above subfloor in accordance with Section 09 29 00.

3.3 INSTALLATION

- .1 Vinyl Sheet (VS).
 - .1 Install vinyl sheet flooring in accordance with reviewed shop drawings and manufacturer's printed installation instructions.
 - .2 Apply manufacturer recommended adhesive uniformly using trowel in accordance with manufacturer's recommendations. Do not spread more adhesive than can be covered before initial set takes place. If adhesive over dries, remove and re-coat affected areas.
 - .3 Lay flooring with seams parallel to building lines to produce minimum number of seams in accordance with reviewed shop drawings.
 - .4 Run vinyl sheet floor grain in one direction and as per manufacturer's printed instructions.
 - .5 Rout joints and heatweld all seams with welding rods in accordance with ASTM F1516, using approved heat welding equipment. Welding rods to be trimmed neatly and left flush with surface of material. Complete trimming after cool down. Blistering or scratching of flooring material along heat welded seams will not be accepted.
 - .6 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.
 - .7 Terminate flooring at centerline of door in openings where adjacent floor finish or colour is dissimilar.
 - .8 Install transition strips at unprotected or exposed edges where flooring terminates or abuts another flooring material.
 - .9 Install resilient sheet flooring in same sequence as produced in factory to minimize colour variations.
 - .10 Continue flooring over areas which will be under built-in furniture, cabinets, equipment, lockers, etc.
 - .11 Install flooring into floor drain collar. Install fastening clamp and strainer.
 - .12 As installation progresses and after installation, roll flooring with 45 kg roller to ensure full and consistent adhesion, roll-out adhesive ridges (trowel marks), and eliminate air pockets in accordance with manufacturer's recommendations.
 - .13 After installing, allow setting time of 48 hours before cleaning. Initial cleaning and preparation in accordance with manufacturer's maintenance instructions.

- .14 Self-Cove Base (SC).
 - .1 Install self-cove base in accordance with reviewed shop drawings and manufacturer's printed installation instructions.
 - .2 Form cove bases in one piece of same material as adjacent resilient sheet flooring extending up wall to height of 100 mm unless otherwise indicated.
 - .3 Install flooring material with continuous seam parallel to building walls as border coving.
 - .4 Use longest practical lengths to minimize vertical joints. Where vertical joints occur, line with joints in field.
 - .5 Install cove base with PVC cover former. At door frames and other projections taper cove former 300 mm back from frame to provide flush cove at face of frame or projection.
 - .6 Adhere self-cove bases to wall surfaces with same adhesive as for resilient sheet flooring.
 - .7 External (outside) corners: form material using butterfly piece fitted net without any gaps. Heat weld seams in accordance with manufacturers current published installation procedures. Side fill piece (boot) with welded seam along base of self-cove not permitted.
 - .8 Internal (inside) corner: form and cut material in line with corner fitted net without any gaps. Heat weld seams in accordance with manufacturers current published installation procedures.
 - .9 Install PVC cap at top of exposed edge unless otherwise indicated. Cover top edge of PVC cap with continuous neat bead of silicone sealant. Colour of sealant to match adjacent wall surface.
 - .10 Install self-cove base at toe space of casework unless indicated otherwise.
- .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. Scribe and fit to door frames and other obstructions.
 - .5 Miter internal corners and wrap external corners. Premoulded corners not permitted.
 - .6 Install rubber base at toe space of casework unless indicated otherwise.

3.4 FIELD QUALITY CONTROL

- .1 Instruct resilient flooring manufacturer representative to visit site at commencement of work as well as periodically throughout duration of work to confirm that conditions are acceptable prior to flooring installation, and that proper procedures are followed during flooring installation.

3.5 CLEANING

- .1 Remove excess adhesive from floor, base and wall surfaces without damage. 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.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 03 30 00 – Cast-In-Place Concrete.
- .2 Section 09 06 00 – Room Finish Schedule.
- .3 Section 09 65 00 – Resilient Flooring.

1.2 REFERENCES

- .1 American Society for Testing and Materials (ASTM).
 - .1 ASTM D4541-22, Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers.
 - .2 ASTM D638-22, Standard Test Method for Tensile Properties of Plastics.
 - .3 ASTM D2794-93(2024), Standard Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact).
 - .4 ASTM D4060-19, Standard Test Method for Abrasion Resistance of Organic Coatings by the Taber Abraser.
 - .5 ASTM D695-23, Standard Test Method for Compressive Properties of Rigid Plastics.
 - .6 ASTM D7234-22, Standard Test Method for Pull-Off Strength of Coatings on Concrete Using Portable Pull-Off Adhesion Testers.
 - .7 ASTM C579-23, Standard Test Methods for Compressive Strength of Chemical-Resistant Mortars, Grouts, Monolithic Surfacing, and Polymer Concretes.
 - .8 ASTM C307-23, Standard Test Method for Tensile Strength of Chemical-Resistant Mortar, Grouts, and Monolithic Surfacing.
 - .9 ASTM C580-18(2023), “Standard Test Method for Flexural Strength and Modulus of Elasticity of Chemical-Resistant Mortars, Grouts, Monolithic Surfacing, and Polymer Concretes.
 - .10 ASTM D2240-15(2021), Standard Test Method for Rubber Property—Durometer Hardness.
 - .11 ASTM C413-18(2023), Standard Test Method for Absorption of Chemical-Resistant Mortars, Grouts, Monolithic Surfacing, and Polymer Concretes.
- .2 Workplace Hazardous Materials Information System (WHMIS).

1.3 SUBMITTALS

- .1 Product Data.
 - .1 Submit product data in accordance with Section 01 33 00.
 - .2 Submit manufacturer’s product specifications including technical data and installation instructions.
 - .3 Submit WHMIS MSDS - Material Safety Data Sheets acceptable to Labour Canada and Health and Welfare Canada indicating VOC content.
- .2 Samples.
 - .1 Submit samples in accordance with Section 01 33 00.
 - .2 Submit three (3) - 300 mm x 300 mm samples of resinous flooring in colour specified, installed on plywood backing, each panel showing slightly different degrees of slip resistance for Contract Administrator’s review. Samples to include integral cove base with zinc cove strip as specified.

- .3 Contract Administrator may request resubmittal of samples until desired degree of slip-resistance is attained. Allow for up to two (2) resubmittals.
- .4 Keep approved sample on site to ensure consistency with slip-resistance of field installed flooring.
- .3 Closeout Submittals.
 - .1 Provide maintenance data including maintenance procedures for stain removal and surface repair for incorporation into Operation and Maintenance Manual specified in Section 01 78 00.

1.4 QUALITY ASSURANCE

- .1 Qualifications.
 - .1 Manufacturer: company specializing in manufacturing the Products specified in this section with minimum three (3) years documented experience.
 - .2 Installer: company specializing in performing the work of this section with minimum three (3) years documented experience and approved by the manufacturer.
- .2 Single Source Responsibility and Qualifications.
 - .1 Obtain resinous flooring materials, fully compatible, from a single manufacturer with not less than 10 years of successful experience in manufacturing and installing principal materials described in this Section.
- .3 Mock-ups.
 - .1 Prepare mock-up of resinous flooring installation in accordance with Section 01 45 00.
 - .2 Prepare mock-up on site as part of final installation in area selected by the Contract Administrator. Mock-up will be reviewed for quality of workmanship, colour, texture, cove base complete-with zinc cove strip, and overall appearance.
 - .3 Once approved, mock-ups will set standard of acceptance for remaining installations.
 - .4 Do not proceed with resinous flooring installation until mock-up area is complete and approved by Contract Administrator.
- .4 Pre-installation Meeting.
 - .1 Convene pre-installation meeting prior to commencement cast-in-place concrete work with concrete trade and Contract Administrator in attendance. Discuss the following:
 - .1 Floor flatness requirements.
 - .2 Convene pre-installation meeting prior to commencement of the resinous flooring installation work with resinous flooring trade and Contract Administrator in attendance. Discuss the following:
 - .1 Floor moisture, pH and bond test results.
 - .2 Facility room temperatures/HVAC requirements.
 - .3 Floor flatness.
 - .4 Mock-up requirements.
 - .5 Installation and application procedures for all products specified including floor preparation, resinous floor system application, curing, integral cove base (inside/outside corners), transition to adjacent flooring materials, co-ordination with work by others, protection of finished work, etc.
 - .6 Quality of workmanship, finish, and texture expected.

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, heated 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.
- .5 Waste Management and Disposal in accordance with Section 01 74 19.

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 Do not install the work of this Section outside of the following environmental ranges without manufacturer's written acceptance:
 - .1 Material Temperature: precondition material for at least 24 hours between 18°C and 30°C.
 - .2 Ambient and Substrate Temperature: min/max 10°/30°C.
 - .3 Substrate temperature must be at least 3°C above measured dew point.
 - .4 Relative Ambient Humidity: maximum ambient humidity 85% (during application and curing).
 - .5 Substrate Moisture: moisture content of concrete substrate must be $\leq 4\%$ by mass as measured with manufacturer recommended concrete moisture meter.
- .3 Maintain constant ambient room temperature for 48 hours before, during and after installation or until cured. Min temperature of 10°C and max temperature of 30°C. Do not apply product while ambient and substrate temperatures are rising.
- .4 Ensure adequate ventilation and airflow.
- .5 Erect suitable barriers and post legible signs at points of entry to prevent traffic and trades from entering the work area during application and curing period of the floor.

Part 2 Products

2.1 MANUFACTURERS

- .1 Basis of Design Products.
 - .1 Resinous Flooring (REF1).
 - .1 MAPEI's Mapecoat Universal Broadcast System with DQ/Mapeflake.
 - .1 Step 1 - Primer: Primer SN (9-15 mils).
 - .2 Step 2 - Broadcast Aggregate: Mapefloor DQ (0.6lbs/ft²).
 - .3 Step 3 - Broadcast Coat: Mapefloor I 302 – Signal white (9-15 mils).
 - .4 Step 4 - Flake Broadcast: Mapeflakes (Lbs required = 12% of total square footage).

- .5 Step 5 - Sealer Coat: Mapecoat Universal (9-15 mils, 1 to 2 coats, depending on desired build).
- .6 Step 6 - Urethane Matte Sealer: Mapefloor Finish 58W (2-4 mils, 2 Coats recommended).
- .2 Resinous Flooring (REF2).
 - .1 MAPEI's Mapecoat Universal Decorative Mapeflake System.
 - .1 Step 1 - Primer: Primer SN (9-15 mils).
 - .2 Step 2 - Broadcast Coat: Mapefloor I 302 SL (9-15 mils).
 - .3 Step 3 - Flake Broadcast: Mapeflakes (Lbs required = 12% of total square footage).
 - .4 Step 4 - Sealer Coat: Mapecoat Universal (9-15 mils, 1 to 2 coats, depending on desired build).
 - .5 Step 5 - Urethane Matte Sealer: Mapefloor Finish 58W (2-4 mils, 2 Coats recommended).
 - .3 Troweled Epoxy Integral Cove Base (REF1, REF2).
 - .1 Step 1 - Cove Primer: Mapefloor I 900.
 - .2 Step 2 - Cove Mortar: Mapefloor EP 20.
 - .3 Step 3 - Broadcast Coat: Mapefloor I 302 SL.
 - .4 Step 4 - Flake Broadcast: Mapeflakes.
 - .5 Step 5 - Sealer: Mapecoat Universal.
 - .4 Epoxy Patching Mortar.
 - .1 MAPEI's Mapefloor Patch.
- .2 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes of the Bidding Procedures*.
- .3 Supply products from single manufacturer and from same dye lot or production run.

2.2 MATERIALS

- .1 Resinous Flooring (REF1).
 - .1 Resinous Flooring System: nominal 3 mm 100% solids, epoxy decorative vinyl flake broadcast flooring system comprised of a penetrating two-component epoxy primer with decorative quartz aggregate, two-component epoxy resin broadcast system, decorative vinyl flake broadcast layer, two coats of high-gloss, epoxy resin seal coat and two coats of aliphatic polyurethane coating in water dispersion with matte finish complete-with integral cove base with zinc cove strip at top of cove, and in accordance with the follow standards:
 - .1 Primer.
 - .1 Tensile Strength: >435 psi in accordance with ASTM D4541.
 - .2 Broadcast Coat.
 - .1 Tensile Strength: 3,240 psi in accordance with ASTM D638.
 - .2 Impact Resistance in accordance with ASTM D2794:
 - .1 Initial Indentation: 5.00 ft.-lbs.
 - .2 Initial Cracking: 10.33 ft.-lbs.
 - .3 Initial Delamination: No delamination.
 - .3 Abrasion resistance: - 0.0032 U.S. oz., in accordance with ASTM D4060
 - .4 Compressive strength: 7 days: 9,979 psi; 28 days: 10,254 psi in accordance to ASTM D695.
 - .5 Coefficient of Friction in accordance with ASTM D1894-61T:

- .1 Steel: Static: 0.31 Kinetic: 0.26.
- .2 Neolite rubber: Static: 0.37 Kinetic: 0.41.
- .3 Sealer Coat.
 - .1 Tensile strength: 3,050 psi in accordance to ASTM D638.
 - .2 Abrasion resistance: - 0.0015 U.S. oz. in accordance with ASTM D4060.
 - .3 Compressive strength in accordance with ASTM D695:
 - .1 7 days: 3,756 psi.
 - .2 28 days: 5,226 psi.
 - .4 Elongation: 25.4% in accordance with ASTM D638
 - .5 Pull-off strength: > 508 psi in accordance with ASTM D7234 (substrate failure)
 - .6 Coefficient of friction:
 - .1 Steel: Static: 0.17; kinetic 0.13.
 - .2 Neolite rubber: Static 0.38; kinetic 0.27.
- .4 Urethane Matte Sealer.
 - .1 Tensile strength: 302.71 psi in accordance with ASTM D638
 - .2 Elongation: 31.46% in accordance with ASTM D638
 - .3 Pull-off strength: 4.479 n/mm2 in accordance with ASTM D7234
 - .4 Abrasion resistance: 0.059 g (substrate failure) in accordance with ASTM D4060.
- .2 Colour(s)/Pattern(s): to be selected by Contract Administrator.
- .2 Resinous Flooring (REF2).
 - .1 Resinous Flooring System: nominal 1 mm 100%, epoxy decorative vinyl flake broadcast flooring system comprised of a penetrating two-component epoxy primer, two – component epoxy resin broadcast system, decorative vinyl flake broadcast layer, two coats of high-gloss, epoxy resin seal coat and two coats of aliphatic polyurethane coating in water dispersion with matte finish complete-with integral cove base with zinc cove strip at top of cove, and in accordance with the follow standards:
 - .1 Primer.
 - .1 Tensile Strength: >435 psi in accordance with ASTM D4541.
 - .2 Broadcast Coat.
 - .1 Tensile Strength: 3,240 psi in accordance with ASTM D638.
 - .2 Impact Resistance in accordance with ASTM D2794:
 - .1 Initial Indentation: 5.00 ft.-lbs.
 - .2 Initial Cracking: 10.33 ft.-lbs.
 - .3 Initial Delamination: No delamination.
 - .3 Abrasion resistance: - 0.0032 U.S. oz., in accordance with ASTM D4060.
 - .4 Compressive strength: 7 days: 9,979 psi; 28 days: 10,254 psi in accordance with ASTM D695.
 - .5 Coefficient of Friction in accordance with ASTM D1894-61T:
 - .1 Steel: Static: 0.31 Kinetic: 0.26.
 - .2 Neolite rubber: Static: 0.37 Kinetic: 0.41.
 - .3 Sealer Coat.
 - .1 Tensile strength: 3,050 psi in accordance with ASTM D638.
 - .2 Abrasion resistance: - 0.0015 U.S. oz. in accordance with ASTM D4060.
 - .3 Compressive strength in accordance with ASTM D695:
 - .1 7 days: 3,756 psi.
 - .2 28 days: 5,226 psi.

- .4 Elongation: 25.4% in accordance with ASTM D638.
- .5 Pull-off strength: > 508 psi in accordance with ASTM D7234 (substrate failure).
- .6 Coefficient of friction:
 - .1 Steel: Static: 0.17; kinetic 0.13.
 - .2 Neolite rubber: Static 0.38; kinetic 0.27.
- .4 Urethane Matte Sealer.
 - .1 Tensile strength: 302.71 psi in accordance with ASTM D638.
 - .2 Elongation: 31.46% in accordance with ASTM D638.
 - .3 Pull-off strength: 4.479 n/mm² in accordance with ASTM D7234.
 - .4 Abrasion resistance: 0.059 g (substrate failure) in accordance with ASTM D4060.
- .2 Colour(s)/Pattern(s): to be selected by Contract Administrator.
- .3 Troweled Epoxy Integral Cove Base complete-with Zinc Cove Strip at top of cove (REF1, REF2).
 - .1 Troweled Epoxy Integral Cove Base System: two-component, pre-filled epoxy primer, three-component epoxy resin mortar, two – component epoxy resin broadcast system, decorative vinyl flake broadcast layer and two coats of high-gloss, epoxy resin seal coat. Cove Base is applied at thickness of 3 mm and to height indicated, and cures to a hard, impact-resistant mortar which exhibits excellent abrasion, wear and chemical resistance, complete-with 18-gauge, 3 mm x 13 mm zinc cove strip at top of cove, and in accordance with the follow standards:
 - .1 Primer.
 - .1 Tensile Strength: >435 psi in accordance with ASTM D4541.
 - .2 Cove Mortar.
 - .1 Compressive Strength: 11,893 psi in accordance to ASTM C579.
 - .2 Tensile Strength: 2,255 psi in accordance to ASTM C307.
 - .3 Flexural Strength: 5,990 psi in accordance to ASTM C580.
 - .4 Flexural Modulus of Elasticity: 2,477,100 psi in accordance to ASTM C580 .
 - .5 Surface Hardness: 83 in accordance to ASTM D2240.
 - .6 Water absorption 0.08% in accordance to ASTM C413.
 - .3 Broadcast Coat.
 - .1 Tensile Strength: 3,240 psi in accordance with ASTM D638.
 - .2 Impact Resistance in accordance with ASTM D2794:
 - .1 Initial Indentation: 5.00 ft.-lbs.
 - .2 Initial Cracking: 10.33 ft.-lbs.
 - .3 Initial Delamination: No delamination.
 - .3 Abrasion resistance: - 0.0032 U.S. oz. in accordance with ASTM D4060.
 - .4 Compressive strength in accordance with ASTM D695:
 - .1 7 days: 9,979 psi.
 - .2 28 days: 10,254 psi.
 - .5 Coefficient of Friction in accordance with ASTM D1894-61T:
 - .1 Steel: Static: 0.31 Kinetic: 0.26.
 - .2 Neolite rubber: Static: 0.37 Kinetic: 0.41.
 - .2 Colour(s)/Pattern(s): to be selected by Contract Administrator.

- .4 Epoxy Patching Mortar.
 - .1 Epoxy Patching Mortar: non-sag, lightweight two-component, 1:1 ratio by volume, 100% solids epoxy patching mortar which exhibits excellent bond strength, and in accordance with the follow standards:
 - .1 Compressive Strength: 5,270 psi in accordance with ASTM C579.
 - .2 Tensile Strength: 1,469 psi in accordance with ASTM D638.
 - .3 Flexural Strength: 2,942 psi in accordance with ASTM C580.
 - .4 Pull-off Strength: > 396 psi (> 2.73 MPa) failure in concrete substrate in accordance with ASTM D7234.
 - .5 Surface hardness in accordance with ASTM D2240:
 - .1 24 hours: 62.
 - .2 7 days: 69.
 - .3 28 days: 70.
- .5 Sealants: elastomeric sealant, gun grade, non-sag, of type recommended by resinous flooring manufacturer.
- .6 Transition Strips: stainless steel of type recommended by manufacturer.

Part 3 Execution

3.1 EXAMINATION

- .1 Examine surfaces to receive resinous flooring for defects and/or site conditions detrimental to proper application and performance of resinous flooring system. Do not begin surface preparation or application until unacceptable conditions have been corrected.
- .2 Smooth flat concrete finish with a tolerance of 3.9 mm (3/16") in 3048 mm (10') to be provided by Section 03 30 00 prior to installation of resinous flooring. Report any discrepancies in writing to Contractor and Contract Administrator. Do not proceed until conditions are acceptable for proper installation.
- .3 Verify floor surfaces are clean, sound and dry, and free of substances and contaminants that may impair adhesion, and work of others such as pipes and conduit penetrating substrate is complete. Report defects and non-conforming work to Contract Administrator and await remedial measures.
- .4 Pre-Installation Testing.
 - .1 Measure and confirm acceptable conditions for Substrate Moisture Content, Ambient Relative Humidity, Ambient and Surface Temperature and Dew Point.
 - .2 Concrete substrate to have a minimum compressive strength of 25 MPa (3,625 psi) at 28 days and a minimum of 1.5 MPa (218 psi) in tension at time of application.
 - .3 Report any discrepancies in writing to Contractor and Contract Administrator. Do not proceed until conditions are acceptable for proper installation.
- .5 Ensure concrete substrate conforms to the minimum requirements of the resinous flooring manufacturer.
- .6 Commencement of installation implies acceptance of all conditions noted above.

3.2 PREPARATION

- .1 Concrete substrate preparation to be as recommended by resinous flooring manufacturer and may include use of diamond grinder, sander, shotblast method and/or other mechanical means for removal of bond inhibiting materials such as curing compounds, dust, form release agents or laitance. Concrete preparation to be in accordance with ICRI Concrete Surface Profile CSP3 minimum prior to coating application.
- .2 Floors to be clean, dry, smooth, level, structurally sound and free from moisture, alkali, dust, solvents, paint, wax, oil, grease, asphalt-based adhesive, sealing compounds and other contaminants that may prevent the resinous flooring from bonding.
- .3 Further to the floor flatness responsibilities of Section 03 30 00, remove sub-floor ridges and bumps that would transmit through resinous flooring and affect installation. Pre-fill surface irregularities, holes and cracks in accordance with manufacturer's recommendations
- .4 Further to the floor flatness responsibilities of Section 03 30 00, fill minor low spots and surface irregularities, cracks, joints, and saw-cuts in concrete floor surfaces with epoxy patching mortar recommended by resinous flooring manufacturer, prior to commencement of installation of flooring surface. Thickness of patching mortar to ensure flat floor and that installation of resinous 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.
- .5 Materials used in sub-floor preparation to be as recommended by resinous flooring manufacturer and chemically and physically compatible with resinous flooring product.
- .6 Perform bond testing to determine compatibility of resinous flooring to the substrate. Prime concrete as required to resinous flooring manufacturer's printed instructions.

3.3 INSTALLATION

- .1 General: apply each component of resinous flooring system in compliance with manufacturer's printed instructions to produce a uniform monolithic wearing surface of thickness indicated, uninterrupted except at expansion joints or other types of joints (if any), indicated or required. Allow proper cure time for each installation step. Fill joints with manufacturer recommended sealant.
- .2 Resinous Flooring (REF1).
 - .1 Primer: mix and apply primer over properly prepared substrate with strict adherence to manufacturer's installation procedures and coverage rates
 - .2 Broadcast: immediately broadcast quartz silica aggregate into the wet primer using into the wet primer using serrated trowel or squeegee. Strict adherence to manufacturer's installation procedures and coverage rates is imperative.
 - .3 Undercoat: mix base material according to manufacturer's recommended procedures. Uniformly spread mixed material over previously applied substrate using manufacturer's installation tool. Roll material with strict adherence to manufacturer's installation procedures and coverage rates.
 - .4 Broadcast: immediately broadcast decorative flakes into the wet undercoat. Strict adherence to manufacturer's installation procedures and coverage rates is imperative.
 - .5 Sealer Coat: remove excess unbonded flakes by lightly brushing and vacuuming the floor surface. Mix and apply sealer with strict adherence to manufacturer's installation procedures.

- .6 Urethane Matte Sealer: lightly sand first sealer coat. Mix and apply second sealer coat with strict adherence to manufacturer's installation procedures.
- .7 Sealers to be applied in two coats at 6-8 mils per coat immediately after mixing using high quality medium nap rollers. Strict adherence to manufacturer's coverage rates must be maintained.
- .3 Resinous Flooring (REF2).
 - .1 Primer: mix and apply primer over properly prepared substrate with strict adherence to manufacturer's installation procedures and coverage rates
 - .2 Broadcast: immediately apply an intermediate coat of broadcast system into the wet primer using serrated trowel or squeegee. Strict adherence to manufacturer's installation procedures and coverage rates is imperative.
 - .3 Undercoat: mix base material according to manufacturer's recommended procedures. Uniformly spread mixed material over previously applied substrate using manufacturer's installation tool. Roll material with strict adherence to manufacturer's installation procedures and coverage rates.
 - .4 Broadcast: immediately broadcast decorative flakes into the wet undercoat. Strict adherence to manufacturer's installation procedures and coverage rates is imperative.
 - .5 Sealer Coat: remove excess unbonded flakes by lightly brushing and vacuuming the floor surface. Mix and apply sealer with strict adherence to manufacturer's installation procedures.
 - .6 Urethane Matte Sealer: lightly sand first sealer coat. Mix and apply second sealer coat with strict adherence to manufacturer's installation procedures.
 - .7 Sealers to be applied in two coats at 6-8 mils per coat immediately after mixing using high quality medium nap rollers. Strict adherence to manufacturer's coverage rates must be maintained.
- .4 Troweled Epoxy Integral Cove Base (REF1, REF2).
 - .1 Form integral cove base in accordance with manufacturer's printed instructions. Provide zinc cove strip at top of all cove base edges.
 - .2 Ensure surfaces to receive coved base are strong, durable and dry. Fill voids, recessed joints and irregularities with epoxy filler.
 - .3 Cove base to receive broadcast and clear epoxy top coats to consistent with the flooring system.
- .5 Follow manufacturer's printed instructions on terminations and connections to walls, drains, doorways, columns and floor-to-floor transitions.
- .6 Apply resinous flooring with care to ensure that no laps, voids, or other marks or irregularities are visible. Apply to achieve appearance of uniform colour, sheen and texture to match the Contract Administrator accepted samples.
- .7 Cure resinous flooring materials in compliance with manufacturer's instructions, taking care to prevent contamination during stages of application and prior to completion of curing process. Close area of application for a minimum of 72 hours after application.

3.4 FIELD QUALITY CONTROL

- .1 Upon request, conduct tests on installed materials, in presence of the Contract Administrator, to confirm overall system thickness and bond strength.
- .2 Remove and replace non-conforming areas.

3.5 CLEANING

- .1 Remove temporary covering and clean resinous flooring just prior to final inspection. Use cleaning materials and procedures recommended by resinous flooring manufacturer.

3.6 PROTECTION

- .1 Prohibit traffic on floor finish until fully cured.
- .2 Protect resinous flooring materials from damage and wear during construction operation. Where temporary covering is required for this purpose, provide plywood runways and comply with manufacturer's recommendations for additional protective materials and method of application.

3.7 SCHEDULES

- .1 Refer to Section 09 06 00.

END OF SECTION

Part 1 General

1.1 SUMMARY

- .1 Section Includes: all labor, materials, tools and other equipment, services and supervision required to complete all exterior and interior painting as indicated in Door Schedule, and Room Finish Schedule, and 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 paint manufacturer's printed instructions and limits defined under Master Painters Institute (MPI) preparation requirements.
 - .2 Priming and painting of all new exposed surfaces indicated.
 - .3 Painting of all semi-concealed areas (e.g. inside of light troughs and valances, behind grilles, and projecting edges above and below sight lines).
 - .4 Painting of exposed to view mechanical (heating, ventilating and plumbing) ductwork and equipment, and electrical work, unless pre-finished.
 - .5 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.
 - .6 Painting (exposed surface and edges) of plywood used as backboards for mounting electrical/data equipment.
- .3 Perform 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 City may be cleaned by the City and charged to the Contractor. All work is to pass the inspection of the City and Contract Administrator.
- .4 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 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 04 00 00 – Masonry.
- .2 Section 05 12 23 – Structural Steel for Buildings.
- .3 Section 05 21 00 – Steel Joist Framing.
- .4 Section 05 21 00 – Steel Decking.
- .5 Section 05 50 00 – Metal Fabrications.
- .6 Section 06 10 00 – Rough Carpentry.
- .7 Section 08 06 00 – Door Schedule.
- .8 Section 08 11 00 – Metal Doors and Frames.
- .9 Section 09 06 00 – Room Finish Schedule.
- .10 Section 09 29 00 – Gypsum Board.

- .11 Mechanical Specifications.
- .12 Electrical Specifications.

1.3 REFERENCES

- .1 Master Painters Institute (MPI).
 - .1 MPI Architectural Painting Specification Manual, including Identifiers, Evaluation, Systems, Preparation and Approved Product List (hereafter referred to as MPI Painting Manual).
- .2 South Coast Air Quality Management District (SCAQMD).
 - .1 Rule 1113 – Architectural Coatings, 2016.
- .3 Green Seal Environmental Standards.
 - .1 GS-11 – Paints, Coatings, Stains, and Sealers, 2015.

1.4 SYSTEM DESCRIPTION

- .1 Performance Requirements.
 - .1 The VOC content of primers and paints used must be less than the VOC content limits stated in Green Seal Environmental Standard GS-11 and SCAQMD Rule 1113.
 - .2 Use only MPI listed materials having min. E2 rating.

1.5 SUBMITTALS

- .1 Samples.
 - .1 Submit samples in accordance with Section 01 33 00.
 - .2 Provide 300 mm x 300 mm sample of each paint colour specified in gloss/sheen required to MPI Painting Manual standards for review and approval.
 - .3 Once approved, samples become acceptable standard of finish quality and workmanship for similar on-site work.
- .2 Quality Assurance/Control Submittals.
 - .1 Submit list of all painting materials to Contract Administrator for review prior to ordering materials. If requested, provide invoice list of all paint materials ordered for project work indicating manufacturer, types and quantities for verification and compliance with specification and design requirements.
 - .2 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.
- .3 Closeout Submittals.
 - .1 Provide maintenance data for incorporation into Operation and Maintenance Manual specified in Section 01 78 00.
 - .2 Provide itemized list complete with manufacturer, paint type and colour coding for all colours used for the City's later use in maintenance.
 - .3 Provide properly packaged maintenance materials as noted herein and obtain signed receipt.

1.6 QUALITY ASSURANCE

- .1 Qualifications.
 - .1 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.
- .2 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.
- .3 Certifications.
 - .1 All materials, preparation and workmanship to conform to requirements of MPI Painting Manual unless otherwise indicated.
 - .2 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).
 - .3 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.
 - .4 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.
- .4 Mock-ups.
 - .1 When requested by the City or Contract Administrator, prepare and paint designated surface, area, room or item (in each color scheme) to requirements specified herein, with specified paint or coating showing selected colors, 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 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 degrees 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 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 Section 01 74 00.
- .7 Waste Management and Disposal in accordance with Section 01 74 19.

1.8 SITE CONDITIONS

- .1 Perform no painting work unless environmental conditions are within MPI and paint manufacturer's requirements or until adequate weather protection is provided.
- .2 Where required, provide suitable weatherproof covering and sufficient heating facilities to maintain minimum ambient air and substrate temperatures for 24 hours before, during, and after paint application.
- .3 Perform no interior painting 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.
- .4 Perform no painting work when relative humidity is above 85% or when dew point is less than 3°C variance between air/surface temperatures.
- .5 Apply paint only to dry, clean, and adequately prepared surfaces in areas where dust is not generated by construction activities such that airborne particles will not affect quality of finished surfaces.

1.9 MAINTENANCE MATERIALS

- .1 At project completion provide 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.

Part 2 Products

2.1 MANUFACTURERS

- .1 Basis of Design Products.
 - .1 Concrete Masonry Units (CMU): INT 4.2D, High Performance Architectural Latex (over latex block filler), (MPI Gloss Level G3 and G5).
 - .1 Block Filler, Latex, Interior/Exterior – MPI #4.
 - .1 PPG Dulux X-Pert Int/Ext Acrylic Latex Block Filler #36250.
 - .2 Latex, Interior, High Performance Architectural, (MPI Gloss Level G3) – MPI #139 (2 coats).
 - .1 PPG Dulux Diamond Interior 100% Acrylic Pearl #14220.
 - .3 Latex, Interior, High Performance Architectural, Semi-Gloss (MPI Gloss Level G5) – MPI #141 (2 coats), locations to be determined by the Contract Administrator.
 - .1 PPG Dulux Diamond Interior 100% Acrylic Latex Semi-Gloss #13210.

- .2 Concrete Masonry Units (CMU where indicated EP): INT 4.2K, W.B. Light Industrial Coating (MPI Gloss Level G3).
 - .1 Latex Block Filler – MPI #4.
 - .1 PPG Dulux X-Pert Int/Ext Acrylic Latex Block Filler #36250.
 - .2 Light Industrial Coating, Interior, Water Based (MPI Gloss Level G3) - MPI #151 (2 coats).
 - .1 PPG Pitt-Glaze WB1 Interior Eggshell Pre-Catalyzed Water-Borne Acrylic Epoxy #16-310C.
- .3 Concrete (underside of hollow core planks where indicated): INT 3.1C, High Performance Architectural Latex (over w.b. alkali-resistant primer), (MPI Gloss Level G2).
 - .1 Primer, Alkali-Resistant, Water Based – MPI #3.
 - .1 PPG Dulux Gripper Int/Ext Universal Acrylic Primer/Sealer #60000A.
 - .2 Latex, Interior, High Performance Architectural, (MPI Gloss Level G2) – MPI #138 (2 coats).
 - .1 PPG Dulux Diamond Interior 100% Acrylic Eggshell #15110.
- .4 Gypsum Board (wall and ceiling surfaces): INT 9.2B, High Performance Architectural Latex (over latex primer/sealer), (MPI Gloss Level G3 and G5).
 - .1 Primer Sealer, Latex, Interior – MPI #50.
 - .1 PPG Dulux Lifemaster Interior Acrylic Primer/Sealer #59113.
 - .2 Latex, Interior, High Performance Architectural, (MPI Gloss Level G3) – MPI #139 (2 coats).
 - .1 PPG Dulux Diamond Interior 100% Acrylic Pearl #14220.
 - .3 Latex, Interior, High Performance Architectural, Semi-Gloss (MPI Gloss Level G5) – MPI #141 (2 coats), locations to be determined by the Contract Administrator.
 - .1 PPG Dulux Diamond Interior 100% Acrylic Latex Semi-Gloss #13210.
- .5 Gypsum Board (wall and ceiling surfaces where indicated EP): INT 9.2L, W.B. Light Industrial Coating (over latex primer sealer), (MPI Gloss Level G3).
 - .1 Primer Sealer, Latex, Interior – MPI #50.
 - .1 PPG Dulux Lifemaster Interior Acrylic Primer/Sealer #59113.
 - .2 Light Industrial Coating, Interior, Water Based (MPI Gloss Level G3) - MPI #151 (2 coats).
 - .1 PPG Pitt-Glaze WB1 Interior Eggshell Pre-Catalyzed Water-Borne Acrylic Epoxy #16-310C.
- .6 Galvanized Metal and Metal Fabrications (interior HM doors and frames, stair railings, pipe grid, misc. metal): INT 5.3M, High Performance Architectural Latex (over w.b. galvanized primer), (MPI Gloss Level G5).
 - .1 Primer, Galvanized, Water Based – MPI #134.
 - .1 PPG Pitt-Tech Plus 4020 PF.
 - .2 Latex, Interior, High Performance Architectural, Semi-Gloss (MPI Gloss Level G5) – MPI #141 (2 coats).
 - .1 PPG Diamond Interior 100% Acrylic Semi-Gloss #13210.
- .7 Galvanized Metal (exterior HM doors and frames, exterior open-air entry canopy framing including roof decking): EXT 5.3J, W.B. Light Industrial Coating (over w.b. primer), (MPI Gloss Level G5).
 - .1 Primer, Galvanized, Water Based – MPI #134.
 - .1 PPG Pitt-Tech Plus 4020 PF.
 - .2 Latex, Exterior Semi-Gloss (MPI Gloss Level G5) – MPI #11 (2 coats).
 - .1 PPG Pitt-Tech Plus Int/Ext Semi-Gloss DTM Industrial Enamel #90-1210.

- .8 Galvanized Metal (exposed ductwork, pipes, conduit where indicated): INT 5.3M, High Performance Architectural Latex (over w.b. galvanized primer), (MPI Gloss Level G2).
 - .1 Primer, Galvanized, Water Based – MPI #134.
 - .1 PPG Pitt-Tech Plus 4020 PF.
 - .2 Latex, Interior, High Performance Architectural, (MPI Gloss Level G2) – MPI #138 (2 coats).
 - .1 PPG Dulux Diamond Interior 100% Acrylic Eggshell #15110.
 - .9 Cast Iron Piping: INT 10.2, Bituminous Coated Surfaces (including cast iron pipe), (over w.b. rust-inhibitive primer).
 - .1 Primer Sealer, Alkyd, Interior (Non MPI).
 - .1 PPG Dulux X-Pert Waterborne Alkyd Primer Sealer #23010.
 - .2 Latex, Interior, High Performance Architectural, Semi-Gloss (MPI Gloss Level G5) – MPI #141 (2 coats).
 - .1 PPG Diamond Interior 100% Acrylic Semi-Gloss #13210.
 - .10 Structural Steel (exposed structure/decking where indicated, pocket door at operable panel partition OP1): INT 5.1R, High Performance Architectural Latex (over q.d. alkyd primer), (MPI Gloss Level G2).
 - .1 Primer, Alkyd, Quick Dry, for Metal – MPI #76.
 - .1 PPG Fast Dry #4180.
 - .2 Latex, Interior, High Performance Architectural, (MPI Gloss Level G2) – MPI #138 (2 coats).
 - .1 PPG Dulux Diamond Interior 100% Acrylic Eggshell #15110.
 - .3 Dryfall Option - PPG Fast Dry #4190 Primer (over q.d. shop primer), PPG Glidden Spraymaster Interior DTM Latex Dryfall #10112.
 - .11 Concrete Floors and Housekeeping Pads (mechanical/electrical rooms where indicated EFP): INT 3.2L, Epoxy High Build - Low Gloss with SRA (slip resistant additive), (MPI Gloss Level G3).
 - .1 Primer, Two-component, Penetrating Epoxy Primer Sealer (Non MPI).
 - .1 Amerlock Sealer.
 - .2 Epoxy High Build - Low Gloss with SRA, MPI #108 (2 coats).
 - .1 PPG Amercoat Amerlock #AK-400.

(Note: eliminate MPI system requirement of First Coat Epoxy MPI #108 (reduced), and replace with 1 coat of two component, epoxy penetrating sealer for green concrete as specified above).
 - .12 Safety Lines: Non MPI.
 - .1 Ennis-Flint, Lead Free, Low VOC, Waterborne Traffic Paint, Colour: Safety Yellow.
 - .13 Fire-Retardant Coatings (plywood panels in janitor rooms and IT rooms, and plywood backboards in mechanical/electrical rooms for mounting electrical equipment): INT 6.2F, Fire Retardant, Pigmented (water-based).
 - .1 Intumescent Fire Retardant Paint (primer as required plus 2-4 coats to achieve net coverage rate required to meet ASTM E84, NFPA 255 or CAN/ULC S102 Class A Rating) – MPI #64 (ULC approved).
 - .1 Flame Control Coatings No. 20-20A Flat Intumescent Fire Retardant Latex Paint.
 - .2 PPG Speedhide Fire Retardant Interior Flat Latex #42-7.
 - .3 Sansin FireStop99 Fire Retardant Coating.
- .2 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes* of the *Bidding Procedures*.

- .3 Supply all products from single manufacturer.

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. to be highest quality product of MPI listed manufacturer and compatible with paint materials being used.
- .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 specified in this Section.
- .4 Paints and coatings to meet flame spread and smoke developed ratings designated by local Code requirements and/or authorities having jurisdiction.

2.3 EQUIPMENT

- .1 Painting 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 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 Contract Administrator.

2.5 FINISHES AND COLOURS

- .1 Unless otherwise specified herein, perform all painting work in accordance with MPI Premium Grade finish requirements.
- .2 Colours as selected by the Contract Administrator from manufacturer's full range of colours after award of Contract.
- .3 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.
- .4 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.
- .5 Plywood service panels (e.g. electrical, telephone and data panels) including edges.

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
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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	

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 Contract Administrator any conditions or surfaces that will adversely affect work of this Section.

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 Shop Primed Metal Surfaces.
 - .2 Shop Primed Pocket Door at Operable Panel Partition OP1.
 - .3 Galvanized and Zinc Coated Metal.
 - .4 Metal Fabrications.
 - .5 Exposed Structural Steel and Decking.
 - .6 Cast Iron Piping.
 - .7 Concrete Block Surfaces.
 - .8 Underside Hollow Core Planks.
 - .9 Gypsum Board Surfaces.
- .2 Remove dust, dirt, and other surface debris by vacuuming or wiping with dry clean cloth.
- .3 Protect rating and instruction labels on doors, frames, equipment, piping, etc. from painting operations by masking, templates, or other suitable protective means and repair any damage caused by failure to provide such protection.
- .4 Protect all adjacent surfaces and areas 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 Confirm preparation and primer used with fabricator of steel items. Refer to Quality Assurance.

3.3 APPLICATION

- .1 Do not apply 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 in workmanlike manner using skilled and trade qualified applicators as noted under Quality Assurance.

- .3 Painting coats specified are intended to cover surfaces satisfactorily when applied at proper consistency and in accordance with manufacturer's recommendations.
- .4 Apply minimum of four (4) coats of paint where deep or bright colours are used to achieve satisfactory results.
- .5 Paint wall graphics where indicated.
- .6 Sand and dust between each coat to provide anchor for next coat and to remove defects visible from distance up to 1000 mm.
- .7 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.

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 to match adjacent surfaces, in following areas:
 - .1 Where exposed-to-view in all exterior and interior areas.
 - .2 In all mechanical and electrical rooms.
 - .3 Do not paint over nameplates.
- .2 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.
- .3 Paint disconnect switches for fire alarm system and exit light systems in red enamel.
- .4 Paint red or band all fire protection piping and sprinkler lines in accordance with mechanical specification requirements. Keep sprinkler heads free of paint.
- .5 Paint yellow or band all natural gas piping in accordance with mechanical specification requirements.
- .6 Prime and paint face and edges of plywood service panels for telephone, data, 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.

3.5 FIELD QUALITY CONTROL/STANDARD OF ACCEPTANCE

- .1 Inspect all surfaces, preparation and paint applications.
- .2 Painted surfaces will be considered to lack uniformity and soundness if any of the following defects are apparent:
 - .1 Brush/roller marks, streaks, laps, runs, sags, drips, heavy stippling, hiding or shadowing by inefficient application methods or poor coverage, skipped or missed areas, and foreign materials in paint coatings.
 - .2 Damage due to touching before paint is sufficiently dry or other contributory cause.
 - .3 Damage due to application on moist surfaces or caused by inadequate protection from the weather.
 - .4 Damage and/or contamination of paint due to blown contaminants (dust, spray paint, etc.).

- .3 Painted surfaces will be considered unacceptable if any of the following are evident under final lighting source (including daylight) for interior surfaces:
 - .1 Visible defects are evident on vertical and horizontal surfaces when viewed at normal viewing angles from a distance of not less than 1000 mm.
 - .2 Visible defects are evident on ceiling, soffit and other overhead surfaces when viewed at normal viewing angles.
 - .3 When the final coat on any surface exhibits a lack of uniformity of color, sheen, texture, and hiding across full surface area.
- .4 Repaint surfaces rejected by the Contract Administrator 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 adjacent exterior and interior surfaces 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 to limit or direct traffic away or around work area as required.

3.7 CLEANING

- .1 Remove all paint where spilled, splashed, splattered or sprayed as work progresses using means and materials that are not detrimental to affected surfaces.
- .2 Keep work area free from 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.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Surface preparation and powder coating of arbour and planters.

1.2 RELATED SECTIONS

- .1 Section 05 50 00 – Metal Fabrications.

1.3 REFERENCES

- .1 American Society for Testing and Materials (ASTM International)
 - .1 ASTM A653/A653M, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process.
 - .2 ASTM D 6386, Practice for Preparation of Zinc (Hot Dip Galvanized) Coated Iron and Steel Products and Hardware Surfaces for Painting.

1.4 PAINT STORAGE

- .1 All painting materials shall be stored in one place. Such storage place shall be kept neat and clean and free from any volatile substance. Oily rags, waste, etc., must be removed from the site every night and every precaution taken against fire.

1.5 JOB CONDITIONS

- .1 All powder coating and finishing shall be done under controlled shop conditions and in accordance with manufacturer's specifications.

Part 2 Products

2.1 GENERAL

- .1 All metal surfaces shall be powder coated.
- .2 Powder coating shall be DuraCoat Powder or approved equal.
- .3 The materials shall be kept in their original containers with seals intact, properly identified.
- .4 Materials shall be applied in accordance with the manufacturers printed instructions. All materials shall be of sufficient body and covering capacity to produce a first class finish in all respects.

- .5 Powder coat finishes shall conform to the following specifications:

<u>Properties</u>	<u>Value</u>	<u>Test Method</u>
Specific Gravity	1.2 - 1.8	ASTM D792
Gloss (60%)	35% - 100%	ASTM 5382
Impact	Up to 160 in. lbs.	ASTM D2794
Flexibility	180° 1/8" mandrel	ASTM D522 Method A
Pencil Hardness	H & greater	ASTM D3363
Crosshatch Adhesion	100% pass	ASTM D3359 Method B
Salt Spray	1000+ hours	ASTM B117
Humidity Resistance	1000+ hours	ASTM D2247

All test performed on 24-gauge Bonderite 1000® panels, electrostatically sprayed at 1.8 - 2.2 mils.

- .6 No claim by the Contractor as to unsuitability or unavailability of any material specified or his/her inability to produce first class work with same will be entertained unless such claims are made in writing.

Part 3 Execution

3.1 WORKMANSHIP

- .1 All galvanizing, powder coating and finishing shall be done by skilled tradespeople in a workmanlike manner. All materials shall be evenly applied so as to be free from sags, runs, crawls or other defects.
- .2 No work shall be done under conditions that are unsuitable for the production of good results. Galvanizing and powder coating must be done in shop.
- .3 All coats shall be thoroughly dry before the succeeding coat is applied.
- .4 Repair all surface defects in accordance with first class practice. All surface defects shall be corrected prior to application of succeeding coats where applicable.
- .5 Powder coats are intended to cover surfaces perfectly. If surfaces are not all covered, further coats shall be applied. All finishes shall be uniform as to sheen, colour and texture.
- .6 All surfaces to be powder coated shall be unmarred, free from rough spots or defects that would affect the finished surface.
- .7 All work where a coat of material has been applied must be inspected and approved by the Contract Administrator before application of the succeeding specified coat; otherwise no credit for the coat applied will be given and the Contractor automatically assumes the responsibility to recoat the work in question at no extra cost.

3.2 COLOUR SCHEDULE

- .1 Contractor shall provide colour samples to the Contract Administrator a minimum of 21 days for approval and selection prior to commencing powder coating.

3.3 SURFACE PREPARATION – NON-GALVANIZED

- .1 Thoroughly sandblast all non-galvanized surfaces to near white and powder coat immediately after.

3.4 SURFACE PREPARATION – GALVANIZED

- .1 Remove dirt, grease and oil from freshly galvanized elements with alkaline cleaning solutions in the pH range of 11 to 12, applied with soft brush. Thoroughly rinse with hot water and let dry completely.
- .2 Profile the cleaned galvanized surface using an abrasive sweep or brush blast with organic ballast or approved alternate with a size of 200 to 500 Microns and a Mhos hardness of 5 or lower. Work to be done by experienced applicator.
- .3 Consult powder coating applicator on the matched passivation treatment for the galvanized surface prior to final finish.

3.5 POWDER COATING SCHEDULE

- .1 All coats shall be shop applied by powder coating methods.
- .2 All coats shall be applied in accordance with manufacturer's specifications.
- .3 Apply a minimum of 2 coats for full coverage or any number of additional coats to achieve the specified finish.
- .4 Powdercoat one sample for approval as standard of finish prior to proceeding with powdercoating for all other works in this contract.

3.6 INSTALLATION

- .1 Touch-up all scratched or damaged surfaces in field after completion of arbour and planter installation.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 04 00 00 – Masonry.
- .2 Section 06 10 00 – Rough Carpentry.
- .3 Section 06 40 00 – Architectural Woodwork.
- .4 Section 09 22 16 – Non-Structural Metal Framing.
- .5 Section 09 29 00 – Gypsum Board.

1.2 REFERENCES

- .1 American Society for Testing and Materials (ASTM).
 - .1 ASTM A653/A653M-20, 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].
- .2 Aluminum Association (AA).
 - .1 Aluminum Alloy Castings - Properties, Processes, and Applications, 2004.
 - .2 Designation System for Aluminum Finishes, 2009.
- .3 Underwriters Laboratories of Canada (ULC).
 - .1 CAN/ULC S706.1-2020, Standard for Wood Fibre Insulating 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.
- .5 Waste Management and Disposal in accordance with Section 01 74 19.

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 Total Performance of the Work. Manufacturer hereby warrants porcelain enamel markerboard surface against manufacturing and material defects including rippling effect on surface, subject to proper care and maintenance, and these or other observed defects and deficiencies will be repaired or replaced to the satisfaction of the Contract Administrator and the City, and at no expense to the City.

Part 2 Products

2.1 MANUFACTURERS

- .1 Basis of Design Products.
 - .1 Markerboards (MB).
 - .1 Vipco Visual Boards 28-gauge, Polyvision e3 Ceramic Steel White Board complete-with 28-gauge Galvanized Steel Backing, Vipco Vantage Series Perimeter J-Trim and Pentray/Chalktray.
 - .2 Waco Porcelain Enamel 28-gauge Steel Whiteboard complete-with 28-gauge Galvanized Steel Backing, Series 3 - #180 Trim and #262 Chalk/Pen Tray.
 - .2 Sliding Markerboards.
 - .1 Waco Porcelain Enamel Horizontal Slider complete-with Series 3 - #180 Trim and #262 Chalk/Pen Tray complete-with custom recessed finger pulls.
- .2 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes* of the *Bidding Procedures*. Note - only manufacturer's products with 28-gauge, galvanized steel backing will be accepted.
- .3 Supply all products from single manufacturer.

2.2 MANUFACTURED UNITS

- .1 Markerboards (MB).
 - .1 Perimeter Trim: extruded satin anodized aluminum alloy 6063-T5 to ASTM B221M, minimum 1.5 mm wall thickness.
 - .2 Chalktray: full length solid extruded aluminum blade-type tray with ribbed section, satin anodized aluminum alloy 6063-T5 to ASTM B221M, corners to be rounded. Note - no chalktray at Lifeskills Suite markerboards only.
 - .3 Facing Sheet: two (2) coats fired vitreous porcelain enamel on minimum 28-gauge (0.37 mm) steel, magnetic surface, white low gloss (matt) finish.
 - .4 Panel Backing Material: 28-gauge galvanized steel to ASTM A653/A653M for fixed wall mounted and sliding panels.
 - .5 Panel Core: 13 mm high quality, moisture resistant fibreboard, free of tar material to CAN/ULC S706, Type II.
 - .6 Joint Reinforcement: concealed mechanical jointing system to provide straight, rigid, continuously supported, tight butt, flush joints at surface.
 - .7 Size: 1220 mm high x lengths as noted on drawings.

- .2 Sliding Markerboards.
 - .1 Similar as above except full perimeter aluminum frame, top hung sliding panels on adjustable self-lubricating nylon rollers and bottom guided by noiseless plastic guides, 28-gauge, galvanized steel backing sheet for sliding panels complete-with custom recessed finger pulls.

2.3 ACCESSORIES

- .1 Anchor Clips, Brackets and Fasteners: concealed type recommended by markerboard manufacturer for fixed mounting.
- .2 Provide the following per room that contains at least one 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 Markerboard Cleaner: Two (2) bottles.

2.4 FABRICATION

- .1 Make finished panels flat and rigid and fit with joint reinforcement. Fit joints between abutting panels with covering trim.
- .2 Aluminum Perimeter 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.

Part 3 Execution

3.1 INSTALLATION

- .1 Install markerboards in accordance with reviewed shop drawings and manufacturer's printed instructions, parallel to floor with uniform vertical surface, plumb and level, to provide rigid secure writing surface.
- .2 Install sliding markerboards into millwork units as detailed. Co-ordinate size and fastening methods with millwork trade in advance of millwork fabrication.
- .3 Confirm fit of markerboards and ensure there are no conflicts with work of other trades. Report any discrepancies to Contract Administrator.

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 04 00 00 – Masonry.

1.2 SUBMITTALS

- .1 Shop Drawings.
 - .1 Submit shop drawings in accordance with Section 01 33 00.
 - .2 Indicate partition panel modules and types, materials, gauges, finishes, gate and other openings, hardware, fastening methods to adjacent structure, and assembly methods.

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.
- .5 Waste Management and Disposal in accordance with Section 01 74 19.

1.4 WARRANTY

- .1 Manufacturer's Product Warranty: provide an extended warranty for Work of this Section consisting of a Limited Lifetime Structural Warranty from date of Total Performance of the Work. Manufacturer hereby warrants wire mesh partitions against manufacturing and materials defects, and these or other observed defects and deficiencies will be repaired or replaced to the satisfaction of the Contract Administrator and the City, and at no expense to the City.

Part 2 Products

2.1 MANUFACTURERS

- .1 Basis of Design Products.
 - .1 Cogan Full Height Wire Mesh Partitions (Construction & Wood Technology, Machining & Welding Technology).
- .2 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes* of the *Bidding Procedures*.
- .3 Supply all products from single manufacturer.

2.2 MATERIALS

- .1 Panels: framed welded wire mesh 50 mm x 50 mm x 10-gauge, reinforced with two welded 13 mm diameter reinforcement rods, dividing panels in equal sections. Frames made of structural angle 32 mm x 32 mm x 12-gauge structurally shaped for extra strength and rigidity, corners notched and seam welded.

- .2 Posts: made of 50 mm x 50 mm x 16-gauge, square seam-welded tubing, engineered for perfect support and rigidity welded to 152 mm x 152 mm x 6 mm baseplate with four oblong holes for easy adjustment.
- .3 Single Sliding Gates: made of the same material and method as the panels, reinforced with 38 mm square tube bolted to the front and leading edges. Sliding gates to be equipped with guide track with three support hangers, trolley wheels, gate guide, receiver, and one set of hasps for padlocking.

2.3 FINISHES

- .1 All components factory powder coat finish, colour: Cogan Grey.

Part 3 Execution

3.1 INSTALLATION

- .1 Install wire mesh partitions in accordance with reviewed shop drawings and manufacturer's printed instructions.
- .2 Erect partition plumb, level, straight, rigidly supported, and securely fastened to abutting surfaces, free from superimposed loads.
- .3 Install sliding gates and adjust for smooth operation and locking.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 09 29 00 – Gypsum Board.

1.2 REFERENCES

- .1 American Society for Testing and Materials (ASTM).
 - .1 ASTM A666-15, Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.

1.3 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.

1.4 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.
- .5 Waste Management and Disposal in accordance with Section 01 74 19.

Part 2 Products

2.1 MANUFACTURERS

- .1 Basis of Design Products.
 - .1 Stainless Steel Corner Guards (CG1, CG2).
 - .1 C/S Acrovyn CO Series Corner Guards.
 - .2 IPC Stainless Steel Corner Guards.
 - .3 Korogard GS Series Corner Guards.
 - .4 Pawling Pro-Tek Stainless Steel Corner Guards.
- .2 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes* of the *Bidding Procedures*.
- .3 Supply all products from a single manufacturer.

2.2 MANUFACTURED UNITS

- .1 Stainless Steel Corner Guards 90° (CG1): to ASTM A666, surface mounted, 16-gauge, Type 304 stainless alloy with No. 4 satin finish, 25 mm x 25 mm legs, 1220 mm long, adhesive only attached.
- .2 Stainless Steel Corner Guards 90° (CG2): same as CG1 except custom length as indicated.

Part 3 Execution

3.1 INSTALLATION

- .1 Install corner guards in accordance with reviewed shop drawings and manufacturer's printed instructions.
- .2 Co-ordinate with appropriate trades responsible for installation of continuous blocking behind gypsum board as required to provide rigidity and strength for guards.
- .3 Install corner guards above specified wall base.
- .4 Apply continuous bead clear caulking along top and outside edges of corner guards.

3.2 CLEANING

- .1 Upon completion of work, make sure that all corner guards are cleaned and free of surface blemishes and fingerprints.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 04 00 00 – Masonry.
- .2 Section 06 10 00 – Rough Carpentry.
- .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 A666-15, Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
- .2 Canadian Standards Association (CSA).
 - .1 CAN/CSA-B651-18, Accessible Design for the 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.
- .6 Waste Management and Disposal in accordance with Section 01 74 19.

Part 2 Products

2.1 MANUFACTURERS

- .1 Acceptable Products.
 - .1 As specified in Schedule at end of this Section.
- .2 Requests for substitutions will be considered in accordance with Section 00 26 00.
- .3 Supply similar products from single manufacturer.

2.2 MATERIALS

- .1 Stainless Steel: to ASTM A666, Type 304, No. 4 satin finish.
- .2 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.
- .3 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 back 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 Hollow masonry units: use toggle bolts drilled into cell/wall cavity.
 - .2 Steel stud walls: install steel back-plate or wood blocking to stud prior to gypsum board finish. Provide plate with threaded studs or plugs.
 - .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:CH	NIC	Chemical Dispenser: Not in Contract; Division supplied and installed. Contractor to provide blocking in wall as required.
W:FM1	ASI 0620 Bobrick B-165 Bradley 781 Frost 941	Framed Mirror: 610 mm wide x 915 mm high to ASTM C1503, complete-with one-piece 19 mm x 19 mm heavy gauge stainless steel channel frame, satin finish.
W:HSD	<i>Division Supplied, Contractor Installed</i>	Hand Sanitizer Dispenser: supplied by the Division, installed by Contactor. Provide blocking in wall as required.
W:KSD	<i>Division Supplied, Contractor Installed</i>	Kitchen Sanitation Dispenser: supplied by the Division, installed by Contactor. Provide blocking in wall as required.
W:LSD	<i>Division Supplied, Contractor Installed</i>	Liquid Soap Dispenser: supplied by the Division, installed by Contactor. Provide blocking in wall as required.
W:MBR	ASI 8215-4 Bobrick B-224 x 36 Bradley 9954 Frost 1114	Mop/Broom Rack: surface mounted 22-gauge stainless steel with four (4) spring-loaded mop/broom holders, 915 mm long, satin finish.
W:NTW	<i>Division Supplied, Contractor Installed</i>	Napkin/Tampon Waste: supplied by the Division, installed by Contactor. Provide blocking in wall as required.
W:RR	NIC	Recycling Receptacles Free Standing: Not in Contract; Division supplied and installed.
W:SCH	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-gauge stainless steel hooks on stainless steel circular base Type 304, No. 4 satin finish. Coat hooks to consist of a combination of two (2) colours from manufacturer's colour selection.
W:TD	<i>Division Supplied, Contractor Installed</i>	Paper Towel Dispenser: supplied by the Division, installed by Contractor. Provide blocking in wall as required.
W:TPD	<i>Division Supplied, Contractor Installed</i>	Toilet Paper Dispenser: supplied by the Division, installed by Contractor. Provide blocking in wall as required.

CODE	MANUFACTURER/MODEL NUMBER	DESCRIPTION
W:WD-W	<i>NIC</i>	Wipe Dispenser-Wet: Not in Contract; Division supplied and installed. Contractor to provide blocking in wall as required.
W:WR	<i>NIC</i>	Waste Receptacles Free Standing: Not in Contract; Division supplied and installed.
Washroom Signage	Included in Interior Signage Cash Allowance	Washroom Signage: locations to be determined.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 04 00 00 – Masonry.
- .2 Section 06 10 00 – Rough Carpentry.
- .3 Section 09 22 16 – Non-Structural Metal Framing.
- .4 Section 09 29 00 – Gypsum Board.

1.2 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.

1.3 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 products with appropriate precautions and care as stated in manufacturer's instructions.
- .4 Cleaning and Waste Management in accordance with Section 01 74 00.
- .5 Waste Management and Disposal in accordance with Section 01 74 19.

1.4 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 Total Performance of the Work. Manufacturer hereby warrants metal lockers 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 Contract Administrator and the City, and at no expense to the City.

Part 2 Products

2.1 MANUFACTURERS

- .1 Basis of Design Products.
 - .1 Lockers (Single Tier, Double Tier, Four Tier).
 - .1 GSS Elite Lockers.
- .2 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes* of the *Bidding Procedures*.

- .3 Supply all products from single manufacturer.

2.2 MANUFACTURED UNITS

- .1 Lockers (Double Tier).
 - .1 Sizes (Double tier): 305 mm (12") wide x 380 mm (15") deep x 1830 mm (72") high.
 - .2 Body: fabricated from min. 20-gauge prefinished steel. Sides to have offsets and backs flanged, formed and factory punched to provide necessary assembly holes. Tops, bottoms and shelves fabricated from 16-gauge prefinished steel and flanged on all four sides with formed under return at the front of the shelves. Provide 16-gauge support bracket installed across centre of locker bottom.
 - .3 Frame: fabricated from minimum 16-gauge prefinished steel welded together from specially formed channel sections of prime cold rolled steel. 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 from minimum 14-gauge outer door panel and minimum 20-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 Coat Hooks: 3 single prong zinc plated steel coat hooks per compartment.
 - .6 Single Point Latching: through a single piece deep-drawn stainless steel 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.

2.3 ACCESSORIES

- .1 Locking System: padlocks by the Division.
- .2 Options.
 - .1 Prefinished steel trim including filler panels, corner angles, top, side and jamb filler trim.
 - .2 Prefinished end panels.
 - .3 Manufacturer's standard number plates.
 - .4 Sloping tops.

2.4 FINISHES

- .1 Shop Finishing.
 - .1 All sheet metal to be thoroughly cleaned, phosphated and factory finished with a high-performance powder coating, electrostatically applied and oven cured to provide a uniform, smooth protective finish.
 - .2 Colour to be selected from manufacturer's full colour selection.
 - .3 Frame colour to match body and door colour.

Part 3 Execution

3.1 INSTALLATION

- .1 Install lockers in accordance with reviewed shop drawings and manufacturer's printed instructions. Refer to architectural drawings for layouts.

END OF SECTION

Part 1 General

1.1 RELATED WORK

- .1 Section 11 06 00 – Equipment Schedule.
- .2 Section 06 10 00 – Rough Carpentry.

1.2 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.
 - .3 Show dimensions, locations of components, special installation conditions and other related data required for co-ordination and installation.
- .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 Materials

2.1 MANUFACTURED UNITS

- .1 Basis of Design Products.
 - .1 Tall Parts Cabinet: Two-Door, metal cabinet, 48.75" wide x 85.5" high x 29.25" deep, and # (5) adjustable shelves per unit, paint finish, colour: to be selected from manufacturers entire selection.
 - .1 McTavish Steelworks, Tall Parts Cabinet.
 - .2 Upper Parts Cabinet: Metal upper cabinet system consisting of peg board flanked by two cabinets on each side, 120.625" wide x 85.5" high x 30.875" deep combined. Paint finish, colour: to be selected from manufacturers entire selection.
 - .1 McTavish Steelworks, Upper Cabinet.
- .2 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes* of the *Bidding Procedures*.
- .3 Supply all products from single manufacturer.

Part 3 Execution

3.1 INSTALLATION

- .1 Install specialties plumb and level, and in accordance with reviewed shop drawings and manufacturer's printed installation instructions.

3.2 CLEANING

- .1 Clean surfaces after installation using manufacturer's recommended cleaning procedures.

3.3 PROTECTION

- .1 Protect specialties from damage until completion of construction.

3.4 SCHEDULES

- .1 Refer to Section 11 06 00.

END OF SECTION

Part 1 General

1.1 RELATED WORK

- .1 Section 03 30 00 – Cast-In-Place Concrete.
- .2 Section 04 00 00 – Masonry.

1.2 SUBMITTALS

- .1 Shop Drawings.
 - .1 Submit product data in accordance with Section 01 33 00.
 - .2 Indicate complete layout and configuration of storage racks including plans and elevations of all components and accessories.
 - .3 Include product literature by manufacturer's catalogue or model number.
 - .4 Provide templates, patterns, fixing diagrams, and other related data required for co-ordination and installation.
- .2 Closeout Submittals.
 - .1 Provide operation and 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 in manufacturer's instructions.
- .4 Cleaning and Waste Management in accordance with Section 01 74 00.
- .5 Waste Management and Disposal in accordance with Section 01 74 19.

Part 2 Materials

2.1 MANUFACTURED UNITS

- .1 Basis of Design Products.
 - .1 Vertical Bar Racks.
 - .1 Uline H-4888 Vertical Bar Rack, 36" wide x 24" deep x 85" high.
 - .2 Cantilever Racks - Single Sided.
 - .1 Uline H-3846 Cantilever Rack - Single Sided, 80" wide x 40" deep x 96" high.
 - .3 Vertical Sheet Racks.
 - .1 Uline H-8383 Vertical Sheet Rack, 48" wide x 36" deep x 42" high.
 - .2 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes* of the *Bidding Procedures*.
 - .3 Supply similar products from single manufacturer.

2.2 MANUFACTURED UNITS

- .1 Vertical Bar Racks.
 - .1 Heavy-duty rack consisting of 11-gauge steel frame construction, 3,000 lb. capacity complete-with three (3) 9" wide storage bays, three (3) 17-gauge shelves, safety chain, concrete anchoring hardware, factory powder-coated paint finish.
- .2 Cantilever Racks - Single Sided.
 - .1 Heavy-duty rack consisting of 12-gauge steel frame construction, 7,500 lb. capacity complete-with eight (8) 24" cantilever rack arms that adjust on 3" centers, factory powder-coated paint finish.
- .3 Vertical Sheet Racks.
 - .1 Heavy-duty rack consisting of 3-gauge steel base and 14-gauge steel removable 1-1/2" diameter uprights, 6,000 lb. capacity complete-with four (4) 7" deep storage bays, concrete anchoring hardware, factory powder-coated paint finish.

Part 3 Execution

3.1 INSTALLATION

- .1 Install storage racks in accordance with reviewed shop drawings and manufacturer's printed instructions.
- .2 Install plumb, level, straight, rigidly supported, and securely fastened to abutting surfaces as applicable, free from superimposed loads.

3.2 CLEANING

- .1 Clean all exposed surfaces after installation using manufacturer's recommended cleaning products and procedures.

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 Work shall be carried out with full cooperation and coordination of work specified in other related sections.

1.2 RELATED WORK SPECIFIED IN LAUNDRY EQUIPMENT SECTIONS.

- .1 Section 11 23 10 – Catalogued Laundry Equipment.

1.3 EXAMINATION

- .1 Carefully examine all drawings and specifications.
- .2 Fully inform himself of existing conditions or limitations.
- .3 No Laundry Equipment Subcontractor, after being awarded the Contract, will be allowed any extra compensation because of his failure to inform himself prior to his bidding of all the requirements of the Contract documents, drawings, specifications, etcetera.
- .4 Should the bidder find any discrepancies in or omissions from the drawings or specifications, or be in doubt as to their meaning, he should at once notify The City or their representative, who will issue written instructions or addenda to all bidders. Oral interpretations or instructions are not acceptable.
- .5 Make a careful examination of the site of the building and investigate all matters relating to the nature of the work to be undertaken, the means of access and egress, and the rights and interests which may be interfered with during the construction of the work.
- .6 Examine the work to which his work is to be applied, anchored or connected and the job conditions, and report to the Construction Manager all unsatisfactory conditions likely to prevent the proper installation of his work (unsatisfactory conditions to be corrected by the Construction Manager).
- .7 Instruct all related trades with regard to the shop drawings and equipment manuals as well as to the requirements for all service hook-up connections.
- .8 Coordinate delivery and installation schedules for all equipment under this section with the Construction Manager.
- .9 Commencement of work under this section shall imply acceptance of all other related work.

1.4 ALTERNATES AND EQUALS

- .1 Pricing to be submitted based on the manufacturer, model and accessories specified.
 - .1 Bidder to submit all pricing based on manufacturer / model specified and where alternate “equal” products are proposed,
 - .1 Bidder to provide separate tender form cost breakdown indicating respective cost for alternate / equal proposed and cost difference to product specified.

- .2 Bidder to provide product literature and pricing for each alternate: bidders are reminded that the manufacturer / models specified set the standard to be met by any alternative product.
- .3 The City will “consider” alternate manufacturers provided they are “equal” in all aspects – all changes to physical size or service requirements must be highlighted in a separate alternate price submission or implications relating to added costs will be considered included within the alternate fixture price.

1.5 DIMENSIONS

- .1 Wall thicknesses and room sizes shown on the drawings are nominal only. The actual size at the building shall be determined by the Contractor.

1.6 MATERIALS/PARTS SUPPLIED BUT NOT INSTALLED

- .1 Mechanically and/or micro-switch operated gas shut-off valve for installation on main gas line to the laundry equipment.

1.7 EQUIPMENT SUPPLIED BY THE CITY

- .1 This section to be responsible for coordinating the setting of these items into place.

1.8 WORK SPECIFIED IN GENERAL CONTRACT

- .1 All mechanical services including; water lines, waste drains, isolation valves, water line strainers, pressure regulating valves, traps, anti-knock air cushion chambers, and final service connections to all fixtures except where specified to the contrary as well as all ducting from dyers to building exterior.
- .2 All electrical services including; conduit and wiring to final connections of all fixtures including liquid tight conduit for all exposed wiring, disconnect switches, starters or other components to facilitate an approved installation unless specified or detailed to the contrary

1.9 REFERENCE STANDARDS

- .1 Sealant and/or caulking material shall be #730 silicone. Where SS units are sealed to walls, use “grey” color. Where plywood counters/cabinets abut walls, use “white” color.
- .2 All work and material shall be in full accordance with the latest rules and regulations of the Provincial and Municipal Departments of Health and/or prevailing rules and regulations pertaining to adequate protection and/or guarding of moving objects or otherwise hazardous locations.
- .3 Regulations, building codes, gas codes, steam codes, and all other codes applying to this section shall be followed.

1.10 DRAWINGS

- .1 Before proceeding with the purchase of major equipment (catalogue items), submit equipment brochure manuals for review.

- .2 Equipment brochure manuals to include itemized equipment list, description as indicated on the drawing, and manufacturer. Individual cut sheets to indicate (by circle, arrow etc.) model number, and all pertinent mechanical and electrical information.
 - .1 Where “Suggested Alternate” equipment is being supplied, any changes in service connections, location or size from those shown on the documentary drawings shall be noted in the submitted drawings.
- .3 All shop drawings and equipment manuals shall be submitted through the Contract Administrator for review and checking. Note: Equipment manuals to indicate specific requirements such as model(s), electrical and mechanical requirements, accessories, etc.

1.11 ABBREVIATIONS

LEC	Laundry Equipment Subcontractor
NIC	Not In (Laundry) Contract
SS	Stainless Steel
CW	Cold Water
HW	Hot Water
W	Waste
AMP	Amperage
KW	Kilowatt
Ph	Phase
V	Volt

1.12 ENVIRONMENTAL REQUIREMENTS

- .1 All finishes/walls, floors and ceilings in all areas where the work under this section is to be installed shall be completed before the equipment is moved into location.

1.13 DELIVERY AND STORAGE

- .1 Deliver all the equipment to the jobsite, unload, and set into place as per plans; no long term storage provisions will be provided.
- .2 Provide separate price to set equipment into place, for each section or for those sections quoted on, made ready for final hook-ups by appropriate subtrades.
- .3 Coordinate delivery and installation dates with the Contractor, The City and Burnstad Consulting.
- .4 All hoisting required, and the costs associated with same, shall be included in the delivery cost indicated by the bidder.

1.14 WASTE MANAGEMENT

- .1 Refer to Division 0 for Construction Waste Management requirements.
- .2 All areas where equipment is being installed is to be cleaned of all packing and crating debris as the work is completed and specifically at the end of each working day.

1.15 INSTALLATION

- .1 The jobsite equipment installation shall be carried out by a “Dealer Approved” supervisor in conjunction with personnel experienced with proper, manufacturer approved, installation of commercial laundry equipment.
- .2 Install all equipment under this section in locations as shown on the drawings and/or as set out under the specifications.
- .3 Do all cutting, patching, and fitting as required for a complete installation, as well as to coordinate with the related trades all work under this section.
- .4 Securely fasten all metal curb bases to the floor. Seal curb bases at the floor (interior and exterior) for full perimeter. Coat upper flanges with mastic sealant before placing equipment.
- .5 Seal and caulk all equipment with silicone sealant after equipment is in location.
- .6 All employees of LEC and their subtrades must comply with the General Contractors Health and Safety Manual. Site specific safety requirements include all workers must wear hard hat, steel toed boots, and safety glasses at all times.

1.16 PROTECTIONS, STORAGE AND MAKING GOOD

- .1 Damaged work shall be made good by those performing the work originally but at the expense of those causing the damage.

1.17 CLEANING OF EQUIPMENT

- .1 Remove all masking protective covering from the equipment and clean prior to final inspection.
- .2 Remove all crates, debris, and other materials resulting from work under this section as installation progresses.

1.18 EQUIPMENT DEMONSTRATION

- .1 Prior to demonstration submit four (4) bound copies of “Operating and Maintenance Manuals” (numbered in sequence) for all major catalogue equipment. Such manuals shall include;
 - .1 The names and addresses of those companies which are designated as “Service Depots” who will supply parts and continuing service for all equipment during the warranty period.
 - .2 Reduced size (1:100 scale) copies of all plans.
 - .3 Itemized fixture list indicating items number (corresponding with plans) description, manufacturer, model & serial number.
 - .4 Operating manuals for all major equipment.
 - .5 Schedule of recommended maintenance to all applicable items with frequency and specifics of each noted accordingly.
 - .6 Maintenance manuals for all major equipment.

- .2 All laundry equipment shall be demonstrated by a competent representative of the laundry equipment supplier to familiarize the staff with the proper operation and maintenance of all equipment under this section.
- .3 Arrange with the factory representatives, where required, of major equipment (catalogue items) to be present at the equipment demonstration.
- .4 Arrangements for the equipment demonstration shall be coordinated with The City.

END OF SECTION

Part 1 General

1.1 RELATED WORK SPECIFIED IN OTHER SECTIONS

- .1 Division 22 – Plumbing.
- .2 Division 23 – HVAC.
- .3 Division 26 – Electrical.

1.2 RELATED WORK SPECIFIED IN LAUNDRY EQUIPMENT SECTIONS.

- .1 Section 11 23 00 – Laundry Equipment General

1.3 SHOP DRAWINGS AND PRODUCTION DATA

- .1 Submit shop drawings and product data in accordance with Section 01 33 00 and 11 23 00.
- .2 Where product data indicates multiple models, clearly identify model specific to this project.
- .3 Clearly identify voltages and phase of power.
- .4 Clearly indicate options / accessories relative to this project.
- .5 Items that have been indicated as “spare number”, “modified items”, “removed items”, or not within the laundry Contract should be included within the specification sheet “booklet”. The sheet should list the job name, item number, description, quantity, and a description of any modifications to be done.

1.4 REFERENCE STANDARDS

- .1 All major equipment units shall comply with the Canadian Standards Association, Canadian Gas Association, Underwriters’ Laboratories Canada Ltd. and Underwriters’ Laboratories Inc. regulations and standards where applicable.
- .2 Any equipment requiring local approval to be included and provided by the KEC.

1.5 WARRANTY/GUARANTEEE

- .1 Where the warranty/guarantee period which is furnished by the manufacturer is for a shorter period than one (1) year, then the cost for an extended warranty/guarantee shall be included in the pricing structure.
- .2 Where the warranty/guarantee cards are furnished with the units or major equipment, they shall be collected, information filled in, and mailed to the manufacturer as part of this section. A written report shall be furnished to the Construction Manager advising that this procedure has been followed.
- .3 Installation date, for the purpose of determining the warranty/guarantee period, shall be deemed to start from the date of the final acceptance of the total installation.

- .4 Warranty/guarantee cards, equipment brochures or installation manuals accompanying the major equipment units shall not be considered as part of or in lieu of the Operating and Maintenance Manuals called for under Section 11 23 00.

1.6 MATERIALS/PARTS SUPPLIED BUT NOT INSTALLED

- .1 PRV to be provided for all gas fired equipment for operation to 7” W.C. max. – to be installed in individual gas feed lines by Mechanical Subcontractor.
- .2 Unless specified, all gas operated equipment to have gas regulators – to be installed in gas feed lines by Mechanical subcontractor.

1.7 INSTALLATION

- .1 Install equipment in accordance with manufacturer’s printed instructions.
- .2 Coordinate connection of mechanical and electrical services.
- .3 Adjust equipment for smooth and proper operation.
- .4 Install natural gas burning appliances and equipment in accordance with CAN1-B149.1-M86.

1.8 ITEMIZED EQUIPMENT

<u>ITEM #4</u>	<u>22lbs. WASHER</u>
QUANTITY	- One (1) required.
MANUFACTURER	- Wascomat
MODEL	- Encore Washer

<u>ITEM #5</u>	<u>22lbs. DRYER</u>
QUANTITY	- One (1) required.
MANUFACTURER	- Wascomat
MODEL	- Encore Dryer

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Work shall be carried out with full cooperation and coordination of work specified in other related sections.

1.2 RELATED WORK SPECIFIED IN FOOD SERVICE SECTIONS

- .1 Section 11 40 10 – Catalogued Equipment.
- .2 Section 11 40 20 – Custom Fabricated Equipment.
- .3 Section 11 41 10 – Pre-Fab Walk-In Boxes.
- .4 Section 23 28 00 – Exhaust Hoods.
- .5 Section 23 38 13 – Fire Suppression.

1.3 EXAMINATION

- .1 Carefully examine all drawings and specifications.
- .2 Fully inform themselves of existing conditions or limitations.
- .3 No Kitchen Equipment Subcontractor, after being awarded the Contract will be allowed any extra compensation because of their failure to inform themselves prior to their bidding of all the requirements of the Contract documents, drawings, specifications, etcetera.
- .4 Should the bidder find any discrepancies in or omissions from the drawings or specifications, or be in doubt as to their meaning, they should at once notify The City or their representative, who will issue written instructions or addenda to all bidders. Oral interpretations of instructions are not acceptable.
- .5 Make a careful examination of the site of the building and investigate all matters relating to the nature of the work to be undertaken, the means of access and egress, and the rights and interest which may be interfered with during the construction of the work.
- .6 Check all door openings and passageways to be sure that the equipment can be conveyed to its proper location within the building.
- .7 Examine the work to which their work is to be applied, anchored or connected and the job conditions, and report to The City all unsatisfactory conditions likely to prevent the proper installation of their work (unsatisfactory conditions to be corrected by the Contractor.
- .8 Instruct all related trades with regard to the shop drawings and equipment manuals as well as to the requirements for all service hook-up connections.
- .9 Coordinate delivery and installation schedules for all equipment under this section with The City.
- .10 Commencement of work under this section shall imply acceptance of other related work.

1.4 ALTERNATES AND EQUALS

- .1 Pricing to be submitted based on the manufacturer, model and accessories specified.
 - .1 Bidder to submit all pricing based on manufacturer / model specified and where alternate “equal” products are proposed,
 - .2 Bidder to provide separate tender form cost breakdown indicating respective cost for alternate / equal proposed and cost difference to product specified.
 - .3 Bidder to provide product literature and pricing for each alternate: bidders are reminded that the manufacturer / models specified set the standard to be met by any alternative product.
- .2 The City will “consider” alternate manufacturers provided they are “equal” in all aspects – all changes to physical size or service requirements must be highlighted in a separate alternate price submission or implications relating to added costs will be considered included within the alternate fixture price.

1.5 DIMENSIONS

- .1 Wall thicknesses and room sizes shown on the drawings are nominal only. The actual size at the building shall be determined by the Contractor.

1.6 MATERIALS/PARTS SUPPLIED BUT NOT INSTALLED

- .1 Mechanically and/or micro-switch operated gas shut-off valve for installation on main gas line to the cooking equipment.

1.7 MATERIALS & WORK SPECIFIED IN OTHER SECTIONS

- .1 All water lines, waste drains, isolation valves, water line strainers, pressure regulating valves, traps, anti-knock air cushion chambers, and final service connections to all fixtures except where specified to the contrary.
- .2 All electrical services, including conduit and wiring to final connections of all fixtures including conduit and wiring from thermostat controls to condensing units and/or evaporator blower coils unless specified or detailed to the contrary.

1.8 REFERENCE STANDARDS

- .1 All major equipment units shall comply with the Canadian Standards Association, Canadian Gas Association, Underwriters’ Laboratories Canada Ltd. and Underwriters’ Laboratories Inc. regulations and standards where applicable.
- .2 Any equipment requiring “local approval” to be included / provided by the equipment Contractor
- .3 Sealant and/or caulking material shall be #730 silicone. Where SS units are sealed to walls, use “grey” color. Where plywood counters/cabinets abut walls, use “white” color.
- .4 All work and material shall be in full accordance with the latest rules and regulations of the Provincial and Municipal Departments of Health and/or prevailing rules and regulations pertaining to adequate protection and/or guarding of moving objects or otherwise hazardous locations.

- .5 Regulations, building codes, gas codes, steam codes, and all other codes applying to this section shall be followed.

1.9 DRAWINGS

- .1 Before proceeding with the purchase of any food service equipment, submit detailed shop drawings for all equipment for review and approval. NOTE: To ensure a complete & coordinated shop drawing package, shop drawings **will not** be reviewed until a complete package (floor plans, spec sheets, custom drawings, walk-in / exhaust canopy drawings etc.) is submitted for review
 - .1 A CAD-generated equipment floor plan will be made available (by Burnstad Consulting only) at the request of the successful KEC. In the event the KEC chooses to use this data, he accepts all responsibility for its accuracy and will modify the resulting drawings to reflect accurately all current information. Reproduced copies of bid documents will not be accepted for this purpose in any fashion. Equipment schedule, elevations, details, Mechanical / Electrical service information etc. will not be made available under any circumstances and is the sole responsibility of the KEC to produce as follows:
 - .1 Submit itemized fixture floor plans (using corresponding item numbers) clearly indicating all depressions, recesses, floor curbs as well as wall and ceiling backing and / or supports
 - .2 Submit separate floor plans for the electrical and mechanical service requirements using a scale of not less than $\frac{1}{4}'' = 1'-0'' / 1:50$ – consistent with project drawing standards. (i.e. Imperial / Metric). These drawings shall include dimensional roughing-in locations, dimensional service connection points, distances, and heights using readily recognizable standard symbols. Note: Indicate item number at the end of the service description. Drawings shall also include an individual equipment list and service schedule. Where “Alternate” equipment is being supplied, changes in service connections, location or size from those shown on the tender drawings shall be noted in the submitted drawings by the KEC. It is the responsibility of the kitchen equipment supplier to coordinate any and all changes with the appropriate sub-trade.
 - .1 **All** service rough-in locations, with the exception of services to be roughed in or stubbed up from floor including but not limited to floor pans, floor drains etc., to be fully dimensioned from exterior / interior walls only. Dimensions from grid lines will not be acceptable.
 - .2 Drawings to clearly identify all service stub-up / drop down locations to island counters, cooking, service walls etc. with all outlets, water lines, gas lines etc. locations noted for information only and not as actual rough-in locations
 - .3 KEC to provide additional Mechanical and Electrical notes as required. Additional notes shall not contradict Mechanical and Electrical notes shown on Food Service drawings. In the event that a contradiction occurs, the Food Service drawings shall take precedence

- .3 Catalogued equipment specification sheets / brochure manuals indicating applicable model(s), electrical and mechanical requirements, accessories, etc.
- .4 Custom manufactured, stainless steel and millwork, shop drawings to consist of plan view, front elevation and cross section views fully dimensioned including to gables, drawers and all components and indicating material gauges and thicknesses.
- .5 Exhaust hoods and Walk-in rooms shop drawings to include plan, elevation and sectional views, list of finishes clearly as well as all components specified.
- .2 Where “Suggested Alternate” equipment is being supplied, any changes in service connections, location or size from those shown on the documentary drawings shall be noted in the submitted drawings.
- .3 All shop drawings and equipment manuals shall be submitted through the Contract Administrator for review and checking.

1.10 DELIVERY AND STORAGE

- .1 Deliver all the equipment to the jobsite, unload, and set into place as per plans; no long term storage provisions will be provided.
- .2 Provide separate price to set equipment into place, for each section or for those sections quoted on, made ready for final hook-ups by appropriate sub-trades.
- .3 Coordinate delivery and installation dates with the Contractor, The City and Burnstad Consulting.
- .4 All hoisting required, and the costs associated with same, shall be included in the delivery cost indicated by the bidder.

1.11 ENVIRONMENTAL REQUIREMENTS

- .1 All finishes/walls, floors and ceilings in all areas where the work under this section is to be installed shall be completed before the equipment is moved into location.

1.12 ABBREVIATIONS

KEC	Kitchen Equipment Subcontractor
NIC	Not In (Kitchen) Contract
SS	Stainless Steel
CW	Cold Water
HW	Hot Water
W	Waste
AMP	Amperage
KW	Kilowatt (Element)
KW	Kilowatt (Motor)
Ph	Phase
V	Volt

1.13 INSTALLATION

- .1 The jobsite equipment installation shall be carried out by an “Approved” supervisor in conjunction with journeyman sheet metal workers, journeyman welders and/or apprenticed sheet metal workers employed by a recognized SS fabricating company duly registered within the jurisdiction of the project.
- .2 Install all equipment under this section in locations as shown on the drawings and/or as set out under the specifications.
- .3 Do all cutting, patching, and fitting as required for a complete installation, as well as to coordinate with the related trades all work under this section.
- .4 Securely fasten all metal curb bases to the floor. Seal curb bases at the floor (interior and exterior) for full perimeter. Coat upper flanges with mastic sealant before placing equipment.
- .5 Seal and caulk all equipment with silicone sealant after equipment is in location.
- .6 All employees of KEC and their sub-trades must comply with The City’s Health and Safety Manual. Site specific safety requirements include all workers must wear hard hat, steel toed boots, and safety glasses at all times.

1.14 EQUIPMENT INSTALLED BUT NOT SUPPLIED

- .1 The City Supplied - this section to make all necessary provisions to allow for installation of these items as noted on drawings. Electrical and Mechanical Subcontractors to make all necessary connections to make all equipment operational.

1.15 WASTE REMOVAL

- .1 The KEC is responsible to make their own provisions for removal of all waste; no additional cost shall be paid for waste removal by The City
- .2 KEC to remove all crates, debris, and other materials (daily) resulting from work under this section as installation progresses.

1.16 PROTECTION, STORAGE AND MAKING GOOD

- .1 Protect the work of other trades from damage due to performing this work.
- .2 Damaged work shall be made good by those performing the work originally but at the expense of those causing the damage.

1.17 CLEANING OF EQUIPMENT

- .1 All areas where equipment is being installed is to be cleaned of all packing and crating debris as the work is completed and specifically at the end of each working day.
- .2 Remove all masking protective covering from the equipment and clean prior to final inspection.
- .3 Remove all crates, debris, and other materials resulting from work under this section as installation progresses.

1.18 OPERATING AND MAINTENANCE MANUALS

- .1 Prior to demonstration submit two (2) bound copies of “Operating and Maintenance Manuals” (numbered in sequence) for all major catalogue equipment. Such manuals shall be bound in a commercial quality hard-cover, three (3) post binder sized to appropriately hold the contents within with clear pocket window on spine clearly indicating project title and contents (Foodservice Equipment), designed to accommodate 215mm x 280mm paper and including;
 - .1 Cover page listing, in corresponding sequential order, indicating items number (corresponding with plans) all food and beverage equipment items identified on bid drawings together with respective quantities, manufacturers, models and serial numbers.
 - .2 The names and addresses of those companies which are designated as “Service Depots” who will supply parts and continuing service for all equipment during the warranty period.
 - .3 .Reduced size (1:100 scale) copies of all plans.
 - .4 Operating and maintenance manuals for all major equipment, separated with marked divider tabs indicating respective item number.
 - .5 Schedule of recommended maintenance to all applicable items with frequency and specifics of each noted accordingly.
 - .6 Completed Refrigeration Checklists as per Section 11 41 10.

1.19 OPERATING AND MAINTENANCE MANUALS

- .1 All equipment, except for custom fabricated, shall be tested and adjusted prior to any equipment demonstration.
- .2 All food service equipment shall be demonstrated by a competent representative of the kitchen equipment supplier to familiarize the staff with the proper operation and maintenance of all equipment under this section.
- .3 Arrange with the factory representatives, where required, of major equipment (catalogue items) to be present at the equipment demonstration.
- .4 Arrangements for the equipment demonstration shall be coordinated with The City.

END OF SECTION

Part 1 General

1.1 RELATED WORK SPECIFIED IN OTHER SECTIONS

- .1 Division 22 – Plumbing.
- .2 Division 23 – HVAC.
- .3 Division 26 – Electrical.

1.2 RELATED WORK SPECIFIED IN FOOD SERVICE SECTIONS.

- .1 Section 11 40 20 – Custom Fabricated Equipment.
- .2 Section 11 41 10 – Pre-Fab Walk-In Boxes.
- .3 Section 23 38 00 – Exhaust Hoods.
- .4 Section 23 38 13 – Fire Suppression.

1.3 SHOP DRAWINGS AND PRODUCT DATA

- .1 Submit shop drawings and product data in accordance with Section 01 33 00 and 11 40 00.
- .2 Where product data indicates multiple models, clearly identify model specific to this project.
- .3 Clearly identify voltages and phase of power.
- .4 Clearly indicate options / accessories relative to this project.
- .5 Items that have been indicated as “spare number”, “modified items”, “removed items”, or not within the kitchen Contract should be included within the specification sheet “booklet”. The sheet should list the job name, item number, description, quantity, and a description of any modifications to be done.

1.4 REFERENCE STANDARDS

- .1 All major equipment units shall comply with the Canadian Standards Association, Canadian Gas Association, Underwriters’ Laboratories Canada Ltd. and Underwriters’ Laboratories Inc. regulations and standards where applicable.
- .2 Any equipment requiring local approval to be included and provided by the KEC.

1.5 WARRANTY/GUARANTEEE

- .1 Where the warranty/guarantee period which is furnished by the manufacturer is for a shorter period than One (1) required year, then the cost for an extended warranty/guarantee shall be included in the pricing structure.
- .2 Where the warranty/guarantee cards are furnished with the units or major equipment, they shall be collected, information filled in, and mailed to the manufacturer as part of this section. A written report shall be furnished to the Construction Manager advising that this procedure has been followed.

- .3 Installation date, for the purpose of determining the warranty/guarantee period, shall be deemed to start from the date of the final acceptance of the total installation.
- .4 Warranty/guarantee cards, equipment brochures or installation manuals accompanying the major equipment units shall not be considered as part of or in lieu of the Operating and Maintenance Manuals called for under Section 11 40 00

1.6 MATERIALS/PARTS SUPPLIED BUT NOT INSTALLED

- .1 Temperature and pressure gauge - Diatrol #536 expansion chamber and pressure regulating valve for installation on incoming hot water line to a hot water booster – to be installed in water supply lines by Mechanical Contractor; refer to Division 22.
- .2 Standard components and accessories as required for waste disposer units – solenoid valve, syphon breaker, switch and flow control valve to be installed in water lines by Mechanical Contractor; solenoid valve, syphon breaker and switch to be interconnected by Electrical Contractor.

1.7 INSTALLATION

- .1 Install equipment in accordance with manufacturer’s printed instructions.
 - .1 Coordinate connection of mechanical and electrical services.
 - .2 Adjust equipment for smooth and proper operation.
 - .3 Install natural gas burning appliances and equipment in accordance with CAN1-B149.1-M86.
 - .4 Unless otherwise noted (in either plans or specifications) all shelving to be assembled based on lowest shelf located 225mm AFF, second shelf 540mm clear of first (lowest), third shelf 405mm clear of second shelf, fourth shelf 305mm clear of third shelf and fifth shelf 305mm clear of fourth shelf.

1.8 ITEMIZED EQUIPMENT

ITEM #2

QUANTITY	-	One (1) required.
MANUFACTURER	-	T & S
MODEL	-	B-1117

FAUCET

ITEM #6

QUANTITY	-	Two (2) sections required; five tier.
MANUFACTURER	-	Metro
COMPONENTS	-	Ten (10) each 1860NC shelves
	-	Eight (8) each 70UP posts
	-	Eight (8) each 5MDA casters; half w/ brakes.

STORAGE SHELVING

ITEM #7

QUANTITY	-	Fourteen (14) sections required; five tier.
MANUFACTURER	-	Metro
COMPONENTS	-	Forty five (45) each 2136NC shelves
	-	Fifteen (15) each 2154NC shelves

DRY STORAGE SHELVING

- NOTE:
- Five (5) each 2160NC shelves
 - Five (5) each 2172NC shelves
 - One (1) each TTE21C end unit kit
 - Six (6) each TTM21C mobile unit kits
 - One (1) TTS16NA track set
 - Twenty four (24) each 70UP posts
 - Twenty four (24) each 5MDA casters; half w/ brakes.
 - KEC to furnish track length to fit snugly between building walls (approx. 5750mm)

ITEM #8 **SPARE**

ITEM #9 **SPARE**

ITEM #10 **SPARE**

ITEM #14 **WALK-IN FREEZER SHELVING**

- QUANTITY
MANUFACTURER
COMPONENTS
- Seven (7) sections required; five tier.
 - Metro
 - Five (5) each MQ2436G shelves
 - Ten (10) each MQ2460G shelves
 - Twenty (20) each MQ2472G shelves
 - Twenty eight (28) each MQ70UPE posts
 - Twenty eight (28) each 5MX casters; half w/ brakes.

ITEM #18 **WALK-IN COOLER SHELVING**

- QUANTITY
MANUFACTURER
COMPONENTS
- Seven (7) sections required; five tier.
 - Metro
 - Five (5) each MQ2436G shelves
 - Ten (10) each MQ2460G shelves
 - Twenty (20) each MQ2472G shelves
 - Twenty eight (28) each MQ70UPE posts
 - Twenty eight (28) each 5MX casters; half w/ brakes.

ITEM #19 **SPARE**

ITEM #22 **WALL MOUNT WIRE STORAGE SHELVING**

- QUANTITY
MANUFACTURER
MODEL
COMPONENTS
- One (1) section required.
 - Metro
 - Smartwall
 - One (1) each SW56K3 wall track
 - Two (2) each SWU30K3 uprights
 - Two (2) each SWS18K3 single shelf supports
 - One (1) each 1848NK3 shelf
 - One (1) each WG1848K3 wire grid

- One (1) each SWA1 accessory pack

ITEM #23

QUANTITY
MANUFACTURER
MODEL
ACCESSORIES

CONVEYOR DISHWASHER c/w HOT WATER BOOSTER

- One (1) required.
- Hobart
- CL44e; 208V 3Ph (Left to right)
- Single point electrical connection (Not including booster)
- 30KW electric booster heater
- Flanged SS adjustable feet
- Drain water tempering kit

ITEM #26

QUANTITY
MANUFACTURER
MODEL
ACCESSORIES

WALL MOUNT HOSE & REEL

- One (1) required.
- T & S
- B-7122-C01
- One (1) each vacuum breaker
- One (1) each mixing valve
- Two (2) each check valves
- Approx. 100mm wide x 50mm deep 1.6mm SS service chase, to conceal surface run water line (by Mechanical) from mixing valve to hose reel mounting location; refer to drawings
- Mechanical Contractor to install components per drawings and manufacturer's instructions

NOTE

ITEM #27

QUANTITY
MANUFACTURER
MODEL

WASTE RECEPTACLE

- Seven (7) required.
- Rubbermaid
- 2620 c/w dolly

ITEM #29

SPARE

ITEM #30

SPARE

ITEM #33

QUANTITY
MANUFACTURER
MODEL

FAUCET

- One (1) required.
- T & S
- B-0290

ITEM #34

QUANTITY
MANUFACTURER
MODEL
ACCESSORIES

PRE-WASH SPRAY c/w ADD-ON FAUCET

- One (1) required.
- T & S
- B-0287
- One (1) each wall support bracket

ITEM #36

QUANTITY
MANUFACTURER
MODEL
COMPONENTS

SS HAND SINK c/w FAUCET

- Five (5) required.
- Eagle
- HSA-10
- SS end splashes
- Five (5) each T & S EC-3101 electronic motion control faucets c/w electric cords & plugs.

ITEM #37

NOTE

SOAP & TOWEL DISPENSERS

- N.I.C. / By Division

ITEM #38

QUANTITY
MANUFACTURER
COMPONENTS

WALL MOUNT WIRE STORAGE SHELVING

- One (1) section required.
- Metro
- Four (4) each 2472NC shelves
- One (1) each SW53C
- One (1) each AW53C

ITEM #39

SPARE

ITEM #40

SPARE

ITEM #41

QUANTITY
MANUFACTURER
MODEL

MOBILE CART

- Four (4) required.
- Hatch
- EUC-A-2135-3

ITEM #42

QUANTITY
MANUFACTURER
COMPONENTS

DRY STORAGE SHELVING

- Seven (7) sections required; five tier.
- Metro
- Five (5) each 2436NC shelves
- Ten (10) each 2460NC shelves
- Twenty (20) each 2172NC shelves
- Twenty eight (28) each 70UP posts
- Twenty eight (28) each 5MDA casters; half w/ brakes.

ITEM #43

QUANTITY
MANUFACTURER
COMPONENTS

MOBILE POT & UTENSIL SHELVING

- One (1) section required; five tier.
- Metro
- Five (5) each MQ2448G shelves
- Four (4) each MQ70UPE posts
- Four (4) each 5MDXA casters; half w/ brakes.

ITEM #47

QUANTITY
MANUFACTURER

CONVECTION OVEN

- One (1) required.
- Doyon

- | | | |
|-------------|---|---|
| MODEL | - | JA28G |
| ACCESSORIES | - | One (1) each 1220mm long flexible T & S gas connector c/w restraint |
| | - | Casters; front locking |
| | - | T&S Posi-set wheel placement guides for rear casters |

ITEM #48

- QUANTITY
MANUFACTURER
MODEL
ACCESSORIES

WATER FILTER

- One (1) required.
- 3M / Cuno
- BEV-140
- Three (3) each replacement cartridges

ITEM #49

SPARE

ITEM #50

SPARE

ITEM #51

- QUANTITY
MANUFACTURER
MODEL
ACCESSORIES

TWIN 12gal. TILTING KETTLES

- One (1) required.
- Cleveland
- TKET-12-T
- Lift off cover (CL) c/w kettle cover holding bracket
- Hot & cold water faucet (DPK) c/w faucet mounting bracket (FBKT)
- SS equipment stand c/w drain drawer and splash shield (ST-55-T)

ITEM #53

- QUANTITY
MANUFACTURER
MODEL
ACCESSORIES

40qt. MIXER

- One (1) required.
- Hobart
- HL400
- Deluxe accessory package c/w SS bowl, beater, wire whip, dough hook, bowl scraper & ingredient chute
- Bowl truck
- Matching 30qt. mixer accessories (SS bowl, beater, wire whip, dough hook, bowl scraper & ingredient chute)

ITEM #57

- QUANTITY
MANUFACTURER
MODEL

SCALE

- Three (3) required.
- Edlund
- BDSS-16

ITEM #58

- QUANTITY
MANUFACTURER
MODEL

MOBILE INGREDIENT BIN

- Four (4) required.
- Cambro
- IBS-20 c/w scoop

ITEM #59

NOTE

MICROWAVE OVEN

- N.I.C. / By Division

ITEM #60

SPARE

ITEM #64

QUANTITY
MANUFACTURER
MODEL

COUNTERTOP INDUCTION COOKTOP

- Four (4) required.
- Garland
- GI-BH/BA3500

ITEM #68

QUANTITY
MANUFACTURER
COMPONENTS

WALK-IN COOLER SHELVING

- Two (2) sections required; five tier.
- Metro
- Ten (10) each MQ2472G shelves
- Eight (8) each MQ70UPE posts
- Eight (8) each 5MX casters; half w/ brakes.

ITEM #69

SPARE

ITEM #70

SPARE

ITEM #74

QUANTITY
MANUFACTURER
COMPONENTS

WALK-IN FREEZER SHELVING

- Three (3) sections required; five tier.
- Metro
- Fifteen (15) each MQ2460G shelves
- Twelve (12) each MQ70UPE posts
- Twelve (12) each 5MX casters; half w/ brakes.

ITEM #76

QUANTITY
MANUFACTURER
MODEL

FAUCET

- One (1) required.
- T & S
- B-1112

ITEM #78

QUANTITY
MANUFACTURER
MODEL

8qt. MIXER

- Eight (8) required.
- Globe
- SP-8

ITEM #79

SPARE

ITEM #81

QUANTITY
MANUFACTURER
MODEL
ACCESSORIES

HEATED HOLDING CABINET

- One (1) required.
- Cres Cor
- H-137-SUA-12D
- Full perimeter bumper

ITEM #82

QUANTITY
MANUFACTURER
MODEL
ACCESSORIES

80qt. MIXER

- One (1) required.
- Hobart
- HL800
- Deluxe accessory package c/w SS bowl, beater, wire whip, dough hook, bowl scraper & ingredient chute
- Bowl truck

ITEM #85

QUANTITY
MANUFACTURER
MODEL
ACCESSORIES

PRE-WASH SPRAY c/w ADD-ON FAUCET

- One (1) required.
- T & S
- B-0287
- One (1) each wall support bracket

ITEM #86

QUANTITY
MANUFACTURER
MODEL

FAUCET

- One (1) required.
- T & S
- B-0290

ITEM #88

QUANTITY
MANUFACTURER
MODEL

FAUCET

- One (1) required.
- T & S
- B-1112

ITEM #89

SPARE

ITEM #93

QUANTITY
MANUFACTURER
MODEL

FAUCET

- Two (2) required.
- T & S
- B-1117

ITEM #99

QUANTITY
MANUFACTURER
MODEL

SALAMANDER

- One (1) required.
- Garland
- MIR-34C

ITEM #103

QUANTITY
MANUFACTURER
MODEL
ACCESSORIES

SINGLE OVEN RANGE c/w BURNER TOP

- Ten (10) required.
- Garland
- G36-6R
- SS backguard with high shelf
- Ten (10) each 1220mm long flexible T&S gas connector c/w restraint
- Casters; front casters to be locking
- T&S Posi-set wheel placement guides for rear casters

ITEM #103A

QUANTITY
MANUFACTURER
MODEL
ACCESSORIES

SINGLE OVEN RANGE c/w BURNERS

- One (1) required.
- Garland
- G24-4L
- Low profile SS backguard
- One (1) each 1220mm long flexible T&S gas connector c/w restraint
- Casters; front casters to be locking
- T&S Posi-set wheel placement guides for rear casters

ITEM #116

QUANTITY
MANUFACTURER
MODEL
ACCESSORIES

30gal. TILTING SKILLET

- One (1) required.
- Cleveland
- SGL-30-TR
- Power tilt with Hand Tilt Override
- Double pantry hot & cold water faucet (DPS14) c/w faucet mounting bracket
- Pan carrier

ITEM #118

QUANTITY
MANUFACTURER
MODEL
ACCESSORIES

40gal. TILTING KETTLE

- One (1) required.
- Cleveland
- KGL-40-T
- Tangent draw-off valve (TD2)
- Double pantry hot & cold water faucet (DPS14) c/w faucet mounting bracket

ITEM #119

SPARE

ITEM #120

QUANTITY
MANUFACTURER
MODEL
ACCESSORIES

DEEP FRYER

- Two (2) required.
- Frymaster
- MJ40
- Frypot cover
- Two (2) each 1220mm long flexible T&S gas connector c/w restraint
- Casters; front locking
- T&S Posi-set wheel placement guides for rear casters

ITEM #122

QUANTITY
MANUFACTURER
MODEL

CONVECTION STEAM COOKER

- One (1) unit required.
- Cleveland
- 24-CGA-10

ITEM #123

QUANTITY	-	One (1) required.
MANUFACTURER	-	3M / Cuno
MODEL	-	BEV-140
ACCESSORIES	-	Three (3) each replacement cartridges

WATER FILTER

ITEM #125

QUANTITY	-	One (1) required.
MANUFACTURER	-	Convotherm
MODEL	-	C4eT 10.20 GS
ACCESSORIES	-	Disappearing door
	-	One (1) each stationary stand CST20CB-4
	-	Autowash starter kit c/w one (1) each jug of C-Clean (detergent) and one (1) each jug of C-Care (rinse) & all hoses required to connect to oven

COMBI OVEN c/w STAND

ITEM #126

QUANTITY	-	One (1) required.
MANUFACTURER	-	3M / Cuno
MODEL	-	BEV-140
ACCESSORIES	-	Three (3) each replacement cartridges

WATER FILTER

ITEM #128

QUANTITY	-	One (1) required.
MANUFACTURER	-	Blodgett
MODEL	-	DFG-100
ACCESSORIES	-	One (1) each 635mm high SS stand c/w rack guides
	-	One (1) each 1220mm long flexible T & S gas connector c/w restraint
	-	Casters; front locking
	-	T&S Posi-set wheel placement guides for rear casters

CONVECTION OVEN

ITEM #130

NOTE	-	N.I.C. / By Division
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POS TERMINAL

ITEM #131

QUANTITY	-	One (1) required.
MANUFACTURER	-	Garland
MODEL	-	GTBG24-AR24
ACCESSORIES	-	One (1) each 1220mm long flexible T & S gas connector c/w restraint
	-	SS splatter guards on rear and sides
	-	SS utility stand c/w casters, front locking
	-	T&S Posi-set wheel placement guides for rear casters

COUNTERTOP BROILER

ITEM #133

QUANTITY
MANUFACTURER
MODEL
ACCESSORIES

NOTE

DROP-IN FOUR WELL HOT / COLD FOOD TABLE

- One (1) required.
- Wells
- HRCP-7400SL
- Applicable hardware for mounting into countertop. KEC to confirm
- Drain valve extension c/w handle to front leading edge of faceplate of Item #132
- KEC to recess control panel into faceplate of Item #132 as per drawing
- KEC to supply & install copper drain line to appropriate floor drain as per drawings
- KEC to supply extended wiring from unit to control panel to suit mounting location if necessary

ITEM #135

QUANTITY
MANUFACTURER
MODEL

HEAT LAMP

- Two (2) required.
- Hatco
- GRAH-42

ITEM #136

QUANTITY
MANUFACTURER
MODEL

REFRIGERATED TABLE

- One (1) required.
- True
- TSSU-72-18-HC

ITEM #138

QUANTITY
MANUFACTURER
MODEL
ACCESSORIES

ICE MAKER c/w BIN

- One (1) required.
- Hoshizaki
- KM-600MAJ
- One (1) each B-500 bin

ITEM #139

QUANTITY
MANUFACTURER
MODEL
ACCESSORIES

WATER FILTER

- One (1) required.
- 3M / Cuno
- ICE-120S
- Three (3) each replacement cartridges

END OF SECTION

Part 1 General

1.1 RELATED WORK SPECIFIED IN OTHER SECTIONS.

- .1 Division 22 – Plumbing.
- .2 Division 23 – HVAC.
- .3 Division 26 – Electrical.

1.2 RELATED WORK SPECIFIED IN FOOD SERVICE SECTIONS.

- .1 Section 11 40 10 – Catalogued Equipment.
- .2 Section 23 38 00 – Exhaust Hoods.

1.3 ACCEPTABLE MANUFACTURERS

- .1 All fabricated equipment, food serving units, tables, sinks, counter tops, etc. described in the following specifications other than by name and catalogue number shall be manufactured by an experienced equipment fabricator with plant, personnel, and engineering facilities to properly design, detail, and manufacture high quality food service equipment.
- .2 All work in the above category shall be manufactured by one manufacturer, and shall be of standard quality and workmanship, and be of uniform design and finish.
- .3 The manufacturer of this equipment must have a minimum of five (5) years' experience in the manufacture or distribution of equipment, as required under this Contract, as his principal product.

1.4 QUALIFICATIONS OF INSTALLER

- .1 Equipment shall be installed by personnel trained in the installation of food service equipment, having at least five (5) years continuous proven experience.
- .2 The Kitchen Equipment Subcontractor shall be responsible for installation and setting-in-place of all equipment, ready for connection by other trades. KEC shall notify the Construction Manager when it is ready for connection. KEC or his representative shall check the operation of the equipment, prior to the demonstration, to see that it is in proper working condition. Equipment not functioning properly shall be fixed, and brought to proper standard working conditions prior to demonstration.

1.5 SHOP DRAWINGS AND PRODUCT DATA

- .1 Submit shop drawings and product data in accordance with Section 01 33 00 and 11 40 00. Note: Drawing must show plan, section, and elevation views.
- .2 Indicate all construction details of equipment by drawings or manufacturer's literature.
- .3 Indicate roughing-in service requirements for mechanical, electrical, and gas operated equipment.

- .4 Items that have been indicated as “spare number”, “modified items”, “removed items”, or not within the kitchen Contract should be included within the specification sheet “booklet”. The sheet should list the job name, item number, description, quantity, and a description of any modifications to be done.

1.6 REFERENCE STANDARDS

- .1 Welding of mild steel shall conform to CSA-W59-1982 regulations. Welding for SS shall conform to CSA W48-2-M1980 regulations.
- .2 Steel shaft - cold-roll commercial quality shall have a minimum coating to ASTM G-90-A526/A527 standard. Thickness as specified.
- .3 Steel shaft, for painted surfaces, shall have a galvaneal coating to conform to ASTM A653/A653M-01a standard.
- .4 Steel sections - structural quality shall have a galvanized coating having a minimum thickness of .05 kg/m².
- .5 SS shall be A.I.S.I. Type 304 unless specified, Grade 18-8. Finish shall be A.I.S.I. #2B or #4 as indicated. Thickness as specified.
- .6 All plywood material for counters, cupboards and cafeteria line front panels shall be good grade “Western Softwood” conforming to CSA 0151-M1978 standards.
- .7 Plastic laminate shall be to CAN3-A172-M79 standard using Type 1B for facing, Type 2A for post forming. Finish shall be Type 4/64. Color, pattern, and manufacture as indicated.
- .8 Glass, float or plate, shall be to CSGB-12-GP-3B standards. Thickness 6mm.
- .9 This section shall take precedence over the Kitchen Equipment Drawings.

1.7 MATERIALS

- .1 General - SS shall be Type 304, 18-8 #4 polished finish or #2B bright finish as specified hereunder.
- .2 The following thicknesses shall be adhered to throughout:

2.0mm	for all covered corner sinks.
1.6mm	for all dishtables, counter tops, overshelves, single pan doors, SS slides, SS grids, and undershelves over 1220mm long.
1.2mm	for all undershelves less than 1220mm long, SS bins (fixed or mobile), counter top sinks, and vertical surfaces.
1.0mm	for all chassis of fixtures, double pan doors, and drawer fronts.
1.0mm	for all refrigerator linings, or as specified.
0.8mm	for all drawer bodies, and door linings.
- .3 Galvanized Steel - composition copper bearing sheet type heavily hot galvanized finish, one coat primer and one coat of grey hammerloid air dry enamel, and shall be used only on equipment in the unexposed locations, and where there is no excess water conditions.
- .4 SS Tubing - to ASTM-A269-83, Type TP304 commercial grade, seamless, welded with A.I.S.I. #4 finish.

- .5 Fastenings - for securing corrosion-resistant or plated metal parts, fastenings to be as corrosion-resistant as and color matched to materials being fastened. Fastenings used for securing unplated ferrous metal or wood parts are to have a minimum protective coating of cadmium or zinc. Where possibility of food or food acid contact, plating to be nickel/chromium, however, cadmium, zinc or other toxic coatings not acceptable. Where screws are necessary, use flat head screws.
- .6 Laminated Wood Tops - maximum 50mm wide clear edge grain strips, laminated with waterproof glue to CSA 0112-Series-M1977 into 32mm thick slabs, sanded smooth and sealed.
- .7 SS adjustable foot inserts (standard models) by Component Hardware:
 - .1 Model A10-1000.
- .8 Unless specified, fiberglass grating to be 38mm high x 38mm square:
 - .1 Grey in color.
 - .2 Grating to be a “grit” type surface.

1.8 FABRICATION

- .1 Fabricate work square, true and straight, to suit installation conditions, and as indicated. Design is to afford maximum sanitary conditions, and is not to have areas where disease-causing bacteria may accumulate; all vertical and horizontal corners to be coved with a 19mm radius.
- .2 Fabricate equipment from SS, unless otherwise indicated.
- .3 Fit and shop-assemble equipment ready for erection where possible.
- .4 Deburr and smooth raw edges prior to forming.
- .5 Straight lengths - counter tops, table tops, drainboards, tray rails, shelving and the like to be one continuous piece if 3000mm or less in length. If over 3000mm, sections to be welded including field joints, unless otherwise indicated.
- .6 Welding - sound, non-porous, and free from imperfections. Weld metal to be color matched to and be as corrosion-resistant as the parent metal. Spot welds, if any, to be minimum 3mm diameter, and have full penetration. Grind exposed welds smooth, and polish to match parent metal. Grind other welds smooth. Welding or finishing is not to impair the corrosion resistance of the finished article. Welds, except spot welds, shall be continuous unless otherwise indicated.

1.9 SINK UNITS

- .1 Sizes as indicated on Kitchen Equipment Drawings, and as specified.
- .2 Compartment material minimum 2.0mm thick SS unless otherwise noted.
- .3 Construction - welded, no solder or fill accepted. All corners to be coved.
- .4 Compartment bottom - slope 13mm down towards drain.
- .5 Each sink shall be equipped with one of the following types of 40mm diameter drains unless specified otherwise:

- .1 Corner type shall be Component Hardware Model E18-1822 c/w SS tailpiece, E15-0242 overflow tube and SS perforated strainer.
- .2 Centre type shall be Component Hardware Model E38-1012 c/w SS tailpiece and SS perforated strainer.
- .3 Lever handle shall be Component Hardware Model D53-7100 c/w SS tailpiece and SS perforated strainer.
- .6 Where multiple compartments are indicated, space between compartments shall be maximum of 25mm. Weld compartments into counter top or drainboards.
- .7 Punch holes for hot and cold water faucets.
- .8 Drainboards 2.0mm thick SS, integral with and sloping down towards compartments.
- .9 Edges up and rolled, dished and boxed or boxed as specified.
- .10 Top of sink edge and drainboard to be a straight horizontal line.
- .11 Corners of tops - outside radius minimum 38mm or mitered.
- .12 Splashback 2.0mm thick SS, rolled up and splayed, integral with sink, drainboard or top. Where counter top or drainboard meets splashback or upturn, cove 19mm unless otherwise indicated. Fill in and weld ends of splashback to 38mm below tops.
- .13 Legs and bracing - demountable of SS tubing with SS Component Hardware socket welded to SS channel which is welded to sink bottom. Legs 41mm OD tubing. Bracing 41mm OD tubing.
- .14 Dowelling - install SS pins in floors and feet for securing feet of equipment where vibration may occur. Dowelling to be installed in all SS tables and cabinets with mechanical or electrical connection. Note: Hole to be drilled in the center of SS foot, not through the SS flange.
- .15 Skirting 1.0mm thick on single or multiple compartment sinks, skirting on exposed external surfaces to extend under sinks 25mm past the bottom radii, be spot welded under sinks, to follow vertical external radii at extreme ends or fitted and welded to integral components as appropriate. Space spot welds a maximum of 100 mm on centers.
- .16 One-piece construction solid undershelf, 1.6mm thick with boxed edge on front with sides and back turned up 38mm and hemmed.
 - .1 For items with a single undershelf, notch and weld to legs 250mm clear off floor at midway adjustment of feet.
 - .2 For items with an intermediate shelf and undershelf, notch and weld undershelf to legs 250mm clear off floor at midway adjustment of feet. Unless otherwise stated, the distance between the underside of intermediate shelf and top of undershelf should be 200mm clear.
- .17 Reinforcing and leg channels 2.0mm thick SS.

1.10 UTILITY AND WORK TABLES

- .1 Sizes as indicated.

- .2 Tops and back / end splashes 1.6mm thick SS with top edges formed as indicated with splashes covered to top.
- .3 Legs and bracing - refer to 1.9.13.
- .4 Dowelling - refer to 1.9.14.
- .5 Undershelf - where indicated, refer to 1.9.16.
- .6 Reinforcing and leg channels spaced to a maximum span of 1220mm between supports, constructed of 2.0mm thick galvanized, not to protrude beyond bottom edge of table top.
- .7 Where receptacles are specified as part of fixture, any within 1500mm of sink to include ground fault interruption (GFI) protection

1.11 DRAWERS

- .1 Sizes as indicated.
- .2 Body material 0.8mm thick SS.
- .3 Front material 1.0mm thick SS with SS channel longitudinal brace where lock goes through.
- .4 Corners welded.
- .5 End rolled up with 13mm SS hem at top.
- .6 Sides rolled up on 19mm radius with 13mm hem at top.
- .7 Rubber bumpers shall be secured at rear to prevent drawers from banging.
- .8 Hardware - tracks with nylon rollers and SS ball bearings in SS channels with easily released stops. Adjust for free running action.
- .9 Housing 0.8mm thick SS. Drawers in open equipment to be housed.
- .10 Unless otherwise specified, drawers to be equipped with Component Hardware P63-1012 SS drawer pull with full grip and framed beveled edge.

1.12 CABINETS AND COUNTERS

- .1 Tops and integral splashbacks 1.6mm thick SS, all welded construction (edges as specified) with back and end splashes covered to top.
- .2 Body 1.2mm thick SS.
- .3 Pilasters 2.0mm thick SS.
- .4 Legs and bracing - demountable of SS 40mm diameter tubing with SS Component Hardware sockets welded to SS channel welded to bottom of top.
- .5 Feet as per 1.7.7.
- .6 Curb mounted units shall be positioned, levelled, and sealed with access provided to all drains. Curb bases custom fabricated of 1.6mm thick galvanized steel all welded channel framing 25mm x 150mm x 25mm lag bolted to floor. Coat upper and lower flanges with mastic sealant prior to final placement of counter/cabinet for complete seal.

- .7 Sliding doors 25mm thick double pan, welded construction of 1.0mm thick SS, sound deadened. SS finish A.I.S.I. #2B is permitted for inside pan. Mount doors on sanitary overhead tracks and ball bearing roller equipped metal door hangers. Guide bottom of doors in open tracks or other sanitary non-accumulative guide method.
- .8 Hinged doors 25mm thick double pan, welded construction of 1.0mm thick SS, sound deadened with door pull, magnetic catch, and full length piano hinges.
- .9 Shelves 1.2mm thick SS, edges boxed, backs up 50mm and folded at backs, adjustable on pilasters.
- .10 Where receptacles are specified as part of fixture, any within 1500mm of sink to include ground fault interruption (GFI) protection

1.13 DISHTABLING

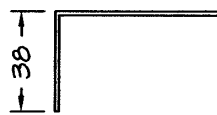
- .1 Dishtable tops to be 1.6mm and completely welded, including garbage disposal bowl where shown. No soldering or riveting permitted. Dishtables to have built-in slope of 20mm per 3000mm with backsplashes level. All corners coved.
- .2 Dishtables to have full channel support bracing across the short width at maximum 915mm intervals. Reinforcing and leg channels 2.0mm thick SS.
- .3 Apply 3M mastic undercoating materials, or equal, to underside.
- .4 All channel supports to have 3.0mm thick neoprene adhesive strips between them and the table for sound deadening.
- .5 To have 38mm rolled front and ends unless ends butt up to wall, then match end to splashback. Radiused bends in all vertical and horizontal sections. All corners shall be bull nosed, ground smooth, and polished.
- .6 Soiled dishtable to have 50mm x approx. 300mm high splayed backsplash (refer to drawings) where table adjoins wall. Secure backsplashes against walls with galvanized Z clips at 750mm maximum spacing.
- .7 Legs and bracing - refer to 1.9.13.
- .8 Dowelling - refer to 1.9.14.
- .9 Soiled dishtable to have 1.2mm SS cladding on wall, 610mm high, kinked 38mm to match splayed splash, and hemmed at top.
- .10 Clean dishtable to have 200mm thick boxed type backsplash. Radiused bends in all vertical and horizontal sections.

1.14 INSTALLATION

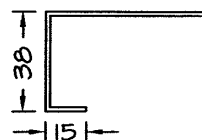
- .1 Install food service equipment plumb with cabinets and counters, level to 1.5mm in 3050mm.
- .2 Level base cabinets by adjusting levelling legs.
- .3 Scribe and fit SS filler strips to irregularities of adjacent surfaces, maximum gap opening 5mm.

- .4 Secure equipment to floor and wall construction using masonry anchors and toggle bolts spaced as indicated.
- .5 Fastening and sealing - where stationary or fixed and matching items butt against one another, join with concealed SS fasteners. Seal joints. Where joints cannot be sealed with single pass, use SS filler strip in conjunction with sealant. Where items are against or through walls or partitions, seal resultant joint.
- .6 After installation, fit and adjust operating hardware.
- .7 Critical installation dimensions: Top of adjustable pot racks to be set at 2135mm A.F.F.

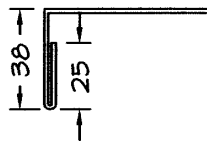
Custom Formed Edges



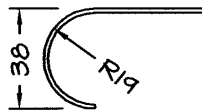
FLANGED



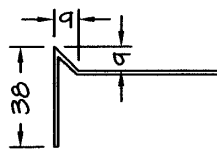
BOXED



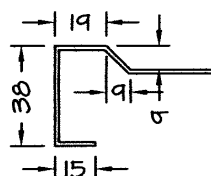
FLANGED
& HEMMED



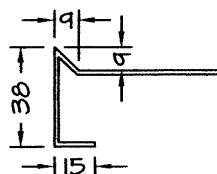
ROLLED



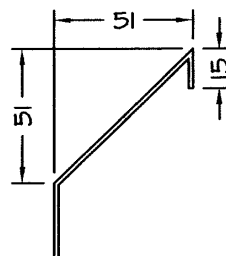
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& BOXED



SPLAYED
BACKSPLASH

1.15 ITEMIZED EQUIPMENT

ITEM #1

QUANTITY
SIZE
CONSTRUCTION
COMPONENTS

SS TABLE c/w SINK

- One (1) required.
- Approx. 1525mm x 760mm x 890mm high.
- As per 1.9; refer to drawings
- 1.6mm SS top w/ boxed edges on front and right end w/ integral 200mm high x 50mm deep splayed back & left end splash.
- One (1) each integral 500mm x 500mm x 250mm deep coved corner sink, located at left end, c/w center basket waste.
- 1.6mm SS undershelf
- SS legs and bracing as per 1.8.13.
- Feet as per 1.6.7
- Z-Clip to wall

ITEM #3

QUANTITY
SIZE
CONSTRUCTION
COMPONENTS

SS WALL SHELF

- One (1) required.
- Approx. 1525mm wide x 305mm deep.
- 1.6mm SS
- 1.6mm SS w/ boxed edges on front and ends
- Back turned up and hemmed to accept Z-clip mounting
- 1.6mm SS gussets, extended down at 45° to wall from front leading edge

ITEM #20

QUANTITY
SIZE

CONSTRUCTION
NOTE:

SS CORNER GUARDS

- Twelve (12) required.
- Eight (8) each approx. 50mm x 50mm x 1220mm high
- Four (4) each approx. 50mm x wall thickness x 50mm x 1220mm high
- 1.6mm SS
- 1.6mm SS “over broke” to ensure snug fit to wall - silicone into place - no mechanical fastening

ITEM #21

QUANTITY
SIZE
CONSTRUCTION
COMPONENTS

CLEAN DISHTABLE

- One (1) required.
- Approx. 2150mm x 760mm x 915mm high
- As per 1.12; refer to drawings
- Integral 200mm high x 175mm deep boxed back and right end splash c/w rolled edge on front. Note: Right end splash to be 50mm deep
- 1.6mm SS undershelf
- SS legs and bracing as per 1.8.13.
- Feet as per 1.6.7.
- Z-Clip to wall

ITEM #24

QUANTITY
SIZE
CONSTRUCTION
COMPONENTS

SS CONDENSATE COLLECTOR HOOD

- One (1) required.
- Approx. 1900mm x 1000mm x 460mm high
- 1.6mm SS
- 1.6mm SS with solid top, all four sides boxed down 460mm, turned in 50mm and up to form gutter
- Internal 610mm x 1300mm 1.6mm SS baffle
- 1.6mm SS ductwork, from top of hood to 25mm above finished ceiling, c/w SS finishing flange at ceiling. Co-ordinate w/ Mechanical

ITEM #25

QUANTITY
SIZE
CONSTRUCTION
COMPONENTS

SOILED DISHTABLE c/w PRE-WASH SINK

- One (1) required.
- "L-Shaped" Approx. 4550mm x 1270mm x 760mm x 915mm high.
- As per 1.12; refer to drawings
- Integral 250mm high x 50mm deep splayed backsplash c/w rolled edge on front & left end.
- One (1) each approx. 500mm x 500mm x 175mm deep pre-wash sink, in center of table, located 3050mm from left end, with center basket waste and removable fully welded rack slides. Provide rack slide storage brackets to the front of sink.
- 1.6mm SS undershelf
- Approx. 610mm wide clear open area, to accommodate Item #27
- 1.6mm SS mounting bracket for controls for Item #26. Bracket to be located to allow mixing valve controls to be 25mm back from front leading edge of table
- SS legs and bracing as per 1.8.13.
- SS feet as per 1.6.7.
- Z-clip to wall

ITEM #28

QUANTITY
SIZE
CONSTRUCTION
COMPONENTS

SS WALL CLADDING

- One (1) lot required.
- One (1) each approx. 4550mm x 865mm high
- One (1) each approx. 875mm x 865mm high
- One (1) each approx. 1900mm x 1220mm high
- One (1) each approx. 1755mm x 915mm high
- One (1) each approx. 760mm x 915mm high
- One (1) each approx. 3355mm x 610mm high
- 1.6mm SS
- Laminate 1.6mm SS to wall and kink over backsplash of Item #25 & 32. Seams to run vertically
- One (1) each 50mm x 50mm x 610mm high 1.6mm SS corner trim strip

- One (1) each 50mm x 50mm x 915mm high 1.6mm SS corner trim strip
- Laminate 50mm 1.6mm SS joint trim strips to all vertical butt joints

ITEM #31

QUANTITY
SIZE
CONSTRUCTION
COMPONENTS

WALL MOUNT SS RACKING SHELF

- One (1) required.
- Approx. 1600mm long
- 1.6mm SS
- 1.6mm SS all welded pan type construction w/ front ends flanged up 25mm and hemmed.
- Slope 45° from wall.
- Provide gussets to wall
- Z-clip to wall

ITEM #32

QUANTITY
SIZE
CONSTRUCTION
COMPONENTS

THREE COMP. POT WASH SINK

- One (1) required.
- Approx. 3355mm x 760mm x 915mm high.
- As per 1.12; refer to drawings.
- Integral 250mm high x 50mm deep splayed backsplash c/w rolled edge on front and ends.
- Two (2) each approx. 610mm wide & one (1) each approx. 760mm wide x 305 deep coved corner pot sinks c/w center basket lever wastes.
- 1.6mm SS undershelves
- SS legs and bracing as per 1.8.13
- SS feet as per 1.6.7
- Z-clip to wall

ITEM #35

QUANTITY
SIZE
CONSTRUCTION
COMPONENTS

SS WALL SHELF

- One (1) required.
- Approx. 610mm wide x 305mm deep.
- 1.6mm SS
- 1.6mm SS w/ boxed edges on front and ends
- Back turned up and hemmed to accept Z-clip mounting
- 1.6mm SS gussets, extended down at 45° to wall from front leading edge

ITEM #45

QUANTITY
SIZE

COMPONENTS

INSULATED SS WALL CLADDING c/w SS GAS LINE CHASE

- One (1) lot required.
- One (1) each approx. 3965 mm long x 1980mm high x 25mm thick; four (4) equally sized panels.
- Wrap mineral wool insulation with 1.6mm SS, boxed front and edges. Turn bottom down 38mm to secure to wall with SS screws. Seams to run vertically

- Approx. 150mm x 150mm x 2150mm high 1.6mm SS gas line chase w/ left side perforated and top finishing flange

ITEM #52

SS FLOOR DRAIN PAN

QUANTITY

- One (1) required.

SIZE

- Approx. 305mm x 305mm; refer to drawing

CONSTRUCTION

- Refer to detail drawing

COMPONENTS

- 2.0mm SS all welded pan sloped to center drain c/w integrally welded in Kason 0463-2010 drain basket assembly

NOTE

- Removable grating to be FS-25 Grit Top Chem Grate
- Contractor to install in floor structure with grate and flange flush with finished floor

SERVICES

- One (1) each 75mm waste by Mechanical Subcontractor

ITEM #54

WALL MOUNT MIXER ACCESSORY RACK

QUANTITY

- One (1) required.

SIZE

- Approx. 610mm long

CONSTRUCTION

- 6mm thick SS flat bar

COMPONENTS

- 6mm x 75mm high SS flat bar w/ four (4) each 150mm long 13mm dia. SS rods spaced approx. 150mm apart and welded at an angle of 45° up from the horizontal

ITEM #55

SS TABLE

QUANTITY

- One (1) required.

SIZE

- Approx. 3660mm x 760mm x 890mm high.

CONSTRUCTION

- As per 1.9; refer to drawings

COMPONENTS

- 1.6mm SS top w/ boxed edges on front and ends w/ integral 100mm high x 25mm deep boxed backsplash.
- 1.6mm SS undershelves
- Approx. 1525mm clear open area, centered below table, to accommodate Item #58
- SS legs and bracing as per 1.8.13.
- Feet as per 1.6.7
- Z-Clip to wall

ITEM #56

SS WALL SHELF

QUANTITY

- One (1) required.

SIZE

- Approx. 3660mm wide x 305mm deep. Note: Approx. 610mm wide section, to be approx. 405mm deep to accommodate Item #59

CONSTRUCTION

- 1.6mm SS

COMPONENTS

- 1.6mm SS w/ boxed edges on front and ends
- Back turned up and hemmed to accept Z-clip mounting
- 1.6mm SS gussets, extended down at 45° to wall from front leading edge

ITEM #61

QUANTITY
SIZE
CONSTRUCTION
COMPONENTS

SS TABLE

- One (1) required.
- Approx. 2660mm x 760mm x 890mm high.
- As per 1.9; refer to drawings
- 1.6mm SS top w/ boxed edges on front and right end w/ integral 100mm high x 25mm deep boxed back & left end splash.
- 1.6mm SS undershelf
- Approx. 610mm clear open area, under left end, to accommodate Item #27
- Bank of three (3) drawers, w/ Component Hardware removable liners, enclosed in cabinet section, under right end
- SS legs and bracing as per 1.8.13.
- Feet as per 1.6.7
- Z-Clip to wall

ITEM #62

QUANTITY
SIZE
CONSTRUCTION
COMPONENTS

SS TABLE

- One (1) required.
- Approx. 2660mm x 760mm x 890mm high.
- As per 1.9; refer to drawings
- 1.6mm SS top w/ boxed edges on front and left end w/ integral 100mm high x 25mm deep boxed back & right end splash.
- 1.6mm SS undershelf
- Approx. 610mm clear open area, under right end, to accommodate Item #27
- Bank of three (3) drawers, w/ Component Hardware removable liners, enclosed in cabinet section, under left end
- SS legs and bracing as per 1.8.13.
- Feet as per 1.6.7
- Z-Clip to wall

ITEM #63

QUANTITY
SIZE

CONSTRUCTION
COMPONENTS

SS WALL SHELF

- Two (2) required.
- Approx. 2660mm wide x 305mm deep. Note: One shelf to have approx. 610mm wide section, approx. 405mm deep to accommodate Item #59
- 1.6mm SS
- 1.6mm SS w/ boxed edges on front and ends
- Back turned up and hemmed to accept Z-clip mounting
- 1.6mm SS gussets, extended down at 45° to wall from front leading edge

ITEM #75

QUANTITY
SIZE

CONSTRUCTION
COMPONENTS

SS COUNTER c/w SINK

- One (1) required.
- “L” Shaped Approx. 1450mm x 1725mm x 760mm x 890mm high
- As per 1.11; refer to drawings
- 1.6mm SS top w/ boxed edges on front and left end w/ integral 100mm high x 25mm deep boxed back & right end splash.
- One (1) each integral 405mm x 500mm x 250mm deep coved corner sink c/w center basket waste enclosed in base cabinet with hinged door, located on right end.
- 1.6mm SS under and intermediate adjustable shelves.
- SS legs and bracing as per 1.8.13.
- Feet as per 1.6.7
- Z-Clip to wall

ITEM #77

QUANTITY
SIZE
CONSTRUCTION
COMPONENTS

MOBILE SS TABLE

- Four (4) required.
- Approx. 2750mm x 760mm x 915mm high
- As per 1.9; refer to drawings
- 2.0mm SS top c/w boxed edges all around
- 1.6mm SS undershelf
- SS legs and bracing as per 1.8.13.
- Casters; w/ brakes

ITEM #80

QUANTITY
SIZE
CONSTRUCTION
COMPONENTS

SS WALL SHELF

- One (1) required.
- Approx. 760mm wide x 305mm deep.
- 1.6mm SS
- 1.6mm SS w/ boxed edges on front and ends
- Back turned up and hemmed to accept Z-clip mounting
- 1.6mm SS gussets, extended down at 45° to wall from front leading edge

ITEM #83

QUANTITY
SIZE
CONSTRUCTION
COMPONENTS

WALL MOUNT MIXER ACCESSORY RACK

- One (1) required.
- Approx. 610mm long
- 6mm thick SS flat bar
- 6mm x 75mm high SS flat bar w/ four (4) each 150mm long 13mm dia. SS rods spaced approx. 150mm apart and welded at an angle of 45° up from the horizontal

ITEM #84

QUANTITY
SIZE
CONSTRUCTION

THREE COMP. POT WASH SINK

- One (1) required.
- Approx. 3355mm x 760mm x 915mm high.
- As per 1.12; refer to drawings.

- COMPONENTS
- Integral 250mm high x 50mm deep splayed backsplash c/w rolled edge on front and ends.
 - Two (2) each approx. 610mm wide & one (1) each approx. 760mm wide x 305 deep coved corner pot sinks c/w center basket lever wastes.
 - 1.6mm SS undershelf
 - Approx. 610mm wide clear open area, under right end, to accommodate Item #27
 - Approx. 3355mm wide x 610mm high 1.6mm SS wall cladding; laminated to wall at sink location and kinked over backsplash
 - SS legs and bracing as per 1.8.13
 - SS feet as per 1.6.7
 - Z-clip to wall

ITEM #87

QUANTITY
SIZE

CONSTRUCTION
COMPONENTS

SS COUNTER c/w SINK

- One (1) required.
- "L" Shaped Approx. 1830mm x 1760mm x 760mm x 890mm high
- As per 1.11; refer to drawings
- 1.6mm SS top w/ boxed edges on front and right end w/ integral 200mm high x 50mm deep splayed left end splash.
- One (1) each integral 405mm x 500mm x 250mm deep coved corner sink c/w center basket waste enclosed in base cabinet with hinged door, located on left end.
- 1.6mm SS under and intermediate adjustable shelves.
- SS legs and bracing as per 1.8.13.
- Feet as per 1.6.7
- Z-Clip to wall

ITEM #90

QUANTITY
SIZE
CONSTRUCTION
COMPONENTS

TABLE MOUNT POT & UTENSIL RACK

- One (1) required.
- Approx. 1220mm x 610mm x 1370mm high
- 6mm x 50mm SS flat bar
- Two (2) each 41mm dia. SS legs, extended thru top of Item #94 and secured rigidly to channels in top. Note: One leg to be fabricated as part of Item #95
- 6mm x 50mm SS flat bar welded to Component Hardware A24-0207 adjustable brackets for mounting to 41mm dia. SS posts. Top bars to be parallel with 610mm space in between. Lower bars to be parallel with 305mm space in between and mount to Component Hardware A24-0207 adjustable brackets.
- Weld flat bar between lower and upper bars at locations shown.

- Twenty five (25) each double sided pot hooks.

ITEM #91

QUANTITY
SIZE
CONSTRUCTION
COMPONENTS

SS TABLE

- One (1) required.
- Approx. 4485mm x 760mm x 890mm high.
- As per 1.9; refer to drawings
- 1.6mm SS top w/ boxed edges on front and left end w/ integral 200mm high x 50mm deep splayed back & right end splash.
- 1.6mm SS undershelf & intermediate shelves. Intermediate shelves on right hand section only
- Bank of three (3) drawers, w/ Component Hardware removable liners, enclosed in cabinet section, under left end
- SS legs and bracing as per 1.8.13.
- Feet as per 1.6.7
- Z-Clip to wall
- Three (3) each SS electrical boxes c/w applicable devices and SS cover plates mounted in backsplash (for connection by Electrical Subcontractor)

ITEM #92

QUANTITY
SIZE
CONSTRUCTION
COMPONENTS

SS PREPARATION TABLE c/w SINK

- One (1) required.
- Approx. 2750mm x 760mm x 890mm high
- As per 1.9; refer to drawings
- 1.6mm SS top w/ boxed edges on front and ends w/ integral 200mm high x 50mm deep splayed backsplash.
- One (1) each integral 500mm x 500mm x 250mm deep coved corner sink c/w center basket waste, located approx. 760mm from left end enclosed in cabinet section c/w hinged door and 2.0mm SS curb base lag bolted to floor
- 1.6mm SS undershelf.
- Approx. 610mm wide clear open area, under left end, to accommodate Item #27
- Two (2) each SS Component Hardware electrical plug boxes and applicable devices and SS cover plates, mounted in backsplash c/w fully concealed pre-wiring to junction boxes located within base of item #93
- SS legs and bracing as per 1.8.13.
- Feet as per 1.6.7

ITEM #94

QUANTITY
SIZE
CONSTRUCTION

SS PREPARATION TABLE c/w SINK

- One (1) required.
- Approx. 2750mm x 760mm x 890mm high
- As per 1.9; refer to drawings

- COMPONENTS
- 1.6mm SS top w/ boxed edges on front and ends w/ integral 200mm high x 50mm deep splayed backsplash.
 - One (1) each integral 500mm x 500mm x 250mm deep coved corner sink c/w center basket waste, located approx. 940mm from right end enclosed in cabinet section c/w hinged door and 2.0mm SS curb base lag bolted to floor and removable side access panel.
 - 1.6mm SS undershelf.
 - Approx. 610mm wide clear open area, under right end, to accommodate Item #27
 - Two (2) each SS Component Hardware electrical plug boxes and applicable devices and SS cover plates, mounted in backsplash c/w fully concealed pre-wiring to junction boxes located within base
 - SS legs and bracing as per 1.8.13.
 - Feet as per 1.6.7

ITEM #95

QUANTITY
SIZE
CONSTRUCTION
COMPONENTS

SS OVERSHELF

- One (1) required.
- Approx. 1530mm wide x 610mm deep.
- 1.6mm SS
- 1.6mm SS w/ boxed edges on front and ends
- Back turned up and hemmed
- Two (2) each 38mm dia. SS legs c/w SS support gussets extended down at 45° to leg front leading edge. Legs to extend thru backsplash of Item #94 and mount rigidly to channels in top. Note: One leg to be fabricated as part of Item #90
- One (1) each SS Component Hardware electrical plug box (mounted below shelf) and applicable device and SS cover plate, c/w fully concealed pre-wiring to junction boxes located within base of item #93

ITEM #96

QUANTITY
SIZE
CONSTRUCTION
COMPONENTS

SS HAND WASH STATION

- One (1) required.
- Approx. 3355mm x 460mm x 825mm high.
- As per 1.12; refer to drawings.
- Integral 305mm high x 50mm deep boxed backsplash c/w boxed edge on front and ends.
- One (1) each approx. full length x 230mm deep x 230mm high coved corner sink / trough c/w center waste
- Five (5) each T & S EC-3100 deck mount electronic motion control faucets c/w electric cords & plugs.
- SS legs and bracing as per 1.8.13; front legs only
- SS feet as per 1.6.7
- Z-Clip to SS Service Wall, Item #97

<u>ITEM #97</u>	<u>SS SERVICE WALL c/w SS SERVICE CHASE</u>
QUANTITY	- One (1) required.
SIZE	- Approx. 3355mm x 305mm x 1370mm high; refer to detail drawings. Note: Right end (approx. 900mm wide) to be 460mm deep to accommodate gas piping / shut-off valves etc.; KEC to coordinate as required
COMPONENTS	- 2.0mm SS curbs (three in total) bolted to floor - 1.6mm SS top shelf with boxed edges all around - 1.6mm SS removable panels with finger holes and grommets; refer to details for locations. - Bottom to be open to allow access to services - Six (6) each SS electrical boxes c/w applicable devices and SS cover plates. All internal wiring to be completed by Electrical Subcontractor - Uni-strut channels, within wall, for mechanical & electrical service installation, KEC to coordinate as required - Two (2) each 305mm x 305mm x 1630mm high 1.6mm SS service chase c/w removable access panels as required
NOTE	- All electrical and mechanical services to service wall to be fully concealed within SS service chase and / or SS curbs. KEC to coordinate as required. - KEC to coordinate with Mechanical Subcontractor, adequate provisions to pipe gas to appliances to meet code requirements
<u>ITEM #100</u>	<u>TUBULAR SS SALAMANDER SHELF</u>
QUANTITY	- One (1) required.
SIZE	- Approx. 1000mm x 560mm deep
CONSTRUCTION	- 38mm square SS tube
COMPONENTS	- Four (4) each 38mm sq. SS tube shelf supports welded to 38mm sq. SS tube frame support legs, at both ends c/w SS support gussets
<u>ITEM #102</u>	<u>SS EXHAUST CANOPY FILLER</u>
QUANTITY	- One (1) lot; one (1) each required.
SIZE	- "U" shaped; 610mm high x 1220mm deep x 610mm high x 615mm wide; refer to drawing
CONSTRUCTION	- 1.6mm SS
COMPONENTS	- 1.6mm SS, bottom, front & back canopy filler; profile to match adjacent exhaust canopies
<u>ITEM #104</u>	<u>SS PREPARATION TABLE</u>
QUANTITY	- Five (5) required.
SIZE	- Approx. 1050mm x 900mm x 915mm high.
CONSTRUCTION	- As per 1.9; refer to drawings

- COMPONENTS
- 1.6mm SS top w/ boxed edges on front and ends w/ integral 100mm high x 25mm deep boxed backsplash
 - 1.6mm SS undershelf
 - SS legs and bracing as per 1.8.13.
 - Feet as per 1.6.7

ITEM #105

MOBILE SS TABLE

- QUANTITY
- SIZE
- CONSTRUCTION
- COMPONENTS
- One (1) required.
 - Approx. 3050mm x 915mm x 915mm high
 - As per 1.9; refer to drawings
 - 1.6mm SS top c/w boxed edges all around
 - 1.6mm SS undershelf
 - SS legs as per 1.8.13.
 - Casters; w/ brakes

ITEM #106

MOBILE SS TABLE

- QUANTITY
- SIZE
- CONSTRUCTION
- COMPONENTS
- One (1) required.
 - Approx. 3050mm x 915mm x 915mm high
 - As per 1.9; refer to drawings
 - 1.6mm SS top c/w boxed edges all around
 - 1.6mm SS undershelf
 - SS legs as per 1.8.13.
 - Casters; w/ brakes

ITEM #107

SS SERVICE WALL c/w SS SERVICE CHASE

- QUANTITY
- SIZE
- COMPONENTS
- Two (2) required.
 - Approx. 3355mm x 305mm x 1370mm high; refer to detail drawing. Note: Right end (of one Cooking side), approx. 900mm wide, to be approx. 460mm deep to accommodate gas piping / shut-off valves etc.; KEC to coordinate as required
 - 2.0mm SS curbs (three in total) bolted to floor
 - 1.6mm SS top shelf with boxed edges all around
 - 1.6mm SS removable panels with finger holes and grommets; refer to details for locations.
 - Bottom to be open to allow access to services
 - Two (2) each SS electrical boxes c/w applicable devices and SS cover plates. All internal wiring to be completed by Electrical Subcontractor
 - Uni-strut channels, within wall, for mechanical & electrical service installation, KEC to coordinate as required
 - One (1) each 305mm x 305mm x 610mm high 1.6mm SS service chase c/w removable access panels as required

- NOTE
- All electrical and mechanical services to service wall to be fully concealed within SS service chase and / or SS curbs. KEC to coordinate as required.
 - KEC to coordinate with Mechanical Subcontractor, adequate provisions to pipe gas to appliances to meet code requirements

ITEM #111

SS EXHAUST CANOPY FILLER PANELS

- QUANTITY
- Two (2) lot required.
- SIZE
- "U" shaped; 610mm high x 2590mm deep x 610mm high x 615mm wide; refer to drawing
- CONSTRUCTION
- 1.6mm SS
- COMPONENTS
- 1.6mm SS, bottom, front & back, canopy filler c/w profile to match adjacent canopies

ITEM #112

MOBILE SS TABLE

- QUANTITY
- Two (2) required.
- SIZE
- Approx. 2600mm x 850mm x 915mm high
- CONSTRUCTION
- As per 1.9; refer to drawings
- COMPONENTS
- 1.6mm SS top c/w boxed edges all around
 - 1.6mm SS undershelf
 - SS legs as per 1.8.13.
 - Casters; w/ brakes

ITEM #114

SS SERVICE WALL / CHASE

- QUANTITY
- One (1) lot required.
- SIZE
- "L-Shaped" approx. 1980mm x 8695mm x 150mm deep x 1980mm high; refer to details
- COMPONENTS
- 1.6mm SS service wall / chase c/w 150mm deep steel supports, solid SS back c/w removable access panels (as required).
 - Six (6) each approx. 1350mm wide x 350mm high open areas, located approx. 350mm AFF to allow passage of gas lines / flexible connectors; refer to detail. Chase to be fabricated to suit gas lines (supplied and installed by Mechanical Subcontractor) required for individual equipment operation.
 - One (1) each approx. 1830mm long x 1980mm high x 25mm thick insulated SS wall cladding section; two (2) equally sized panels. Cladding to consist of mineral wool insulation wrapped with 1.6mm SS, boxed front and edges. Turn bottom down 38mm to secure to wall with SS screws. Seams to run vertically
 - One (1) each approx. 400mm x 150mm x 3000mm high 1.6mm SS gas line chase w/ 1850mm high hinged door.

- NOTE
- Note: Door to be sized to allow full access to mechanical gas shut-off valves etc. KEC to coordinate as required
 - All electrical and mechanical services to service wall to be fully concealed within SS service chase. KEC to coordinate as required.
 - KEC to coordinate with Mechanical Subcontractor, adequate provisions to pipe gas to appliances to meet code requirements

ITEM #117

QUANTITY
SIZE
CONSTRUCTION
COMPONENTS

SS FLOOR DRAIN PAN

- Two (2) required.
 - Approx. 1250mm x 850mm; refer to drawing
 - Refer to detail drawing
 - 2.0mm SS all welded pan sloped to centre drain c/w integrally welded in Kason 0463-2010 drain basket assembly
 - Removable grating to be FS-25 Grit Top Chem Grate separated into two (2) equal sections
 - One (1) each 850mm long 2.0mm “U-Shaped” cap where pans butt together; tack weld in place
- NOTE
- Contractor to install in floor structure with grate and flange flush with finished floor
- SERVICES
- Two (2) each 75mm waste by Mechanical Subcontractor

ITEM #124

QUANTITY
SIZE
CONSTRUCTION
COMPONENTS

SS FLOOR DRAIN PAN

- One (1) required.
 - Approx. 275mm x 405mm; refer to drawing
 - Refer to detail drawing
 - 2.0mm SS all welded pan sloped to centre drain c/w integrally welded in Kason 0463-2010 drain basket assembly
 - Removable grating to be FS-25 Grit Top Chem Grate
- NOTE
- Contractor to install in floor structure with grate and flange flush with finished floor
- SERVICES
- One (1) each 75mm waste by Mechanical Subcontractor

ITEM #129

QUANTITY
SIZE
CONSTRUCTION
COMPONENTS

SS CABINET

- One (1) required.
- Approx. 760mm x 760mm x 250mm deep.
- As per 1.11; refer to drawings
- 1.6mm SS cabinet to suit Water Filters; Items #123 & 126
- Hinged doors as per 1.11.8 c/w windows. Note: Windows to be centered at gauge locations of water filters
- Internal plywood support backing

- NOTE - Top of cabinet to be fully open to allow passage of water lines in / out of water filters as required. KEC to coordinate with Mechanical

ITEM #132

SS SERVERY TABLE

- QUANTITY - One (1) required.
- SIZE - Approx. 5600mm x 760mm x 915mm high; refer to drawings.
- CONSTRUCTION - As per 1.9.
- COMPONENTS - 1.6mm SS top c/w integral 100mm high x 25mm deep boxed partial backsplashes. Note: Top to be approx. 1035mm at pass-thru opening
- 1.6mm SS undershelves
- 1.6mm SS faceplate to conceal Item #133. KEC to mount control panel as per drawings.
- Approx. 610mm wide clear open area, under left end, to accommodate Item #27
- SS legs as per 1.8.13.
- Feet as per 1.6.7.
- Z-Clip to wall
- NOTE - KEC to coordinate cut-out size & location for Item #133.

ITEM #134

SS OVERSHELF & SNEEZEGUARD

- QUANTITY - One (1) required.
- SIZE - Approx. 3200mm x 305mm x 400mm high; refer to drawings.
- CONSTRUCTION - 1.6mm SS
- COMPONENTS - 1.6mm SS shelf w/ boxed edges all around
- 9mm tempered glass, front and ends, enclosed in S-1 channel; allow 15mm top air space, and 25mm bottom air space.
- 25mm square tube SS legs with concealed inserts for mounting to counter top. Note: Electrical service to Heat Lamp, Item #135, to be concealed within one leg.
- Slope front 10°

ITEM #137

SS WALL SHELF

- QUANTITY - One (1) required.
- SIZE - Approx. 1865mm wide x 305mm deep.
- CONSTRUCTION - 1.6mm SS
- COMPONENTS - 1.6mm SS w/ boxed edges on front and ends
- Back turned up and hemmed to accept Z-clip mounting
- 1.6mm SS gussets, extended down at 45° to wall from front leading edge

END OF SECTION

Part 1 General

1.1 RELATED WORK SPECIFIED IN OTHER SECTIONS

- .1 Division 22 – Plumbing
- .2 Division 26 – Electrical

1.2 RELATED WORK SPECIFIED IN FOOD SERVICE SECTIONS

- .1 Section 11 40 10 – Catalogued Equipment

1.3 SOURCE QUALITY AND CONTROL

- .1 Refrigerated compartments shall be manufactured and installed by a company having personnel competent in the manufacturing and installation of pre-fab walk-in freezers and coolers, and having at least five (5) years continuous experience.

1.4 DRAWINGS

- .1 Submit shop drawings in accordance with Sections 01 33 00 and 11 40 00.

1.5 MAINTENANCE DATA AND OPERATING INSTRUCTIONS

- .1 Provide maintenance data and operating instructions for incorporation into maintenance manual specified in Section 11 40 00.

1.6 WARRANTY/GUARANTEES

- .1 The manufacturer shall warrant that all parts and components of all walk-in boxes with the exception of the refrigeration systems shall be free from defects and/or poor workmanship for a period of two (2) years from the date of the final acceptance of the total installation. Actual panels shall be warranted for a period of ten (10) years against delamination and/or insulation failure. Such faulty panels shall be repaired or replaced within sixty (60) days after receiving a written request within the warranty period without any cost to The City. Damaged and/or faulty panels shall not be erected.
- .2 Condensing units and evaporator coils shall carry a One (1) required year parts and labor warranty – compressors shall carry an additional four (4) year warranty.

1.7 MATERIALS

- .1 SS Sheet Metal: 22ga. to ASTM-A167-82, Type 304 with AISI #4 finish.
- .2 Galvanized Steel Sheet Metal: 14ga. commercial grade to ASTM-A526-71 with galvanized zinc coating to ASTM-A525-79, designation G90.
- .3 Mild Steel: Cold rolled sheet to SAE1010 to 1020 suitably prepared for specified finish.
- .4 White enamel baked on 26ga. galvanized stucco / embossed steel or galvanized steel.
- .5 Insulated floor finish, when face of panel is the final floor finish, 14ga. textured aluminum.

- .6 Insulation for Panels and Screeds: 100% rigid Urethane shall be foamed-in-place (poured not frothed), with a density of 2.2lbs / cu.ft. – 35 kg / cu.m. and a flame spread of 25 or lower and 450 for smoke developed per ASTM E84
- .7 Each joint shall have factory installed polyvinyl chloride (PVC) double lined compression gaskets, for application in temperatures ranging between minus 20C and plus 10C, to ensure tightly sealed joints and eliminate water vapor permeability. Gasket shall be resistant to oil, fats, water and detergent.

1.8 FABRICATION

- .1 Panel Sections: To consist of precision die formed metal pans placed in heated molds with liquid urethane injected between them; all coved corner construction. Formed tongue and groove panel edges and panel to be poured in one operation. No wood or synthetic hard rail framing or reinforcing will be used in the wall or ceiling panels. Once heat-cured, the insulation shall bind tenaciously to the metal skins to form a rigid panel 4 in. / 100mm thick.
- .2 Locking Devices: Panel sections to have cam-action locking devices, spaced at not over 3'-6". Male and female lock pockets, as an assembly, are to be set into position prior to urethane insulation being poured, and are to provide continuous perimeters of steel when panels are erected.
- .3 Corner panels to incorporate tongue and groove joints with internal locking devices as per panel sections.
- .4 Insulated floor panels to be 14ga. textured aluminum; recessed into floor as per detail drawing; provide 14ga. SS freezer door threshold to cover insulated panel "breaker strip", heater cable as well as mortar joint (between panel and building floor); break threshold edges to provided tapered fit to floors.
- .5 Door Panels: Insulated and finished as per exterior and interior panels with 915mm x 1980mm clear door opening unless otherwise specified, reinforced to prevent door panels from twisting, racking or warping. Ensure that doors will close and seal opening. Equip each door panel with:
 - .1 One (1) required in fitting flush mounted type door (swing indicated in item description) to fit door opening, insulated and finished same as panels, having 1220mm high x 16ga. SS push/kickplates on both exterior and interior, and having soft thermoplastic gasket with magnetic steel core at top and both sides, adjustable rubber wiper gasket at bottom. Gaskets to be oil, fat, water and sunlight resistant and be replaceable.
 - .2 Hinges, spring loaded, self-closing type, with SS pin and nylon cam-type bearing, of polished aluminum.
 - .3 One (1) required latch, to match hinges, for opening door by breaking force of trigger-action door closer and magnetic gasket. Latch to have cylinder type lock and have inside safety release handle.
 - .4 One (1) required hydraulic action positive door snubber located on top, exterior of door panel.
 - .5 Two (2) built-in heater cables on freezer doors, to prevent condensation or frost forming around perimeter of door and door opening; One (1) required cable

- inside top and both sides of door under magnetic gasketing. Heaters to be thermostatically controlled.
- .6 One (1) required LED light, with guard, mounted over door on interior of panel, operated from toggle switch with pilot light, mounted 1100mm from floor on exterior of panel, adjacent to latch. All factory pre-wired and terminating in vapor-tight junction box that light is mounted on.
 - .7 One (1) required 50mm dia. flush-face dial-type thermometer to provide temperature readings from -51C to 27C, and mounted on hinge side of panel approximately 1500mm from floor. Cover sensing bulb with protective SS molding.
- .6 Ceiling Panels: Reinforced externally as required, to support blower coils. Where external reinforcement is needed and through-fasteners are used, fasteners are to be of low heat conducting material such as Teflon. Insert fasteners in Teflon sleeves to prevent compressing of insulation.
 - .7 Removable Closure Panels: From top of erected prefabricated ceiling panels to finished building ceiling. Cover strips or angles to extend from building floor to ceiling closure panels between exposed ends of walk-in boxes and building walls. Closure panels, cover strips or angles finish to match exposed exterior wall panels.
 - .8 Two-Way Heated Pressure Relief Port: Installed in freezer door panel and pre-wired to light fixture junction box.
 - .9 Fluorescent lights, when specified, to be 1220mm long and include two (2) bulbs per unit. Standard configuration to include two (2) fluorescent lights per box, as well as One (1) required compact fluorescent light as per 7.05.6.
 - .10 LED lights, when specified, to be Kason 1810LX4000. Standard configuration to include two (2) LED lights per box, as well as One (1) required compact fluorescent light as per 7.05.6.

1.9 WORKMANSHIP

- .1 Erect work true-to-line, plumb, square, and level with all joints aligned. Joints and intersecting members to be accurately fitted, made in true planes, and be adequately fastened.

1.10 INSTALLATION

- .1 Unless otherwise indicated, install units within 25mm of building walls with minimum 25mm clearance between top of unit and room ceiling. Fasten screeds to building and/or wearing floor as per manufacturer's instructions.
- .2 Contractor to provide dry sand bed compacted to 30psi, leveled to suit pre-fab floor panels, for all walk-in recesses (in building floor slabs).
- .3 Caulk around perimeter of panels.
- .4 Fill space between perimeter of floor panels and edge of floor depression with concrete or non-shrink grout, and trowel flush with floor slab – by Contractor.

- .5 Cut or drill holes in panels, as required to accommodate electrical and mechanical services, runs or connections. Holes to have Teflon sleeves inserted and sealed. After installation of services, remaining space to be filled with insulation.
- .6 Cap all wrench access holes with an in-fitting, flush, removable plug.
- .7 Install removable closure panels (when required), cover strips, and angles.
- .8 Provide thresholds, heaters, and urethane insulation for floors, and supervise installation.

1.11 CLEANING AND ADJUSTING

- .1 Upon completion of work, clean equipment apparatus, remove protective coverings, and test and adjust operating equipment. Re-finish damaged coatings and finishes.

1.12 REMOTE REFRIGERATION EQUIPMENT

- .1 Quality and Source:
 - .1 Comply with National, Provincial and Municipal Codes. Conform to current CSA-B52 Code for Mechanical refrigeration, current CSAB-31.5, Code for Refrigerant Piping, current HRAI standards and current Environment Canada standards.
 - .2 Refrigeration equipment shall be the product of manufacturer regularly engaged in the production of refrigeration equipment on a continuous basis for a minimum of ten (10) years. Manufactured equipment shall be tested and rated in accordance with ARI standard 210.
 - .3 Systems shall be installed by qualified tradesmen holding valid Alberta Certificates of Proficiency as Refrigeration Mechanics.
 - .4 The refrigeration systems will hold compartments at design temperatures as follows: Freezers: -23.5°C, Coolers: +4°C. Summer Condenser ambient: +40°C, Winter Condenser ambient: -40°C.
- .2 Refrigeration equipment for remote installation fully automatic in operation, and to conform to the following minimum requirements:
 - .1 Outdoor condensing units: Condensing units with factory air cooled condensers to be complete with motor, compressor, compressor suction and discharge service valves, winter-sized heated and insulated receiver equipped with inlet/outlet service valves and safety pressure relief valve, flooded head pressure control, isolation valves, and all other necessary components. Compressor to be hermetic or accessible-hermetic type. Freezer and cooler units to be provided with crankcase heaters. Units shall be designed for 16 to 18 hour operation for coolers, and 20 to 22 hours for freezers, at specified evaporator temperature and 32.2°C condenser ambient temperature. Standard of acceptance: Comparable to RUSSELL, COPELAND, LARKIN, TECUMSEH or BOHN.
 - .2 Evaporator: Forced-convection, unit-cooler type made to be suspended from ceiling panels complete with forced-air discharge in two directions parallel to ceiling. Air circulating motor, multi-fin and tube type coil (and grill) to be assembled within protective housing. Expansion valve with strainer and inlet and outlet connections also to be contained within this housing. Air circulation motors to be lifetime sealed and entire unit-cooler assembly readily accessible

- for cleaning. Provide drip pan and drain connection. Unit coolers to be equipped with mounting brackets for installation and controls for safe and satisfactory operation. Evaporator shall have a working T.D. of 5.6°C when matched to the compressor unit at design operating conditions. Standard of acceptance: BOHN, LARKIN, KEEPRIE, REF-PLUS.
- .3 When walk-in is used for freezer applications, an automatic system for defrosting unit cooler including electric heaters and defrost termination control to be supplied.
 - .4 Locate evaporator units at centre of refrigerated compartment ceilings or at locations shown on equipment plan.
- .3 Medium temperature systems for walk-in boxes shall include the following accessories, furnished and installed:
- .1 An Electronic Thermostat that can also manage the defrost cycles (Air Defrost) in intervals or Schedules , readings in Celsius or Fahrenheit and mounted on evaporator
 - .2 Dual pressure controls. Regardless of manufacturer’s standard supplied pressure control with condensing unit, the system will be fitted with a dual pressure control to protect compressor from operating at pressures hazardous to equipment. Standard of acceptance: PENN, RANCO or equal.
 - .3 Factory installed TX Valve & Solenoid Valve
 - .4 Filter drier unit shall be the molded, solid core type containing a crystalline form of activated aluminum and a molecular sieve for the elimination of water and acid from the system. Filter driers to be installed with sweat type connections. Standard of acceptance: SPORLAN, ALCO or equal.
 - .5 Liquid line sight glass: Liquid and moisture indicator complete with a plastic protector cap and sweat type connections. Standard of acceptance: SPORLAN “See-all”, ALCO or equal.
 - .6 Optional : Ability to add Communication, Data Logging, Local or remote Alarms (remote alarm via e-mail or text message).
- .4 Low temperature systems for walk-in boxes shall include the following accessories, which shall be furnished and installed:
- .1 An Electronic Thermostat that can also manage the defrost cycles (Electric) in intervals or Schedules with Termination sensor, readings in Celsius or Fahrenheit and mounted on evaporator.
 - .2 Dual pressure controls. Regardless of manufacturer’s standard supplied pressure control with condensing unit, the system will be fitted with a dual pressure control to protect compressor from operating at pressures hazardous to equipment. Standard of acceptance: PENN, RANCO or equal.
 - .3 Factory installed TX Valve & Solenoid Valve.
 - .4 Filter drier unit shall be the molded, solid core type containing a crystalline form of activated aluminum and a molecular sieve for the elimination of water and acid from the system. Filter driers to be installed with sweat type connections. Standard of acceptance: SPORLAN, ALCO or equal.

- .5 Liquid line sight glass: Liquid and moisture indicator complete with a plastic protector cap and sweat type connections. Standard of acceptance: SPORLAN “See-all”, ALCO or equal.
 - .6 Suction accumulator: Insulate accumulator with 12.5mm Armaflex insulation or provide 1.2mm SS drain pan under accumulator piped to nearest drain.
 - .7 Condensate drain line heat trace: Provide self-regulating type heat tape on entire length of drain line within the low temperature compartment. Spiral wrap the tape on drain line at 12.5mm centers. Insulate over heat tape with 12.5mm Armaflex insulation. Standard of acceptance: FREEZGARD H610-120 Volt or equal.
 - .8 Optional : Ability to add Communication, Data Logging, Local or remote Alarms (remote alarm via e-mail or text message).
- .5 Refrigerant
- .1 All refrigeration systems to operate on R448 & R449.
- .6 Refrigeration Piping
- .1 Size piping for minimum pressure drops in the system. Minimum temperature drop in systems to be 1.0°C for suction, hot gas, and for liquid line. Pipe sizing shall be in accordance with latest ASHRAE standards.
 - .2 All tubing runs shall be pre-planned to ensure that runs are as short as possible using the minimum number of fittings. Crossovers will be kept to an absolute minimum, and the complete installation will provide maximum accessibility for service requirements.
 - .3 Piping shall be hard drawn, bright annealed refrigerant grade ACR copper manufactured in accordance with ASME standards. Pipe material shall be cleaned, dried, nitrogen filled and sealed against contamination at the point of manufacture. The use of soft copper is prohibited.
 - .4 Fittings shall be wrought type as manufactured by MUELLER. Do not use cast type fittings. All elbows and return bends shall be 90° long radius, except for traps in risers, which may be formed of short sweep elbows or short return bends or factory built traps. Do not use 45° elbows.
 - .5 Shut-off/isolation valves to be refrigeration grade angle, globe and ball type. Standard of acceptance: MUELLER STREAMLINE.
 - .6 Extreme care shall be taken to keep the entire system clean and dry during installation. Hard drawn copper must remain capped and prior to assembly and must be inspected for visible signs of dirt, filings or moisture. Any foreign materials must be removed with a clean dry swab. Make joints with brazed copper-to-copper couplings.
 - .7 Silver braze joints using copper-phosphorus alloy with melting point between 600°C and 800°C using current quality control procedures. To prevent copper-oxide (scale) on inside of piping, dry nitrogen must be passed through tubing while brazing at a rate of one cubic foot per hour.
 - .8 All refrigeration lines shall be supported or hung using uni-strut with hydrosorb clamps. Piping shall be supported from solid surface at minimum 1500mm intervals, and within 600mm of each change in direction.

- .9 Slope horizontal lines minimum of 1:200 in the direction of flow. Provide oil traps at the base of all suction and discharge risers. Use double risers as required to obtain proper velocity in vertical risers to assure oil return. Provide staged oil traps in suction risers where the evaporator is below the compressor. Maximum oil lift in one stage shall be 6 m.
 - .10 Arrange piping loops in evaporator suction lines to prevent liquid refrigerant from draining into the compressor during shut down and prevent oil in an active evaporator from draining into an idle evaporator.
 - .11 Arrange piping to prevent compressor or condenser vibrations from being transmitted to piping. Run discharge lines at least 10 pipe diameters in each of three directions before first support or provide vibrasorber connectors. Provide vibrasorber pipe connections to spring isolated equipment.
- .7 Refrigeration Piping Insulation
- .1 Suction lines for coolers shall be insulated with 12.5mm wall ARMAFLEX.
 - .2 Suction lines for freezers shall be insulated with 19mm wall ARMAFLEX.
 - .3 Indoor refrigerant condensate return lines returning from air-cooled outdoor condensers which operate in winter shall be insulated with 19mm wall ARMAFLEX.
 - .4 Hot gas lines which have potential to be a safety hazard shall be insulated with 12.5mm ARMAFLEX.
 - .5 Heat traced condensate drain lines within low temperature refrigerated compartments shall be insulated with 12.5mm wall ARMAFLEX.
 - .6 All insulation joints to be glued.
 - .7 Paint piping insulation exposed to outdoors with two coats of paint.
 - .8 All suction line piping insulation and drain line piping insulation within refrigerated compartments shall be clad using white PVC cladding and white PVC molded elbows. Seal waterproof with white PVC adhesive tape and white PVC adhesive. Standard of acceptance: PROTO-0.38mm PVC cladding/PVC molded fittings/PVC adhesive tape/PVC adhesive.
- .8 Testing, Evacuation, Charging, Start-Up
- .1 All leak testing and evacuation to be done to current Environment Canada and HRAI standards.
 - .2 At completion of installation, pressurize system with nitrogen and check for leaks. Repair leaks and re-test.
 - .3 Clean and dehydrate each system with a high vacuum pump. Do not use compressor. Each system is to be evacuated to below 500 microns, and that vacuum broken with dry nitrogen and re-evacuated until 500 microns can be held for 2 hours with the system isolated from the vacuum pump. Fresh oil must be used in the vacuum pump for each system evacuation.
 - .4 Before any motor unit is operated, the lubrication shall be checked and rectified if improper. Use only oil as approved by the original equipment manufacturer. Re-check compressor crankcase oil level after 24 hours of operation.
 - .5 Startup system. Charge and check out operation. Assure that refrigerant charge is adequate for winter operation of system. Submit refrigeration checklists to

Contract Administrator providing model numbers and serial numbers of equipment, refrigerant charge, pressures, temperatures, TXV superheat settings and defrost timer settings. Record voltage and amperage draws of compressors, evaporator fans and condenser fans under load conditions.

- .9 Warranty/Guarantee
 - .1 Provide Warranty certificate and proper documentation for operation and maintenance of systems. Provide on-site instruction for The City personnel.
 - .2 The Contractor shall warranty all equipment, materials, and workmanship for a period of One (1) required year. Compressors shall carry an extended four (4) year parts (only) replacement warranty.

Item: **Item #11 – Walk-in Freezer** Refrigeration Company: _____

Compressor Make & Model: _____ Technician's Name: _____

Evaporator Make & Model: _____ Location: _____

PRESTART CHECKLIST: **DATE:** _____

Vacuum:	Microns:	Check insulation:
Check piping for rubbing, vibrations, & proper slope	<input type="checkbox"/>	Full pipe coverage: <input type="checkbox"/>
Welds mirror checked:	<input type="checkbox"/>	Joints glued: <input type="checkbox"/>
Oil Trap; location as required:	<input type="checkbox"/>	Pipe cooler/case penetrations sealed: <input type="checkbox"/>
Condensate drain trapped:	<input type="checkbox"/>	Outdoor insulation is painted or covered: <input type="checkbox"/>
Cond. Fan motor volt/phase wire matches nameplate:	<input type="checkbox"/>	Evap. fan motor volt/phase wire matches nameplate: <input type="checkbox"/>
Compressor volt/phase wire matches nameplate:	<input type="checkbox"/>	Refrigerant type: _____ Lbs.:
Oil type:	Check level: <input type="checkbox"/>	Electrical conduit properly sealed (freezer only) <input type="checkbox"/>
Time clock set-times/24hrs	Length:	Temp. control settings:
Press control settings:	Low Pressure:	Oil failure setting:
	High Pressure:	Outdoor condensing unit low ambient protected: <input type="checkbox"/>

AFTER SYSTEM IS RUNNING: **DATE:** _____

Discharge pressure:	Suction pressure:
Sight glass: <input type="checkbox"/> Clear:	Superheat:
Check oil level (after 24 hrs.): <input type="checkbox"/>	Oil pressure (net):
Evap. fan voltage-nameplate: L1 _____ L2 _____ L3 _____	Evap. fan amp-nameplate: L1 _____ L2 _____ L3 _____
Actual: L1 _____ L2 _____ L3 _____	Actual: L1 _____ L2 _____ L3 _____
Cond. Fan voltage-nameplate: L1 _____ L2 _____ L3 _____	Cond. fan amp-nameplate: L1 _____ L2 _____ L3 _____
Actual: L1 _____ L2 _____ L3 _____	Actual: L1 _____ L2 _____ L3 _____
Comp. voltage-nameplate: L1 _____ L2 _____ L3 _____	Comp. amp-nameplate: L1 _____ L2 _____ L3 _____
Actual: L1 _____ L2 _____ L3 _____	Actual: L1 _____ L2 _____ L3 _____
Condenser fan cycling:	Holdback valve settings:
Defrost heater voltage: nameplate _____ Actual _____	Hot gas defrost:
Defrost heater amperage: nameplate _____ Actual _____	Space temperature:
	Cond. drain heat tape working (freezer) <input type="checkbox"/>
	Door heaters and heated vent working (freezer) <input type="checkbox"/>

Item: **Item #15 – Walk-in Cooler** Refrigeration Company: _____

Compressor Make & Model: _____ Technician's Name: _____

Evaporator Make & Model: _____ Location: _____

PRESTART CHECKLIST: **DATE:** _____

Vacuum:	Microns:	Check insulation:
Check piping for rubbing, vibrations, & proper slope	<input type="checkbox"/>	Full pipe coverage: <input type="checkbox"/>
Welds mirror checked:	<input type="checkbox"/>	Joints glued: <input type="checkbox"/>
Oil Trap; location as required:	<input type="checkbox"/>	Pipe cooler/case penetrations sealed: <input type="checkbox"/>
Condensate drain trapped:	<input type="checkbox"/>	Outdoor insulation is painted or covered: <input type="checkbox"/>
Cond. Fan motor volt/phase wire matches nameplate:	<input type="checkbox"/>	Evap. fan motor volt/phase wire matches nameplate: <input type="checkbox"/>
Compressor volt/phase wire matches nameplate:	<input type="checkbox"/>	Refrigerant type: _____ Lbs.:
Oil type:	Check level: <input type="checkbox"/>	Electrical conduit properly sealed (freezer only) <input type="checkbox"/>
Time clock set-times/24hrs	Length:	Temp. control settings:
Press control settings:	Low Pressure:	Oil failure setting:
	High Pressure:	Outdoor condensing unit low ambient protected: <input type="checkbox"/>

AFTER SYSTEM IS RUNNING: **DATE:** _____

Discharge pressure:	Suction pressure:
Sight glass: <input type="checkbox"/> Clear:	Superheat:
Check oil level (after 24 hrs.): <input type="checkbox"/>	Oil pressure (net):
Evap. fan voltage-nameplate: L1 _____ L2 _____ L3 _____	Evap. fan amp-nameplate: L1 _____ L2 _____ L3 _____
Actual: L1 _____ L2 _____ L3 _____	Actual: L1 _____ L2 _____ L3 _____
Cond. Fan voltage-nameplate: L1 _____ L2 _____ L3 _____	Cond. fan amp-nameplate: L1 _____ L2 _____ L3 _____
Actual: L1 _____ L2 _____ L3 _____	Actual: L1 _____ L2 _____ L3 _____
Comp. voltage-nameplate: L1 _____ L2 _____ L3 _____	Comp. amp-nameplate: L1 _____ L2 _____ L3 _____
Actual: L1 _____ L2 _____ L3 _____	Actual: L1 _____ L2 _____ L3 _____
Condenser fan cycling:	Holdback valve settings:
Defrost heater voltage: nameplate _____ Actual _____	Hot gas defrost:
Defrost heater amperage: nameplate _____ Actual _____	Space temperature:
	Cond. drain heat tape working (freezer) <input type="checkbox"/>
	Door heaters and heated vent working (freezer) <input type="checkbox"/>

Item: **Item #65 – Walk-in Cooler** Refrigeration Company: _____

Compressor Make & Model: _____ Technician's Name: _____

Evaporator Make & Model: _____ Location: _____

PRESTART CHECKLIST: **DATE:** _____

Vacuum:	Microns:	Check insulation:
Check piping for rubbing, vibrations, & proper slope	<input type="checkbox"/>	Full pipe coverage: <input type="checkbox"/>
Welds mirror checked:	<input type="checkbox"/>	Joints glued: <input type="checkbox"/>
Oil Trap; location as required:	<input type="checkbox"/>	Pipe cooler/case penetrations sealed: <input type="checkbox"/>
Condensate drain trapped:	<input type="checkbox"/>	Outdoor insulation is painted or covered: <input type="checkbox"/>
Cond. Fan motor volt/phase wire matches nameplate:	<input type="checkbox"/>	Evap. fan motor volt/phase wire matches nameplate: <input type="checkbox"/>
Compressor volt/phase wire matches nameplate:	<input type="checkbox"/>	Refrigerant type: _____ Lbs.:
Oil type:	Check level: <input type="checkbox"/>	Electrical conduit properly sealed (freezer only) <input type="checkbox"/>
Time clock set-times/24hrs	Length:	Temp. control settings:
Press control settings:	Low Pressure:	Oil failure setting:
	High Pressure:	Outdoor condensing unit low ambient protected: <input type="checkbox"/>

AFTER SYSTEM IS RUNNING: **DATE:** _____

Discharge pressure:	Suction pressure:
Sight glass: <input type="checkbox"/> Clear:	Superheat:
Check oil level (after 24 hrs.): <input type="checkbox"/>	Oil pressure (net):
Evap. fan voltage-nameplate: L1 ____ L2 ____ L3 ____	Evap. fan amp-nameplate: L1 ____ L2 ____ L3 ____
Actual: L1 ____ L2 ____ L3 ____	Actual: L1 ____ L2 ____ L3 ____
Cond. Fan voltage-nameplate: L1 ____ L2 ____ L3 ____	Cond. fan amp-nameplate: L1 ____ L2 ____ L3 ____
Actual: L1 ____ L2 ____ L3 ____	Actual: L1 ____ L2 ____ L3 ____
Comp. voltage-nameplate: L1 ____ L2 ____ L3 ____	Comp. amp-nameplate: L1 ____ L2 ____ L3 ____
Actual: L1 ____ L2 ____ L3 ____	Actual: L1 ____ L2 ____ L3 ____
Condenser fan cycling:	Holdback valve settings:
Defrost heater voltage: nameplate _____ Actual _____	Hot gas defrost:
Defrost heater amperage: nameplate _____ Actual _____	Space temperature:
	Cond. drain heat tape working (freezer) <input type="checkbox"/>
	Door heaters and heated vent working (freezer) <input type="checkbox"/>

Item: **Item #71 - Walk-in Freezer** Refrigeration Company: _____

Compressor Make & Model: _____ Technician's Name: _____

Evaporator Make & Model: _____ Location: _____

PRESTART CHECKLIST: **DATE:** _____

Vacuum:	Microns:	Check insulation:
Check piping for rubbing, vibrations, & proper slope	<input type="checkbox"/>	Full pipe coverage: <input type="checkbox"/>
Welds mirror checked:	<input type="checkbox"/>	Joints glued: <input type="checkbox"/>
Oil Trap; location as required:	<input type="checkbox"/>	Pipe cooler/case penetrations sealed: <input type="checkbox"/>
Condensate drain trapped:	<input type="checkbox"/>	Outdoor insulation is painted or covered: <input type="checkbox"/>
Cond. Fan motor volt/phase wire matches nameplate:	<input type="checkbox"/>	Evap. fan motor volt/phase wire matches nameplate: <input type="checkbox"/>
Compressor volt/phase wire matches nameplate:	<input type="checkbox"/>	Refrigerant type: _____ Lbs.:
Oil type:	Check level: <input type="checkbox"/>	Electrical conduit properly sealed (freezer only) <input type="checkbox"/>
Time clock set-times/24hrs	Length:	Temp. control settings:
Press control settings:	Low Pressure:	Oil failure setting:
	High Pressure:	Outdoor condensing unit low ambient protected: <input type="checkbox"/>

AFTER SYSTEM IS RUNNING: **DATE:** _____

Discharge pressure:	Suction pressure:
Sight glass: <input type="checkbox"/> Clear:	Superheat:
Check oil level (after 24 hrs.): <input type="checkbox"/>	Oil pressure (net):
Evap. fan voltage-nameplate: L1 _____ L2 _____ L3 _____	Evap. fan amp-nameplate: L1 _____ L2 _____ L3 _____
Actual: L1 _____ L2 _____ L3 _____	Actual: L1 _____ L2 _____ L3 _____
Cond. Fan voltage-nameplate: L1 _____ L2 _____ L3 _____	Cond. fan amp-nameplate: L1 _____ L2 _____ L3 _____
Actual: L1 _____ L2 _____ L3 _____	Actual: L1 _____ L2 _____ L3 _____
Comp. voltage-nameplate: L1 _____ L2 _____ L3 _____	Comp. amp-nameplate: L1 _____ L2 _____ L3 _____
Actual: L1 _____ L2 _____ L3 _____	Actual: L1 _____ L2 _____ L3 _____
Condenser fan cycling:	Holdback valve settings:
Defrost heater voltage: nameplate _____ Actual _____	Hot gas defrost:
Defrost heater amperage: nameplate _____ Actual _____	Space temperature:
	Cond. drain heat tape working (freezer) <input type="checkbox"/>
	Door heaters and heated vent working (freezer) <input type="checkbox"/>

1.13 ITEMIZED EQUIPMENT

ITEM #11 & #15

QUANTITY
MANUFACTURER
SIZE

CONSTRUCTION
COMPONENTS

NOTE

WALK-IN FREEZER c/w INSULATED FLOOR & WALK-IN COOLER

- One (1) each required.
 - Norbec
 - Walk-In Freezer - Approx. 5600mm x 2580mm x 2590mm high; refer to drawing
 - Walk-In Cooler - Approx. 5600mm x 2580mm x 2590mm high; refer to drawing
 - As per 1.7; 26ga. White embossed finish
- To each room, add the following components
- 14ga. galvanized finished recessed insulated floor (Walk-In Freezer only); refer to drawings
 - 915mm wide hinged walk-in doors c/w windows & 1220mm high 1.6mm SS kickguards; both sides
 - Flush mounted model FAD-100 audio/visual, hi-low temperature alarm with sensor bulbs and alarm system monitor. Must be capable of connecting to DDC system if required
 - Provide 610mm high 1.6mm SS wall cladding around entire interior perimeter of both rooms and 1220mm high 1.6mm SS cladding across entire exposed exterior walls.
 - Colour matching top enclosure panels and trim strips to finished ceiling and adjacent building walls
 - LED lights; Walk-In Freezer – Six (6) each, Walk-In Cooler – Six (6) each
 - Seal tight conduit and pre-wiring to light fixtures; by Electrical Subcontractor

ITEM #12

QUANTITY
MANUFACTURER
MODEL
ACCESSORIES
NOTE

WALK-IN FREEZER EVAPORATOR COIL

- One (1) required.
- As per 1.11.2.2.
- As per 1.11.
- As per 1.11.
- This section is responsible for all electrical control wiring to various components between condensing unit & evaporator; single point connection by Electrical Subcontractor
- Complete “refrigeration system” design, for applicable room, to be designed based on operating conditions indicated in 1.11.1.4 & 1.11.2.1.

ITEM #13

QUANTITY
MANUFACTURER

WALK-IN FREEZER CONDENSING UNIT

- One (1) required.
- As per 1.11.2.2.

- MODEL - As per 1.11.
- ACCESSORIES - As per 1.11.
- NOTE - This section is responsible for all electrical control wiring to various components between condensing unit & evaporator; single point connection by Electrical Subcontractor.
- Complete “refrigeration system” design, for applicable room, to be designed based on operating conditions indicated in 1.11.1.4 & 1.11.2.1.

ITEM #16

WALK-IN COOLER EVAPORATOR COIL

- QUANTITY - One (1) required.
- MANUFACTURER - As per 1.11.2.2.
- MODEL - As per 1.11.
- ACCESSORIES - As per 1.11.
- NOTE - This section is responsible for all electrical control wiring to various components between condensing unit & evaporator; single point connection by Electrical Subcontractor
- Complete “refrigeration system” design, for applicable room, to be designed based on operating conditions indicated in 1.11.1.4 & 1.11.2.1.

ITEM #17

WALK-IN COOLER CONDENSING UNIT

- QUANTITY - One (1) required.
- MANUFACTURER - As per 1.11.2.2.
- MODEL - As per 1.11.
- ACCESSORIES - As per 1.11.
- NOTE - This section is responsible for all electrical control wiring to various components between condensing unit & evaporator; single point connection by Electrical Subcontractor.
- Complete “refrigeration system” design, for applicable room, to be designed based on operating conditions indicated in 1.11.1.4 & 1.11.2.1.

ITEM #65 & #71

WALK-IN COOLER & WALK-IN FREEZER c/w INSULATED FLOOR

- QUANTITY - One (1) each required.
 - MANUFACTURER - Norbec
 - SIZE - Walk-In Cooler - Approx. 3300mm x 2180mm x 2590mm high; refer to drawing
 - Walk-In Freezer - Approx. 3300mm x 1750mm x 2590mm high; refer to drawing
 - CONSTRUCTION COMPONENTS - As per 1.7; 26ga. White embossed finish
- To each room, add the following components

- 14ga. galvanized finished recessed insulated floor (Walk-In Freezer only); refer to drawings
- 915mm wide hinged walk-in doors c/w windows & 1220mm high 1.6mm SS kickguards; both sides
- Flush mounted model FAD-100 audio/visual, hi-low temperature alarm with sensor bulbs and alarm system monitor. Must be capable of connecting to DDC system if required
- Provide 610mm high 1.6mm SS wall cladding around entire interior perimeter of both rooms and 1220mm high 1.6mm SS cladding across entire exposed exterior walls.
- Colour matching top enclosure panels and trim strips to finished ceiling and adjacent building walls
- LED lights; Walk-In Freezer – Two (2) each, Walk-In Cooler – Two (2) each
- Seal tight conduit and pre-wiring to light fixtures; by Electrical Subcontractor

NOTE

ITEM #66

QUANTITY
MANUFACTURER
MODEL
ACCESSORIES
NOTE

WALK-IN COOLER EVAPORATOR COIL

- One (1) required.
- As per 1.11.2.2.
- As per 1.11.
- As per 1.11.
- This section is responsible for all electrical control wiring to various components between condensing unit & evaporator; single point connection by Electrical Subcontractor
- Complete “refrigeration system” design, for applicable room, to be designed based on operating conditions indicated in 1.11.1.4 & 1.11.2.1.

ITEM #67

QUANTITY
MANUFACTURER
MODEL
ACCESSORIES
NOTE

WALK-IN COOLER CONDENSING UNIT

- One (1) required.
- As per 1.11.2.2.
- As per 1.11.
- As per 1.11.
- This section is responsible for all electrical control wiring to various components between condensing unit & evaporator; single point connection by Electrical Subcontractor.
- Complete “refrigeration system” design, for applicable room, to be designed based on operating conditions indicated in 1.11.1.4 & 1.11.2.1.

ITEM #72

QUANTITY
MANUFACTURER
MODEL
ACCESSORIES
NOTE

WALK-IN FREEZER EVAPORATOR COIL

- One (1) required.
- As per 1.11.2.2.
- As per 1.11.
- As per 1.11.
- This section is responsible for all electrical control wiring to various components between condensing unit & evaporator; single point connection by Electrical Subcontractor
- Complete “refrigeration system” design, for applicable room, to be designed based on operating conditions indicated in 1.11.1.4 & 1.11.2.1.

ITEM #73

QUANTITY
MANUFACTURER
MODEL
ACCESSORIES
NOTE

WALK-IN FREEZER CONDENSING UNIT

- One (1) required.
- As per 1.11.2.2.
- As per 1.11.
- As per 1.11.
- This section is responsible for all electrical control wiring to various components between condensing unit & evaporator; single point connection by Electrical Subcontractor.
- Complete “refrigeration system” design, for applicable room, to be designed based on operating conditions indicated in 1.11.1.4 & 1.11.2.1.

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 American Society for Testing and Materials (ASTM).
 - .1 ASTM E2180-18, Standard Test Method for Determining the Activity of Incorporated Antimicrobial Agent(s) In Polymeric or Hydrophobic Materials.
 - .2 ASTM G21-15(2021)e1, Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.
- .2 National Fire Protection Association (NFPA).
 - .1 NFPA 701-2023, Standard Methods of Fire Tests for Flame Propagation of Textiles and Films.
- .3 Underwriters Laboratories of Canada (ULC).
 - .1 CAN/ULC S109-14 (R2019), Standard Method for Flame Tests of Flame-Resistant Fabrics and Films.

1.3 SYSTEM DESCRIPTION

- .1 Design Requirements.
 - .1 Manual Roller Window Shade – Single (RS) (1:107 Food & Nutrition).
 - .1 Easy-lift chainless operated single roller shade system, ceiling mounted square cassette complete-with mounting brackets, roller tubes, hembars, hardware and accessories, 1% open sun control fabric.

1.4 SUBMITTALS

- .1 Shop Drawings.
 - .1 Submit shop drawings in accordance with Section 01 33 00.
 - .2 Submit manufacturer’s descriptive literature and details indicating materials, finishes, and installation instructions for each type of manual roller window shade specified.
 - .3 Clearly indicate all components, finishes and perimeter construction conditions, installation, all applicable dimensions in relation to jambs, head anchorage details, hardware and accessories.
 - .4 Provide head, jamb and sill details and relevant dimensions for mounting requirements for each product type and mounting condition.
 - .5 Provide shade schedule indicating room number, quantities and key to details.
- .2 Samples.
 - .1 Submit samples in accordance with Section 01 33 00.
 - .2 Submit one fully operational manual window shade sample complete with specified shade fabric including sample of seam/batten when applicable.
- .3 Test Reports.
 - .1 Submit test reports in accordance with Section 01 33 00.

- .2 Test Reports to be from and based upon tests performed by qualified independent testing agency acceptable to authorities having jurisdiction, showing evidence that materials comply with requirements specified for flammability of materials in accordance with CAN/ULC S109 and NFPA 701.
- .4 Closeout Submittals.
 - .1 Provide operation and maintenance data for incorporation into Operation and Maintenance Manual specified in Section 01 78 00.

1.5 QUALITY ASSURANCE

- .1 Qualifications.
 - .1 Skilled tradesmen to be employed by specialty company recognized and trained as proved installer by manufacturer, and with extensive experience in installation of products specified.
- .2 Regulatory Requirements.
 - .1 Manufacturer's drapery materials to meet requirements for high degree of flame resistance in accordance with CAN/ULC S109 and NFPA 701.
- .3 Mock-up.
 - .1 Prepare mock-up of manual roller window shade installation in accordance with Section 01 45 00. Locate mock-up as part of final installation.
 - .2 Mock-up will be reviewed for quality of workmanship, operation, and overall appearance.
 - .3 Once approved, mock-up will set standard of acceptance for remaining installations.
 - .4 Do not proceed with manual roller window shade installation until mock-up is complete and approved by Contract Administrator.

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 Section 01 74 00.
- .5 Waste Management and Disposal in accordance with Section 01 74 19.

1.7 WARRANTY

- .1 Manufacturer's Product Warranty: provide an extended warranty for Work of this Section from date of Total Performance of the Work to term of warranty specified. Manufacturer hereby warrants manual window shades 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 Contract Administrator and the City, and at no expense to the City.
 - .1 Manual Roller Window Shade (RSS): five (5) years against manufacturing and materials defects.

- .2 Sunscreen Fabric (BF): 10 years against manufacturing and materials defects.

Part 2 Products

2.1 MANUFACTURERS

- .1 Basis of Design Products.
 - .1 Manual Roller Window Shade – Single (RS).
 - .1 Roller Window Shade.
 - .1 Altex Deko SafeGuard S-70 Square Cassette Lite Lift Chainless Roller Window Shade complete-with Mermet E Screen (1% open) Sun Control Fabric. Colour: to be determined.
- .2 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes of the Bidding Procedures*.
- .3 Supply all products from single manufacturer.

2.2 COMPONENTS

- .1 Clutch Brake Manual System.
 - .1 Chain-operated, roller shade with multi-layer, coil spring system. Drive system must be reversible for future alterations and on-site maintenance.
 - .2 Internal Tension Idler (I.T.I.) limiter automatically adjusts and controls the amount of torque and speed ratio in order to provide a constantly smooth operation of shade system regardless of width and height.
 - .3 Drive sprocket must contain non-locking integrated pressure springs for increased operational performance.
 - .4 System shall be capable of smoothly raising and lowering shade to any desired height and maintaining position without slippage.
 - .5 System MUST ALLOW FOR THE ABILITY TO LOWER THE SHADE BY PULLING ON THE HEMBAR without damage to the clutch or spring.
 - .6 System shall provide for a maximum fabric gap of 42 mm total of both sides.
 - .7 Clutch must brake at point of pull release.
 - .8 Clutch may be mounted on either the left or right side of the roller tube.
- .2 Hardware.
 - .1 Shade universal mounting units must be interchangeable from wall to ceiling mount.
 - .2 Universal Drive-Idler must be free of exposed fasteners or rivets.
 - .3 Pre-mount all shades and be ship as fully assembled unit.
 - .4 Deko shades are supplied as single banded only units.
 - .5 Idle-end plug must allow for internal rotation of tube and must lock in place utilizing square end-pin.
 - .6 Shade mechanisms and drive units to be integrated into universal mounting units that prevent unwanted movement and misalignment.
- .3 Ceiling Mounted Cassette.
 - .1 Two-piece extruded aluminum cassette with bottom closure for regular roll installation measuring 79 mm x 80 mm c/w noise reduction seals for sound isolation of the mechanism.

- .2 Finish: All exposed to view components shall be powder coating finish in custom colour to match Contract Administrator's sample
- .4 Roller Tube.
 - .1 Roller tubes shall be extruded aluminum in 32 mm, 38 mm, or 46 mm with reinforced internal ribs to provide maximum span without tube deflection. Tube sizes will be determined by the manufacturer dependent on shade size.
- .5 Hem Bar.
 - .1 Hem Bar (bottom bar) shall be oval shaped tubular extruded aluminum with an integrated recess to secure the fabric without visible connectors. End plugs shall be screwed securely to the ends showing no exposed aluminum.

2.3 FABRIC

- .1 Sunscreen Fabric (SF): to be free of warping, bowing and fraying and as follows:
 - .1 Fabric Composition: 37% fibreglass/63% vinyl.
 - .2 Width: to suit window opening.
 - .3 Openness Factor: Approx. 1%.
 - .4 Weight: 16.25 oz/yd²
 - .5 Flame Resistance: to NFPA 701 and CAN/ULC S109.
 - .6 Bacterial and Fungal Resistance: to ASTM E2180 and ASTM G21.
 - .7 Colour: to be selected from manufacturer's entire selection.

2.4 FABRICATION

- .1 Prior to fabrication, field measure each area which is to receive roller shade installation to establish the exact size and layout of the units as shown on drawings.

Part 3 Execution

3.1 EXAMINATION

- .1 Examine finished openings for deficiencies that may preclude satisfactory installation.
- .2 Verify adequacy of blocking and framing required to support manual roller window shade assembly.
- .3 Notify the Contract Administrator of unsatisfactory substrate preparation before proceeding. Do not begin installation until substrates have been properly prepared. Start of installation will be considered acceptance of substrates.

3.2 PREPARATION

- .1 Verify all measurements on site.
- .2 Check heat and ventilation grilles and appliances on site with due regard to installation of manual roller window shades. Advise the Contract Administrator of conditions that may cause scorching, billowing, or other unusual conditions.
- .3 Prepare surfaces using methods recommended by manufacturer for achieving best result for substrate under the project conditions.

3.3 INSTALLATION

- .1 Install manual roller window shade systems and fabrics in accordance with reviewed shop drawings and manufacturer's printed instructions.
- .2 Fabric to hang flat, without waves, buckling or distortion. The edge, when trimmed, to hang straight without raveling.
- .3 Adjust level, projection and shade centering from mounting bracket where applicable. Verify there is no telescoping of shade fabric. Ensure smooth shade operation.
- .4 Provide adequate clearance to permit unencumbered operation of entire system.

3.4 ADJUSTING

- .1 Adjust roller shade systems to operate smoothly and free from binding or malfunction throughout entire range.

END OF SECTION

Part 1 General

1.1 RELATED WORK

- .1 Section 04 00 00 – Masonry.

1.2 REFERENCES

- .1 Canadian Standards Association (CSA).
 - .1 CSA W117.2-19, Safety in Welding, Cutting, and Allied Processes.

1.3 SUBMITTALS

- .1 Shop Drawings.
 - .1 Submit product data in accordance with Section 01 33 00.
 - .2 Indicate complete layout and configuration of welding booths including plans and elevations of all components and accessories.
 - .3 Include product literature by manufacturer's catalogue or model number.
 - .4 Provide templates, patterns, fixing diagrams, and other related data required for coordination and installation.
- .2 Closeout Submittals.
 - .1 Provide operation and 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 in manufacturer's instructions.
- .4 Cleaning and Waste Management in accordance with Section 01 74 00.
- .5 Waste Management and Disposal in accordance with Section 01 74 19.

Part 2 Materials

2.1 MANUFACTURED UNITS

- .1 Basis of Design Products.
 - .1 Modular Welding Booth Panels.
 - .1 Lincoln Electric ASGL15788-34 Modular Welding Booth Panels.
 - .2 Strip Curtain Kit.
 - .1 Lincoln Electric ASGL15788-8 Modular Welding Booth Curtain Kit complete-with AGO Industries 30 VS-222-G Gold Vinyl Strips (80 mil).
- .2 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes* of the *Bidding Procedures*.
- .3 Supply similar products from single manufacturer.

2.2 MANUFACTURED UNITS

- .1 Modular Welding Booth Panels.
 - .1 5'-0" wide x 7'-6" high heavy-duty steel frame construction consisting of 11-gauge, reinforced frame and 16-gauge sheet metal side panels, factory powder-coated with anti-reflective black finish paint.
- .2 Strip Curtain Kit.
 - .1 8" x 80 mil Gold see-through vinyl weld strip curtain, 5' high x 6' wide with 2" overlap complete-with 2" x 2" x 3/16" angle iron mounting plate and mounting hardware.

Part 3 Execution

3.1 INSTALLATION

- .1 Install equipment in accordance with reviewed shop drawings and manufacturer's printed instructions.
- .2 Install plumb, level, straight, rigidly supported, and securely fastened to abutting surfaces as applicable, free from superimposed loads.

3.2 CLEANING

- .1 Clean all exposed surfaces after installation using manufacturer's recommended cleaning products and procedures.

3.3 PROTECTION

- .1 Protect installed product and finish surfaces from damage during construction.

END OF SECTION

Part 1 General

1.1 Section Includes

- .1 Documents and certain applicable terminology.
- .2 Associated requirements.
- .3 Work expectations.
- .4 Work by other parties.
- .5 Words and terms.
- .6 Examination
- .7 Closeout submittals
- .8 Operation and maintenance manual format.
- .9 Contents each volume.
- .10 Recording actual site conditions.
- .11 Record documents.
- .12 Warranties and bonds.
- .13 Quality Assurance.
- .14 Demonstration and Training
- .15 Conditions for Demonstrations
- .16 Shop drawings and product data.
- .17 Samples.
- .18 Certificates and transcripts.
- .19 Product quality, availability, storage, handling, protection, and transportation.
- .20 Product changes and substitutions.
- .21 Manufacturer's instructions.
- .22 Quality of Work, coordination and fastenings.
- .23 Accessibility of Equipment
- .24 Coordination, work for other trades, electrical requirements, temporary use of equipment.
- .25 Existing facilities.

1.2 Related Sections

- .1 Applicable sections in Division 01, including:
 - .1 Allowances
 - .2 Construction Progress Documentation.
 - .3 Submittal Procedures.
 - .4 Product Exchange Procedures.
 - .5 Substitutions
 - .6 LEED Requirements and Procedures.

.7 Closeout Submittals.

.2 This section describes common work applicable to all Sections within project Divisions 21, 22, 23 and 25.

1.3 Complementary Documents

- .1 Drawings, specifications, and schedules are complementary to each other and what is called for by one will be binding as if called for by all.
- .2 Should any discrepancy appear between the drawings and specifications, which leaves the Contractor in doubt as to the true intent and meaning of the plans, and specifications, the Contractor shall obtain a ruling in writing from the Contract Administrator in writing before submitting the bid. If this is not done it will be assumed that the most expensive alternative has been included in the bid price.
- .3 The drawings for mechanical work are performance drawings. They are generally diagrammatic and are not to scale unless detailed otherwise. They establish scope, material and installation quality and are not detailed installation instructions showing every offset, fitting, valve or every difficulty encountered during execution of work and will not be used as an excuse for deficiencies or omissions. Where required installations are not shown on plans or are only shown diagrammatically, install in such a way as to conserve headroom and interfere as little as possible with free use or space through which they pass, while adequate space is allowed for service, maintenance, repair, or replacement for all equipment.
- .4 Drawings indicate general location and route of new and existing mechanical systems. The review of exact location and routing of systems prior to bidding is the responsibility of the Contractor. Install piping and duct systems not exactly shown in plan or indicated by note, by graphic, or diagrammatically in schematic or riser diagrams to provide an operational assembly or system.
- .5 Install components to physically conserve headroom, to minimize furring spaces, to accommodate installed Work, or other obstructions.
- .6 Install ceiling mounted or exposed mechanical components such as diffusers, sprinkler heads and grilles in accordance with reflected ceiling drawings or floor plans.
- .7 Locate devices with primary regard for convenience of operation and usage.
- .8 Examine all discipline drawings, specifications, and schedules and related Work to ensure that Work can be satisfactorily executed. Conflicts or additional Work beyond Work described, to be brought to the attention of the Contract Administrator.
- .9 All specification sections of the Project Manual and Drawings are affected by requirements of Division 01 sections.

1.4 Description Of The Work

- .1 Division of the Work among other Contractors, subContractors, suppliers or vendors is solely the Contractor's responsibility. Neither The City nor Contract Administrator assumes any responsibility to act as an arbiter to establish subcontract terms or disagreements between sectors or disciplines of the Work.

1.5 Contract Method

- .1 Construct Work under the Contract requirements in the applicable Division 00 sections.
- .2 Refer to Section 01 21 00 for cash allowances.
- .3 Contract Documents were prepared by the Contract Administrator for The City. Any use which a third party makes of the Contract Documents, or any reliance on or decisions to be made based on them, are the responsibility of such third parties. The Contract Administrator accepts no responsibility for any damages suffered by any third party as a result of decisions made or actions based on the Contract Documents.

1.6 Permits, Inspection And Testing

- .1 File all necessary notices and approved layouts, obtain and pay for all Local Authority and Fire Underwriters Inspections, approvals and permits applicable to each Mechanical Section. Make changes required to secure Local Authorities approval, without extra cost. Where conflicting requirements occur, comply with most stringent regulation. Note that requirements shown or specified may exceed minimum standards set by Local Authorities.
- .2 The Regulations of the A.S.M.E. Code and the Provincial Labour Department shall cover the design, manufacture, installation, welding and tests of piping and other equipment as specified hereafter.
- .3 Obtain Registration Certificates for all pressure vessels, with suitable metal-framed glass covers installed where directed. Furnish all certificates required by Local Authorities before acceptance of building by The City.
- .4 The City may request the Mechanical Section to operate device or material installed for such time as Contract Administrator may require, as a thorough test, before final acceptance. Such tests shall not be construed as evidence of acceptance, and no claim for cost of such operation for test, or damage due to inadequacy or defect will be recognized.
- .5 Note that site reviews by the Contract Administrator are for the purpose of determining in general if the work is proceeding in accordance with the Contract Documents, and to endeavour to guard The City against defects and deficiencies and not to superintend the execution of the work, which is the Mechanical Subcontractor's and their Subcontractors' responsibility.

1.7 Words And Terms

- .1 Conform to definitions and their defined meanings as in The City General Terms.
- .2 Refer to The City General Terms for Specification Grammar.
- .3 Conform to the following definitions and their defined meanings in addition to those referenced in The City General Terms:
 - .1 Install: To remove from site storage, move or transport to intended location, install in position, connect to utilities, repair site caused damage, and make ready for use.
 - .2 Supply: To acquire or purchase, ship or transport to the site, unload, remove packaging to permit inspection for damage, re-package, replace damaged items, and safely store on-site.

- .3 Provide: Wherever the term "provide" is used in relationship to equipment, piping and other materials specified for the work, it means "supply, install and connect". Wherever the terms "provide" is used in connection with services such as testing, balancing, start-up, preparation of drawings for any part of the work, it means procure, prepare, supervise, take responsibility for, and pay for these services.
- .4 Typical: A representative characteristic that is standard for all installations whether individually noted or not throughout the documents. "Typical" applies to each individual or combined installation except where specifically noted or otherwise indicated that the application is non-typical.
- .5 Exposed: Any work not concealed in wall, shaft, or ceiling cavities or spaces. Work behind doors, in closets or cupboards or under counters is considered exposed.
- .6 New: Produced from new materials.
- .7 Renewed: Produced or rejuvenated from an existing material to like-new condition to serve a new or existing service.
- .8 Defective: A condition determined exclusively by the Contract Administrator.

1.8 Examination

- .1 Inspect existing conditions, including elements or adjacent Work subject to irregularities, damage, movement, including Work during cutting and patching.
- .2 After uncovering, inspect conditions affecting performance of the Work.
- .3 Examine all Contract documents to ensure work can be performed without changes to the Work as shown on plans. No allowance will be made later for necessary changes, unless notification of interferences have been brought to Contract Administrator's attention in writing, prior to bid closing.
- .4 Verify that materials and equipment can be delivered to the place of the work and that sufficient space and access is available to permit installation as shown on the drawings.
- .5 Verify the locations and inverts of service lines leaving and entering building to ensure their proper function prior to commencing work.

1.9 Closeout Submittals

- .1 Prepare instructions and data using personnel experienced in maintenance and operation of described products.
- .2 Four (4) weeks prior to Substantial Performance of the Work, submit to the Contract Administrator, three (3) final copies of operating and maintenance manuals in Canadian English.
- .3 Copy will be returned with Contract Administrator's comments.
- .4 Revise content of documents as required prior to final submittal.
- .5 Two (2) weeks prior to Substantial Performance of the Work, submit to the Contract Administrator, three (3) final copies of operating and maintenance manuals, revised as per Contract Administrator's comments.

- .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 Summary audit documents associated with requirements for LEED classification documentation.
- .8 If requested, furnish evidence as to type, source and quality of products provided.
- .9 Defective products will be rejected, regardless of previous inspections. Replace products at own expense.
- .10 Pay costs of transportation.

1.10 Operation And Maintenance Manual Format

- .1 Refer also to Section 01 78 00 for formats for manuals. Where there is a discrepancy with this section, follow the requirements of 01 78 00.
- .2 Organize data in the form of an instructional manual.
- .3 Electronic format: Provide all documentation in electronic PDF format for Contract Administrator review and final submission. Electronic file organization shall represent the printed version.
- .4 Binders: vinyl, hard covered, 3 'D' ring, loose leaf 8.5 x 11 inch (219 x 279 mm) with spine and face pockets.
- .5 When multiple binders are used, correlate data into related consistent groupings. Identify contents of each binder on spine.
- .6 Cover: Identify each binder with type or printed title 'Project Record Documents'; list title of project and identify subject matter of contents.
- .7 Arrange content by systems under Section numbers and sequence of Table of Contents.
- .8 Provide tabbed fly leaf for each separate product and system, with typed description of product and major component parts of equipment.
- .9 Text: Manufacturer's printed data, or typewritten data.
- .10 Drawings: provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.

1.11 Contents - Each Volume

- .1 Refer also to Section 01 78 00 for formats for contents. Where there is a discrepancy with this section, follow the requirements of 01 78 00.
- .2 Table of Contents: Provide:
 - .1 Title of project.
 - .2 Date of submission.
 - .3 Names, addresses, and telephone numbers of Contract Administrator and Contractor with name of responsible parties.
 - .4 Schedule of products and systems, indexed to content of volume.
- .3 For each product or system, list names, addresses and telephone numbers of Subcontractors and suppliers, including local source of supplies and replacement parts.

- .4 Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation; delete inapplicable information. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions specified in Section 01 45 00.
- .5 Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams.
- .6 Certificate of Acceptance: Relevant certificates issued by authorities having jurisdiction, including code compliance certificate, life safety systems performance certificate. pressure vessel acceptance.
- .7 Training: Refer to Demonstration and Training in this Section.

1.12 Recording Actual Site Conditions

- .1 Record information on a full-sized set of drawings, and within the Project Manual.
- .2 Annotate with coloured felt tip marking pens, maintaining separate colours for each major system, for recording changed information.
- .3 Record information concurrently with construction progress. Do not conceal Work of the Project until required information is accurately recorded.
- .4 Contract drawings and shop drawings: legibly mark each item to record actual construction, including:
 - .1 Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
 - .2 Measured locations of internal utilities and appurtenances, referenced to visible and accessible features of construction.
 - .3 Field changes of dimension and detail.
 - .4 Changes made by change orders.
 - .5 Details not on original Contract Drawings.
 - .6 References to related shop drawings and modifications.
- .5 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.

1.13 Record Documents

- .1 Prior to Substantial Performance of the Work, electronically transfer the marked-up information from the as-built documents, as follows:
 - .1 Drawings:
 - .1 Scan the full-sized field-verified as-built drawing set and save to PDF format. Scans shall be in colour and with good resolution to ensure drawings and markups are legible. Submit for Contract Administrator review.
 - .2 Transfer the reviewed marked up information to AutoCAD and produce an electronic record set in PDF format and AutoCAD DWG format.
 - .2 Specifications: Adobe Acrobat (PDF).

- .2 Mark revised documents as "RECORD DOCUMENTS". Include all revisions.
- .3 Submit completed record documents to Contract Administrator on a CD, DVD, or by electronic transfer.

1.14 Warranties And Bonds

- .1 Refer also to Section 01 78 00 for Warranties and Bonds.
- .2 Provide written guarantee that complete installation including materials, work and operation of all equipment provide under Mechanical Sections are first class in every respect, subject only to improper usage by The City, and make good forthwith when reported all defects which develop within one year from date of acceptance of building by The City at no additional cost to The City.
- .3 In addition, guarantee heating and cooling systems through one complete heating or cooling season, as applicable.
- .4 Deliver to The City all equipment manufacturer's guarantees specified in excess of one year.

1.15 Environmental And Leed Related Requirements

- .1 All paints and coatings wet-applied on site must meet the applicable VOC limits of the California Air Resources Board (CARB), Suggested Control Measure (SCM) for Architectural Coatings, or the South Coast Air Quality Management District (SCAQMD) Rule 1113.
- .2 All adhesives and sealants wet-applied on site must meet the applicable chemical content requirements of SCAQMD Rule 1168 Adhesive and Sealant Applications, as analyzed by the methods specified in Rule 1168. The provisions of SCAQMD Rule 1168 do not apply to adhesives and sealants subject to consumer product VOC regulations.

1.16 Fabrication And Workmanship

- .1 Employ skilled mechanics in their respective trades, under competent supervision, and where required by Provincial or Local regulations holder of acceptable qualification certificates.

1.17 Quality Assurance

- .1 Provide testing organization services as specified in subsequent Sections.
- .2 Testing organization: Current member in good standing of their respective professional or industry organization and certified to perform specified services.
- .3 Comply with applicable procedures and standards of the certification sponsoring association.
- .4 Perform services under direction of supervisor qualified under certification requirements of sponsoring association.
- .5 Qualifications:
 - .1 Provide adequate workforce training through meetings and demonstrations.
 - .2 Provide a designated experienced person on site with de-construction experience throughout the project for consultation and supervision purposes.

1.18 Demonstration And Training

- .1 Refer also to Section 01 79 00 for Demonstration and Training. Where there is a discrepancy with this section, follow the requirements of 01 79 00.
- .2 Instruct The City's designated employees in proper care, operation, use and maintenance of all systems and equipment, and provide general explanatory literature required and start up supervision and instructions.
- .3 Provide two (2) weeks prior notice to The City to schedule the training.
- .4 The City will provide list of personnel to receive instructions, and will coordinate their attendance at agreed-upon times.
- .5 Upon completion of instructions, forward to Contract Administrator with a copy to The City a letter indicating person instructed and dates that the instruction took place. If in Contract Administrator's opinion, this is not done satisfactorily, Contract Administrator may direct such instruction, and charge all costs involved to relevant section.

1.19 Conditions For Demonstrations

- .1 Equipment has been inspected and put into operation in accordance with related sections.
- .2 Testing, adjusting, and balancing have been performed and equipment and systems are fully operational.
- .3 Provide copies of completed operation and maintenance manuals for use in demonstrations and instructions.

1.20 Shop Drawings - Administrative Requirements

- .1 Shop drawings shall be submitted electronically in PDF format documents to shopdrawings@eppsiepmann.com.
- .2 Shop drawing documents shall be grouped by specification section. Clearly list the specification section on the front page or cover sheet of the submittal. Shop drawings related to multiple sections may not be grouped together into a single document. Documents that are groups incorrectly will be returned without being examined and shall be considered rejected.
- .3 Each drawing shall include the name of project as found on the drawings or specifications, the equipment supplier and the specification section that the equipment is specified under.
- .4 Submit to Contract Administrator submittals listed for review. Submit with reasonable promptness and in orderly sequence so as to not cause delay in Work. Failure to submit in ample time is not considered sufficient reason for an extension of Contract Time and no claim for extension by reason of such default will be allowed.
- .5 Work affected by submittal shall not proceed until review is complete.
- .6 Present Shop Drawings, product data, samples and mock-ups in SI Metric and/or Imperial inch-pound units, to match the units used in the schedules.

- .7 Review submittals prior to submission to Contract Administrator. This review represents that necessary requirements have been determined and verified, or will be, and that each submittal has been checked and co-ordinated with requirements of Work and Contract Documents.
- .8 Submittals not stamped, signed, dated, identified as to specific project, and attesting to their being reviewed will be returned without being examined and shall be considered rejected.
- .9 Notify Contract Administrator, in writing at time of submission, identifying deviations from requirements of Contract Documents stating reasons for deviations.
- .10 Verify field measurements and affected adjacent Work are coordinated.
- .11 Contractor's responsibility for errors and omissions in submission is not relieved by Contract Administrator's review of submittals.
- .12 Contractor's responsibility for deviations in submission from requirements of Contract Documents is not relieved by Contract Administrator review.
- .13 Keep one (1) reviewed copy of each submission on site.

1.21 Shop Drawings And Product Data

- .1 The term "Shop Drawings" means drawings, diagrams, illustrations, schedules, performance charts, brochures and other data which are to be provided by Contractor to illustrate details of a portion of Work.
- .2 Indicate materials, methods of construction and attachment or anchorage, erection diagrams, connections, explanatory notes and other information necessary for completion of Work. Where articles or equipment attach or connect to other articles or equipment, indicate that such items have been coordinated, regardless of Section under which adjacent items will be supplied and installed. Indicate cross references to design drawings and specifications. Indicate layouts, quantity, details of equipment, control wiring diagrams, sizes, capacities and roughing in and exact requirements for concrete pits, bases and other supporting members.
- .3 Each shop drawing must be certified by manufacturer and as such shall indicate that all product engineering has been performed to ensure the product will meet the requirements of the intended installation.
- .4 Shop drawings for grilles, registers and diffusers shall be accompanied by an itemized list indicating the unit locations by room number and the unit size.
- .5 Allow ten (10) days for Contract Administrator's review of each submission.
- .6 Adjustments made on Shop Drawings by Contract Administrator are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to Contract Administrator prior to proceeding with Work.
- .7 Make changes in Shop Drawings as Contract Administrator may require, consistent with Contract Documents. When resubmitting, notify Contract Administrator in writing of any revisions other than those requested.
- .8 Accompany submissions with transmittal letter, containing:
 - .1 Date.
 - .2 Project title and number.

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- .3 Contractor's name and address.
 - .4 Identification and quantity of each shop drawing, product data and sample.
 - .5 Other pertinent data.
 - .9 Submissions shall include:
 - .1 Date and revision dates.
 - .2 Project title and number.
 - .3 Name and address of:
 - .1 Subcontractor.
 - .2 Supplier.
 - .3 Manufacturer.
 - .4 Contractor's stamp, signed by Contractor's authorized representative certifying approval of submissions, verification of field measurements and compliance with Contract Documents.
 - .5 Details of appropriate portions of Work as applicable:
 - .1 Fabrication.
 - .2 Layout, showing dimensions, including identified field dimensions, and clearances.
 - .3 Setting or erection details.
 - .4 Capacities.
 - .5 Performance characteristics.
 - .6 Standards.
 - .7 Operating weight.
 - .8 Wiring diagrams.
 - .9 Single line and schematic diagrams.
 - .10 Relationship to other parts of the Work.
 - .10 After Contract Administrator's review, distribute copies.
 - .11 Submit one (1) copy of Shop Drawings as a pdf document by email attachment for each requirement requested in specification Sections and as Contract Administrator may reasonably request. Any electronic copy of shop drawings shall bear all the required marks of certification and approval by the manufacturer and Contractor(s) as indicated above. The Contract Administrator will review and mark up one copy of the shop drawing, and return to the Contractor by email attachment. The Contractor shall then make copies as required for ordering and documentation purposes. Multiple copies of shop drawings will not be returned.
 - .12 Submit one electronic copy of product data sheets or brochures for requirements requested in specification sections and as requested by Contract Administrator where Shop Drawings will not be prepared due to standardized manufacture of product. Submittals shall be submitted as a pdf document by email attachment, or delivered as a hard copy. Any electronic copy of shop drawings shall bear all the required marks of certification and approval by the manufacturer and Contractor(s) as indicated above.
 - .13 Delete information not applicable to project.
 - .14 Supplement standard information to provide details applicable to project.

- .15 If upon review by Contract Administrator, no errors or omissions are discovered or if only minor corrections are made, one electronic copy will be returned and fabrication and installation of Work may proceed. If Shop Drawings are rejected, noted copy will be returned and re-submission of corrected Shop Drawings, through same procedure indicated above, must be performed before fabrication and installation of Work may proceed. The Contractor shall then make copies as required for ordering and documentation purposes. Multiple copies of shop drawings will not be returned.
- .16 Checking of shop drawings by the Contract Administrator does not constitute acceptance of responsibility. Such checking constitutes assistance only to the Mechanical Division in the proper execution of their work.

1.22 Samples

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

1.23 Mock-up

- .1 Erect mock-ups to the requirements of Division 01.

1.24 Certificates And Transcripts

- .1 Submit LEED credit criteria associated with specified products in accordance with LEED requirements.

1.25 Product Quality

- .1 Products, materials, equipment, parts or assemblies (referred to as Products) incorporated in Work: New, not damaged or defective, of best quality (compatible with specification requirements) for purpose intended. If requested, provide evidence as to type, source and quality of Products provided.
- .2 Defective Products, whenever identified prior to completion of Work, will be rejected, regardless of previous inspections. Inspection does not relieve responsibility, but is precaution against oversight or error. Remove and replace defective Products at own expense and be responsible for delays and expenses caused by rejection.

- .3 Should any dispute arise as to quality or fitness of Products, decision rests strictly with Contract Administrator.
- .4 Unless otherwise indicated in specifications, maintain uniformity of manufacture for any particular or like item throughout building.
- .5 Permanent labels, trademarks and nameplates on Products are not acceptable in prominent locations, except where required for operating instructions, or when located in mechanical or electrical rooms.

1.26 Availability

- .1 Immediately upon signing Contract, review Product delivery requirements and anticipate foreseeable supply delays for any items.
- .2 If delays in supply of Products are foreseeable, notify Contract Administrator of such, in order that substitutions or other remedial action may be authorized in ample time to prevent delay in performance of Work.
- .3 In event of failure to notify Contract Administrator at commencement of Work and should it subsequently appear that Work may be delayed for such reason, Contract Administrator reserves right to substitute more readily available Products of similar character, at no increase in Contract Price or Contract Time.

1.27 Storage And Protection

- .1 Store and protect Products in accordance with manufacturers' written instructions.
- .2 Store with seals and labels intact and legible.
- .3 Store sensitive Products in weather tight, climate controlled, enclosures in an environment favourable to Product.
- .4 For exterior storage of fabricated Products, place on sloped supports above ground.
- .5 Cover Products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of Products.
- .6 Cover open ends of pipes, fixtures, ductwork, etc. to prevent entry of building rubbish.
- .7 Store loose granular materials on solid flat surfaces in a well-drained area. Prevent mixing with foreign matter.
- .8 Provide equipment and personnel to store Products by methods to prevent soiling, disfigurement, or damage.
- .9 Arrange storage of Products to permit access for inspection. Periodically inspect to verify Products are undamaged and are maintained in acceptable condition.

1.28 Transportation And Handling

- .1 Transport and handle Products in accordance with manufacturer's written instructions.
- .2 Promptly inspect shipments to ensure that Products comply with requirements, quantities are correct, and Products are undamaged.
- .3 Provide equipment and personnel to handle Products by methods to prevent soiling, disfigurement, or damage.

- .4 Protect all finished and unfinished work from soiling or damage, cover floors with tarpaulins or plywood as necessary, and repair any damage resulting from work of Mechanical Section.
- .5 Protect finished surfaces to remain exposed, by paper, polyethylene or other satisfactory removable protective covering using paste acceptable to fixture manufacturer to prevent possible damage to finishes, until all reason for construction damage has passed and until acceptance by The City, and make good any such damage.

1.29 Special Cleaning

- .1 Maintain tidiness within work of Mechanical Sections and at completion remove protective paper, labels, etc. and tools and waste materials. Leave clean and in perfect operating condition.
- .2 Remove dirt, rubbish, grease, and dust for which this section is responsible from all exposed surfaces and fixtures.
- .3 Operate, drain and flush out bearings and refill with new charge of lubricant, before final acceptance.
- .4 Thoroughly clean piping, ducts and equipment of dirt, cuttings and other foreign substances within the scope of work area. Disconnect, clean and reconnect whenever necessary for purpose of locating and removing obstructions. Repair work damaged in course of removing obstructions. Refer to 23 31 00 for any additional duct cleaning requirements.
- .5 Clean exposed surfaces of mechanical equipment, ductwork, piping, etc., and polish plated work.
- .6 Protect bearings and shafts during installation. Grease shafts and sheaves to prevent corrosion. Supply and install extended nipples to outside of bearing enclosures for lubrication purposes.
- .7 Remove tools, surplus, and waste material from the building site upon completion of work. Clean grease, dirt, and excess material from walls, floors, ceilings, surfaces, and fixtures for which this Contractor was responsible, and leave the premises suitable for immediate use.
- .8 At the end of construction all systems shall be left ready for operation.
- .9 This Section shall be responsible for repair work as may be necessary to remove dents and touch-up of factory finishes.

1.30 Product Changes & Substitutions

- .1 Change in Product/Products: Submit request for substitution or alternative in accordance with this Section, the Instructions to Bidders, and Division 01 Product Exchange Procedures Division 01 Substitutions Sections. In case of a discrepancy between this section and Division 00 and Divisions 01, the more stringent requirements shall apply.
- .2 The Instructions to Bidders specify time restrictions for submitting requests for Substitutions during the bidding period to requirements specified in this section.

- .3 Document each request with complete data substantiating compliance of proposed Substitution with Contract Documents.
- .4 Any substituted item submitted for consideration must not exceed the available space and weight limitations, and all additional costs for mechanical, electrical, structural and architectural revisions required to incorporate the substituted material shall be the responsibility of the Mechanical Division. Review maximum dimensions and weights when provided in the specification and schedules, and where not specified review the drawings for space limitations.
- .5 A request constitutes a representation that the Bidder:
 - .1 Has investigated proposed Product and determined that it meets or exceeds the quality level of the specified Product.
 - .2 Will provide the same warranty for the Substitution as for the specified Product.
 - .3 Will coordinate installation and make changes to other Work which may be required for the Work to be complete with no additional cost to The City.
 - .4 Waives claims for additional costs or time extension which may subsequently become apparent.
 - .5 Will reimburse The City and Contract Administrator for review or redesign services associated with re-approval by authorities.
- .6 Substitutions will not be considered when they are indicated or implied on shop drawing or product data submittals, without separate written request, or when acceptance will require revision to the Contract Documents.

1.31 Existing Utilities

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

1.32 Manufacturer's Written Instructions

- .1 Unless otherwise indicated in the specifications, install or erect Products to manufacturer's written instructions. Do not rely on labels or enclosures provided with Products. Obtain written instructions directly from manufacturers.
- .2 Notify Contract Administrator in writing, of conflicts between specifications and manufacturer's instructions, so that Contract Administrator may establish course of action.
- .3 Improper installation or erection of Products, due to failure in complying with these requirements, authorizes Contract Administrator to require removal and re-installation at no increase in Contract Price or Contract Time.

1.33 Quality Of Work

- .1 Ensure Quality of Work is of highest standard, executed by workers experienced and skilled in respective duties for which they are employed. Immediately notify Contract Administrator if required Work is such as to make it impractical to produce required results.
- .2 Do not employ anyone unskilled in their required duties. Contract Administrator reserves right to require dismissal from site any workers deemed incompetent or careless.
- .3 Decisions as to standard or fitness of Quality of Work in cases of dispute rest solely with Contract Administrator, whose decision is final.
- .4 Assume full responsibility for layout of own work and for any damage caused to property of others through improper location or poor workmanship.

1.34 Accessibility Of Equipment

- .1 The City places a high priority on being able to safely and efficiently gain access to systems and equipment for replacement and repair. All equipment must be accessible, as defined as follows:
 - .1 Ceiling mounted equipment shall only be considered accessible if a tradesman can place both hands on the equipment components which requires services (ie: fan motor, belt, pulley, bearing, fire damper linkages, 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 or 10 foot step ladder. Access panels provided in drywall shall be sized and placed in such a manner that trades personnel can place two hands on the equipment components as stated above. Equipment located above acoustic tile ceiling shall be positioned in such a manner that equipment and its components can be accessed through a full tile which does not contain any devices such as light fixtures, speakers, smoke detectors or sprinkler heads. If this is not possible, it should be reviewed by the Contract Administrator/The City before deemed acceptable.
 - .2 Conduit, pipe, ducting and support racking or any other obstruction to accessibility shall be relocated at the Contractor's expense by the Contractor's forces.

1.35 Coordination

- .1 Ensure cooperation of workers in laying out Work. Maintain efficient and continuous supervision.
- .2 Be responsible for coordination and placement of openings, sleeves and accessories.
- .3 Check levels shown before commencement to ensure adequate falls for sewers and pipes and report discrepancies immediately. Failure to so check and report does not relieve this section from responsibility for consequent extra expenditures.
- .4 Where space is indicated as reserve for future equipment, leave clear and install piping and other work so that connections can be made to future equipment.

- .5 Secure approval where necessary to cut holes in either finished or unfinished work, employ section whose work is involved, cut openings no larger than necessary and without damage to adjoining work and carefully repair all damage to match adjacent work. Note the Mechanical Division is responsible for all required cutting and patching relating to this Contract, except as specifically noted otherwise.
- .6 Provide and set bolts, templates, sleeves and fixing materials for fixing work under this section securely to work provided under other sections, in advance of other work, where required.
- .7 Locate all openings in walls, partitions, beams, etc. required for installation of ducts, pipes and equipment, etc. specified in this section of the specifications and frame all openings as required.
- .8 Installation of all equipment shall allow sufficient space to facilitate ease of maintenance. Clearance space shall allow for the removal of all components of equipment without hindrance. Where clearance requirements are not shown on the mechanical plans, manufacturer clearances must be maintained at a minimum.

1.36 Work For Other Trades

- .1 The Mechanical Subcontractor shall install rough-ins and/or connections for all equipment requiring mechanical services, as shown on drawings or mentioned elsewhere in the specifications.
- .2 Supply other trades with all necessary details, rough-in drawings, wiring diagrams, etc. as required.

1.37 Electrical Requirements

- .1 Motors and electrical equipment supplied under Mechanical Division shall comply with Electrical Section and electrical characteristics scheduled or shown.
- .2 See "Installation and Wiring Controls" in Electrical Section for equipment supplied under Electrical Section.
- .3 The Electrical section shall provide starters for all motors and wire from starters to motors, unless otherwise indicated.
- .4 The Electrical section shall wire between starters and switching components such as relays, float switches, and pressure switches.
- .5 Supply to Electrical Section within four (4) weeks after Contract award, fully detailed diagrams of power and control wiring required for equipment supplied by Sections 21 – 25.
- .6 Motors shall be squirrel cage induction type 1800 RPM unless otherwise noted. Where dampness occurs, all motors and electrical apparatus such as float switches, etc. supplied integrally with any piece of apparatus, shall be totally enclosed.
- .7 All motors 1 hp and larger shall be high efficiency as defined in CSA C390.

1.38 Concealment

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

- .2 Before installation, inform Contract Administrator if there is interference. Install as directed by Contract Administrator.

1.39 Access Panels

- .1 Provide in ample time for installation under relevant sections all necessary access panels in walls and ceilings to allow access to dampers, valves, etc., size 300 mm x 300 mm (12" x 12") min. or as required for proper maintenance with steel panel and frame, similar to Acudor, type to suit application. Instruct relevant section for proper location of access panels. Final locations subject to Contract Administrator's approval. ULC approved access panels must be provided where access is through or into a fire partition or assembly. If access doors have been specified by architectural sections the architectural specification shall supersede this section.

1.40 Remedial Work

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

1.41 Location Of Fixtures

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

1.42 Fastenings

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

1.43 Fastenings - Equipment

- .1 Use fastenings of standard commercial sizes and patterns with material and finish suitable for service.
- .2 Use heavy hexagon heads, semi-finished unless otherwise specified. Use Type 304 or 316 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.

1.44 Temporary Use Of Equipment

- .1 No portion of any mechanical system or equipment provided under Mechanical Sections may be used for temporary heating without Contract Administrator's written permission and observance of the following procedure:
 - .1 Oil and grease motor, fan and pump bearings, etc. check on a regular basis and maintain as recommended by manufacturer.
 - .2 Maintain and clean when necessary cleanable type filters and clean and oil just prior to take-over of building by The City. Replace throwaway type filters.
 - .3 Ensure that mechanical air handling equipment is not operated during painting.
 - .4 Employ equipment manufacturers and subtrades to ensure and certify that all systems and equipment are in proper condition, and guarantee all work used prior to take-over as for new work, from date of acceptance of building by The City.
 - .5 If permission for temporary use of mechanical equipment is granted, use Canadian Plumbing and Mechanical Contractor's Association standard form of agreement as basis of responsibilities. Guarantee on complete installation shall not start until acceptance of building by The City.
- .2 All return air grilles/openings shall be equipped with MERV 8 filters to keep return air system clean of dust and dirt if air handling equipment is being used before turnover to The City.

1.45 Protection Of Work In Progress

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

1.46 Equipment Start Up, And Verification Reports

- .1 The Contractor shall supply the equipment start-up reports for the mechanical equipment being installed.
 - .1 Forms shall be filled out in full, with all required and suggested fields.
 - .2 Forms shall include tester's signature and the signature by the project manager for the Mechanical Subcontractor.
- .2 The controls Contractor shall supply a completed sequence verification checklist confirming all points of the system are functioning, reporting, and properly executing the sequence operation.
 - .1 Forms shall be developed and filled out by the Contractor
 - .2 Forms shall include tester's signature and the signature by the project manager for the Mechanical Subcontractor.

END OF SECTION

Part 1 General

1.1 Section Includes

- .1 Pipe, fittings, valves, and connections for sprinkler, standpipe and fire hose, combination sprinkler and standpipe systems.
- .2 Back flow prevention

1.2 Related Sections

- .1 Submittal Procedures.
- .2 Product Requirements.
- .3 Closeout Submittals.
- .4 Painting: Preparation and painting of fire protection piping systems.
- .5 Section 21 13 00 - Sprinklers.
- .6 Section 23 05 53 - Mechanical Identification.
- .7 Section 23 05 29 - Supports and Anchors.

1.3 REFERENCES

- .1 ASME Boiler and Pressure Vessel Code Section IX - Welding and Brazing Qualifications.
- .2 ASME B16.1 - Cast Iron Pipe Flanges and Flanged Fittings.
- .3 ASME B16.3 - Malleable Iron Threaded Fittings.
- .4 ASME B16.4 - Cast Iron Threaded Fittings.
- .5 ASME B16.5 - Pipe Flanges and Flanged Fittings.
- .6 ASME B16.9 - Factory-made Wrought Steel Buttwelding Fittings.
- .7 ASME B16.11 - Forged Fittings Socket Welding and Threaded.
- .8 ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings.
- .9 ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
- .10 ASME B16.25 - Buttwelding Ends.
- .11 ASME B36.10 - Welded and Seamless Wrought Steel Pipe.
- .12 ASTM A135 - Electric-Resistance-Welded Steel Pipe.
- .13 ASTM A47/A47M - Ferritic Malleable Iron Castings.
- .14 ASTM A53/A53M - Pipe, Steel, Black and Hot-Dipped, Zinc-coated Welded and Seamless.
- .15 ASTM A234/A234M - Piping Fittings of Wrought-Carbon Steel and Alloy Steel for Moderate and High Temperature Service.
- .16 ASTM A795 - Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use.
- .17 ASTM B32 - Solder Metal.

- .18 ASTM B75/B75M - Seamless Copper Tube.
- .19 ASTM B88 - Seamless Copper Water Tube.
- .20 ASTM B251 - General Requirements for Wrought Seamless Copper and Copper-Alloy Tube.
- .21 AWS A5.8 - Filler Metal for Brazing and Braze Welding.
- .22 AWS D10.10 - Recommended Practices for Local Heating of Welds in Piping and Tubing.
- .23 AWWA C110 - Ductile-Iron and Gray-Iron Fittings 76 mm through 1219 mm (3 Inch through 48 inch) for Welder.
- .24 AWWA C151 - Ductile Iron Pipe, Centrifugally Cast, for Water.
- .25 NFPA 13 - Installation of Sprinkler Systems.
- .26 NFPA 14 - Installation of Standpipe, Private Hydrants, and Hose Systems.
- .27 NFPA 24 - Installation of Private Fire Service Mains and Their Appurtenances
- .28 NFPA 25 – Standard for the Inspection, Testing and Maintenance of Water Based Fire Protection Systems
- .29 UL - Fire Resistance Directory.
- .30 UL 262 - Gate Valves for Fire-Protection Service.
- .31 UL 312 - Check Valves for Fire-Protection Service.
- .32 UL 405 - Fire Department Connections.
- .33 Underwriters Laboratories of Canada (ULC)
- .34 NSF/ANSI 61 – Drinking Water System Components – Health Effects
- .35 AWWA C220 – Stainless Steel Pipe 1/2In. (13 mm) and Larger.
- .36 ASTM A312 – Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes
- .37 ASTM A779 – Standard Specification for Welded, Unannealed Austenitic Stainless Steel Tubular Products

1.4 Submittals For Review

- .1 Section: Procedures for submittals.
- .2 Product Data: Provide manufacturers catalogue information. Indicate valve data and ratings.
- .3 Shop Drawings:
 - .1 Indicate pipe materials used, jointing methods, supports, floor and wall penetration seals. Indicate installation, layout, weights, mounting and support details, and piping connections.
 - .2 Indicate hazard levels, and NFPA codes that are applicable to the system.

1.5 Submittals At Project Closeout

- .1 Section: Procedures for submittals.
- .2 Project Record Documents: Record actual locations of components and tag numbering.

- .3 Operation and Maintenance Data: Include installation instructions and spare parts lists.

1.6 Quality Assurance

- .1 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.
- .2 Carbon steel pipe and fittings manufactured in China or India will not be permitted.
- .3 Installer Qualifications: Company specializing in performing the work of this section with minimum five years documented experience, licensed in the Province of Manitoba, member in good standing with the Canadian Automatic Sprinkler Association, and approved by manufacturer.

1.7 Regulatory Requirements

- .1 Conform to ULC., UL., FM.
- .2 Sprinkler Systems: Conform to NFPA 13.
- .3 Welding Materials and Procedures: Conform to Manitoba Department of Labour and ASME Code requirements.
- .4 Valves: Bear UL/ULC label or marking. Provide manufacturer's name and pressure rating marked on valve body.
- .5 Products Requiring Electrical Connection: Listed and classified as suitable for the purpose specified and indicated.

1.8 Delivery, Storage, And Protection

- .1 Section: Transport, handle, store, and protect products.
- .2 Deliver and store valves in shipping containers, with labelling in place.
- .3 Provide temporary protective coating on cast iron and steel valves.
- .4 Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

1.9 Extra Materials

- .1 Section: Operation and Maintenance Data.
- .2 Provide two of valve stem packings for each size and type of valve installed.

1.10 Design Calculations

- .1 The contractor shall carry out all necessary calculations and shall submit all calculations, data, and drawings in conformance with the requirements of NFPA 13 and the local authority having jurisdiction for Contract Administrator's review prior to proceeding with work. All design calculations are to be sealed by a Professional Engineer registered in the province of Manitoba and shall be stamped reviewed by the authority having jurisdiction. Calculations shall be completed based on direction and restrictions given on drawings.
- .2 The design shall be based on hazard occupancy as scheduled in Section 21 13 00.

- .3 The contractor shall be responsible to obtain water supply flow and pressure from the local municipal authority. If this information is not available, the contractor shall include all costs necessary for the testing.

1.11 Inspection And Tests

- .1 All inspections and tests required by the above-mentioned authorities and agencies shall be arranged for and performed by this contractor.
- .2 Inspections and testing to comply with NFPA 25.
- .3 Carry out any necessary flow tests without extra compensation.
- .4 All piping and fittings in the standpipe and sprinkler systems shall be hydrostatically tested at a pressure of 1380 kPa (200psi) for 2 hours without evidence of loss or leakage or as per NFPA 13 and/or 14.

Part 2 Products

2.1 ABOVE GROUND PIPING AND FITTINGS

- .1 Steel Pipe: ASTM A53; ASTM A135; ASTM A135 UL listed, threadable, light wall; ASTM A795; or ASME B36.10; Schedule 40 black as scheduled below.
 - .1 Steel Fittings: ASME B16.9, wrought steel, buttwelded; ASME B16.25, buttweld ends; ASTM A234, wrought carbon steel and alloy steel; ASME B16.5, steel flanges and fittings; ASME B16.11, forged steel socket welded and threaded.
 - .2 Cast Iron Fittings: ASME B16.1, flanges and flanged fittings; ASME B16.4, threaded fittings.
 - .3 Malleable Iron Fittings: ASME B16.3, threaded fittings ASTM A47.
 - .4 Mechanical Grooved Couplings: Malleable iron housing clamps to engage and lock, "C" shaped elastomeric sealing gasket, steel bolts, nuts, and washers; galvanized for galvanized pipe.
 - .5 Mechanical Formed Fittings: Carbon steel housing with integral pipe stop and O-ring pocked and O-ring, uniformly compressed into permanent mechanical engagement onto pipe.
- .2 Stainless Steel pipe over 50mm (2"): Schedule 10, type 304/304L or 316/316L. Pipe to meet ASTM 312 or ASTM 778.
 - .1 Fittings:
 - .1 Welded fittings to ASTM A312 or A778 or,
 - .2 Grooved fittings to ANSI/NSF 61 & ANSI/NSF 372 for potable water service.

2.2 Flexible Sprinkler Hose

- .1 Stainless steel braided flexible sprinkler hose
 - .1 Construction: 300 series stainless steel, EPDM gasket seal, nylon isolation ring, zinc plated carbon steel nuts and nipples.
 - .2 Inlet connectons:
 - .1 Grooved
 - .2 NPT threaded to NFPA standards
 - .3 Reducers provided by flexible hose manufacturer.
- .2 cUL listed or FM approval

- .3 Working conditions
 - .1 Maximum temperature: 107°C (225°F)
 - .2 Maximum Working Pressure: 1206 kPa (175 psi) cUL listed [1375 kPa/200 psi (FM Approval)]
 - .3 Minimum bend radius: 51 mm (2 inch) cULus Listed [178 mm (7 inch) FM approval]
- .4 Bracket assemblies by hose manufacturer approved for hose application.

2.3 BACKFLOW PREVENTERS

- .1 Listed Double Check Valve Assemblies:
 - .1 Manufacturers:
 - .1 Beeco.
 - .2 Zurn.
 - .3 Watts.
 - .4 Substitutions: Refer to Section 21 05 00.
 - .2 ANSI/ASSE 1024 / CSA B64.4

2.4 Gate Valves

- .1 Up to and including 50 mm (2 Inches):
 - .1 Bronze body, bronze trim, rising stem, handwheel, solid wedge or disc, threaded ends.
- .2 Over 50 mm (2 Inches):
 - .1 Iron body, bronze trim, rising stem pre-grooved for mounting tamper switch, handwheel, OS&Y, solid rubber covered bronze or cast iron wedge, flanged grooved ends.
- .3 Over 100 mm (4 Inches):
 - .1 Iron body, bronze trim, non-rising stem with bolted bonnet, solid bronze wedge, flanged ends, iron body indicator post assembly.

2.5 Globe Or Angle Valves

- .1 Up to and including 50 mm (2 Inches):
 - .1 Bronze body, bronze trim, rising stem and handwheel, inside screw, renewable rubber disc, threaded ends, with backseating capacity repackable under pressure.
- .2 Over 50 mm (2 Inches):
 - .1 Iron body, bronze trim, rising stem, handwheel, OS&Y, plug-type disc, flanged ends, renewable seat and disc.

2.6 Ball Valves

- .1 Up to and including 50 mm (2 Inches):
 - .1 Bronze two piece body, brass, chrome plated bronze, or stainless steel ball, teflon seats and stuffing box ring, lever handle and balancing stops, threaded ends with union.
- .2 Over 50 mm (2 Inches):

- .1 Cast steel body, chrome plated steel ball, teflon seat and stuffing box seals, lever handle or gear drive handwheel for sizes 250 mm (10 inches) and over, flanged.

2.7 Butterfly Valves

- .1 Bronze Body:
 - .1 Stainless steel disc, resilient replaceable seat, threaded or grooved ends, extended neck, handwheel and gear drive and integral indicating device, and built-in tamper proof switch.
- .2 Cast or Ductile Iron Body
 - .1 Cast or ductile iron, chrome or nickel plated ductile iron or aluminum bronze disc, resilient replaceable EPDM seat, wafer, lug, or grooved ends, extended neck, handwheel and gear drive and integral indicating device, and tamper switch rated 10 amp at 115 volt AC.

2.8 Check Valves

- .1 Up to and including 50 mm (2 Inches):
 - .1 Bronze body and swing disc, rubber seat, threaded ends.
- .2 Over 50 mm (2 Inches):
 - .1 Iron body, bronze trim, swing check with rubber disc, renewable disc and seat, flanged ends with automatic ball check.
- .3 100 mm (4 Inches) and Over:
 - .1 Iron body, bronze disc, stainless steel spring, resilient seal, threaded, wafer, or flanged ends.

2.9 Drain Valves

- .1 Compression Stop:
 - .1 Bronze with hose thread nipple and cap.
- .2 Ball Valve:
 - .1 Brass with cap and chain, 20 mm (3/4 inch) hose thread unless otherwise noted.

2.10 Floor Plates

- .1 In new construction, where pipes pass through concrete or masonry walls provide steel pipe sleeves full thickness of wall.
- .2 In new construction, risers shall have watertight floor sleeves as recommended in NFPA 13. In renovation or existing construction, cored openings are acceptable provided the penetration is sealed and watertight, and meets all requirements of NFPA 13.
- .3 Provide split or solid round floor plates on all exposed pipes passing through walls, floors, or ceilings.

2.11 Specialties

- .1 Sight glass shall be a combination moisture and liquid indicator with protection cap. Sight glass shall be Alco, Mueller, Sporlan or Henry. Size shall be full line size.

- .2 Pressure gauges shall comply with NFPA 13 and NFPA14. Port connection shall not be smaller than 6.4mm. The pressure limit must not be less than twice the working pressure of the sprinkler/standpipe system.
- .3 Signs
 - .1 Signs indicating valves shall be secured with metal wire or chains.
 - .2 Shall identify the portion of building served.
 - .3 Sign shall be made out of metal or rigid plastic
 - .4 As per NFPA 13 & 14

Part 3 Execution

3.1 Preparation

- .1 Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
- .2 Remove scale and foreign material, from inside and outside, before assembly.
- .3 Prepare piping connections to equipment with flanges or unions.

3.2 Installation

- .1 Use grooved mechanical couplings and fasteners only in accessible locations.
- .2 Install piping to NFPA 13 for sprinkler systems, NFPA 14 for standpipe and hose systems, and NFPA 24 for service mains as applicable.
- .3 Pipe 38mm (1-1/2") and smaller shall be joined by threaded connections.
- .4 Pipe 50mm (2") and larger may be joined by roll groove mechanical joints.
- .5 Flexible sprinkler hoses acceptable where site conditions permit usage.
- .6 Provide galvanized pipe and fittings for dry sprinkler systems.
- .7 All pipe installed so as to be inaccessible shall be joined by welded fittings. Piping in bulkheads or behind drywall shall be considered accessible. Piping in shaft walls or behind fire-rated drywall shall be considered inaccessible.
- .8 Welded pipe sections shall be shop fabricated as far as possible to minimize field welding required.
- .9 Ensure fittings, mechanical couplings, and rubber gaskets are supplied by the same manufacturer.
- .10 Side outlet mechanical tees that are comprised of gasketed cast iron housings that fully encircle the pipe and are secured with through-bolts are acceptable. Mechanical tees that use U-bolts or wire to secure the tee to the pipe will not be accepted.
- .11 Route piping in orderly manner, plumb and parallel to building structure and as instructed on drawings. Maintain gradient.
- .12 Install piping to conserve building space, to not interfere with use of space and other work.
- .13 Group piping whenever practical at common elevations.
- .14 In new construction, sleeve pipes passing through concrete or masonry partitions, walls, and floors.

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- .15 Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
 - .16 Slope piping and arrange systems to drain at low points. Use eccentric reducers to maintain top of pipe level.
 - .17 Prepare pipe, fittings, supports, and accessories for finish painting. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.
 - .18 Do not penetrate building structural members unless indicated.
 - .19 In new construction, provide sleeves when penetrating footings floors and walls. Seal pipe and sleeve penetrations to achieve fire resistance equivalent to fire separation required. Sleeve locations shall be noted on shop drawings.
 - .20 When installing more than one piping system material, ensure system components are compatible and joined to ensure the integrity of the system. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.
 - .21 Install valves with stems upright or horizontal, not inverted. Remove protective coatings prior to installation.
 - .22 Provide gate, ball or butterfly valves for shut-off or isolating service.
 - .23 Provide drain valves at main shut-off valves, low points of piping and apparatus. Obtain written approval from Contract Administrator for final locations of all drain valves not shown on drawings.
 - .24 All drains shall be routed to sanitary drainage points. Draining to the storm sewer system or sump pits is not allowed.
 - .25 Division 26 to wire monitoring alarm switches for each supervised valve. Alarms shall be connected to the annunciator panel.
 - .26 Final inspection and testing to conform to NFPA 25.

END OF SECTION

Part 1

General

1.1 Section Includes

- .1 Wet-pipe sprinkler assembly.
- .2 Dry-pipe sprinkler assembly.
- .3 System design, installation, and certification.
- .4 Fire department connections.

1.2 Related Sections

- .1 Section - Trenching.
- .2 Section - Mechanical Identification.
- .3 Section - Vibration Isolation.
- .4 Section - Equipment Wiring: Electrical characteristics and wiring connections.

1.3 References

- .1 NFPA 13 - Installation of Sprinkler Systems.
- .2 NFPA 15 - Water Spray Fixed Systems for Fire Protection.
- .3 FM - Factory Mutual Approval Guide.
- .4 NFPA 70 - National Electrical Code.
- .5 UL - Fire Resistance Directory.
- .6 UL 199 - Automatic Sprinklers for Fire-Protection Service.
- .7 Underwriters Laboratories of Canada (ULC)

1.4 System Description

- .1 System to provide coverage for entire building.
- .2 Provide system to NFPA 13 requirements.
- .3 Determine volume and pressure of incoming water supply from water flow test data.
- .4 Interface system with building fire and smoke alarm system if applicable.
- .5 Provide fire department connections where indicated.

1.5 Submittals For Review

- .1 Section: Procedures for submittals.
- .2 Product Data: Provide data on sprinklers, valves, and specialties, including manufacturers catalogue information. Submit performance ratings, rough-in details, weights, support requirements, and piping connections.
- .3 Shop drawings:

- .1 Submit working plans for sprinkler systems in accordance with requirements of NFPA 13, this specification, and the Contract drawings. Plans shall include sprinkler locations coordinated with the architectural reflected ceiling plan and with the mechanical drawing set. All plans shall be sealed by a Professional Engineer registered in the province of Manitoba prior to submission to the Contract Administrator for review, regardless of the size of the project.
- .2 The Contract drawings and specifications include project-specific requirements that may exceed the minimum requirements of the NFPA codes. These items shall be included in the fire protection Contractor's work and shown on the working plans.
- .3 Submit calculations in accordance with NFPA 13 requirements.
- .4 Submit to authority having jurisdiction for review and approval prior to submission to Contract Administrator. Submit proof of approval to Contract Administrator.

1.6 Submittals At Project Closeout

- .1 Section: Procedures for submittals.
- .2 Project Record Documents: Record actual locations of sprinklers and deviations of piping from drawings. Indicate drain and test locations.
- .3 Manufacturer's Certificate: Certify that system has been tested and meets or exceeds specified requirements and code requirements.
- .4 Operation and Maintenance Data: Include components of system, servicing requirements, record drawings, inspection data, replacement part numbers and availability, and location and numbers of service depot.
- .5 Warranty: Submit manufacturer warranty and ensure forms have been completed in The City's name and registered with manufacturer.

1.7 Quality Assurance

- .1 Perform Work to NFPA 13.
- .2 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.
- .3 Installer Qualifications: Company specializing in performing the work of this section with minimum 5 years documented experience.
- .4 Design system under direct supervision of a Professional Engineer registered in the province of Manitoba experienced in design of this Work and licensed at the place where the Project is located.

1.8 Regulatory Requirements

- .1 Conform to ULC and FM.
- .2 Perform Work to NFPA 13 .
- .3 Equipment and Components: Bear ULC, UL, FM label or marking.
- .4 Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

1.9 Delivery, Storage, And Protection

- .1 Section: Transport, handle, store, and protect products.
- .2 Store products in shipping containers and maintain in place until installation. Provide temporary inlet and outlet caps. Maintain caps in place until installation.

1.10 Extra Materials

- .1 Section: Operation and maintenance data.
- .2 Provide extra sprinklers to NFPA 13.
- .3 Provide suitable wrenches for each sprinkler type.
- .4 Provide metal storage cabinet located adjacent to alarm valve.

Part 2 Products

2.1 SPRINKLERS

- .1 Suspended Ceiling:
 - .1 Type: Semi-recessed pendant type with matching push on escutcheon plate.
 - .2 Escutcheon Plate Finish: To match sprinkler body.
 - .3 Fusible Link: Glass bulb type temperature rated for specific area hazard unless otherwise noted.
 - .4 Application specific requirements:
 - .1 Linear wood ceiling (LWCS): Provide concealed sprinkler complete with satin chrome cover as noted on architectural reflected ceiling plans.
 - .2 Drywall (Gyproc Wall Board – GWB): Provide concealed sprinkler complete with white cover on white ceilings. Provide samples of colours for ceilings painted other than white for selection by architectural.
 - .3 MultiPurpose Room (MPR): Brushed/Satin chrome plated finish. Where brushed/satin finish not available from manufacturer, provide alternate request for selection by architectural.
 - .4 All other areas: Enamel, colour White
- .2 Exposed Area Type:
 - .1 Type: Standard upright type.
 - .2 Finish: Brass
 - .3 Fusible Link: Glass bulb type temperature rated for specific area hazard unless otherwise noted.
 - .4 Provide heads with white enamel finish in areas where exposed structure is to be painted (ESP) as noted on architectural reflected ceiling plans.
 - .5 Application specific requirements:
 - .1 Gymnasium, Fitness and Gym Storage: Brushed/Satin chrome plated finish. Where brushed/satin finish not available from manufacturer, provide alternate request for selection by architectural.
 - .2 STEM Labs and Art Room: Brushed/Satin chrome plated finish. Where brushed/satin finish not available from manufacturer, provide alternate request for selection by architectural.

- .3 Vocational: Brushed/Satin chrome plated finish. Where brushed/satin finish not available from manufacturer, provide alternate request for selection by architectural.
 - .4 Mechanical, Electrical Rooms: Brass
 - .5 All other service areas: Brass
- .3 Guards: Finish to match sprinkler finish.

2.2 PIPING SPECIALTIES

- .1 Wet Pipe Sprinkler Alarm Valve: Check type valve with divided seat ring, rubber faced clapper to automatically actuate water motor alarm and electric alarm, with pressure retard chamber and variable pressure trim ; with test and drain valve.
- .2 Dry Pipe Sprinkler Alarm Valve: Check type valve with divided seat ring, rubber faced clapper to automatically actuate water motor alarm and electric alarm, with accelerator ; with test and drain valve.
- .3 Water Motor Alarm: Hydraulically operated impeller type alarm with aluminum alloy chrome plated gong and motor housing, nylon bearings, and inlet strainer.
- .4 Electric Alarm: Electrically operated chrome plated gong with pressure alarm switch.
- .5 Pressure Gauge: Provide ULC FM approved listed for fire protection, having aluminum cases, bronze geared movements, bronze bourdon type, friction glass cover and precision type pointer. Accuracy to be 1% of full span. Gauges shall be 100mm diam. throughout. Pressure range shall be selected so that needle is approximately vertical at normal system pressure. Gauges shall have dual scale (psi/kPa) with psi more prominent.
- .6 Pressure Reducing Valves: Provide, where required, ULC and FM labelled pressure reducing valves (PRV) with adjustable spring range, sized to suit required flow and pressure differential, capable of maintaining differential pressure at 138 kPa (20 psi) during both flow and static conditions. Provide all necessary trim: Downstream and upstream pressure gauges, isolation valves, by-pass valves, pressure relief valve on low pressure side to compensate for leakage across the PRV.
- .7 Water Flow Switch: Vane type switch for mounting horizontal or vertical, with two contacts; rated 10 amp at 125 volt AC and 2.5 amp at 24 volt DC.
- .8 Fire Department Connections:
 - .1 Flush Mount Type: Brass finish.
 - .2 Outlets: Single 100mm (4") Angled Stortz type with thread size to suit fire department hardware; threaded dust cap and chain of matching material and finish.
 - .3 Drain: 19 mm (3/4 inch) automatic drip, outside.
 - .4 Label: "Sprinkler - Fire Department Connection". Contractor shall submit wording to local fire department for approval.

2.3 Splash Pad

- .1 Provide a splash pad at the point of discharge for the drains outside of the building, if the ground will be disturbed by the flow of water.

Part 3 Execution

3.1 Installation

- .1 Install to NFPA 13.
- .2 Install equipment to manufacturers written instructions.
- .3 Install buried shut-off valves in valve box. Provide post indicator.
- .4 Provide approved double backflow preventer assembly at sprinkler system water source connection as required by authority having jurisdiction.
- .5 Locate fire department connection with sufficient clearance from walls, obstructions, or adjacent fire department connectors to allow full swing of fire department wrench handle.
- .6 Coordinate location of outside alarm gong on building wall with Fire Alarm Contractor.
- .7 Place pipe runs to minimize obstruction to other work.
- .8 Place piping in concealed spaces above finished ceilings.
- .9 Centre sprinklers in one direction only in ceiling tile with location in other direction at $\frac{1}{4}$, $\frac{1}{2}$, or $\frac{3}{4}$ of the ceiling tile length, dependent upon spacing and coordination with ceiling elements. Layout instructions provided on the architectural and mechanical drawings override spacing instruction given above.
- .10 Apply masking tape or paper cover to ensure concealed sprinklers, cover plates, and sprinkler escutcheons do not receive field paint finish. Remove after painting. Replace painted sprinklers.
- .11 Install and connect to fire pump system to Section 21 11 00, NFPA 13.
- .12 Install air compressor on vibration isolators. Refer to Section 23 05 48.
- .13 Flush entire piping system of foreign matter.
- .14 Install guards on sprinklers where indicated and as per NFPA 13.
- .15 Hydrostatically test entire system. Test shall be witnessed by authority having jurisdiction.
- .16 System drains and test connections: run to the nearest open drain in the building or to outdoors through wall away from paved areas. Seal and caulk around piping through wall and provide escutcheon and prime paint all metal surfaces exposed to outdoors.
- .17 Before commencement of any work, examine work of other trades and make immediate report to Contract Administrators of any defect or interference affecting work or guarantee of this work.
- .18 If drilling of structural beams or other load bearing members is required by design or by site conditions for passage of piping, obtain Contract Administrators approval for location and proposed drilling procedure before drilling. Drill only in locations previously approved by Contract Administrator. Where drilling is required by design or existing site conditions, be responsible for carrying out same to approved procedure.
- .19 Allow for expansion and Contraction when installing pipe hangers.
- .20 Install horizontal valves with stems upright where space allows.

-
- .21 Carefully coordinate work with other trades so that unnecessary offsets and revisions to the approved drawings are avoided. Failure to coordinate does not relieve Contractor from meeting performance standards.
 - .22 The Project Coordinator shall approve any shutdowns of existing water distribution systems, fire sprinkler systems, domestic water systems or fire alarm systems. Provide advance written notice at least 14 days prior to the shutdown to the Construction Coordinator.
 - .23 Application specific sprinklers such as window sprinklers shall be installed in accordance with the listing requirements.

3.2 Interface With Other Products

- .1 Ensure required devices are installed and connected as required to fire alarm system.

3.3 COMMISSIONING

- .1 Inspection of the fire suppression system to include requirements of NFPA 25.

END OF SECTION

Part 1

General

1.1 Section Includes

- .1 Fire Extinguishers

1.2 Related Sections

- .1 Section 21 05 00 – Submittal Procedures.
- .2 Section 21 05 00 - Product Requirements.
- .3 Section 21 05 00 – Closeout Submittals.
- .4 Section 21 11 00 - Fire Protection Piping.
- .5 Section 21 13 00 - Sprinklers.
- .6 Section 23 05 53 - Mechanical Identification.
- .7 Section 26 05 80 - Equipment Wiring: Electrical characteristics and wiring connections.

1.3 References

- .1 FM - Factory Mutual Approval Guide.
- .2 NFPA 10 - Portable Fire Extinguishers.
- .3 NFPA 13 – Installation of Sprinkler Systems
- .4 NFPA 14 - Installation of Standpipe, Private Hydrants, and Hose Systems.
- .5 NFPA 25 - Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems
- .6 UL - Fire Protection Equipment Directory.
- .7 ITS (Intertek Testing Services) - Certification Listings.

1.4 Submittals For Review

- .1 Section 21 05 00: Procedures for submittals.
- .2 Product Data: Provide manufacturer's catalogue sheet for equipment indicating rough-in size, finish, and accessories.
- .3 Shop Drawings: Indicate supports, components, accessories, and sizes.

1.5 Submittals At Project Closeout

- .1 Section 21 05 00: Procedures for submittals.
- .2 Project Record Documents: Record actual locations of components.
- .3 Operation Data: Include manufacturer's data.
- .4 Maintenance Data: Include servicing requirements and test schedule.
- .5 Certificates: Provide certificate of compliance from authority having jurisdiction indicating approval of field acceptance tests.

1.6 Quality Assurance

- .1 Perform Work to NFPA 10.
- .2 Installer Qualifications: Company specializing in performing the work of this section with minimum 5 years experience.

1.7 Delivery, Storage, And Protection

- .1 Section 21 05 00: Transport, handle, store, and protect products.
- .2 Deliver and store products in shipping packaging until installation.

Part 2 Products

2.1 MATERIALS

- .1 Aluminum: Alloy and temper recommended by aluminum producer and manufacturer for type of use and finish indicated, and as follows:
 - .1 Sheet: ASTM B 209M (ASTM B 209).
 - .2 Extruded Shapes: ASTM B 221M (ASTM B 221).
- .2 Stainless-Steel Sheet: ASTM A 666, Type 304.

2.2 FIRE EXTINGUISHERS

- .1 Multi-Purpose Dry Chemical: Cartridge operated with hose and shut-off nozzle or integral shut-off nozzle.
 - .1 2.2 kg (5 pound) capacity with 2A:40B:C rating (min.)
 - .2 4.5 kg (10 pound) capacity with 4A:60B:C rating (min.).
 - .3 4.5 kg (10 pound) capacity with K rating for kitchens.
- .2 Carbon Dioxide: Insulated handle, hose and horn discharge assembly, self-closing lever or squeeze grip operated, insulated handle.
 - .1 4.5 kg (10 pound) capacity with 10BC rating.

2.3 Fire Extinguishers Cabinets

- .1 Cabinet Type: Suitable for fire extinguishers.
- .2 Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - .1 Potter Roemer LLC;
 - .1 Fully Recessed FE-R: Alta 7020-HR-DV-6-STEEL-FP, inside box dimensions: 9"x24"x5.75", red lettering, Duo-Vertical Panel w/ 1/8" clear acrylic glazing, flush pull handle
 - .2 Semi-Recessed FE-S: Alta 7022-HR-DV-STEEL-FP, inside box dimensions: 9"x24"x5.75", red lettering, Duo-Vertical panel with tempered safety glass, flush pull handle
 - .3 Semi-Recessed, Fire Rated RFE-S: Alta FRC7022-HR-DV-STEEL-FP, inside box dimensions: 9"x24"x5.75", red lettering, Duo-Vertical panel with tempered safety glass, flush pull handle
 - .4 Surface Mounted (no Cabinet), FE: Wall bracket to mount fire extinguisher.
 - .5 Recessed Lockable FE-L: Alta 7020-STEEL-FS, inside box dimensions: 9"x24"x5.75", flush solid metal door with lock

- .2 Alternate Manufacturers:
 - .1 National Fire Equipment Ltd.
 - .2 J. L. Industries, Inc., a division of Activar Construction Products Group
 - .3 Modern Metal Products, Division of Technico Inc.
 - .4 Moon-American
- .3 Cabinet Construction: 1-hour fire rated where required.
 - .1 Fire-Rated Cabinets: Construct fire-rated cabinets with double walls fabricated from 1.1 mm- (0.0428-inch-) thick, cold-rolled steel sheet lined with minimum 16 mm- (5/8-inch-) thick, fire-barrier material. Provide factory-drilled mounting holes.
- .4 Cabinet Material: Aluminum or Stainless-steel sheet.
 - .1 Shelf: Same metal and finish as cabinet.
- .5 Recessed Cabinet - Gym and Mini Gym only: Cabinet box recessed in walls of sufficient depth to suit style of trim indicated.
 - .1 Exposed Flat Trim: One-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend).
 - .2 Door Style: Flush opaque panel, frameless, with no exposed hinges
- .6 Semi-recessed Cabinet – All other areas: Cabinet box partially recessed in walls of sufficient depth to suit style of trim indicated; with one-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend). Provide where walls are of insufficient depth for recessed cabinets but are of sufficient depth to accommodate semi-recessed cabinet installation.
 - .1 Square-Edge Trim: 32- to 38-mm (1-1/4- to 1-1/2-inch) backbend depth.
 - .2 Rolled-Edge Trim: 64-mm (2-1/2-inch) backbend depth.
 - .3 Door Style: Fully glazed, frameless, backless, acrylic panel
 - .4 Door Glazing (semi-recessed only): Acrylic sheet.
 - .1 Acrylic Sheet Color: Clear transparent acrylic sheet.
- .7 Recessed Cabinet – For sprinkler condensate drains: Cabinet box recessed in walls of sufficient depth to suit style of trim indicated.
 - .1 Exposed Flat Trim: One-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend).
 - .2 Door Style: Flush metal opaque panel, frameless, with no exposed hinges, with lock
- .8 Cabinet Trim Material: Same material and finish as door.
- .9 Door Material: Aluminum or Stainless-steel sheet.
- .10 Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.
 - .1 Provide recessed door pull and friction latch.
 - .2 Provide continuous hinge, of same material and finish as trim, permitting door to open 180 degrees.
- .11 Accessories:

- .1 Mounting Bracket: Manufacturer's standard steel, designed to secure fire extinguisher to fire protection cabinet, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish.
- .2 Lettered Door Handle: One-piece, cast-iron door handle with the word "FIRE" embossed into face.
- .3 Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated.
 - .1 Identify fire extinguisher in fire protection cabinet with the words "FIRE EXTINGUISHER".
 - .1 Location: Applied to cabinet door.
 - .2 Application Process: Silk-screened.
 - .3 Lettering Color: Red.
 - .4 Orientation: Horizontal.
- .12 Finishes:
 - .1 Manufacturer's standard baked-enamel paint for the following:
 - .1 Exterior of cabinet door and trim except for those surfaces indicated to receive another finish.
 - .2 Interior of cabinet and door.
 - .2 Aluminum: Baked enamel or powder coat.
 - .3 Stainless Steel: No. 2B No. 4 or No. 6

Part 3

Execution

3.1

Installation

- .1 Install to manufacturer's written instructions.
- .2 Install to NFPA 10.
- .3 Locate and secure cabinets plumb and level. Establish top of cabinet (inside horizontal surface) 1675 mm (66 inches) above finished floor.

3.2

Field Quality Control

- .1 Test entire system to NFPA 10 and NFPA 25.
- .2 Test shall be witnessed by authority having jurisdiction.

END OF SECTION

Part 1

General

1.1

Section Includes

- .1 Disinfection of potable water distribution.
- .2 Testing and reporting results.

1.2

Related Sections

- .1 Section 33 11 16 - Site Water Utility Distribution Piping.
- .2 Section 22 10 00 - Plumbing Piping: Disinfection of building domestic water piping system.

1.3

Price And Payment Procedures

- .1 Unit Prices: Section 01 22 00 - Measurement of quantities and payment procedures affecting this section.
 - .1 Disinfection: By the linear metre (foot). Includes preparing, disinfecting, testing, and reporting.

1.4

References

- .1 AWWA B300-04 - Hypochlorites.
- .2 AWWA B301-04 - Liquid Chlorine.
- .3 AWWA B302-05 - Ammonium Sulfate.
- .4 AWWA B303-05 - Sodium Chlorite.
- .5 AWWA C651-05 - Disinfecting Water Mains.

1.5

Submittals For Information

- .1 Section 21 05 00: Submission procedures.
- .2 Test Reports: Indicate results comparative to specified requirements.

1.6

Closeout Submittals

- .1 Section 21 05 00: Submission procedures.
- .2 Record Documentation:
 - .1 Disinfection report:
 - .1 Type and form of disinfectant used.
 - .2 Date and time of disinfectant injection start and time of completion.
 - .3 Test locations.
 - .4 Initial and 24 hour disinfectant residuals (quantity in treated water) in ppm for each outlet tested.
 - .5 Date and time of flushing start and completion.
 - .6 Disinfectant residual after flushing in ppm for each outlet tested.
 - .2 Bacteriological report:
 - .1 Date issued, project name, and testing laboratory name, address, and telephone number.
 - .2 Time and date of water sample collection.

- .3 Name of person collecting samples.
- .4 Test locations.
- .5 Initial and 24 hour disinfectant residuals in ppm for each outlet tested.
- .6 Coliform bacteria test results for each outlet tested.
- .7 Certification that water conforms, or fails to conform, to bacterial standards.

1.7 Quality Assurance

- .1 Perform Work in accordance with AWWA C651.
- .2 Water Treatment Firm: Company specializing in disinfecting potable water systems specified in this Section with minimum three (3) years documented experience.
- .3 Testing Firm: Company specializing in testing potable water systems, approved by the Province of Manitoba.
- .4 Submit bacteriologist's signature and authority associated with testing.

1.8 Regulatory Requirements

- .1 Conform to applicable code or regulation for performing the work of this Section.
- .2 Provide certificate of compliance from authority having jurisdiction indicating approval of water system.

Part 2 Products

2.1 Disinfection Chemicals

- .1 Chemicals: AWWA B300, Hypochlorite, AWWA B301, Liquid Chlorine, AWWA B302, Ammonium Sulfate, and AWWA B303, Sodium Chlorite.

Part 3 Execution

3.1 Examination

- .1 Section 21 05 00: Verify existing conditions before starting work.
- .2 Verify that piping system has been cleaned, inspected, and pressure tested.
- .3 Perform scheduling and disinfecting activity with start-up, testing, adjusting and balancing, demonstration procedures, including coordination with related systems.

3.2 Execution

- .1 Provide and attach required equipment to perform the work of this Section.
- .2 Introduce treatment into piping system.
- .3 Maintain disinfectant in system for 24 hours.
- .4 Flush, circulate, and clean until required cleanliness is achieved; use municipal domestic water.
- .5 Replace permanent system devices removed for disinfection.
- .6 Pressure test system to 690 kPa (100 psi) plus the system height in water column pressure for a period of twelve (12) hours. Repair leaks and re-test.

3.3 Field Quality Control

- .1 Section 01 45 00: Field inspection and testing.
- .2 Test samples in accordance with AWWA C651.

END OF SECTION

Part 1 General

1.1 Section Includes

- .1 Pipe, pipe fittings, valves, and connections for piping systems.
 - .1 Sanitary sewer.
 - .2 Domestic water.
 - .3 Storm water.
 - .4 Natural gas.

1.2 Related Sections

- .1 Section 08 31 00 - Access Doors and Frames.
- .2 Section 09 90 00 - Painting.
- .3 Section 23 05 48 - Vibration Isolation.
- .4 Section 23 05 53 - Mechanical Identification.
- .5 Section 23 07 19 - Piping Insulation.
- .6 Section 23 05 16 – Piping Expansion Compensation.
- .7 Section 23 05 29 – Supports and Anchors.
- .8 Section 26 05 80 - Equipment Wiring: Electrical characteristics and wiring connections.

1.3 References

- .1 ASTM E814 - Fire Tests of Through-Penetration Fire Stops.
- .2 CAN/CSA-B1800 - Thermoplastic non-pressure piping
- .3 NSF/ANSI 14 - Plastics Piping System Components and Related Materials
- .4 ASTM D4101 - Standard Classification System and Basis for Specification for Polypropylene Injection and Extrusion Materials
- .5 ASTM F1412. - Standard Specification for Polyolefin Pipe and Fittings for Corrosive Waste Drainage Systems
- .6 ASME B31.9 - Building Services Piping.
- .7 ASME SEC IV - Construction of Heating Boilers.
- .8 ASME SEC IX - Welding and Brazing Qualifications.
- .9 ASME B16.3 - Malleable Iron Threaded Fittings.
- .10 MSS SP58 - Pipe Hangers and Supports - Materials, Design and Manufacturer.
- .11 MSS SP69 - Pipe Hangers and Supports - Selection and Application.
- .12 MSS SP-80 - Bronze Gate, Globe, Angle and Check Valves.
- .13 MSS SP89 - Pipe Hangers and Supports - Fabrication and Installation Practices.
- .14 MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.
- .15 NCPWB - Procedure Specifications for Pipe Welding.

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- .16 UL 1479 - Fire Tests of Through-Penetration Firestops.
 - .17 ASTM F708 - Design and Installation of Rigid Pipe Hangers.
 - .18 AWS A5.8 - Filler Metals for Brazing and Braze Welding.
 - .19 ASME B16.22-2001 (R2005) - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
 - .20 ASME B16.26 - Copper Alloy Bronze Fittings for Flared Copper Tubes.
 - .21 ASME B16.4 - Grey Iron Threaded Fittings.
 - .22 AWWA C651 - Disinfecting Water Mains.
 - .23 ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings.
 - .24 ASTM B42 - Seamless Copper Pipe, Standard Sizes.
 - .25 ASTM B43 - Seamless Red Brass Pipe, Standard Sizes.
 - .26 ASTM B68 - Seamless Copper Tube, Bright Annealed.
 - .27 ASTM B75 - Seamless Copper Tube.
 - .28 ASTM B22.18-03 - Seamless Copper Water Tube.
 - .29 ASTM B251 - General Requirements for Wrought Seamless Copper and Copper-Alloy Tube.
 - .30 ASTM B302 - Threadless Copper Pipe, Standard Sizes.
 - .31 ASME B16.1 - Cast Iron Pipe Flanges and Flanged Fittings.
 - .32 ASME B16.23 - Cast Copper Alloy Solder Joint Drainage Fittings - DWV.
 - .33 ASME B16.32 - Cast Copper Alloy Solder Joint Fittings for Solvent Drainage Systems.
 - .34 ASTM A74 - Cast Iron Soil Pipe and Fittings.
 - .35 ASTM B306 - Copper Drainage Tube (DWV).
 - .36 ASME B16.29 - Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings - DWV.
 - .37 ASTM B32-04 - Solder Metal.
 - .38 CISPI 301 - Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste and Vent Piping Applications.
 - .39 CISPI 310 - Joints with Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications.
 - .40 MSS SP-85 - Cast Iron Globe & Angle Valves, Flanged and Threaded Ends.
 - .41 MSS SP-70 - Cast Iron Gate Valves, Flanged and Threaded Ends.
 - .42 MSS SP-71 - Cast Iron Swing Check Valves, Flanged and Threaded Ends.
 - .43 MSS SP-78 - Cast Iron Plug Valves, Flanged and Threaded Ends.
 - .44 ASTM D2665 - Poly (Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings.
 - .45 ASTM D2564 - Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems.

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- .46 ASTM D2855-96 (2002) - Standard Practice for Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings.
 - .47 ASTM D2729 - Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
 - .48 ASTM D2241 - Poly (Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series).
 - .49 ASTM D3034 - Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
 - .50 ASTM F477 - Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
 - .51 AWWA C905 - Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 14 inch - 48 inch (350 mm - 1200mm).
 - .52 ASTM C1053 - Borosilicate Glass Pipe and Fittings for Drain, Waste, and Vent (DWV) Applications.
 - .1 CAN/CSA-B1800 - Thermoplastic non-pressure piping
 - .2 NSF/ANSI 14 - Plastics Piping System Components and Related Materials
 - .3 ASTM D4101 - Standard Classification System and Basis for Specification for Polypropylene Injection and Extrusion Materials
 - .4 ASTM F1412. - Standard Specification for Polyolefin Pipe and Fittings for Corrosive Waste Drainage Systems
 - .5 ASTM D1785 - Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
 - .6 ASTM D2466 - Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
 - .7 AWWA C900 - Polyvinyl Chloride (PVC) Pressure Pipe (and Fabricated Fittings), 4 inch - 12 inch (100 mm - 300 mm), for Water Distribution.
 - .8 CSA B137.2 - Polyvinylchloride (PVC) injection-moulded gasketed fittings for pressure applications
 - .9 CSA B137.3 - Rigid polyvinylchloride (PVC) pipe and fittings for pressure applications
 - .10 CSA B137.3.1 - Molecularly oriented polyvinylchloride (PVCO) pipe for pressure applications
 - .11 ASTM D2239 - Polyethylene (PE) Plastic Pipe (SIDR-PR) Based on Controlled Inside Diameter.
 - .12 AWWA C901 - Polyethylene (PE) Pressure Pipe and Tubing, 1/2 inch - 3 inch (13 mm - 76 mm) for Water Service.
 - .13 ASTM D2447 - Polyethylene (PE) Plastic Pipe, Schedules 40 and 80, Based on Outside Diameter.
 - .14 ASTM D2609 - Plastic Insert Fittings for Polyethylene (PE) Plastic Pipe.
 - .15 CAN/CSA B137.9-17 - Polyethylene/aluminum/polyethylene (PE- AL-PE) composite pressure-pipe systems
 - .16 ASTM F679 - Poly (Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings.
 - .17 CAN/CSA-B1800-15 - Thermoplastic non-pressure piping.
 - .18 ASME B31.1 - Power Piping.

- .19 CAN/CSA B137.4-17 - Polyethylene (PE) piping systems for gas services
- .20 CAN/CSA B137.4.1-17 - Electrofusion-type polyethylene (PE) fittings for gas services
- .21 CAN/CSA B149.1 – Natural Gas and Propane Installation Code.
- .22 AGA Z21.22 - Relief Valves and Automatic Gas Shutoff Devices for Hot Water Supply Systems.
- .23 ASME B31.2 - Fuel Gas Piping.
- .24 NFPA 54 - National Fuel Gas Code.
- .25 NFPA 58 - Liquefied Petroleum Gas Code.
- .26 ASTM D2513 - Thermoplastic Gas Pressure Pipe, Tubing, and Fittings.
- .27 ASTM A47/A47M - Ferritic Malleable Iron Castings.
- .28 ASTM A53/A53M - Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
- .29 ASTM A234/A234M - Piping Fittings of Wrought-Carbon Steel and Alloy Steel for Moderate and High Temperature Service.
- .30 AWWA C105 - Polyethylene Encasement for Ductile-Iron Piping Systems.
- .1 NSF/ANSI 61 – Drinking Water System Components – Health Effects

1.4 Submittals For Review

- .1 Section 21 05 00: Submission procedures.
- .2 Product Data: Provide data on all valves larger than 50mm (2”), and all backflow prevention devices and accessories. Provide manufacturers catalogue information. Indicate valve data and ratings.

1.5 Closeout Submittals

- .1 Section 21 05 00: Submission procedures.
- .2 Record Documentation: Record actual locations of valves on record drawings.

1.6 Quality Assurance

- .1 Perform Work to the standards of the Province and Municipality of Jurisdiction.
- .2 Valves: Manufacturer's name and pressure rating marked on valve body.
- .3 Welding Materials and Procedures: Conform to ASME SEC IX and applicable Provincial labour regulations.
- .4 Welder's Certification: To Manitoba Department of Labour standards.
- .5 Identify pipe with marking including size, ASTM material classification, ASTM specification, potable water certification, water pressure rating.
- .6 Carbon steel pipe and fittings manufactured in China or India will not be permitted.

1.7 Regulatory Requirements

- .1 Perform Work to the latest version of the Manitoba Plumbing Code and local Municipal requirements
- .2 Perform natural gas and propane work to the latest version of the CSA B149.1 gas code, Manitoba Gas Notices and local Municipal requirements.
- .3 Conform to applicable code for installation of backflow prevention devices.
- .4 Provide certificate of compliance from authority having jurisdiction indicating approval of installation of backflow prevention devices.

1.8 Delivery, Storage, And Protection

- .1 Refer to specification section Product Requirements: Transport, handle, store, and protect products.
- .2 Accept valves on site in shipping containers with labelling in place. Inspect for damage.
- .3 Provide temporary protective coating on cast iron and steel valves.
- .4 Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.
- .5 Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

1.9 Environmental Requirements

- .1 Refer to specification section Environmental Protection: Environmental conditions affecting products on site.
- .2 Do not install underground piping when bedding is wet or frozen.

Part 2 Products

2.1 SANITARY SEWER PIPING, BURIED BEYOND 1500 MM (5 FEET) OF BUILDING

- .1 PVC Pipe: SDR 35; CAN/CSA B1800.
 - .1 Fittings: PVC.
 - .2 Joints: ASTM F477, elastomeric gaskets.

2.2 Sanitary Sewer Piping, Buried Within 1500 Mm (5 Feet) Of Building

- .1 Cast-iron mechanical joint or pipe and fittings to CSA B70, Class 4000
 - .1 Fittings: Cast iron.
 - .2 Joints: ASTM C564 and CISPI Standard 310, neoprene gasket system and stainless steel clamp-and-shield assemblies.
- .2 PVC Pipe: CAN/CSA B1800
 - .1 Fittings: PVC.
 - .2 Joints: ASTM D2855, solvent weld to ASTM D2564.

2.3 Sanitary Sewer Piping, Above Grade

- .1 75mm (3") and over - Cast Iron Pipe: CISPI 301, hubless, service weight. Class 4000
 - .1 Fittings: Cast iron.

- .2 Joints: ASTM C564 and CISPI Standard 310, neoprene gasket system and stainless steel clamp-and-shield assemblies.
- .2 Copper Tube: ASTM B306, DWV.
 - .1 Fittings: ASTM B306 with lead-free soldered cast brass drainage fittings to CSA B158.1 or wrought copper fittings to ANSI B16-29
 - .2 Joints: ASTM B32, lead-free solder, Grade 50B.
- .3 Urinal drains: On all cast-iron / copper DWV systems, the drains serving urinals from the fixture outlet to the branch main and the vents from fixture outlet to branch vent shall be PVC DWV pipe. Pipe and fittings with solvent cement socket fittings.
- .4 PVC Pipe with FSR25: CAN/CSA B1800
 - .1 Fittings: PVC.
 - .2 Joints: ASTM D2855, solvent weld to ASTM D2564.
- .5 PVC Pipe with FSR25/SDC50: CAN/CSA B1800 Piping shall be tested and listed in accordance with CAN/ULC-S102.2 and clearly marked with the certification logo indicating a flame spread rating (FSR) not exceeding 25 and a smoke developed classification (SDC) not exceeding 50.
 - .1 Fittings: PVC.
 - .2 Joints: ASTM D2855, solvent weld to ASTM D2564.
 - .3 Manufacturer: IPEX System XFR or equal.

2.4 SEWAGE AND SUMP PUMP DISCHARGE PIPING, ABOVE GRADE

- .1 Copper Tubing: ASTM B88, Type L hard drawn.
 - .1 Fittings: 50-50 solder

2.5 Sewage And Sump Pump Discharge Piping, Below Grade

- .1 PVC Pipe: CAN/CSA B1800
 - .1 Fittings: PVC.
 - .2 Joints: ASTM D2855, solvent weld to ASTM D2564.

2.6 Chemical Resistant Sewer Piping

- .1 Flame Retardant SCH 40 (Blue in color) Polypropylene Pipe: CAN/CSA B1800, NSF 14, ASTM D4101 & ASTM F1412.
 - .1 Fittings: NSF or ASTM F 1673 and ASTM E84.
 - .1 Fittings shall be NSF listed and have an integral heavy gauge, nickel/chrome electrical resistance wire molded in place in the fitting body. Copper wire elements, loose wire or other loose joint components, are prohibited.
 - .2 Fittings shall be Enfield or approved equal.
 - .3 Fittings shall be NSF listed, be of all plastic construction and be designed to lock into a machined groove on the mating piping.
 - .4 All fittings shall have integrally molded union connections. No metallic grab rings or clamps shall be allowed.
 - .5 Fittings containing EVA (ethylene vinyl acetate) are strictly prohibited.
 - .6 Couplings shall not be added to make mechanical joint fittings.
 - .7 Fittings shall be IPEX Labline or approved equivalent
 - .2 Joints:

- .1 Method of joining shall be electro fusion. Control Unit shall be equipped with input and output voltage sensors and temperature sensors to automatically adjust fusion time and audible alarms to indicate cycle interruptions and completion of the joining process. The unit shall be capable of multiple joints simultaneously. Electrofusion process shall be in strict accordance with manufacturer's recommendations.
- .2 Connections between polypropylene and other piping materials shall be made using Enfield adapters according to manufacturer's recommendations.
- .3 All electrofusion machines shall be third party certified by UL and CSA.
- .3 Manufacturer: IPEX ENFIELD or equal
 - .1 Connections between polypropylene pipe and matched fittings shall be made using the manufacturer approved joint..
- .4 Manufacturer: IPEX Labline or equal.
- .5 Pipe and fittings must be supplied by same manufacturer.
- .6 Certified Firestop systems as required, and installed as per manufacturers listings
- .7 Plenum rated installations:
 - .1 Material: Flame retardant with flame spread rating of 25 and a smoke developed classification not exceeding 50.
 - .2 Manufacturer: IPEX Plenumline or equal

2.7 Water Piping, Buried Beyond 1500 Mm (5 Feet) Of Building

- .1 PVC Pipe: AWWA C900.
 - .1 Joints: CSA B137.3 ring gasket joints class 150
- .2 Up to 50mm (2"): Soft temper copper, Type K: ASTM B88
 - .1 Fittings: ANSI B22.18 or ANSI B16.18 soldered pressure fittings.
 - .2 Joints: ASTM B32, lead-free solder, Grade 50B.

2.8 Water Piping, Buried Within 1500 Mm (5 Feet) Of Building

- .1 Up to 50mm (2"): Soft temper copper, Type K: ASTM B88
 - .1 Fittings: ANSI B22.18 or ANSI B16.18 soldered pressure fittings.
 - .2 Joints: ASTM B32, lead-free solder, Grade 50B.

2.9 Water Piping, Above Grade

- .1 Copper Tubing 50mm (2") and under: ASTM B88, Type L hard drawn.
 - .1 Fittings: ASME B16.18, cast copper alloy or ASME B16.22, wrought copper and bronze.
 - .2 Joints ASTM B32, solder, Grade 95TA.
- .2 Copper Tubing over 50mm (2"): ASTM B88, Type L hard drawn.
 - .1 Fittings: Silver brazed fittings.

2.10 STORM WATER PIPING, BURIED WITHIN 1500 MM (5 FEET) OF BUILDING

- .1 PVC Pipe: SDR 35; CAN/CSA B1800.
 - .1 Fittings: PVC.
 - .2 Joints: ASTM F477, elastomeric gaskets.

2.11 Storm Water Piping, Above Grade

- .1 Cast Iron Pipe: ASTM A74 extra heavy weight. Class 4000
 - .1 Fittings: Cast iron.
 - .2 Joints: ASTM C564, neoprene gasket system or lead and oakum.
- .2 Cast Iron Pipe: CISPI 301, hubless, service weight. Class 4000
 - .1 Fittings: Cast iron.
 - .2 Joints: ASTM C564 and CISPI Standard 310, neoprene gasket system and stainless steel clamp-and-shield assemblies.
- .3 PVC Pipe: CAN/CSA B1800
 - .1 Fittings: PVC.
 - .2 Joints: ASTM D2855, solvent weld to ASTM D2564.
- .4 Non-combustible PVC Pipe: piping shall be tested and listed in accordance with CAN/ULC-S102.2 and clearly marked with the certification logo indicating a flame spread rating of 25 and a smoke developed classification not exceeding 50.
 - .1 Fittings: PVC.
 - .2 Joints: ASTM D2855, solvent weld to ASTM D2564.
 - .3 Manufacturer: IPEX System XFR or equal

2.12 Natural Gas Piping, Buried Within 1500 Mm (5 Feet) Of Building

- .1 Steel Pipe: ASTM A53 Schedule 40 black.
 - .1 Fittings: ASTM A234/A234M, forged steel welding type.
 - .2 Joints: ASME B31.9, welded.
 - .3 Jacket: AWWA C105 polyethylene jacket or double layer, half-lapped 0.25 mm (10 mil) polyethylene tape.

2.13 Natural Gas Piping, Above Grade

- .1 Steel Pipe: ASTM A53 Schedule 40 Black.
 - .1 Fittings: ASME B16.3, malleable iron, or ASTM A234/A234M, forged steel welding type.
 - .2 Joints: NFPA 54, threaded or welded to ANSI B31.9.

2.14 Flanges, Unions, And Couplings

- .1 Pipe Size 80 mm (3 inches) and under:
 - .1 Ferrous pipe: Class 150 malleable iron threaded unions.
 - .2 Copper tube and pipe: Class 150 bronze unions with soldered joints.
- .2 Pipe Size Over 25 mm (1 inch):
 - .1 Ferrous pipe: Class 150 malleable iron threaded or forged steel slip-on flanges; preformed neoprene gaskets.
 - .2 Copper tube and pipe: Class 150 slip-on bronze flanges; preformed neoprene gaskets.
- .3 Grooved and Shouldered Pipe End Couplings:
 - .1 Housing: Malleable iron clamps to engage and lock, designed to permit some angular deflection, Contraction, and expansion; steel bolts, nuts, and washers; galvanized for galvanized pipe.
 - .2 Sealing gasket: "C" shape composition sealing gasket.

- .4 Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.

2.15 GLOBE VALVES

- .1 Construction Up To and Including 80 mm (3 inches), bronze disc:
 - .1 Manufacturers:
 - .1 Red-White/Toyo
 - .2 Kitz
 - .3 Crane
 - .4 Substitutions: Refer to Section 21 05 00.
 - .2 MSS SP-80, Class 150, bronze body, bronze trim, handwheel, bronze, solder ends.
- .2 Construction Up To and Including 80 mm (3 inches), teflon disc:
 - .1 Manufacturers:
 - .1 Kitz
 - .2 Crane
 - .3 Substitutions: Refer to Section 21 05 00.
 - .2 MSS SP-80, Class 150, bronze body, bronze trim, handwheel, teflon disc, solder ends.
- .3 Construction: 50 mm (2 inches) and Larger:
 - .1 Manufacturers:
 - .1 Red-White/Toyo
 - .2 Kitz
 - .3 Crane
 - .4 Substitutions: Refer to Section 21 05 00.
 - .2 MSS SP-85, Class 150, iron body, bronze trim, handwheel, outside screw and yoke, renewable bronze plug-type disc, renewable seat, flanged ends.

2.16 BALL VALVES

- .1 Manufacturers:
 - .1 MAS
 - .2 Kitz
 - .3 Crane.
 - .4 Substitutions: Refer to Section 21 05 00.
- .2 Construction 63 mm (2.5 inches) and smaller:
 - .1 MSS SP-110, Class 150, 2760 kPa (400 psi) brass,
 - .2 Two piece body,
 - .3 316 stainless ball and trim, full port, teflon seats and stuffing box ring, blow-out proof stem, lever handle, solder ends.
- .3 Construction 75mm (3 inches) and larger:
 - .1 Ball valves shall be of the floating-ball design capable of providing bi-directional, tight shutoff in accordance with MSS SP-72.
 - .2 The valves shall be rated at 150# WSP/300# WOG.
 - .3 Bodies shall be ductile iron per ASTM A536, With ANSI Class 150 raised-face flanges.
 - .4 The interior and exterior of the body shall be epoxy-coated.

- .5 The ball shall be PFA infused stainless steel, with a stainless steel blowout-proof stem.
- .6 The seats and body seals shall be PTFE.
- .7 The stem seal shall be PTFE, externally adjustable chevron type.
- .8 Valves shall be equipped with locking handles as standard. If service conditions require, valves may be equipped with 2" square operating nuts, manual gear operators, or pneumatic, electric, or hydraulic actuators.

2.17 Plug Valves

- .1 Manufacturers:
 - .1 Nordstrom Valves, Inc. MSS SP-78, Type II.
 - .2 Substitutions: Refer to Section 21 05 00.
- .2 Construction 50 mm (2 inches) and smaller: Figure 114, MSS SP-78, 2700 kPa (400 psi), cast iron body and plug, pressure lubricated, teflon or Buna N packing, flanged or threaded ends. Provide lever operator with set screw.
- .3 Construction 65 mm (2-1/2 inches) and larger: MSS SP-78, 1200 kPa (175 psi), cast iron body and plug, pressure lubricated, teflon or Buna N packing, flanged ends. Provide lever operator with set screw.

2.18 Flow Controls

- .1 Manufacturers:
 - .1 Watts.
 - .2 Conbraco.
 - .3 Substitutions: Refer to Section 21 05 00.
- .2 Construction: Class 150, brass or bronze body with union on inlet and outlet, temperature and pressure test plug on inlet and outlet, blowdown/backflush drain.
- .3 Calibration: Control flow within 5 percent of selected rating, over operating pressure range of 10 times minimum pressure required for control, maximum pressure 24 kPa (3.5 psi).

2.19 Swing Check Valves

- .1 Construction: Up to and including 80 mm (3 inches):
 - .1 Manufacturers:
 - .1 Kitz.
 - .2 Substitutions: Refer to Section 21 05 00.
 - .2 MSS SP-80, Class 150, bronze body and cap, bronze swing disc with rubber seat, solder ends.
- .2 Construction: 50 mm (2 inches) and Larger:
 - .1 Manufacturers:
 - .1 American Valve, Inc.
 - .2 Kitz Corporation.
 - .3 Watts Regulator ;
 - .4 Zy-Tech Global Industries, Inc.
 - .5 Substitutions: Refer to Section 21 05 00.
 - .2 MSS SP-71, Class 125, iron body, bronze swing disc, renewable disc seal and seat, flanged ends.

2.20 Spring Loaded Check Valves

- .1 Manufacturers:
 - .1 Class 150: Mueller 72-IHB-3-H (Ductile Iron Body) Moygro &-I515WM5B (SS Disc, Viton Seat)
 - .2 Substitutions: Refer to Section 21 05 00.
- .2 Class 150, iron body, bronze trim, stainless steel springs, bronze disc, Buna N seals, wafer style ends.

2.21 Water Pressure Reducing Valves

- .1 Construction: Up to 50 mm (2 inches):
 - .1 Manufacturers:
 - .1 Ames ACV
 - .2 Honeywell International Inc.
 - .3 Watts Regulator
 - .4 Substitutions: Refer to Section 21 05 00.
 - .2 MSS SP-80, bronze body, stainless steel and thermoplastic internal parts, fabric reinforced diaphragm, strainer, threaded and double union ends.
- .2 Construction over 50 mm (2 inches):
 - .1 Manufacturers:
 - .1 Ames ACV
 - .2 Honeywell International Inc.
 - .3 Watts Regulator
 - .4 Substitutions: Refer to Section 21 05 00.
 - .2 MSS SP-85, cast iron body, bronze fitted, elastomeric diaphragm and seat disc, flanged.

2.22 Relief Valves

- .1 Pressure Relief:
 - .1 Manufacturers:
 - .1 Watts
 - .2 Substitutions: Refer to Section 21 05 00.
 - .2 AGA Z21.22 certified, bronze body, teflon seat, steel stem and springs, automatic, direct pressure actuated.
- .2 Temperature and Pressure Relief:
 - .1 Manufacturers:
 - .1 Watts
 - .2 Conbraco
 - .3 Substitutions: Refer to Section 21 05 00
 - .2 AGA Z21.22 certified, bronze body, teflon seat, stainless steel stem and springs, automatic, direct pressure actuated, temperature relief maximum 98.9 degrees C (210 degrees F), capacity ASME SEC IV certified and labelled.

2.23 Strainers

- .1 Construction: Size 50 mm (2 inch) and under:
 - .1 Manufacturers:
 - .1 Spirax-Sarco

- .2 Substitutions: Refer to Section 21 05 00.
- .2 Threaded bronze body Y pattern 2070 kPa (300 psi) CWP, Y pattern with 0.8 mm 1/32 inch stainless steel perforated screen.
- .2 Construction: Size 40 mm (1-1/2 inch) to 100 mm (4 inch):
 - .1 Manufacturers:
 - .1 Spirax-Sarco
 - .2 Substitutions: Refer to Section 21 05 00.
 - .2 Class 125, bronze body, Y pattern, flanged ends, with 1.6 mm (1/16 inch) stainless steel perforated screen.

2.24 Fire Stop Systems

- .1 General Purpose Fire Stopping Sealant:
 - .1 Manufacturers:
 - .1 Dow Corning Silicone Elastomer Fire Stop Penetration Seal and/or Dow-Corning liquid silicone elastomer Fire Stop Foam of density, width and depth to maintain assembly fire resistive rating.
 - .2 Hilti.
 - .3 Substitutions: Refer to Section 21 05 00.
 - .2 Water based, non-slumping, premixed sealant with intumescent properties, rated for 3 hours per ASTM E814 and UL 1479.
- .2 DWV Plastic Pipe Systems Fire Stopping Sealant:
 - .1 Manufacturers:
 - .1 Hilti FS-ONE Intumescent Firestop Sealant
 - .2 Substitutions: Refer to Section 21 05 00.
 - .2 Silicone based, premixed sealant with intumescent properties, vibration and moisture resistant, rated for 3 hours per ASTM E814 and UL 1479 with metal collars.

Part 3 Execution

3.1 Examination

- .1 Section 21 05 00: Verify existing conditions before starting work.
- .2 Verify that excavations are to required grade, dry, and not over-excavated.

3.2 Preparation

- .1 Ream pipe and tube ends. Remove burrs.
- .2 Remove scale and dirt, on inside and outside, before assembly.
- .3 Prepare piping connections to equipment with flanges or unions.

3.3 Installation

- .1 Install to manufacturer's written instructions.
- .2 Groove couplings shall not be used in mechanical rooms.
- .3 Provide non-conducting dielectric connections wherever jointing dissimilar metals.
- .4 Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.

- .5 Install piping to maintain headroom, conserve space, and not interfere with use of space.
- .6 Group piping whenever practical at common elevations.
- .7 Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment. Refer to Section 23 05 16.
- .8 Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings. Refer to Section 23 07 19.
- .9 Provide access where valves and fittings are not exposed. Coordinate size and location of access doors with Section 08 31 00.
- .10 Establish elevations of buried piping outside the building to ensure not less than 2.4 m (8 ft) of cover.
- .11 Install vent piping penetrating roofed areas to maintain integrity of roof assembly.
- .12 Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.
- .13 Provide support for utility meters to requirements of utility companies.
- .14 Prepare exposed, unfinished pipe, fittings, supports, and accessories ready for finish painting. Refer to Section 09 90 00.
- .15 Support for buried pipe under concrete structural slabs shall be hung from the slab using epoxy coated or stainless steel hangers, hardware and hanger rod secured to the rebar.
- .16 Excavate to Sections 31 23 18 and 31 23 23 for work of this Section.
- .17 Backfill to Sections 31 23 16 and 31 23 23 for work of this Section.
- .18 Install bell and spigot pipe with bell end upstream.
- .19 Install valves with stems upright or horizontal, not inverted.
- .20 Pipe vents from gas pressure reducing valves to outdoors and terminate in weather-proof hood.
- .21 Install water piping to ASME B31.9.
- .22 Sleeve pipes passing through partitions, walls and floors. Set sleeves in concrete forms for all pipes passing through concrete walls, beams and slabs.
- .23 Install 100 mm (4 inch) concrete curbs around all pipe penetrations in mechanical rooms.
- .24 Pipe sleeves to extend above floor line as follows:
 - .1 Unfinished areas – 25 mm (1 inches).
 - .2 Finished areas (copper sleeves) – 7 mm (1/4 inches).
 - .3 Mechanical rooms, kitchens and washrooms – 100 mm (4 inches).
- .25 Caulk sleeves to provide watertight installation.
- .26 Where pipes pass through floors and walls in finished areas and where exposed to view, provide Crane #10 B.C. chrome-plated, pressed steel floor plates.

- .27 Install galvanized, oversize pipe sleeves on passing through walls or partitions, for building into wall construction, by other trades.
- .28 Sleeves and holes for piping on cold water systems shall be large enough to accommodate pipe insulation. Insulation on piping for hot water systems may stop at walls or floors.
- .29 Prior to installing sleeves in concrete beams, receive final jobsite approval by Structural Contract Administrator.
- .30 Storm water piping: Install clamps across all no-hub MJ couplings on piping 125 mm (5") and larger for all horizontal piping, including elbows at the base of vertical pipes. Refer to 23 05 29 for supports and anchors on storm water piping.
- .31 Chemical resistant piping: buried piping to be electrofused, mechanical joints acceptable where exposed and maintainable.

3.4 Pipe Pressure Testing

- .1 Do not insulate pipe prior to pressure testing. Pressure test in sections if necessary before concealing or insulating pipe.
- .2 Do not introduce water for testing where freezing conditions exist or where piping systems being tested are located above sensitive areas or equipment that may be damaged or contaminated by water leakage.
- .3 Hydraulically test all pipe. Pneumatic testing not permitted without prior approval from the Contract Administrator and the Authority Having Jurisdiction.
- .4 Should leaks develop in any part of the piping system, remove and replace defective sections, fittings and equipment. Pipe dope, caulking, tape, lead wool, dresser couplings, etc. shall not be used to correct deficiencies. The Contractor shall be responsible for all cleanup related to leakage during flushing, testing, and chemical treatment of piping, including original building piping if included in the testing.
- .5 Subject piping to a hydrostatic pressure of at least that 1-½ times the operating pressure of the system for a period of at least 12 hours. If leaks are detected, such leaks shall be repaired and the test started over. Record results and submit witnessed (by Contract Administrator or The City's representative) reports to the Contract Administrator.
- .6 Cast iron piping systems: water-test each portion of the system for 15 minutes at a head pressure of 10' of water. Test procedure shall be in accordance with CISPI and the manufacturer's recommendations. Compressed air shall not be used for testing.
- .7 Register pressures at the highest system point.
- .8 Provide at least 48 hours (during working days) notice to Contract Administrator or The City's Representative prior to testing to allow the tests to be witnessed.

3.5 APPLICATION

- .1 Use grooved mechanical couplings and fasteners only in accessible locations. Grooved couplings shall not be used in mechanical rooms.
- .2 Install unions downstream of valves and at equipment or apparatus connections.
- .3 Install brass male adapters each side of valves in copper piped system. Solder adapters to pipe.

- .4 Install ball valves for shut-off and to isolate equipment, part of systems, or vertical risers.
- .5 Install globe or ball valves for throttling, bypass, or manual flow control services.
- .6 Provide spring loaded check valves on discharge of water pumps.
- .7 Provide plug valves in natural and propane gas systems for shut-off service.
- .8 Provide flow controls in water recirculating systems where indicated.
- .9 PVC DWV piping installed in non-combustible buildings shall comply with the restrictions in the following table.

COMBUSTIBLE PIPE APPLICATIONS SUITABILITY FOR USE					
Product	NON-COMBUSTIBLE BUILDING				
	General Usage	Air Plenum ¹	Vertical Services Spaces ²	High-Rise Building	Underground
Combustible Pipe FSR25: (eg. IPEX System 15)	P	N ³	N	N	P
Combustible Pipe FSR25/SDC50: (eg. IPEX XFR, CPVC)	P	P	N	P	P
MJ Grey Coupling	P	P	N	P	N
1. Restrictions for air plenums also apply to combustible buildings as well. 2. Certified firestopping devices are required whenever the system penetrates a vertical or horizontal separation, and shall be certified to CAN4-S115 and tested with a pressure differential of 50 Pa. 3. Sizes 20" and 24" are N					

3.6 Erection Tolerances

- .1
- .2 Establish invert elevations, slopes for drainage to one percent (1/8 inch per foot) minimum, except pipe sized 75 mm (3 inches) or less shall have a slope no less than two percent (1/4 inch per foot). Maintain gradients.
- .3 Slope water piping minimum 0.25 percent and arrange to drain at low points.

3.7 Disinfection Of Domestic Water Piping System

- .1 Disinfect water distribution system to Section 22 05 81.

3.8 Service Connections

- .1 Provide new sanitary and storm sewer services. Before commencing work check invert elevations required for sewer connections, confirm inverts and ensure that these can be properly connected with slope for drainage and cover to avoid freezing.
- .2 Provide new water service complete with approved reduced pressure double check backflow preventer and water meter with by-pass valves and pressure reducing valve. Meter and valve arrangement to confirm to the requirements of the Authority Having Jurisdiction.
 - .1 Provide 1.20 mm (18 gauge) galvanized sheet metal sleeve around service main to 150 mm (6 inch) above floor and 1800 mm (6 feet) minimum below grade. Size for minimum of 50 mm (2 inches) of loose batt insulation stuffing.
- .3 Provide new gas service complete with gas meter and regulators. Gas service distribution piping to have initial minimum pressure of 34 kPa (5 psi inch wg). Provide regulators on each line serving gravity type appliances, sized to equipment.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Flexible Pipe Connections.
- .2 Roof and floor drains.
- .3 Vent Stack Jack.
- .4 Trap Seal Primers.
- .5 Cleanouts.
- .6 Wall Hydrants
- .7 Washing machine recessed valve assembly.
- .8 Backflow preventers.
- .9 Water hammer arrestors.
- .10 Potable Water Automatic Balancing Valves
- .11 Interceptors (GI, SI)
- .12 Thermostatic mixing valves
- .13 Sump Pits

1.2 RELATED SECTIONS

- .1 Section 01 11 00 - Summary of Work: Product requirements for The City Provided equipment.
- .2 Roofing Section.
- .3 Section 22 10 00 - Plumbing Piping.
- .4 Section 22 42 02 - Plumbing Fixtures.
- .5 Section 22 47 00 - Plumbing Equipment.
- .6 Section 26 05 80 - Equipment Wiring: Electrical characteristics and wiring connections.

1.3 REFERENCES

- .1 ASME - SEC 8D - Boilers and Pressure Vessels Code - Rules for Construction of Pressure Vessels.
- .2 ASME A112.21.1 - Floor Drains.
- .3 ASME A112.21.2 - Roof Drains.
- .4 ASME A112.26.1 - Water Hammer Arrestors.
- .5 ASSE 1011 - Hose Connection Vacuum Breakers.
- .6 ASSE 1012 - Backflow Preventers with Immediate Atmospheric Vent.
- .7 ASSE 1013 - Backflow Preventers, Reduced Pressure Principle.
- .8 ASSE 1019 - Wall Hydrants, Frost Proof Automatic Draining Anti-Backflow Types.
- .9 ASTM C478 - Precast Reinforced Concrete Manhole Sections.

- .10 AWWA C506 - Backflow Prevention Devices - Reduced Pressure Principle and Double Check Valve Types.
- .11 NSF/ANSI 61 – Drinking Water System Components – Health Effects
- .12 PDI G-101 - Testing and Rating Procedure for Grease Interceptors with Appendix of Sizing and Installation Data.
- .13 PDI WH-201 - Water Hammer Arrestors.
- .14 CSA B125.3 – Plumbing Fittings

1.4 SUBMITTALS FOR REVIEW

- .1 Section 21 05 00: Submission procedures.
- .2 Product Data: Provide component sizes, rough-in requirements, service sizes, and finishes.
- .3 Shop Drawings: Indicate dimensions, weights, and placement of openings and holes.

1.5 CLOSEOUT SUBMITTALS

- .1 Section 21 05 00: Submission procedures.
- .2 Operation Data: Indicate frequency of treatment required for interceptors.
- .3 Maintenance Data: Include installation instructions, spare parts lists, exploded assembly views.
- .4 Record Documentation: Record actual locations of equipment, cleanouts, backflow preventers, water hammer arrestors.

1.6 MAINTENANCE MATERIAL SUBMITTALS

- .1
- .2 Extra Stock Materials: Supply two (2) loose keys for outside hose bibs.

1.7 QUALITY ASSURANCE

- .1 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three (3) years documented experience.

1.8 REGULATORY REQUIREMENTS

- .1 Perform Work to the latest version of the Manitoba Plumbing Code and local Municipal requirements.
- .2 All components installed in domestic water system to be lead free.

1.9 DELIVERY, STORAGE, AND PROTECTION

- .1 Section 21 05 00: Transport, handle, store, and protect products.
- .2 Accept specialties on site in original factory packaging. Inspect for damage.

Part 2 Products

2.1 ROOF DRAINS

- .1 Manufacturers:
 - .1 Mifab
 - .2 Zurn
 - .3 Watts.
 - .4 Substitutions: Refer to Section 21 05 00.
- .2 Controlled Flow Roof Drain:
 - .1 Assembly: ANSI A112.21.2.
 - .2 Body: Lacquered cast iron with sump.
 - .3 Strainer: Removable cast metal dome with vandal proof screws.
 - .4 Accessories: Coordinate with roofing type, refer to Roofing Section:
 - .1 Membrane flange and membrane clamp with integral gravel stop.
 - .2 Adjustable under deck clamp.
 - .3 Roof sump receiver.
 - .4 Waterproofing flange.
 - .5 Parabolic controlled flow weir.
 - .6 Levelling frame.
 - .7 Adjustable extension sleeve for roof insulation.
 - .8 Strainer free area of 43 square inches.
 - .9 Tamperproof strainer and fastening
- .5 RD-1:
 - .1 Size: 4" (100mm)
 - .2 Flow: 13.25gpm
- .6 RD-2:
 - .1 Size: 4" (100mm)
 - .2 Flow: 15.5gpm
- .7 RD-3:
 - .1 Size: 4" (100mm)
 - .2 Flow: 17.25gpm
- .8 RD-4 with mesh covered dome:
 - .1 Size: 4" (100mm)
 - .2 Flow: 15.5gpm
 - .3

2.2 VENT STACK JACKS

- .1 Manufacturer
 - .1 Thaler
 - .2 Substitutions: Refer to Section 21 05 00.
- .2 Flat Roof, no cap, insulated vent stack;
 - .1 13" (330 mm) high [19" (483 mm) high] 0.064" (1.6 mm) mill finish 1100-0T alloy aluminum, 0.031" (0.79 mm) 22 ga. Type 304 stainless steel to CSA B272-93 complete with pre-moulded urethane insulation liner
 - .2 Size to be 2" (51 mm), 3" (76 mm), 4" (102 mm), 5" (127mm), or 6" (152 mm) diameter
 - .3 EPDM Triple Pressure Grommet Seal and EPDM Base Seal, PVC coated deck flange or bituminous painted deck flange, coordinate with roofing contractor.
- .3 Flat Roof, Removable Cap, insulated vent stack;

- .1 18" (457 mm) high 0.064" (1.6 mm) mill finish 1100-OT alloy aluminum, 0.031" (0.79 mm) 22 ga. Type 304 stainless steel to CSA B272-93 complete with pre-moulded urethane insulation liner and removable cap and stainless steel screws
- .2 Size to be 2" (51 mm), 3" (76 mm), 4" (102 mm), 5" (127mm), 6" (152 mm), 7" (178 mm), 8" (203mm), or 10" (254mm) diameter
- .3 EPDM Triple Pressure Grommet Seal and EPDM Base Seal, PVC coated deck flange or bituminous painted deck flange, coordinate with roofing contractor
- .4 Optional S.S.. vandal proof cap;

2.3 FLOOR DRAINS

- .1 Manufacturers:
 - .1 Mifab
 - .2 Zurn.
 - .3 Watts.
 - .4 Jay R. Smith
 - .5 Substitutions: Refer to Section 21 05 00.
- .2 Floor Drain
 - .1 ANSI A112.21.1,
 - .2 Epoxy coated cast iron two piece body with double drainage flange,
 - .3 Weep holes,
 - .4 ½" trap primer connection port,
 - .5 Refer to floor drain schedule below,
 - .6 Funnels shall be supplied in lieu of strainer as noted in schedule below,
 - .7 Floor with Surface Membrane
 - .1 Reversible clamping collar,
 - .2 Primary and secondary weep holes,
 - .3 Adjustable 5" (127mm) 7" (178mm) strainer with surface membrane clamp, refer to schedule for type.

.8

.9 Floor Drain Schedule

Tag	Body Material	Inlet Strainer	Vandal Proof	Sediment Bucket	Trap Seal Primer
FD-1	Epoxy coated Cast Iron	Heavy Duty, Nickel Bronze	No	No	Yes
FD-2	Epoxy coated Cast Iron	Nickel Bronze, 4"x9" Funnel	No	No	Yes
FD-3	Cast Iron	Stainless Steel Strainer	No	No	No
FD-5	Epoxy coated Cast Iron	Heavy Duty, Nickel Bronze	No	Yes	Yes
FD-6	Epoxy coated Cast Iron	Nickel Bronze Funnel Hub	No	No	Yes

- .10 Contractor shall provide the floor drain suitable for the finished floor unless otherwise noted on the drawing. Refer to architectural details and plans for membrane requirements. Floors with sheet membranes (vinyl floor, etc) shall have surface membrane clamp.
- .11

2.4 TRAP SEAL PRIMER

- .1 Manufacturers:
 - .1 Mifab
 - .2 Zurn.
 - .3 Watts.
 - .4 Precision Plumbing Products.
 - .5 Substitutions: Refer to Section 21 05 00.
- .2 Pressure drop activated brass trap seal primer
 - .1 Inlet opening of 1/2" (13mm) male N.P.T. and outlet opening of female 1/2" (13mm) N.P.T.
 - .2 Complete with four view holes and removable filter screen.
 - .3 Requires no site adjustments and no air pre-charge.
 - .4 Each trap seal primer shall be installed with brass trap seal primer air gap fitting,
 - .5 Where multiple floor drains are being served install a trap seal primer distribution unit.
 - .6 Primers shall be installed with union directly upstream, and shut off valve.
 - .7 Supply line to primer shall have a reverse bend in it to reduce the change of sediment collecting in primer, refer to manufacturer's installation instructions.

2.5 CLEANOUT COVERS

- .1 Exterior Surfaced Areas:
 - .1 Manufacturers:
 - .1 Mifab
 - .2 Zurn.
 - .3 Watts.
 - .4 Substitutions: Refer to Section 21 05 00.
 - .2 Round cast nickel bronze access frame and non-skid cover.
- .2 Exterior Unsurfaced Areas:
 - .1 Line type with lacquered cast iron body and round epoxy coated gasketed cover.
- .3 Interior Finished Floor Areas:
 - .1 Lacquered cast iron body with anchor flange, reversible clamping collar, threaded top assembly, and round gasketed scored cover in service areas and round gasketed depressed cover with or without surface membrane clamp as required to accept floor finish in finished floor areas.
- .4 Interior Finished Wall Areas:
 - .1 Line type with lacquered cast iron body and round epoxy coated gasketed cover, and round stainless steel access cover secured with machine screw.
- .5 Interior Unfinished Accessible Areas:
 - .1 Caulked or threaded type.
 - .2 Bolted stack cleanouts on vertical rainwater leaders.

2.6 EXTERIOR WALL HYDRANTS (WH-1)

- .1 Wall Hydrant:
 - .1 Manufacturers, Watts Model HY-725

- .1 Mifab
- .2 Zurn.
- .3 Substitutions: Refer to Section 21 05 00.
- .2 Concealed type, self draining, non freeze wall hydrant
- .3 With ANSI/ASSE 1019 approved anti-siphon and vandal resistant integral vacuum breaker, 3/4" (19) male hose connection.
- .4 Hydrant assembly complete with neoprene plunger to control both the flow and drain functions, hardened bronze operating stem, drain port under the hexagon nut, heavy duty brass casing, 360 degree swivel inlet connection, heavy duty chrome plated bronze head casting, polished chrome plated face plate and satin finished nickel bronze box with hinged locking cover.
- .5 Operating key to be furnished with each hydrant.

2.7 FLEXIBLE PIPE CONNECTORS

- .1 Manufacturers:
 - .1 Flextrol
 - .2 Flex Tech Industries
 - .3 Hydro-flex
 - .4 Substitutions: Refer to Section 21 05 00
- .2 Supply and install where shown on the drawings as in details, flexible pipe connectors as manufactured by Flex Tech Industries, selected to meet operating and test pressures of systems served.
- .3 Minimum 450 mm (18") in length unless otherwise noted.
- .4 Domestic Water Services
 - .1 Up to 50 mm (2") - bronze connectors constructed of Phosphor corrugated bronze hose and bronze single braid with brass male ends.
 - .2

2.8 BACKFLOW PREVENTERS

- .1 Reduced Pressure Backflow Preventers (RPB):
 - .1 Manufacturers:
 - .1 Zurn.
 - .2 Watts.
 - .3 Substitutions: Refer to Section 21 05 00.
 - .2 ANSI/ASSE 1013 / CSA B64.4,
 - .3 Bronze body with bronze internal parts and stainless steel springs,
 - .4 Two independently operating, spring loaded check valves,
 - .5 Diaphragm type differential pressure relief valve located between check valves,
 - .6 Third check valve that opens under back pressure in case of diaphragm failure,
 - .7 Non-threaded vent outlet,
 - .8 Assembled with two gate valves, strainer, and four test cocks.
- .2 Reduced Pressure Zone Backflow Preventers (RPZ):
 - .1 Manufacturers:
 - .1 Zurn.
 - .2 Watts.
 - .3 Substitutions: Refer to Section 21 05 00.
 - .2 ANSI/ASSE 1013 / CSA B64.4,

- .3 Bronze body
- .4 Internal pressure relief valve between to positive seating independent check modules
- .5 Check modules with captures springs and silicone seats (replaceable)
- .6 No exposed threads or screws in waterways
- .7 Single access bronze cover secured with stainless bolts
- .8 Assembled with two resilient seated isolation valves and four resilient ball valve test cocks and air gap drain fitting.

2.9 GREASE INTERCEPTORS

- .1 Manufacturer: Schier
- .2 Other acceptable manufacturers offering equivalent products.
 - .1 Substitutions: Refer to Section 21 05 00.
- .3 Capacity:
 - .1 As per Schedule.
 - .2 Minimum grease removal efficiency: 90% as per ASME A112.14.3.
- .4 Construction:
 - .1 Constructed of seamless, polyethylene. Interceptor shall be furnished for above or below grade installation. Interceptor shall be certified to ASME A112.14.3 (type C) and CSA B481.1, with field adjustable riser system, built-in flow control, built-in test caps and three outlet options. Cover shall provide water/gas-tight seal and have minimum 16,000 lbs. load capacity.
- .5

2.10 WATER HAMMER ARRESTORS

- .1 Manufacturers:
 - .1 Mifab
 - .2 Zurn.
 - .3 Watts.
 - .4 Substitutions: Refer to Section 21 05 00.
- .2 ANSI A112.26.1,
 - .1 Stainless steel construction,
 - .2 Bellows type sized to PDI WH-201,
 - .3 Pre-charged suitable for operation in temperature range -73 to 149 degrees C (-100 to 300 degrees F) and maximum 1700 kPa (250 psi) working pressure.

2.11 POTABLE WATER AUTOMATIC BALANCING VALVES

- .1 Manufacturers:
 - .1 Victaulic/IMI TA (Tour & Andersson) Series 76X
 - .2 Substitutions: Refer to Section 21 05 00.
- .2 Construction up to and including 50mm (3/4" inch):
 - .1 Lead-free construction, Certified in accordance with NSF/ANSI 61 for commercial cold and hot water service, rated to 83°C (180°F), and NSF/ANSI 372
 - .2 Series 300 stainless steel body, nickel plated brass union nut.
 - .3 One-piece body to include a handle ball valve, a flow control cartridge assembly.

- .4 Dual pressure or pressure/temperature test valves for verifying accuracy of flow performance for all sizes combined with a manual air vent, and a union end.
- .5 Valve shall be suitable for a flow range of 0.33 GPM/1.50 LPM to 12 GPM/45.4 LPM and flow rate pre-set accuracy variation of +/-5% over 95% of the control range
- .6 Valves shall be offered with two pressure differential control ranges of 13-220 kPa (2-3 psi) or 35-414 kPa (5-60 psi) differential
- .3 Valve shall come fully assembled and be permanently marked to show direction of flow; shall have a body tag to indicate flow rate and model number.
- .4 Valve internal control mechanism shall consist of a stainless steel one-piece cartridge with segmented port design and full travel linear coil spring.
- .5 Manufacturer shall be able to provide certified independent laboratory tests verifying accuracy of performance.
- .6 All flow control valve cartridges shall be warranted by the manufacturer for five years from date of sale

2.12 WASHING MACHINE CONNECTION

- .1 WM-1: Clothes Washing Machine Connection Box
 - .1 Manufacturers:
 - .1 Mifab
 - .2 Zurn.
 - .3 Watts.
 - .4 Substitutions: Refer to Section 21 05 00.
 - .2 Encased washing machine valve,
 - .3 16 ga type 304 stainless steel preformed rough-in box,
 - .1 Provide rough-in box suitable for fire rated walls where required.
 - .4 Brass single lever valve handle for hot and cold water connections,
 - .5 Socket for 50 mm (2 inch) waste, slip in finishing cover.

2.13 DISHWASHING MACHINE CONNECTIONS

- .1 DW-1: Residential type dishwasher
 - .1 Provide domestic hot water supply and drain connections for dishwasher to neighboring sink.
- .2 DW-2: Commercial type dishwasher
 - .1 Provide drain connection for dishwasher to nearby floor drain.
 - .2 Provide tempering valve on drain line complete with cold water connection.
 - .3 Provide domestic hot water supply connection to dishwasher.

2.14 BACK WATER VALVES

- .1 Cast Iron:
 - .1 Manufacturers:
 - .1 Mifab
 - .2 Zurn.
 - .3 Watts.
 - .4 Substitutions: Refer to Section 21 05 00.

.2 ANSI A112.21.2; lacquered cast iron body and cover, brass valve, 150 mm (6 inch) extension sleeve, and access cover.

.2 PVC

.1 Manufacturers:

.1 IPEX

.2 Canplus

.3 Substitutions: Refer to Section 21 05 00.

.2 CAN/CSA-B181.2, "Polyvinylchloride (PVC) and Chlorinated Polyvinylchloride (CPVC) Drain, Waste Vent Pipe and Pipe Fittings

.3 Size to match drain pipe, extension sleeve, and access cover.

.4

.5

Part 3 Execution

3.1 INSTALLATION

.1 Install to manufacturer instructions.

.2 Install approved potable water protection devices on plumbing lines where contamination of domestic water may occur; on boiler feed water lines, janitor rooms, fire sprinkler systems, premise isolation, irrigation systems, flush valves, interior and exterior hose bibs.

.3 All water cross connection and backflow prevention shall comply with City of Winnipeg By-Law 2289 and CSA B64.10. Note that where severe hazards exist, an approved control device must be installed both on service pipe as well as on pipe at source of potential contamination.

.4 Expenses for material, installation, testing and approval of cross connection and backflow prevention shall be paid by this division.

.5 Provide minimum 1-1/4" (32mm) clearance between backflow preventer body and adjacent structure (wall, ceiling, etc.) and equipment. Clearance space to be sufficient to facilitate easy removal for servicing. The BFP shall be located no higher on wall than 48" (1200mm) above the finished floor.

.6 Backflow preventers shall be sized for the maximum rated flow of the equipment it is serving.

.7 All testable backflow prevention devices shall be installed in accessible locations as defined by CSA-B64.10-01. If this cannot be accomplished, locate unit with additional piping to accessible location at no extra cost to The City.

.8 Pipe relief from backflow preventer to nearest drain.

.9 Install water hammer arrestors complete with accessible isolation valve on hot and cold water supply piping to equipment.

END OF SECTION

Part 1 General

1.1 Section Includes

- .1 Lavatories.
- .2 Service sinks.
- .3 Showers.
- .4 Sinks.
- .5 Urinals.
- .6 Water closets.
- .7 Electric water coolers.
- .8 Eye wash fountains.
- .9 Emergency showers.
- .10 Wash Fountains

1.2 Related Sections

- .1 Section 21 05 00 – Submittal Procedures.
- .2 Section 01 45 00 - Quality Assurance.
- .3 Section 21 05 00 - Product Requirements.
- .4 Section 21 05 00 - Closeout Submittals.
- .5 Section 06 40 00 - Architectural Cabinetwork:
 - .1 Preparation of counters for sinks,
 - .2 Lavatory tops.
- .6 Section 07 92 00 - Joint Sealants: Seal fixtures to walls and floors.
- .7 Section 23 05 29 - Supports And Anchors.
- .8 Section 22 10 00 - Plumbing Piping.
- .9 Section 22 42 01 - Plumbing Specialties.
- .10 Section 22 47 00 - Plumbing Equipment.
- .11 Section 26 05 80 - Equipment Wiring: Electrical characteristics and wiring connections.

1.3 References

- .1 CSA B651 – Barrier-free Design.
- .2 ANSI Z124.1 - Gel-Coated Glass-Fibre Reinforced Polyester Resin Bathtub Units.
- .3 ANSI Z124.2 - Gel-Coated Glass-Fibre Reinforced Polyester Resin Shower Receptor and Shower Stall Units.
- .4 ANSI Z358.1 - Emergency Eye Wash and Shower Equipment.
- .5 ARI 1010 - Self-Contained Mechanically Refrigerated Drinking Water Coolers.

- .6 ASME A112.6.1 - (Floor Affixed) Supports for Off-the-Floor Plumbing Fixtures for Public Use.
- .7 ASME A112.18.1 / CSA-B125.1-05- Plumbing Fixture Fittings.
- .8 ASME A112.19.1 / CSA B45.2-08 - Enamelled Cast Iron Plumbing Fixtures.
- .9 ASME A112.19.2 / CSA B45.1-08 - Vitreous China Plumbing Fixtures.
- .10 ASME A112.19.3 / CSA B45.4-08- Stainless Steel Plumbing Fixtures (Designed for Residential Use).
- .11 ASME A112.19.4 - Porcelain Enamelled Formed Steel Plumbing Fixtures.
- .12 ASME A112.19.5 - Trim for Water-Closet Bowls, Tanks, and Urinals.
- .13 NFPA 70 - National Electrical Code.
- .14 NBCC 2010 - National Building Code of Canada
- .15 NPCC 2010 – National Plumbing Code of Canada
- .16 NFCC 2010 – National Fire Code of Canada

1.4 Submittals For Review

- .1 Section 21 05 00: Submission procedures.
- .2 Product Data: Provide catalogue illustrations of fixtures, sizes, rough-in dimensions, utility sizes, trim, and finishes.

1.5 CLOSEOUT SUBMITTALS

- .1 Section 21 05 00: Submission procedures.
- .2 Maintenance Data: Include fixture trim exploded view and replacement parts lists.
- .3 Warranty Documentation: Submit manufacturer warranty and ensure forms have been completed in The City's name and registered with manufacturer.

1.6 Quality Assurance

- .1 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three (3) years documented experience.

1.7 Regulatory Requirements

- .1 Products Requiring Electrical Connection: Listed and classified by CSA as suitable for the purpose specified and indicated.

1.8 Delivery, Storage, And Protection

- .1 Section 21 05 00: Transport, handle, store, and protect products.
- .2 Accept fixtures on site in factory packaging. Inspect for damage.
- .3 Protect installed fixtures from damage by securing areas and by leaving factory packaging in place to protect fixtures and prevent use.

Part 2 Products

2.1

Fixtures

- .1 Refer to plans for quantities and locations.
- .2 LAV-1: Stainless Steel Wall Hung Basin, Electronic Faucet, Hardwired:
 - .1 Manufacturer: Franke Model WHB2221-8.
 - .2 Other acceptable manufacturers offering equivalent products.
 - .1 Elkay.
 - .2 Substitutions: Refer to Section 21 05 00.
 - .3 ASME A112.19.2 / CSA B45.1:
 - .1 Stainless Steel wall hung lavatory,
 - .2 546 x 532 mm (21-1/4 x 20-15/16 inch),
 - .3 Ledge back,
 - .4 Drillings on 100 mm (4 inch) centres,
 - .5 Rectangular basin and splash lip,
 - .6 Integral overflow.
 - .7 Angle valve screwdriver stop,
 - .8 Chrome-plated copper supplies.
 - .4 ADA / CSA B651:
 - .1 Barrier-free compliant.
 - .5 Lavatory Sensor Faucet:
 - .1 Manufacturer: Delta Model 591TPA0250
 - .2 Other acceptable manufacturers offering equivalent products.
 - .1 Substitutions: Refer to Section 21 05 00.
 - .3 ASME A112.18.1/CSA B125.1:
 - .1 Hands free (touchless) on/off faucet,
 - .2 Proximity™ sensing technology,
 - .3 Adjustable sensing range and timeout,
 - .4 Chrome plated cast spout body,
 - .5 Serviceable filter screen upstream of the solenoid,
 - .6 Vandal resistant 0.5 gpm (1.9 L/min) spray outlet,
 - .7 Hard Wire (24VAC) infrared electronic handwash(Product supplied with a Converter to convert 24VAC to 6 VDC) 4" (102mm) centers - 2-1/2" x 7" (64 mm x 178 mm) forged coverplate with locking mechanism (anti-rotation), 3 hole installation,
 - .8 Supplied with open grid strainer, chrome finish
 - .9 Recessed mounted wall box to house supplies, transformer and converter. Coordinate installation of trap and drain rough-in to accommodate recessed box.
 - .6 Accessories:
 - .1 Chrome plated 1.3 mm (17 gauge) brass P-trap with clean-out plug and arm with escutcheon.
 - .2 Offset waste with perforated open strainer.
 - .3 Angle valve screwdriver stop,
 - .4 Chrome-plated copper supplies.
 - .5 Shroud (WHB221-RS) to conceal trap and water supplies.
 - .6 Provide grounding clip for use with stainless steel basin.

- .7 Wall Mounted Carrier:
 - .1 Manufacturer: Mifab Model MC-41
 - .2 Other acceptable manufacturers offering equivalent products.
 - .1 Watts
 - .2 Zurn.
 - .3 Substitutions: Refer to Section 21 05 00.
 - .3 ASME A112.6.1:
 - .1 Cast iron and steel frame with two structural steel legs,
 - .2 Lugs for floor and wall attachment,
 - .3 Concealed arm supports,
 - .4 Bearing plate and studs.

- .3 MS-1: Floor Mount, Moulded Stone, Wall Mount Two Handle Manual Faucet
 - .1 Manufacturer: Proflo PFMB2424S - 24" x 24" x 10" (610 x 610 x 254 mm)
 - .2 Other acceptable manufacturers offering equivalent products.
 - .1 Zurn.
 - .2 American Standard
 - .3 Configuration:
 - .1 Size: 600 x 600 x 250 mm (24 x 24 x 10 inch),
 - .2 Floor mounted molded high density mop service composite basin, with 832 hose and holder, 889 cc. mop hanger, and 600 mm (24") vinyl bumper guard, stainless steel wall guard.
 - .3 Stainless steel strainer.
 - .4 Trim:
 - .1 Manufacturer: Delta Model 28T2383.
 - .1 Not permitted.
 - .2 ASME A112.18.1
 - .1 Polished chrome wallmount service faucet with rigid spout, 8" centres, cast brass construction, chrome-plated.
 - .2 Two handle with integral check stops, polished chrome plated finish, lever-blade handles.
 - .3 Long rigid spout with pail hook and adjustable top wall brace, pail hook and 3/4" hose thread on spout.
 - .4 Body mounted angle vacuum breaker, garden hose end outlet on spout.
 - .5 Vacuum breaker, integral stops.
 - .5 Accessories:
 - .1 1.5 m (5 feet) of 13 mm (1/2 inch) diameter plain end reinforced rubber hose,
 - .2 Hose clamp hanger,
 - .3 Mop hanger.

- .4 SK-5: Stainless Steel, Free Standing, Triple Bowl, Two Handle Manual Faucet, with Sprayer
 - .1 Manufacturer: Franke Model LBT8610P-1.
 - .1 Substitutions: Refer to Section 21 05 00.
 - .2 ASME A112.19.3:

- .1 53-3/8" length, 16 gauge,
- .2 Three compartment commercial sink, 10" deep bowls
- .3 Type 304 stainless steel,
- .4 10" backsplash, 1-1/8" diameter holes, 8" centers
- .3 Trim:
 - .1 Manufacturer: T&S MPY-8DCN-12-CR.
 - .1 Substitutions: Refer to Section 21 05 00.
 - .2 ASME A112.18.1:
 - .1 203mm (8") deck mount faucet and sprayer pre-rinse unit,
 - .2 Quarter turn ceramic cartridges with check valves
 - .3 Faucet with 12" swing nozzle,
 - .4 24" flexible stainless steel hose,
 - .5 0.65 GPM low flow spray valve
 - .6 6" adjustable wall brackets
 - .3 NSF 61
 - .1 Lead Free compliant
- .4 Accessories:
 - .1 Chrome plated 1.3 mm (17 gauge) brass P-trap with clean-out plug and arm with escutcheon,
 - .2 Angle valve screwdriver stop,
 - .3 Chrome-plated copper supplies.
- .5 SK-6: Stainless Steel, Counter Mount, Double Bowl, Two Handle Manual Faucet
 - .1 Manufacturer: Franke Commercial LBD6408P-1
 - .1 Kindred
 - .2 Substitutions: Refer to Section 21 05 00.
 - .2 ASME A112.19.3:
 - .1 18-8 stainless steel sink, 18 gauge, satin finished bowl,
 - .2 Type 304 stainless steel,
 - .3 Faucet ledge, three hole, 8" centres
 - .4 Fully undercoated sink, self rimming,
 - .5 3-1/2" (89mm) basket strainer waste filling and installation kit.
 - .3 Trim:
 - [OR]
 - .1 Manufacturer: Delta Model 26C3134.
 - .1 Substitutions: Refer to Division 01.
 - .2 ASME A112.18.1:
 - .1 Two handle brass deckmount faucet,
 - .2 3-hole 203mm (8"),
 - .3 Heavy Duty cast brass body, 203mm (8") swing spout with 360 degree rotation,
 - .4 Vandal resistant 5.7L/min (1.5gpm) aerator.
 - .3 NSF 61
 - .1 Lead Free compliant
 - .2 Accessories:
 - .1 Chrome plated 1.3 mm (17 gauge) brass P-trap with clean-out plug and arm with escutcheon,

- .2 Angle valve screwdriver stop,
- .3 Chrome-plated copper supplies.
- .6 SK-7: Stainless Steel, Counter Mount Barrier Free, Double Bowl, Two Handle Manual Faucet
 - .1 Manufacturer: Franke Commercial ALBD6406P-1
 - .1 Kindred
 - .2 Substitutions: Refer to Section 21 05 00.
 - .2 ASME A112.19.3:
 - .1 18-8 stainless steel sink, 18 gauge, satin finished bowl,
 - .2 Type 304 stainless steel,
 - .3 Faucet ledge, three hole, 8" centres
 - .4 Fully undercoated sink, self rimming,
 - .5 3-1/2" (89mm) basket strainer waste filling and installation kit.
 - .3 Trim:
 - [OR]
 - .4 Manufacturer: Delta Model 26C3134.
 - .1 Substitutions: Refer to Division 01.
 - .5 ASME A112.18.1/CSA B125.1:
 - .1 Two handle brass deckmount faucet,
 - .2 3-hole 203mm (8"),
 - .3 Heavy Duty cast brass body, 203mm (8") swing spout with 360 degree rotation,
 - .4 Vandal resistant 5.7L/min (1.5gpm) aerator.
 - .5 102mm (4") blade handles – ADA compliant
 - .6 Metal –color indexed
 - .7 Vandal resistant screws
 - .8 NSF 61
 - .9 Lead Free compliant
 - .6 Accessories:
 - .1 Chrome plated 1.3 mm (17 gauge) brass P-trap with clean-out plug and arm with escutcheon,
 - .2 Barrier Free Trap covers
 - .3 Angle valve screwdriver stop,
 - .4 Chrome-plated copper supplies.
- .7 SK-8: Stainless Steel, Kitchen Handwash, Wall Hung, Electronic Faucet
 - .1 Manufacturer: Franke WHB1617-7
 - .1 Substitutions: Refer to Section 21 05 00.
 - .2 ASME A112.19.3:
 - .1 18-8 type 304 Stainless steel wall hung kitchen handwash,
 - .2 Nominal dimension; 16-1/2"17" (419x432mm)
 - .3 Satin finished bowl,
 - .4 Grid strainer and one piece wall hanger bracket included,
 - .5 3 hole 1 1/4" (32mm) diameter, 4" (102mm) center set
 - .6 Angle valve screwdriver stop,
 - .7 Shroud (WT-RS) to cover the trap and water supplies.
 - .3 Lavatory Battery Sensor Faucet:
 - .1 Manufacturer: Delta 591LF-HGMHDF
 - .2 Other acceptable manufacturers offering equivalent products.

- .1 Substitutions: Refer to Section 21 05 00.
- .3 ASME A112.18.1:
 - .1 Hands free (touchless) on/off faucet,
 - .2 Spout mounted infrared sensor,
 - .3 7.05" long rigid spout,
 - .4 Vandal resistant 0.5 gpm (1.9 L/min) spray outlet,
 - .5 ADA compliant Hard Wire (24VAC) electronic handwash
 - .6 Supplied with open grid strainer, chrome finish
- .4 Accessories:
 - .1 Chrome plated 1.3 mm (17 gauge) brass P-trap with clean-out plug and arm with escutcheon.
 - .2 Angle valve screwdriver stop,
 - .3 Chrome-plated copper supplies.
- .5 Wall Mounted Carrier:
 - .1 Manufacturer: Mifab Model MC-41
 - .2 Other acceptable manufacturers offering equivalent products.
 - .1 Watts
 - .2 Zurn.
 - .3 Substitutions: Refer to Section 21 05 00.
 - .3 ASME A112.6.1:
 - .1 Cast iron and steel frame with two structural steel legs,
 - .2 Lugs for floor and wall attachment,
 - .3 Concealed arm supports,
 - .4 Bearing plate and studs.
 - .4
 - .1
- .8 WC-2: Barrier Free Water Closet, Floor Mounted, Electronic Flush Valve, Hardwired
 - .1 Manufacturer: Kohler Model K-96057.
 - .1 Other acceptable manufacturers offering equivalent products.
 - .1 American Standard.
 - .2 Contrac.
 - .3 Substitutions: Refer to Section 21 05 00.
 - .2 ASME A112.19.2 / CSA B45.1:
 - .1 Floor mounted, vitreous china closet bowl, with elongated rim,
 - .2 (1-1/2 inch) 38 mm top spud,
 - .3 China bolt caps.
 - .4 2-18" fully glazed trapway
 - .3 ADA / CSA B651:
 - .1 422mm (16-5/8 inch) high bowl.
 - .2 Exposed Sensor Operated Flush Valve (Hard Wired) – Barrier Free:
 - .1 Manufacturer: Delta Model 81T201HWA.
 - .1 Substitutions: Refer to Section 21 05 00.
 - .2 ASME A112.19.2 / CSA B45.1:

- .1 Exposed chrome plated, electronic infrared sensor flush valve
- .2 Chloramine resistant diaphragm with forged brass diaphragm retainer and renewable seat.
- .3 Distance measurement based on bowl length for activation setting. Field adjustable.
- .4 Integral screwdriver stop and vacuum breaker,
- .5 Metal non hold open over-ride button, ADA compliant
- .6 Pressure loss check angle stop with cap,
- .7 Factory set to 6 lpf (1.6 gpf) flush volume. Adjustable to 4.8lpf (1.28 gal). Confirmation of field adjustments by contractor to be provided to Contract Administrator.
- .8 Valve outlet tube 292 mm (11-1/2 inches) height
- .9 Complete with junction box and stainless steel cover plate.
- .10 120V to 24V transformer required.
 - .1 110 to 24VAC Class II 20VA ()
 - .2 Manufacturer: Delta Model 060704A
- .3 Seat:
 - .1 Manufacturer: Kohler K-4650
 - .2 Other acceptable manufacturers offering equivalent products.
 - .1 Bemis 1950SS.
 - .2 Substitutions: Refer to Section 21 05 00.
 - .3 Solid white plastic, open front with cover, extended back,
 - .4 Self-sustaining hinge, brass bolts,
 - .5 Sized for elongated bowl.
- .4 Back Rest:
 - .1 Manufacturer: Franke CM-16104.
 - .2 Other acceptable manufacturers offering equivalent products.
 - .1 Substitutions: Refer to Section 21 05 00.
 - .3 Stainless steel bar uses #4 gloss with flanges and covers.
 - .4 Antique white solid core plastic laminate 10"x4" panel back.
 - .5 Concealed snap flanges and mounting hardware included.
 - .6 Provide adequate backing in wall for support and comply to local codes for barrier free requirements.

2.2 Wash Fountains

- .1 Bowl:
 - .1 Manufacturer: Bradley Terreon model TDB3103.
 - .1 Substitutions: Refer to Section 21 05 00.
 - .2 Semi-circular shallow bowl washfountain, Terreon, 914mm (36") diameter bowl size, pedestal mounted, ADA compliant, backsplash.
 - .3 Off-line vent with supplies from above.
 - .4 Electronic infrared control valve, includes solenoid and low voltage plug-in adapter

- .5 Classic sprayhead
- .6 Tempered line
- .7 Strainer and check valves.

2.3 Electric Drinking Fountains

- .1 Combination Drinking Fountain & Bottle Filler:
 - .1 Manufacturer: Elkay Model: EZO8WSSK
 - .1 Substitutions: Refer to Section 21 05 00.
 - .2 Construction to: ASME A112.19.3/CSA B45.4, CSA C22.2, NSF 42, NSF 53, NSF 61, NSF 372, UL 399
 - .3 Unit shall provide 8.0 gph of 50°F water at 90°F ambient and 80°F inlet water.
 - .4 Bottle filling unit shall include an electronic sensor for no-touch activation with an automatic 30-second shut-off timer.
 - .5 Shall provide 1.1-1.5 gpm flow rate with laminar flow to minimize splashing.
 - .6 Shall include antimicrobial protected plastic components to prevent mold and mildew.
 - .7 Hands free operation
 - .8 Shall include the WaterSentry® Plus filter, certified to NSF/ANSI 42 and 53 for lead reduction, with visual monitor to indicate when replacement is necessary.
 - .9 Bottle Filling unit shall meet ADA guidelines for parallel approach.
 - .10 Cooler shall meet ADA guidelines for frontal or parallel approach.
 - .11 Motor Compressor: sealed, reciprocating type, 1/5HP, 115VAC, 60Hz single phase. Sealed-in lifetime oil supply.
 - .12 Condenser: Fan cooled, copper tube with aluminum fan motor is permanently lubricated.
 - .13 Cooling Unit: Combination tube-tank type. Tube portion is continuous coil of copper tubing. Tank is copper, tinned and insulated with EPS foam.
 - .14 Refrigerant Control: Refrigerant HFC-134a is controlled by accurately calibrated capillary tube for positively trouble-free operation.
 - .15 Temperature Control: Enclosed adjustable thermostat is factory preset. Requires no adjustment other than for altitude requirements.
 - .16 Complete with 3 pack replacement filter, and vandal resistant streamSaver bubbler.
 - .17 1-1/4" P-trap, SS braided supply with stops.
 - .18 Electrical: Maximum 370 W (1/5 hp) compressor,
 - .19 2 m (6 foot) cord and plug for connection to electric wiring system including grounding connector.

2.4 Emergency Eye Wash

- .1 EW-1:
 - .1 Manufacturer: Bradley Model S19224.
 - .2 Other acceptable manufacturers offering equivalent products.
 - .1 Substitutions: Not permitted.
- .2 ANSI/ISEA Z358.1:
 - .1 Wall-mounted eye wash with two GS plus spray heads, ABS plastic bowl, ½" IPS chrome-plated brass stay-open ball valve, epoxy coated cast aluminium flag handle, and aluminium wall bracket.

- .2 Each spray head to have removable ABS plastic spray cover, reticulated polyurethane filter, self-regulating flow control and integral "Flip-top" dust cover.
- .3 Eye-wash thermostatic mixing valve:
 - .1 Manufacturer: Bradley Model S19-2000 EF08.
 - .1 Substitutions: Refer to Section 21 05 00.
 - .2 ANSI Z358.1:
 - .1 Valve has flow rate of 0.5 to 6 gallons per minute (GPM).
 - .2 Valve has bimetallic thermostat that is preset at 85°F (29°C).
 - .3 High temperature limit stop is set to 90°F (32°C).
 - .4 Valve has thermometer on outlet to monitor delivered water temperature.
 - .5 Fail Safe: In the event of loss of hot water the internal bypass allows valve to deliver cold water to safety units. In event of loss of cold water, valve will close and not deliver water.
 - .6 Heavy duty mounting bracket. 1/2" nominal sweat female inlets with integral checkstops and strainers. 1/2" NPT threaded female outlet.
 - .7 Mounting: Unit is mounted in 18 gauge Type 304 stainless steel recessed housing. Cabinet has hinged door with lock.

Part 3 Execution

3.1 Examination

- .1 Verify that walls and floor finishes are prepared and ready for installation of fixtures.
- .2 Verify that electric power is available and of the correct characteristics.
- .3 Confirm that millwork is constructed with adequate provision for the installation of counter top lavatories and sinks.

3.2 Preparation

- .1 Rough-in fixture piping connections to minimum sizes indicated in fixture rough-in schedule for particular fixtures.

3.3 Installation

- .1 Install to manufacturer's instructions.
- .2 Install each fixture with trap, easily removable for servicing and cleaning.
- .3 Provide chrome plated rigid supplies to fixtures with screwdriver stops, reducers, and escutcheons. Install all exposed piping and valves neatly and close to the wall. Supplies should be run as plumb as possible.
- .4 Install components level and plumb.
- .5 All mixing valves serving multiple fixtures shall be installed in recessed cabinets.
- .6 Tempered domestic water pipe shall run fully concealed within plumbing chase and only penetrate wall directly inline with each faucet. There shall be one penetration per faucet. Domestic water pipe penetration shall be 200mm below counter height. Isolate each fixture with chrome plated stops. Exposed pipe shall be chrome plated copper.

- .7 Sanitary pipe serving lavatories shall run fully concealed within plumbing chase and only penetrate wall directly inline with each basin. No lateral offset will be permitted. There shall be one penetration per basin. All exposed sanitary pipe shall be chrome plated complete with echeloned plates at wall. Echeloned plate shall be secured to wall with silicone.
- .8 Install lavatory mixing valves neatly and out of site under millwork unless specified as installed in recessed cabinet. Secure with proper fasteners – galvanized strapping is not acceptable. Where provided on the drawings, refer to mixing valve installation details.
- .9 The temperature of water discharging into a bathtub or shower shall be set and tested by the contractor to not exceed 120°F (49°C).
- .10 Install and secure fixtures in place with wall supports or wall carriers (as specified in Part 2 Products) and bolt, washer, nut fasteners.
- .11 Seal fixtures to wall and floor surfaces with sealant as specified in Section 07 92 00, colour to match fixture.
- .12 Seal sinks and lavatories to the millwork. Install gasket where supplied or recommended by sink or lavatory manufacturer.
- .13 Solidly attach water closets to floor with lag screws. Lead flashing is not intended hold fixture in place.
- .14 Emergency shower / eye-wash stations should be installed so that shower head is at least 82" above floor and 32" from wall or nearest obstruction.
- .15 Thermally insulate and jacket all exposed drain pipe extensions, traps, and trap arms below barrier-free wall-hung lavatories.
- .16 Transformers serving electronic plumbing fixtures shall be supplied by this section. Coordinate installation with electrical trades. Low voltage wiring by this section. Contractor is responsible for coordinating quantity of transformers required. Transformers shall be installed in nearest fully accessible ceiling space unless noted otherwise on drawings. Coordinate exact location with The City.

3.4 Interface With Other Products

- .1 Review millwork shop drawings. Confirm location and size of fixtures and openings before rough-in and installation.

3.5 Adjusting

- .1 Adjust stops or valves for intended water flow rate to fixtures without splashing, noise, or overflow.
- .2 Adjust stops or valves to comply with specified flow rates.
- .3 Adjust sensor ranges to allow consistent operation of fixtures.

3.6 Cleaning

- .1 Clean plumbing fixtures and equipment.

3.7 Protection Of Finished Work

- .1 Section 01 78 40: Protecting installed work.

.2 Do not permit use of fixtures.

END OF SECTION

Part 1

General

1.1 Section Includes

- .1 Pumps.
 - .1 Sump Pumps.

1.2 Related Sections

- .1 Section 26 05 80 - Equipment Wiring: Electrical characteristics and wiring connections.

1.3 References

- .1 ASHRAE 90A - Energy Conservation in New Building Design.
- .2 ASME Section 8D - Boilers and Pressure Vessel Codes - Rules for Construction of Pressure Vessels.
- .3 CSA B51-03 - Boiler, Pressure Vessel, and Pressure Piping Code.
- .4 NFPA 30 - Flammable and Combustible Liquids Code, 2008 Edition.
- .5 NFPA 54 - National Fuel Gas Code, 2006 Edition.
- .6 NFPA 58 - Liquefied Petroleum Gas Code, 2008 Edition.
- .7 UL 1453 - Electric Booster and Commercial Storage Tank Water Heaters.
- .8 UL 174 - Household Electric Storage Tank Water Heaters.
- .9 CSA B64 Definitions, General Requirements, and Test Methods for Vacuum Breakers and Backflow Preventers
- .10 CAN/CSA-C191 - Performance of Electric Storage Tank Water Heaters for Domestic Hot Water Service.
- .11 ANSI Z21.10.3/CSA 4.3 - Gas water heaters - Volume III, Storage water heaters with input ratings above 75,000 Btu per hour, circulating and instantaneous

1.4 Submittals For Review

- .1 Section 21 05 00: Submission procedures.
- .2 Product Data:
 - .1 Provide dimension drawings of water heaters indicating components and connections to other equipment and piping.
 - .2 Indicate pump type, capacity, power requirements.
 - .3 Provide certified pump curves showing pump performance characteristics with pump and system operating point plotted. Include NPSH curve when applicable.
 - .4 Provide electrical characteristics and connection requirements.
- .3 Shop Drawings:
 - .1 Indicate heat exchanger dimensions, size of tappings, and performance data.
 - .2 Indicate dimensions of tanks, tank lining methods, anchors, attachments, lifting points, tappings, and drains.

1.5 Closeout Submittals

- .1 Section 21 05 00: Submission procedures.

- .2 Record Documentation: Record actual locations of components and electrical power supply.
- .3 Operation and Maintenance Data: Include operation, maintenance, and inspection data, replacement part numbers and availability, and service depot location and telephone number.
- .4 Warranty Documentation: Submit manufacturer warranty and ensure forms have been completed in The City's name and registered with manufacturer.

1.6 Quality Assurance

- .1 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three (3) years experience.
- .2 Provide pumps with manufacturer's name, model number, and rating/capacity identified.
- .3 Ensure products and installation of specified products are to recommendations and requirements of the following organizations:
 - .1 American Gas Association (AGA).
 - .2 National Sanitation Foundation (NSF).
 - .3 American Society of Mechanical Engineers (ASME).
 - .4 National Board of Boiler and Pressure Vessel Inspectors (NBBPVI).
 - .5 National Electrical Manufacturers' Association (NEMA).
 - .6 Underwriters Laboratories (UL).
- .4 Ensure pumps operate at specified system fluid temperatures without vapour binding and cavitation, are non-overloading in parallel or individual operation, operate within 25 percent of midpoint of published maximum efficiency curve.

1.7 Regulatory Requirements

- .1 Conform to CGA / AGS requirements for water heaters.
- .2 Conform to ASME Section 8D for manufacture of pressure vessels for heat exchangers.
- .3 Conform to ASME Section 8D for tanks.
- .4 Products Requiring Electrical Connection: Listed and classified by testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

1.8 Delivery, Storage, And Protection

- .1 Section 21 05 00: Transport, handle, store, and protect products.
- .2 Provide temporary inlet and outlet caps. Maintain caps in place until installation.

1.9 Warranty

- .1 Section 21 05 00: Warranties.
- .2 Provide a five (5) year warranty to include coverage for failure to meet specified requirements, for domestic water heaters, water storage tanks, and packaged water heating systems.

Part 2 Products

- .1

2.2 Submersible Sump Pumps

- .1 Manufacturers:
 - .1 Little Giant WS50HM Series.
 - .2 Liberty
 - .3 ITT / Goulds.
 - .4 Barnes.
 - .5 Substitutions: Refer to Section 21 05 00.
- .2 Type: Completely submersible, vertical, centrifugal.
- .3 Motor: thermal overload protected, stainless-steel heat-treated shaft, continuous duty oil-free motor, permanently lubricated lip seal.
- .4 Casing: Cast iron pump body.
- .5 Impeller: Glass-reinforced thermoplastic, stainless-steel heat-treated shaft.
- .6 Solids handling capability: 1/2".
- .7 Bearings: Ball bearings.
- .8 Accessories: Oil resistant 3 m (10 foot) cord and plug with three-prong connector for connection to electric wiring system.
- .9 Controls: Automatic, mercury-free mechanical float switch with separate liquid level control high level alarm.
- .10 Controls:
 - .1 Duplex Alarm System & Pump Control – (Little Giant)
 - .2 Controls the pump and warns of high liquid levels
 - .3 NEMA 4X ultraviolet stabilized thermoplastic enclosure
 - .4 HOA switch allows for "Hand" (manual) "Off" or "Automatic" operation
 - .5 Control/Alarm ON/OFF switch controls power to the control float and circuitry; this and the pump HOA switch provide an additional safety feature when servicing
 - .6 Entire unit UL listed and tested by UL to CSA standards
 - .7 Two sensor floats and an alarm float included
 - .8 Designed to operate with or without optional fourth
 - .9 83-85db audible alarm buzzer
- .11 Performance:
 - .1 Refer to schedule.
 - .2

Part 3 Execution

3.1 Installation

- .1 Install water heaters to manufacturer's instructions and to local regulations and requirements.
- .2 Coordinate with plumbing piping and related fuel piping, gas venting, and electrical work to achieve operating system.
- .3 Pumps:

-
- .1 Ensure shaft length allows sump pumps to be located minimum 600 mm (24 inches) below lowest invert into sump pit and minimum (150 mm 6 inches) clearance from bottom of sump pit.
 - .2 Provide air cock and drain connection on horizontal pump casings.
 - .3 Provide line sized isolating valve and strainer on suction and line sized soft seated check valve and balancing valve on discharge.
 - .4 Decrease from line size with long radius reducing elbows or reducers.
 - .5 Support piping adjacent to pump such that no weight is carried on pump casings.
 - .6 Provide supports under elbows on pump suction and discharge line sizes 100 mm (4 inches) and over.
 - .7 Ensure pumps operate at specified system fluid temperatures without vapour binding and cavitation, are non-overloading in parallel or individual operation, and operate within 25 percent of midpoint of published maximum efficiency curve.
 - .8 Align and verify alignment of base mounted pumps prior to start-up.
 - .9 Oil sensing probes to be tested for proof of activation during installation.

END OF SECTION

Part 1

General

1.1

Section Includes

- .1 Single phase electric motors.
- .2 Three phase electric motors.

1.2

Related Sections

- .1 Section 21 05 00 – Submittal Procedures.
- .2 Section 21 05 00 - Product Requirements.
- .3 Section 21 05 00 - Closeout Submittals.
- .4 Section 26 05 80 - Equipment Wiring: Electrical characteristics and wiring connections.

1.3

References

- .1 AFBMA 9 - Load Ratings and Fatigue Life for Ball Bearings.
- .2 AFBMA 11 - Load Ratings and Fatigue Life for Roller Bearings.
- .3 IEEE 112 - Test Procedure for Polyphase Induction Motors and Generators.
- .4 NEMA MG 1 - Motors and Generators.

1.4

Submittals

- .1 Section 21 05 00: Procedures for submittals.
- .2 Product Data: Provide wiring diagrams with electrical characteristics and connection requirements.
- .3 Test Reports: Indicate test results verifying nominal efficiency and power factor for three phase motors larger than 15 Kw (20 horsepower).
- .4 Manufacturer's Installation Instructions: Indicate setting, mechanical connections, lubrication, and wiring instructions.

1.5

Operation And Maintenance Data

- .1 Section 21 05 00: Submittals for project closeout.
- .2 Operation Data: Include instructions for safe operating procedures.
- .3 Maintenance Data: Include assembly drawings, bearing data including replacement sizes, and lubrication instructions.

1.6

Qualifications

- .1 Manufacturer: Company specializing in manufacture of electric motors and their accessories, with minimum three years documented product development, testing, and manufacturing experience.

1.7

Regulatory Requirements

- .1 Conform to applicable electrical code.

- .2 Products Requiring Electrical Connection: Listed and classified by testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

1.8 Delivery, Storage, And Handling

- .1 Section 21 05 00: Transport, handle, store, and protect products.
- .2 Protect motors stored on site from weather and moisture by maintaining factory covers and suitable weather-proof covering. For extended outdoor storage, remove motors from equipment and store separately.

1.9 Warranty

- .1 Section 21 05 00: Submittals for project closeout.
- .2 Provide three year warranty.
- .3 Warranty: Include coverage for motors larger than 20 horsepower.

Part 2 Products

2.1 MANUFACTURERS

- .1 Baldor.
- .2 Toshiba.
- .3 WEG
- .4 Substitutions: Refer to Section 21 05 00.

2.2 GENERAL CONSTRUCTION AND REQUIREMENTS

- .1 Motors less than 250 Watts, for intermittent service: Equipment manufacturer's standard and need not conform to these specifications.
- .2 Electrical Service:
 - .1 The following are required electrical characteristics unless otherwise indicated in the drawings and schedules.
 - .2 Motors 0.5 kW (3/4 hp) and smaller: 115 volts, single phase, 60 Hz.
 - .3 Motors Larger than 0.5 kW (3/4 hp): 575 volts, three phase, 60 Hz.
 - .4 Motors Larger than 0.5 kW (3/4 hp): 208 volts, three phase, 60 Hz.
 - .5 Motors Larger than 0.5 kW (3/4 hp): 208 volts, single phase, 60 Hz.
- .3 Type:
 - .1 Open drip-proof except where specifically noted otherwise.
 - .2 Motors: Design for continuous operation in 40 degrees C environment.
 - .3 Design for temperature rise to NEMA MG 1 limits for insulation class, service factor, and motor enclosure type.
 - .4 Motors with frame sizes 254T and larger: Energy Efficient Type.
- .4 Explosion-Proof Motors: UL approved and labelled for hazard classification, with over temperature protection.
- .5 Visible Nameplate: Indicating motor horsepower, voltage, phase, cycles, RPM, full load amps, locked rotor amps, frame size, manufacturer's name and model number, service factor, power factor, efficiency.
- .6 Wiring Terminations:

- .1 Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclose terminal lugs in terminal box sized to code, threaded for conduit.
- .2 For fractional horsepower motors where connection is made directly, provide conduit connection in end frame.

2.3 Single Phase Power - Split Phase Motors

- .1 Starting Torque: Less than 150 percent of full load torque.
- .2 Starting Current: Up to seven times full load current.
- .3 Breakdown Torque: Approximately 200 percent of full load torque.
- .4 Drip-proof Enclosure: Class A (50 degrees C temperature rise) insulation, NEMA Service Factor, prelubricated sleeve or ball bearings.
- .5 Enclosed Motors: Class A (50 degrees C temperature rise) insulation, 1.0 Service Factor, prelubricated ball bearings.

2.4 Single Phase Power - Permanent-split Capacitor Motors

- .1 Starting Torque: Exceeding one fourth of full load torque.
- .2 Starting Current: Up to six times full load current.
- .3 Multiple Speed: Through tapped windings.
- .4 Open Drip-proof or Enclosed Air Over Enclosure: Class A (50 degrees C temperature rise) insulation, minimum 1.0 Service Factor, prelubricated sleeve or ball bearings, automatic reset overload protector.

2.5 Single Phase Power - Capacitor Start Motors

- .1 Starting Torque: Three times full load torque.
- .2 Starting Current: Less than five times full load current.
- .3 Pull-up Torque: Up to 350 percent of full load torque.
- .4 Breakdown Torque: Approximately 250 percent of full load torque.
- .5 Motors: Capacitor in series with starting winding; provide capacitor-start/capacitor-run motors with two capacitors in parallel with run capacitor remaining in circuit at operating speeds.
- .6 Drip-proof Enclosure: Class A (50 degrees C temperature rise) insulation, NEMA Service Factor, prelubricated bearings.
- .7 Enclosed Motors: Class A (50 degrees C temperature rise) insulation, 1.0 Service Factor, pre-lubricated ball bearings.

2.6 Single Phase Power – Electronic Commutated Motors (ecm)

- .1 Motor to be a DC electronic commutation type motor (ECM) specifically designed for fan applications.
- .2 Permanently lubricated with ball bearings.
- .3 Motor shall be a minimum of 85% efficient.

- .4 Internal motor circuitry shall convert AC power supplied to the fan to DC power.
- .5 Motor shall be speed controllable down to 20% of full speed.
- .6 Speed shall be controlled by either a potentiometer dial mounted at the motor or by a 0-10 VDC signal.

2.7 Three Phase Power - Squirrel Cage Motors

- .1 Starting Torque: Between 1 and 1-1/2 times full load torque.
- .2 Starting Current: Six times full load current.
- .3 Power Output, Locked Rotor Torque, Breakdown or Pull Out Torque: NEMA Design B characteristics.
- .4 Design, Construction, Testing, and Performance: Conform to NEMA MG 1 for Design B motors.
- .5 Insulation System: NEMA Class B or better.
- .6 Testing Procedure: To IEEE 112. Load test motors to determine free from electrical or mechanical defects in compliance with performance data.
- .7 Motor Frames: NEMA Standard T-Frames of steel, aluminum, or cast iron with end brackets of cast iron or aluminum with steel inserts.
- .8 Thermistor System (Motor Frame Sizes 254T and Larger): Three PTC thermistors imbedded in motor windings and epoxy encapsulated solid state control relay for wiring into motor starter; refer to Section 25 50 03 - Variable Frequency Controllers.
- .9 Bearings: Grease lubricated anti-friction ball bearings with housings equipped with plugged provision for relubrication, rated for minimum AFBMA 9, L-10 life of 20,000 hours. Calculate bearing load with NEMA minimum V-belt pulley with belt centre line at end of NEMA standard shaft extension. Stamp bearing sizes on nameplate.
- .10 Sound Power Levels: To NEMA MG 1.
- .11 Part Winding Start where indicated: Use part of winding to reduce locked rotor starting current to approximately 60 percent of full winding locked rotor current while providing approximately 50 percent of full winding locked rotor torque.
- .12 Weatherproof Epoxy Sealed Motors: Epoxy seal windings using vacuum and pressure with rotor and starter surfaces protected with epoxy enamel; bearings double shielded with waterproof non-washing grease.
- .13 Nominal Efficiency: As scheduled at full load and rated voltage when tested to IEEE 112.
- .14 Nominal Power Factor: As scheduled at full load and rated voltage when tested to IEEE 112.

2.8 MOTORS CONTROLLED BY VARIABLE FREQUENCY DRIVES

- .1 Motors controlled by variable frequency drives (VFDs) shall comply with requirements of CSA Specification C22.2 No. 100-95, Clause 12.4 and shall be permanently marked with the following in addition to the normal marking requirements:
 - .1 Machine Application (Inverter Duty);
 - .2 Speed range over which the machine is designed to operate;

- .3 Type of torque application for which the machine is designed (eg. VT (variable torque), CT (constant torque), Chp (constant horsepower) or equivalent);
- .4 Type(s) of inverter(s) with which the machine is intended to be used (eg.: VSI or VVI (6-step voltage source), CSI (6-step current source), VPWM (voltage-source pulse width modulated), LCI (load commutated), cyclonverter, or equivalent).

Part 3 Execution

3.1 Application

- .1 Single phase motors for shaft mounted fans, oil burners, centrifugal pumps: Split phase type.
- .2 Single phase motors for shaft mounted fans or blowers: Permanent split capacitor type.
- .3 Single phase motors for [fans], [pumps] [blowers] [air compressors]: Capacitor start type.
- .4 Single phase motors for [fans] [blowers] [pumps]: Capacitor start, capacitor run type.
- .5 Motors located in exterior locations, wet air streams downstream of sprayed coil dehumidifiers, draw through cooling towers, air cooled condensers, humidifiers, direct drive axial fans, roll filters, explosion proof environments, dust collection systems, [_____]: Totally enclosed type.
- .6 Motors located in outdoors, wet air streams downstream of sprayed coil dehumidifiers, draw thru cooling towers, humidifiers, [_____]: Totally enclosed weatherproof epoxy-treated type.
- .7 Motors located in outdoors, draw thru cooling towers, [_____]: Totally enclosed weatherproof epoxy-sealed type.

3.2 Installation

- .1 Install to manufacturer's written instructions.
- .2 Install securely on firm foundation. Mount ball bearing motors with shaft in any position.
- .3 Check line voltage and phase and ensure agreement with nameplate.

3.3 NEMA OPEN MOTOR SERVICE FACTOR SCHEDULE

	kW (HP)	3600 RPM	1800 RPM	1200RPM	900RPM
	0.12-0.25(1/6-1/3)	1.35	1.35	1.35	1.35
	0.38(1/2)	1.25	1.25	1.25	1.15
	0.5(3/4)	1.25	1.25	1.15	1.15
	0.75(1)	1.25	1.15	1.15	1.15
	1.1-111(1.5-150)	1.15	1.15	1.15	1.15

3.4 PERFORMANCE SCHEDULE: THREE PHASE - ENERGY EFFICIENT, OPEN DRIP-PROOF

	kW (HP)	RPM (Syn)	NEMA Frame	Minimum Percent Efficiency	Minimum Percent Power Factor
	0.75(1)	1200	145T	81	72
	1.1(1-1/2)	1200	182T	83	73

	kW (HP)	RPM (Syn)	NEMA Frame	Minimum Percent Efficiency	Minimum Percent Power Factor
	1.5(2)	1200	184T	85	75
	2.25(3)	1200	213T	86	60
	3.7(5)	1200	215T	87	65
	5.6(7-1/2)	1200	254T	89	73
	7.5(10)	1200	256T	89	74
	11(15)	1200	284T	90	77
	15(20)	1200	286T	90	78
	18(25)	1200	324T	91	74
	22.5(30)	1200	326T	91	78
	30(40)	1200	364T	93	77
	37(50)	1200	365T	93	79
	45(60)	1200	404T	93	82
	56(75)	1200	405T	93	80
	75(100)	1200	444T	93	80
	93(125)	1200	444T	93	84
	0.75(1)	1800	143T	82	84
	1.1(1-1/2)	1800	145T	84	85
	1.5(2)	1800	145T	84	85
	2.25(3)	1800	182T	86	86
	3.7(5)	1800	184T	87	87
	5.6(7-1/2)	1800	213T	88	86
	7.5(10)	1800	215T	89	85
	11(15)	1800	256T	91	85
	15(20)	1800	256T	91	86
	18(25)	1800	284T	91	85
	22.5(30)	1800	286T	92	88
	30(40)	1800	324T	92	83
	37(50)	1800	326T	93	85
	45(60)	1800	364T	93	88
	56(75)	1800	365T	93	88
	75(100)	1800	404T	93	83
	93(125)	1800	405T	93	86
	112(150)	1800	444T	93	85
	150(200)	1800	445T	94	85
	1.1(1-1/2)	3600	143T	82	85

	kW (HP)	RPM (Syn)	NEMA Frame	Minimum Percent Efficiency	Minimum Percent Power Factor
	1.5(2)	3600	145T	82	87
	2.25(3)	3600	145T	84	85
	3.7(5)	3600	182T	85	86
	5.6(7-1/2)	3600	184T	86	88
	7.5(10)	3600	213T	87	86
	11(15)	3600	215T	89	89
	15(20)	3600	254T	90	92
	18(25)	3600	256T	90	92
	22.5(30)	3600	284T	91	91
	30(40)	3600	286T	92	92
	37(50)	3600	324T	93	89
	45(60)	3600	326T	93	91
	56(75)	3600	364T	93	88
	75(100)	3600	365T	92	88

3.5 Performance Schedule: Three Phase-energy Efficient, Totally Enclosed, Fan Cooled

	kW(HP)	RPM(Syn)	NEMA Frame	Minimum Percent Efficiency	Minimum Percent Power Factor
	0.75(1)	1200	145T	81	72
	1.1(1-1/2)	1200	182T	83	65
	1.5(2)	1200	184T	85	68
	2.25(3)	1200	213T	85	63
	3.7(5)	1200	215T	86	66
	5.6(7-1/2)	1200	254T	89	68
	7.5(10)	1200	256T	89	75
	11(15)	1200	284T	90	72
	15(20)	1200	286T	90	76
	18(25)	1200	324T	90	71
	22.5(30)	1200	326T	91	79
	30(40)	1200	364T	92	78
	37(50)	1200	365T	92	81
	45(60)	1200	404T	92	83
	56(75)	1200	405T	92	80
	75(100)	1200	444T	93	83
	93(125)	1200	445T	93	85
	0.75(1)	1800	143T	82	84
	1.1(1-1/2)	1800	145T	84	85
	1.5(2)	1800	145T	84	85

	kW(HP)	RPM(Syn)	NEMA Frame	Minimum Percent Efficiency	Minimum Percent Power Factor
	2.25(3)	1800	182T	87	83
	3.7(5)	1800	184T	88	83
	5.6(7-1/2)	1800	213T	89	85
	7.5(10)	1800	215T	90	84
	11(15)	1800	254T	91	86
	15(20)	1800	256T	91	85
	18(25)	1800	284T	92	84
	22.5(30)	1800	286T	93	86
	30(40)	1800	324T	93	83
	37(50)	1800	326T	93	85
	45(60)	1800	364T	93	87
	56(75)	1800	365T	93	87
	75(100)	1800	405T	94	86
	93(125)	1800	444T	94	87
	112(150)	1800	445T	94	88
	150(200)	1800	447T	95	87
	1.1(1-1/2)	3600	143T	82	85
	1.5(2)	3600	145T	82	87
	2.25(3)	3600	182T	82	87
	3.7(5)	3600	184T	85	88
	5.6(7-1/2)	3600	213T	86	86
	7.5(10)	3600	215T	86	86
	11(15)	3600	254T	88	91
	15(20)	3600	256T	89	89
	18(25)	3600	284T	90	92
	22.5(30)	3600	286T	91	92
	30(40)	3600	324T	91	91
	37(50)	3600	326T	90	92
	45(60)	3600	364T	91	93
	56(75)	3600	365T	91	91
	75(100)	3600	405T	92	92

END OF SECTION

Part 1

General

1.1

Section Includes

- .1 Flexible pipe connectors.
- .2 Expansion joints and compensators.
- .3 Pipe loops, offsets, and swing joints.

1.2

Related Sections

- .1 Section 21 11 00 - Fire Protection Piping.
- .2 Section 22 10 00 - Plumbing Piping.
- .3 Section 23 21 00 - Hydronic Piping.

1.3

References

- .1 MIL-E-17814E - Expansion Joints, Pipe, Slip-Type, Packed.

1.4

Performance Requirements

- .1 Provide structural work and equipment required to control expansion and contraction of piping. Verify that anchors, guides, and expansion joints provided, adequately protect system.
- .2 Expansion Calculations:
 - .1 Installation Temperature (hot water heating, domestic hot water): 10 degrees C (50 degrees F).
 - .2 Hot Water Heating: 99 degrees C (210 degrees F).
 - .3 Domestic Hot Water: 60 degrees C (140 degrees F).
 - .4 Installation Temperature (chilled water): 27 degrees C (80 degrees F).
 - .5 Chilled Water: 7 degrees C (45 degrees F).
 - .6 Safety Factor: 30 percent.

1.5

Submittals

- .1 Section 21 05 00: Procedures for submittals.
- .2 Product Data:
 - .1 Flexible Pipe Connectors: Indicate maximum temperature and pressure rating, face-to-face length, live length, hose wall thickness, hose convolutions per metre(foot) and per assembly, fundamental frequency of assembly, braid structure, and total number of wires in braid.
 - .2 Expansion Joints: Indicate maximum temperature and pressure rating, and maximum expansion compensation.
- .3 Design Data:
 - .1 Indicate selection calculations.
 - .2 Provide steam piping layout from connection to central plant supply to building entry with measurements including location and size of expansion loops and anchors based on site conditions.
 - .3 Provide piping layout with measurements including location and size of expansion loops and anchors based on site conditions.

- .4 Manufacturer's Installation Instructions: Indicate special procedures, and external controls.

1.6 Project Record Documents

- .1 Section 21 05 00: Submittals for project closeout.
- .2 Record actual locations of flexible pipe connectors, expansion joints, anchors, and guides.

1.7 Operation And Maintenance Data

- .1 Section 21 05 00: Submittals for project closeout.
- .2 Maintenance Data: Include adjustment instructions.

1.8 Qualifications

- .1 Manufacturer: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- .2

1.9 Delivery, Storage, And Handling

- .1 Section 21 05 00: Transport, handle, store, and protect products.
- .2 Accept expansion joints on site in factory packing with shipping bars and positioning devices intact. Inspect for damage.
- .3 Protect equipment from exposure by leaving factory coverings, pipe end protection, and packaging in place until installation.

1.10 Warranty

- .1 Warranty: Include coverage for leak free performance of packed expansion joints.

1.11 Extra Materials

- .1 Section 21 05 00: Submittals for project closeout.
- .2 Provide two 340 gm (12 ounce) containers of packing lubricant and cartridge style grease gun.

Part 2 Products

2.1

2.2 Flexible Pipe Connectors

- .1 Steel Piping:
 - .1 Manufacturers:
 - .1 HYSPAN.
 - .2 Substitutions: Refer to Section 21 05 00
 - .2 Inner Hose: Stainless Steel.
 - .3 Exterior Sleeve: Double braided stainless steel.
 - .4 Pressure Rating: [862 kPa (125 psig) WSP and 204 degrees C (400 degrees F)] [1380 kPa (200 psi) WOG and 121 degrees C (250 degrees F)].

- .5 Joint: As specified for pipe joints.
- .6 Size: Use pipe sized units.
- .7 Maximum offset: 20 mm (3/4 inch) on each side of installed centre line.
- .2 Copper Piping – domestic water services up to and including 50 mm (2"):
 - .1 Manufacturers:
 - .1 Hydro Flex Inc.
 - .2 HYSPAN.
 - .3 Substitutions: Refer to Section 21 05 00.
 - .2 Inner Hose: Bronze
 - .3 Exterior Sleeve: Single braided bronze.
 - .4 Pressure Rating: [862 kPa (125 psig) WSP and 204 degrees C (400 degrees F)] [1380 kPa (200 psi) WOG and 121 degrees C (250 degrees F)].
 - .5 Joint: As specified for pipe joints.
 - .6 Size: Use pipe sized units
 - .7 Maximum offset: 20 mm (3/4 inch) on each side of installed centre line.
- .3 Copper Piping – domestic water services up over 50 mm (2"):
 - .1 Manufacturers:
 - .1 Hydro Flex Inc.
 - .2 Substitutions: Refer to Section 21 05 00.
 - .2 Inner Hose: Bronze
 - .3 Exterior Sleeve: Single braided stainless steel with Van Stone floating flanges and stainless steel sleeve at all wetted areas.
 - .4 Pressure Rating: [862 kPa (125 psig) WSP and 204 degrees C (400 degrees F)] [1380 kPa (200 psi) WOG and 121 degrees C (250 degrees F)].
 - .5 Joint: flanged.
 - .6 Size: Use pipe sized units
 - .7 Maximum offset: 20 mm (3/4 inch) on each side of installed centre line.
- .4 Copper Piping – heating water, chilled water, and condenser water up to and including 50 mm (2"):
 - .1 Manufacturers:
 - .1 Hydro Flex.
 - .2 Substitutions: Refer to Section 21 05 00.
 - .2 Inner Hose: 300 series stainless steel.
 - .3 Exterior Sleeve: Braided stainless steel.
 - .4 Pressure Rating: [862 kPa (125 psig) WSP and 204 degrees C (400 degrees F)] [1380 kPa (200 psi) WOG and 121 degrees C (250 degrees F)].
 - .5 Joint: threaded male ends.
 - .6 Size: Use pipe sized units
 - .7 Maximum offset: 20 mm (3/4 inch) on each side of installed centre line.
- .5 Copper Piping – heating water, chilled water, and condenser water up to over 50 mm (2"):
 - .1 Manufacturers:
 - .1 Model G-FLEX.
 - .2 Substitutions: Refer to Section 21 05 00.
 - .1 neoprene and nylon body, cadmium steel flanges, spring wire beading. Where excess vibration and noise is encountered use Model GD-FLEX double sphere.
 - .2 Pressure Rating: [862 kPa (125 psig) WSP and 204 degrees C (400 degrees F)] [1380 kPa (200 psi) WOG and 121 degrees C (250 degrees F)].

- .3 Joint: As specified for pipe joints.
- .4 Size: Use pipe sized units
- .5 Maximum offset: 20 mm (3/4 inch) on each side of installed centre line.

2.3 Expansion Joints

- .1 Stainless Steel Bellows Type:
 - .1 Manufacturers:
 - .1 HYSPAN Model 8503
 - .2 Flextronics.
 - .3 Substitutions: Refer to Section 21 05 00.
 - .2 Pressure Rating: [862 kPa (125 psig) WSP and 204 degrees C (400 degrees F)] [1380 kPa (200 psig) WOG and 121 degrees C (250 degrees F)].
 - .3 Maximum Compression: 45 mm (1-3/4 inch).
 - .4 Maximum Extension: 6 mm (1/4 inch).
 - .5 Joint: As specified for pipe joints.
 - .6 Size: Use pipe sized units.
 - .7 Application: Steel piping 75 mm (3 inch) and under.
- .2 External Ring Controlled Stainless Steel Bellows Type:
 - .1 Manufacturers:
 - .1 HYSPAN Model 3500 series.
 - .2 Flextronics.
 - .3 Substitutions: Refer to Section 21 05 00.
 - .2 Pressure Rating: [862 kPa (125 psig) WSP and 204 degrees C (400 degrees F)] [1380 kPa (200 psig) WOG and 121 degrees C (250 degrees F)] [1550 kPa (225 psig) and 21 degrees C (70 degrees F)].
 - .3 Maximum Compression: 24 mm (15/16 inch) [32 mm(1-1/4 inch)].
 - .4 Maximum Extension: 8 mm (5/16 inch) [10 mm(3/8 inch)].
 - .5 Maximum Offset: 3 mm (1/8 inch) [8 mm(5/16 inch)] [[_____] mm([_____] inch)].
 - .6 Joint: Flanged.
 - .7 Size: Use pipe sized units.
 - .8 Accessories: Internal flow liner. Externally guided.
 - .9 Application: Steel piping over 75 mm (3 inch).
- .3 Low Pressure Compensator for Wall Fin Elements and Baseboard:
 - .1 Manufacturers:
 - .1 HYSPAN Model 8501.
 - .2 Substitutions: Refer to Section 21 05 00.
 - .2 Working Pressure: 550 kPa (80 psig).
 - .3 Maximum Temperatures: 121 degrees C (250 degrees F).
 - .4 Maximum Compression: 12.7 mm (1/2 inch).
 - .5 Maximum Extension: 4.0 mm (5/32 inch).
 - .6 Joint: Soldered
 - .7 Size: Use pipe sized units
 - .8 Application: Copper or steel piping 50 mm (2 inch) and under.
- .4 Pipe Alignment Guides:
 - .1 Manufacturers:
 - .1 Anvil.
 - .2 HYSPAN.

- .3 Substitutions: Refer to Section 21 05 00.
- .2 Two piece welded steel with enamel paint, bolted, with spider to fit standard pipe, frame with four mounting holes, clearance for minimum 25 mm (1 inch) thick insulation, minimum 75 mm (3 inch) travel.

Part 3 Execution

3.1 Installation

- .1 Provide support and equipment required to control expansion and contraction of piping. Provide loops, pipe offsets, and swing joints, or expansion joints where required and where indicated on the drawings.
- .2 If not otherwise indicated on the drawings 1200 mm x 1200 mm (4' x 4') expansion loops shall be installed on all copper hot water heating piping having a straight run in excess of 12 m (40'). The expansion loop shall be centred in the straight run, with alignment guides on each side of the loop and anchors at the extreme ends of the pipe run. Similar loops shall be installed on straight runs of steel steam, condensate and hot water piping which exceeds 18 m (60') in length.
- .3 Follow Manufacturer's written instructions in regard to proper length, anchoring and guiding, pre-compression, removal of spacers, and testing.
- .4 When expansion joints are installed at ambient temperatures higher than minimum system operating temperature, they shall be precompressed prior to installation, to allow for eventual contraction of piping.
- .5 Construct spool pieces to exact size of flexible connection for future insertion.
- .6 Install flexible pipe connectors on pipes connected to equipment supported by vibration isolation. Provide line size flexible connectors.
- .7 Install flexible connectors at right angles to displacement. Install one end immediately adjacent to isolated equipment and anchor other end. Install in horizontal plane unless indicated otherwise.
- .8 Rigidly anchor pipe to building structure where necessary. Provide pipe guides so movement is directed along axis of pipe only. Erect piping such that strain and weight is not on cast connections or apparatus.
- .9 Provide victaulic piping with minimum one joint per 25 mm (1 inch) pipe diameter instead of flexible connector supported by vibration isolation. Victaulic piping need not be anchored.

3.2 Manufacturer's Field Services

- .1 Provide inspection services by flexible pipe manufacturer's representative for final installing and certify installation is to manufacturer's recommendations and connectors are performing satisfactorily.

END OF SECTION

Part 1

General

1.1

Section Includes

- .1 Positive displacement meters.
- .2 Flow meters.
- .3 Pressure gauges and pressure gauge taps.
- .4 Thermometers and thermometer wells.
- .5 Static pressure gauges.
- .6 Filter gauges.

1.2

Related Sections

- .1 Section 25 50 02 - Digital Control Equipment.
- .2 Section 25 90 00 - Sequence Of Operation.
- .3 Section 23 21 00 - Hydronic Piping: Installation of thermometer wells and pressure gauge tappings.

1.3

References

- .1 ASME B40.100 - Pressure Gauges and Gauge Attachments.
- .2 ASME MFC-3M - Measurement of Fluid Flow in Pipes Using Orifice, Nozzle and Venturi.
- .3 ASTM E1 - Specification for ASTM Thermometers.
- .4 ASTM E77 - Inspection and Verification of Thermometers.
- .5 AWWA C700 - Cold Water Meters - Displacement Type, Bronze Main Case.
- .6 AWWA C701 - Cold Water Meters - Turbine Type, for Customer Service.
- .7 AWWA C702 - Cold Water Meters - Compound Type.
- .8 AWWA C706 - Direct-Reading, Remote Registration System for Cold-Water Meters.
- .9 AWWA M6 - Water Meters - Selection, Installation, Testing, and Maintenance.
- .10 ISA RP 3.2 - Flange Mounted Sharp Edged Orifice Plates for Flow Measurement.
- .11 UL 393 - Indicating Pressure Gauges for Fire-Protection Services.
- .12 UL 404 - Gauges, Indicating Pressure, for Compressed Gas Service.

1.4

Submittals For Review

- .1 Section 21 05 00: Procedures for submittals.
- .2 Product Data: Provide list which indicates use, operating range, total range and location for manufactured components.

1.5

Submittals At Project Closeout

- .1 Section 21 05 00: Submittals for project closeout.

- .2 Project Record Documents: Record actual locations of components and instrumentation.

1.6 Environmental Requirements

- .1 Section 21 05 00: Environmental conditions affecting products on site.
- .2 Do not install instrumentation when areas are under construction, except for required rough-in, taps, supports and test plugs.

1.7 Extra Materials

- .1 Section 21 05 00: Submittals for project closeout.
- .2 Provide two bottles of red gauge oil for static pressure gauges.

Part 2 Products

2.1 PRESSURE GAUGES

- .1 Manufacturers:
 - .1 Winters.
 - .2 Trerice.
 - .3 Ashcroft.
 - .4 Substitutions: Refer to Section 21 05 00.
- .2 Gauge: ASME B40.1, stainless steel case, phosphor bronze bourdon tube, rotary brass movement, brass socket, with front recalibration adjustment, black scale on white background.
 - .1 Case: Steel with bronze or brass bourdon tube.
 - .2 Gauges shall be dry – no glycerine or silicone fill.
 - .3 Size: 102 mm (4 inch) diameter dial - gauges located up to 3000 mm (10'-0") above finished floor.
 - .4 Size: 152 mm (6 inch) diameter dial - gauges located above 3000 mm (10'-0") above finished floor.
 - .5 Range: gauges shall be selected based on the application to show twice the normal operating pressure with indicating needle at 12 o'clock position for normal operating pressure.
 - .6 Mid-Scale Accuracy: One percent (1%) of full span.
 - .7 Scale: Both psi and kPa with psi prominent figure.

2.2 Pressure Gauge Tappings

- .1 Gauge Cock: Tee or lever handle, brass for maximum 1034 kPa (150 psig).
- .2 Needle Valve: Brass 6 mm (1/4 inch) NPT for minimum 1034 kPa (150 psig).
- .3 Pulsation Damper: Pressure snubber, brass with 6 mm (1/4 inch) connections.
- .4 Syphon for gauges on steam systems: Stainless-steel shut-off ball valve complete with 1/4" NPT stainless-steel coil syphon rated minimum 1723 kPa (250 psig) working pressure.

2.3 Stem Type Thermometers

- .1 Manufacturers:
 - .1 Winters.
 - .2 Trerice.

- .3 Ashcroft.
- .4 Substitutions: Refer to Section 21 05 00.
- .2 Thermometer: ASTM E1, adjustable angle, blue organic fluid, lens front tube, cast aluminum case with enamel finish, cast aluminum adjustable joint with positive locking device.
- .3 Choice of stem types shall not be made until piping and equipment, etc., has been erected. Stem type must be approved by Contract Administrator.
 - .1 Size: 225 mm (9 inch) scale.
 - .2 Window: Clear heavy-duty strength glass or acrylic.
 - .3 Stem: Minimum length 152 mm (6 inch).
 - .4 Accuracy: ASTM E77 2 percent. Calibration: Both degrees F and degrees C.

2.4 Dial Thermometers

- .1 Manufacturers:
 - .1 Winters.
 - .2 Terice.
 - .3 Ashcroft.
 - .4 Substitutions: Refer to Section 21 05 00.
- .2 Thermometer: ASTM E1, stainless steel case, adjustable angle with front recalibration, bimetallic helix actuated with silicone fluid damping, white with black markings and black pointer hermetically sealed lens, stainless steel stem.
- .3 Choice of stem types shall not be made until piping and equipment, etc., has been erected. Stem type must be approved by Contract Administrator.
 - .1 Size: 75 mm (3 inch) diameter dial - thermometers located up to 1500 mm (5'-0") above finished floor.
 - .2 Size: 125 mm (5 inch) diameter dial - thermometers located above 1500 mm (5'-0") above finished floor.
 - .3 Lens: Clear heavy-duty strength glass.
 - .4 Accuracy: 1 percent.
 - .5 Calibration: Both degrees F and degrees C.

2.5 Thermometer Supports

- .1 Socket: Brass separable sockets for thermometer stems with or without extensions as required, and with cap and chain.
- .2 Flange: 75 mm (3 inch) outside diameter reversible flange, designed to fasten to sheet metal air ducts, with brass perforated stem.

2.6 Test Plugs

- .1 Test Plug: 6 mm (1/4 inch) or 13 mm (1/2 inch) brass or stainless steel (depending on system) fitting and cap for receiving 3 mm (1/8 inch) outside diameter pressure or temperature probe with neoprene core for temperatures up to 93 degrees C (200 degrees F), Nordel core for temperatures up to 176 degrees C (350 degrees F), Viton core for temperatures up to 204 degrees C (400 degrees F).

- .2 Test Kit: Carrying case, internally padded and fitted containing two 60 mm (2-1/2 inch) diameter pressure gauges, two gauge adapters with 3 mm (1/8 inch) probes, two 38 mm (1-1/2 inch) dial thermometers.

2.7 Static Pressure Gauges

- .1 90 mm (3-1/2 inch) diameter dial in metal case, diaphragm actuated, black figures on white background, front recalibration adjustment, 2 percent of full scale accuracy.
- .2 Inclined manometer, red liquid on white background with black figures, front recalibration adjustment, 3 percent of full scale accuracy.
- .3 Accessories: Static pressure tips with compression fittings for bulkhead mounting, 6 mm (1/4 inch) diameter tubing.

Part 3 Execution

3.1 Installation

- .1 Install to manufacturer's written instructions.
- .2 Install positive displacement meters with isolating valves on inlet and outlet. Provide full line size valved bypass with globe valve for liquid service meters.
- .3 Provide one pressure gauge per pump, installing taps before strainers and on suction and discharge of pump. Pipe to gauge.
- .4 Install pressure gauges with pulsation dampers. Provide needle valve to isolate each gauge. Provide syphon on gauges in steam systems. Extend nipples and syphons to allow clearance from insulation.
- .5 Gauges subject to vibration shall have copper tube extension and shall be located away from source of vibration; preferably on an adjacent wall or other stable mounting surface.
- .6 Install thermometers in piping systems in sockets in short couplings. Enlarge pipes smaller than 60 mm (2-1/2 inch) for installation of thermometer sockets. Ensure sockets allow clearance from insulation.
- .7 Install thermometers with back or bottom inlet stems, depending on which is better for ease of reading.
- .8 Brass separable wells to have insulation extensions, where mounted on insulated piping or equipment, to ensure dials are clear. Stems and wells to be immersed in liquid flow, minimum length of stems to be 152mm.
- .9 Where a separable well is mounted in pipe 38mm diam. or less, enlarge pipe to 50mm diam. for well length plus 76mm.
- .10 Install thermometers in air duct systems on flanges.
- .11 Dial thermometers to be installed on air handling units on outside-air ducts, mixed air ducts, and supply-air ducts.
- .12 Install thermometer sockets adjacent to controls systems thermostat, transmitter, or sensor sockets. Refer to Section 25 50 01 and/or 25 50 02.
- .13 Locate duct mounted thermometers minimum 10 feet (3 m) downstream of mixing dampers, coils, or other devices causing air turbulence.

- .14 Install static pressure gauges at all built-up filter banks, unitary filter sections, and supply fan discharge.
- .15 Coil and conceal excess capillary on remote element instruments.
- .16 Provide instruments with scale ranges selected according to service with largest appropriate scale.
- .17 Install gauges and thermometers in locations where they are easily read from normal operating level. Install vertical to 45 degrees off vertical.
- .18 Adjust gauges and thermometers to final angle, clean windows and lenses, and calibrate to zero.
- .19 Locate test plugs adjacent to control device sockets.
- .20 Install thermometers on supply and return fluid lines serving air handling unit coils.

END OF SECTION

Part 1

General

1.1

Section Includes

- .1 Flexible Pipe Connectors
- .2 Expansion tanks.
- .3 Air vents.
- .4 Air-sediment separators.
- .5 Hydraulic Separator
- .6 Strainers.
- .7 Pump suction diffusers.
- .8 Combination fittings.
- .9 Flow indicators, controls, meters.
- .10 Relief valves.
- .11 Glycol specialties.
- .12 Condensate pumps

1.2

Related Sections

- .1 Section 22 42 01 - Plumbing Specialties: Backflow Preventers.
- .2 Section 23 05 29 – Support and Anchors.
- .3 Section 23 07 19 – Piping Insulation.
- .4 Section 23 21 00 - Hydronic Piping.
- .5 Section 23 21 23 – HVAC Pumps.
- .6 Section 23 25 00 - Chemical Treatment For Piping: Pipe Cleaning.

1.3

References

- .1 ASME - SEC 8D - Boilers and Pressure Vessels Code - Rules for Construction of Pressure Vessels.
- .2 ASTM D1784 – Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds
- .3 NBCC 2010 - National Building Code of Canada
- .4 NPCC 2010 – National Plumbing Code of Canada
- .5 NFCC 2010 – National Fire Code of Canada

1.4

Submittals

- .1 Section 21 05 00: Procedures for submittals.
- .2 Product Data: Provide product data for manufactured products and assemblies required for this project. Include component sizes, rough-in requirements, service sizes, and finishes. Include product description, model and dimensions.

.3 Submit inspection certificates for pressure vessels from authority having jurisdiction.

.4 Manufacturer's Installation Instructions: Indicate hanging and support methods, joining procedures.

1.5 Project Record Documents

.1 Section 21 05 00: Submittal Procedures.

.2 Record actual locations of hydronic specialties.

1.6 Operation And Maintenance Data

.1 Section 21 05 00: Submittal Procedures.

.2 Maintenance Data: Include installation instructions, assembly views, lubrication instructions, and replacement parts list.

1.7 Quality Assurance

.1 Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three (3) years documented experience.

1.8 Delivery, Storage, And Handling

.1 Section 21 05 00: Transport, handle, store, and protect products.

.2 Accept valves on site in shipping containers with labeling in place. Inspect for damage.

.3 Provide temporary protective coating on cast iron and steel valves.

.4 Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

.5 Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

1.9 Maintenance Service

.1 Provide service and maintenance of glycol system for one (1) year from date of substantial completion.

.2 Provide a monthly visit to make glycol fluid concentration analysis on site with refractive index measurement instrument. Detail findings with maintenance personnel in writing of corrective actions needed including analysis and amounts of glycol or water added.

Part 2 Products

2.1 FLEXIBLE PIPE CONNECTORS

.1 Manufacturers:

.1 Flextrol

.2 Flex Tech Industries

.3 Hydro-flex

.4 Substitutions: Refer to Section 21 05 00

.2 Supply and install where shown on the drawings as in details, flexible pipe connectors as manufactured by Flex Tech Industries, selected to meet operating and test pressures of systems served.

- .3 Minimum 450 mm (18") in length unless otherwise noted.
- .4 Heating Water Services, Condenser and Chilled Water Systems
 - .1 [Up to 50 mm (2") -] Stainless steel connectors constructed of 304 series stainless corrugated hose and braid with steel ends to match equipment.
 - .2 Over 50 mm (2") - flexible rubber joint with neoprene and nylon body, cadmium steel flanges, spring wire beading.

2.2 Replaceable Bladder Type Expansion Tanks

- .1 Manufacturers:
 - .1 Bell and Gossett
 - .2 Taco
 - .3 Armstrong
 - .4 Armtrol
 - .5 Calefactio
 - .6 Substitutions: Refer to Section 21 05 00
- .2 Provide pre-charged, replaceable bladder expansion tanks meeting current ASME and CSA code requirements designed for a minimum working pressure of 860 kPa (125 psi).
- .3 Tanks to be constructed of mild steel with finish painted surface and complete with all necessary tappings in combination with fill valve and automatic vent, angle cocks and guards.
- .4 Air charging valve connection to be .302"-32 (standard tire valve).
- .5 Bladders to be Butyl or EPDM.
- .6 Sizes to be as shown on the drawings and as specified.
- .7 Expansion tanks shall be finish painted
- .8 Hot Water Heating and Chilled Water Systems:
 - .1 Select expansion tank pressure relief valve as noted in schedule.
 - .2 Set pressure reducing valve as noted in schedule.

2.3 Diaphragm-type Expansion Tanks

- .1 Manufacturers:
 - .1 Bell and Gossett
 - .2 Taco
 - .3 Armstrong
 - .4 Armtrol
 - .5 Calefactio
 - .6 Substitutions: Refer to Section 21 05 00
- .1 Provide pre-charged, diaphragm expansion tanks meeting current ASME and CSA code requirements designed for a minimum working pressure of 860 kPa (125 psi).
- .2 Tanks to be constructed of mild steel with finish painted surface and complete with all necessary tappings in combination with fill valve and automatic vent, angle cocks and guards.
- .3 Air charging valve connection to be standard Schrader tire valve.
- .4 Diaphragm to be Heavy Duty Butyl Rubber.

- .5 Sizes to be as shown on the drawings and as specified.
- .6 Expansion tanks shall be finish painted
- .7 Hot Water Heating and Chilled Water Systems:
 - .1 Select expansion tank pressure relief valve as noted in schedule.
 - .2 Set pressure reducing valve as noted in schedule.

2.4 Air Vents

- .1 Manual Type:
 - .1 Manufacturers:
 - .1 Dole
 - .2 Bell and Gossett
 - .3 Taco
 - .4 Maid O'Mist
 - .5 Watts
 - .6 Substitutions: Refer to Section 21 05 00
 - .2 Short vertical sections of 50 mm (2 inch) diameter pipe to form air chamber, with 3 mm (1/8 inch) brass needle valve at top of chamber.
 - .3 On aqueous glycol systems, provide with threaded or sweat connection for drainage connection.
- .2 Float Type:
 - .1 Manufacturers:
 - .1 Maid O'Mist
 - .2 Watts
 - .3 Bell and Gossett
 - .4 Taco
 - .5 Armstrong
 - .6 Armtrol
 - .7 Substitutions: Refer to Section 21 05 00
 - .2 Brass or semi-steel body, copper, polypropylene, or solid non-metallic float, stainless steel valve and valve seat; suitable for system operating temperature and pressure; with isolating valve.

2.5 Air And Air-sediment Separators

- .1 Small In-line Air Separators on services less than 50mm (2 inches):
 - .1 Manufacturers:
 - .1 Bell and Gossett
 - .2 Taco
 - .3 Armstrong
 - .4 Substitutions: Refer to Section 21 05 00
 - .2 In-line integral weir style separator; heavy duty cast iron construction; tested for 1207 kPa (175 psig) operating pressure and maximum working pressure of 150 degrees C (300 degrees F)
- .2 Coalescing In-line Air Separators on services less than 50mm (2 inches):

- .1 Manufacturers:
 - .1 Spyrotherm
 - .2 Bell and Gossett
 - .3 Taco
 - .4 Substitutions: Refer to Section 21 05 00
- .2 Coalescing style in-line separator; steel body; tested and stamped to ASME SEC 8-D; for 1035 kPa (150 psig) operating pressure.
- .3 Copper tube core with continuous wound copper wire medium.
- .4 Unit to be complete with separate venting chamber and shall have top mounted full port float and brass venting mechanism. Venting mechanism shall be threaded to allow for the piping of overflow.
- .5 Elimination efficiency:
 - .1 Free air – 100%
 - .2 Entrained air – 100%
 - .3 Dissolved air – 99.6%
- .3 Tangential/vortex style In-line Air Separators:
 - .1 Manufacturers:
 - .1 Bell and Gossett
 - .2 Taco
 - .3 Armstrong
 - .4 Substitutions: Refer to Section 21 05 00
 - .2 Tangential/vortex style in-line separator; steel body; tested and stamped to ASME SEC 8-D; for 862 kPa (125 psig) operating pressure.
 - .3 Unit to be complete with internal 304 stainless steel strainer.
 - .4 Unit shall be complete with threaded air vent connection and threaded blowdown connection.
- .4 Combination Air & Air-Sediment Separators:
 - .1 Manufacturers:
 - .1 Spyrotherm
 - .2 Bell and Gossett
 - .3 Taco
 - .4 Armstrong
 - .5 Substitutions: Refer to Section 21 05 00
 - .2 Coalescing style in-line dirt and air separator; steel body; tested and stamped to ASME SEC 8-D; for 862 kPa (125 psig) operating pressure.
 - .3 Removable Coalescing medium to be stainless steel.
 - .4 Unit to be complete with separate venting chamber and shall have top mounted full port float and brass venting mechanism. Venting mechanism shall be threaded to allow for the piping of overflow.
 - .5 Unit complete with removable end cover for access to coalescing medium.

2.6 Hydraulic Separator

- .1 Manufacturers:
 - .1 Bell and Gossett

- .2 Taco
- .3 Armstrong
- .4 Substitutions: Refer to Section 21 05 00
- .2 Operating Data
 - .1 With Insulation
 - .1 Working Pressure: 150 psi
 - .2 Operating Temperature – Threaded: 32°-210°F
 - .3 Operating Temperature – Flanged: 32°-220°F
 - .2 Without Insulation
 - .1 Working Pressure: 150 psi
 - .2 Operating Temperature – Threaded and Flanged: 32°-230°F
- .3 Threaded Connections: 1", 1-1/4", 1-1/2" FNPT with Unions
- .4 Flanged Connections: 2", 2-1/2", 3" & 4" ANSI 150 CLASS
- .5 Materials:
 - .1 Body: Steel
 - .2 Air Vent: Brass
 - .3 Drain Valve: Brass
 - .4 Insulation – Threaded: PEX
 - .5 Insulation – Flanged: Polyurethane Foam
- .6 Medium: water, glycol solution non-hazardous
 - .1 Percentage of Glycol Maximum: 30% Threaded & 50% Flanged
- .7 Included Accessories
 - .1 Air-vent and check valve assembly
 - .2 Drain valve
 - .3 Insulation

2.7 Strainers

- .1 Manufacturers:
 - .1 Watts
 - .2 Crane
 - .3 Mueller
 - .4 Substitutions: Refer to Section 21 05 00.
- .2 On Liquid heat transfer services,
 - .1 50 mm (2 inch) and under:
 - .1 Screwed brass or iron body for 1200 kPa (175 psig) working pressure, Y pattern with stainless steel or Monel perforated screen.
 - .2 Mesh:
 - .1 0.8 mm (1/32 inch) serving all temperature control valves, automatic flow control devices,
 - .2 1.6 mm (1/16 inch) serving pumps on systems with dirt-air separators,
 - .2 Size 63 mm (2-1/2 inch) and larger:

- .1 Flanged iron body for 1200 kPa (175 psig) working pressure, Y pattern with stainless steel or Monel perforated screen.
- .2 Mesh:
 - .1 0.8 mm (1/32 inch) serving all temperature control valves, automatic flow control devices,
 - .2 3.2 mm (1/8 inch) serving pumps on systems with dirt air separators,

2.8 Pump Suction Diffusers

- .1 Manufacturers: Suction diffuser shall match supplied pump manufacturer.
 - .1 Bell and Gossett
 - .2 Taco
 - .3 Armstrong
 - .4 Substitutions: Refer to Section 21 05 00
- .2 Fitting: Angle pattern, cast-iron body, threaded for 50 mm (2 inch) and smaller, flanged for 65 mm (2-1/2 inch) and larger, rated for 1200 kPa (175 psig) working pressure.
- .3 Suction diffuser to be complete with inlet vanes, cylinder strainer with 5 mm (3/16 inch) diameter openings, disposable fine mesh strainer to fit over cylinder strainer.
- .4 Accessories: Adjustable foot support, blowdown tapping in bottom, gauge tapping in side.

2.9 COMBINATION PUMP DISCHARGE (TRIPLE-DUTY) VALVES

- .1 Manufacturers:
 - .1 Bell and Gossett
 - .2 Taco
 - .3 Armstrong
 - .4 Substitutions: Refer to Section 21 05 00
- .2 Valves: Straight or angle pattern, flanged cast-iron valve body with bolt-on bonnet for 1200 kPa (175 psig) operating pressure.
- .3 Valve to be complete with :
 - .1 non-slam check valve with spring-loaded bronze disc and seat,
 - .2 stainless steel stem,
 - .3 calibrated adjustment permitting flow regulation, brass readout,
- .4 Packing to be Teflon-Graphite.
 - .1 NO ASBESTOS PERMITTED.

2.10 Manual Flow Controls

- .1 Manufacturers:
 - .1 Griswold Controls
 - .2 Bell and Gossett
 - .3 Watts.
 - .4 Tour & Andersson.
 - .5 Substitutions: Refer to Section 21 05 00.
- .2 Up to and including 50mm (2 inch):

- .1 Brass or bronze body, rated for 2750 kPa (400 psi) at 120 degrees C (250 degrees F),
 - .2 sweat or NPT end connections,
 - .3 full port nickel-plated brass ball valve with Teflon seats,
 - .4 temperature and pressure test valves and air vent,
 - .5 handle complete with memory stop and graduated markings.
- .3 50mm to 300mm (2 inch to 12 inch):
- .1 Carbon steel body, rated for 1200 kPa (175 psi) at 120 degrees C (250 degrees F),
 - .2 flanged end connections,
 - .3 carbon steel low-loss venturi with Piezon-Ring,
 - .4 bronze disc butterfly valve,
 - .5 temperature and pressure test valves and air vent,
- .4 Calibration: Control flow within 3 percent of selected rating, over operating pressure range of 10 times minimum pressure required for control.

2.11 Automatic Flow Controls

- .1 Manufacturers:
 - .1 Griswold Controls
 - .2 Nexus
 - .3 Hays.
 - .4 Substitutions: Refer to Section 21 05 00.
- .2 Valve internal control mechanism shall consist of a stainless steel one-piece cartridge with segmented port design and full travel linear coil spring.
- .3 Manufacturer shall be able to provide certified independent laboratory tests verifying accuracy of performance.
- .4 All flow control valve cartridges shall be warranted by the manufacturer for five years from date of sale.
- .5 Up to and including 50mm (2 inch):
 - .1 Cast brass body, rated at no less than 1900 kPa (275 psi) at 120 degrees C (250 degrees F),
 - .2 shall be constructed in a one-piece body to include a handle ball valve, a flow control cartridge assembly, dual pressure or pressure/temperature test valves for verifying accuracy of flow performance for all sizes combined with a manual air vent, and a union end which will accept various end pieces,
 - .3 shall include a removable 20 mesh stainless steel strainer,
 - .4 available flow rates shall be from 0.25 GPM to 160.0 GPM,
 - .5 the body design shall allow inspection or removal of cartridge or strainer without disturbing piping connections.
 - .6 the body design shall allow inspection or repair of handle operated stem without disturbing piping connections. The repairable stem shall include two Teflon seals and one EPDM O-ring for protection against chemicals and modulating temperature,
 - .7 the valve shall come fully assembled and be permanently marked to show direction of flow; shall have a body tag to indicate flow rate and model number.
- .6 50mm to 500mm (2 inch to 20 inch):

- .1 Class 150 Flange End Valves:
 - .1 Shall consist of steel pipe with flange ends, and stainless steel flow control cartridge assembly;
 - .2 rated assembly at 1585 kPa (230 psi) at 150 degrees C (300 degrees F);
 - .3 shall be supplied with dual pressure or pressure/temperature test valves for verifying accuracy of flow performance for all sizes;
 - .4 shall have flange ends compatible with ANSI B 16.5-1968 150 lb. Steel flanges;
 - .5 shall be permanently marked to show direction of flow, shall have body tag to indicate model number and flow rate;
 - .6 shall be available in 50mm through 500mm (2 inch through 20 inch) sizes with flow rates from 0.8 L/s to 430 L/s (14.0 GPM to 6,800.0 GPM).
- .2 Class 300 Flange End Valves:
 - .1 Shall consist of steel pipe with flange ends, and stainless steel flow control cartridge assembly;
 - .2 rated assembly at 4515 kPa (655 psi) at 150 degrees C (300 degrees F);
 - .3 shall be supplied with dual pressure or pressure/temperature test valves for verifying accuracy of flow performance for all sizes;
 - .4 shall have flange ends compatible with ANSI B 16.5-1968 300 lb. Steel flanges;
 - .5 shall be permanently marked to show direction of flow, shall have body tag to indicate model number and flow rate;
 - .6 shall be available in 2" through 20" sizes with flow rates from 14.0 GPM to 6,800.0 GPM.
- .7 Automatic flow control valve cartridges shall automatically control flow rates with 5 percent accuracy over an operating pressure differential range of at least 14 times the minimum required for control. Four operating pressure ranges shall be available with the minimum range requiring less than 20 kPa (3 PSID) to actuate the mechanism.

2.12 Relief Valves

- .1 Manufacturers:
 - .1 Kunkle
 - .2 Spiraz-Sarco
 - .3 Watts
 - .4 Bell and Gossett
 - .5 Substitutions: Refer to Section 21 05 00.
- .2 AMSE Section VIII rated valve:
 - .1 Carbon steel body, resilient EPDM or EPR soft seat, stainless steel stem and springs, packed leaver with gag. All wetted parts on leaver and gag screw to be stainless steel.

- .2 Must be rated and stamped for ASME Section VIII.
- .3 On 63mm (2 ½ inch) and larger connections, provide 150# flanges.
- .3 Non-ASME rated valve:
 - .1 Bronze body, teflon seat, stainless steel stem and springs, automatic, direct pressure actuated.
 - .2 Designed for liquid service.

2.13 Glycol Feed System

- .1 Manufacturers:
 - .1 Axiom.
 - .2 Calefactio
 - .3 Substitutions: Refer to Section 21 05 00.
- .2 Glycol systems shall be equipped with a mix-and-fill tank with manual fill capabilities, hose bib from domestic water for tank filling, and tank level alarm. Direct-connect city makeup lines to glycol systems are NOT permitted.
- .3 The entire system to be factory pre-piped and pre-wired with numbered terminal strip for wiring of remote items such as the pressure switch and the contact head meter.
- .4 Unit to be complete with low-level pump cutout float switch, which plugs directly into standard duplex outlet and stops the pump if glycol level is too low.
- .5 The piping system shall be provided with a low-pressure sensor, which shall alarm on the DDC system. On alarm generation, feed system will be manually started after checking for system leaks. This manual operation will avoid feed system from automatically filling and compensating for a system leak. Fully automatic operation can be selected by HOA switch if suitable for system.
- .6 Unit to be complete with low-level remote monitoring panel complete with dry contacts and be connected to DDC system alarm.
MEDIUM SYSTEM
- .7 Provide packaged glycol feed system consisting of:
 - .1 208 litre (55 US gal.) polyethylene tank with cover;
 - .2 Pump suction hose with inlet strainer;
 - .3 Pressure pump with thermal cut-out;
 - .4 Integral pressure switch;
 - .5 Integral check valve;
 - .6 Cord and plug;
 - .7 Pre-charged accumulator tank with EPDM diaphragm;
 - .8 Manual diverter valve for purging air and agitating contents of storage tank;
 - .9 Adjustable 35-380 kPa (5-55 psi) pressure regulating valve with pressure gauge;
 - .10 Integral replaceable strainer;
 - .11 Built-in check valve;
 - .12 Union connection; 12 mm (1/2") x 900 mm (36") long flexible connection hose with check valve.
- .8 System shall be compatible with glycol solutions.
- .9 Pump shall be capable of running dry without damage.
- .10 Power supply: 3-prong plug and cord, 115v/60/1, 0.7 amps.

- .11 Unit shall be completely assembled and certified to CSA standard C22.2 No 68.

2.14 Glycol Solution

- .1 Glycol Solution:
- .1 Manufacturers:
 - .1 Dow Model Dowfrost
 - .2 Brenntag Model Stanfrost
 - .3 Substitutions: Refer to Section 21 05 00.
 - .2 Provide aqueous solution by using propylene glycol and distilled or de-ionized water and shall contain red dye for easy leak detection.
 - .1 Following systems to be filled with aqueous glycol solution. Solution shall be blended up with propylene glycol at percentage indicated and remainder with distilled or de-ionized water concentration. Heat recovery system – 50% (-37°C freeze point).
 - .2 Glycol heating system – 35% (-15°C freeze point)
 - .3 Provide high grade (virgin) industrial inhibited propylene glycol. Recycled glycol or commercially available antifreeze solutions are not acceptable. Also, provide two additional 205 litre (45 gal.) drums of propylene glycol/distilled water solution above quantity required to fill systems. The manufacturer of fluid must provide written documentation stating the fluid passed ASTM standards. The supplier must supply a certificate of analysis that guarantees the content of the product provided.
 - .4 Glycol solution supplier shall provide The City and Contract Administrator with written analysis results of tested product after installation, and also provide free analysis on an annual basis.

2.15 CONDENSATE PUMPS FAN COIL

- .1 Manufacturers:
 - .1 Blue Diamond Maxi Blue
 - .2 Substitutions: none
- .2 Provide where required and as per detail, pipe to condensate drain connection. Unit shall be ULc listed for plenum rated installation. (UL-2043). Pumps shall be capable of running dry and continuously.
- .3 Warrantee – 3 years
- .4 Performance
 - .1 Max flow 3.7 g/hr (14 l/h)
 - .2 Max Head 23 feet (10 PSI)
 - .3 Max Suction 16.5 (7.1 PSI)
 - .4 Sound 21 dba
- .5 Accessories
 - .1 Reservoir Sensor
 - .2 Temperature sensor
 - .3 Drainstick
- .6 Electrical
 - .1 208-230 volt

Part 3 Execution

3.1

Installation

- .1 Install specialties to manufacturer's written instructions.
- .2 Adjust expansion tank pressure to suit design criteria and as directed by the Contract Administrator.
- .3 Install pressure gauge at inlet to tank.
- .4 Provide valved drain connection on tank side of expansion tank isolation valve.
- .5 Provide union connection and isolation valve at each tank to allow removal of tank without disrupting service.
- .6 Where large air quantities can accumulate, provide enlarged air collection standpipes.
- .7 Provide manual air vents at system high points and as indicated.
- .8 For automatic air vents in ceiling spaces or other concealed locations, provide vent tubing to nearest drain.
- .9 On aqueous glycol systems, automatic air vents are not permitted.
- .10 Pipe all air vents on aqueous glycol systems back to glycol fill tank. Piping to be a minimum of 12mm (1/2 inches)
- .11 Provide air separator on suction side of system circulation pump and connect to expansion tank.
- .12 Provide valved drain and hose connection on strainer blow down connection.
- .13 Supply and install strainers ahead of all temperature control valves, pressure reducing valves, pump suction and where indicated on the drawings.
- .14 Provide pump suction fitting on suction side of base mounted centrifugal pumps [where indicated]. Remove temporary strainers after cleaning systems.
- .15 Provide combination pump discharge valve on discharge side of base mounted centrifugal pumps [where indicated].
- .16 Support pump fittings with floor mounted pipe and flange supports.
- .17 Provide radiator valves on water inlet to terminal heating units such as radiation, unit heaters, and fan coil units.
- .18 Provide radiator balancing valves on water outlet from terminal heating units such as radiation, unit heaters, and fan coil units.
- .19 Provide relief valves on pressure tanks, low pressure side of reducing valves, heat exchangers, and expansion tanks.
- .20 Select system relief valve capacity so that it is greater than make-up pressure reducing valve capacity. Select equipment relief valve capacity to exceed rating of connected equipment.
- .21 Pipe relief valve outlet to nearest floor drain.
- .22 Where one line vents several relief valves, make cross sectional area equal to sum of individual vent areas.
- .23 Clean and flush glycol system before adding glycol solution. Refer to Section 23 25 00.

- .24 Feed glycol solution to system through make-up line with pressure regulator, venting system high points.
- .25 Perform tests determining strength of glycol and water solution and submit written test results.

END OF SECTION

Part 1 General

1.1 Section Includes

- .1 Pipe and equipment hangers and supports.
- .2 Equipment bases and supports.
- .3 Sleeves and seals.
- .4 Flashing and sealing equipment and pipe stacks.

1.2 Related Sections

- .1 Section 03 30 00 - Cast-in-place Concrete: Equipment bases.
- .2 Section 07 84 00 - Firestopping: Joint seals for piping and duct penetration of fire rated assemblies.
- .3 Section 09 90 00 - Painting.
- .4 Section 21 11 00 - Fire Protection Piping.
- .5 Section 23 07 19 - Piping Insulation.
- .6 Section 23 07 16 - Equipment Insulation.
- .7 Section 22 10 00 - Plumbing Piping.
- .8 Section 23 21 00 - Hydronic Piping.

1.3 References

- .1 ASME B31.1 - Power Piping.
- .2 ASME B31.2 - Fuel Gas Piping.
- .3 ASME B31.5 - Refrigeration Piping and Heat Transfer Components.
- .4 ASME B31.9 - Building Services Piping.
- .5 ASTM F708 - Design and Installation of Rigid Pipe Hangers.
- .6 CSA 149.1 - Natural gas and propane installation code
- .7 MSS SP58 - Pipe Hangers and Supports - Materials, Design and Manufacturer.
- .8 MSS SP69 - Pipe Hangers and Supports - Selection and Application.
- .9 MSS SP89 - Pipe Hangers and Supports - Fabrication and Installation Practices.
- .10 NFPA 13 - Installation of Sprinkler Systems.
- .11 NFPA 14 - Installation of Standpipe, Private Hydrants, and Hose Systems.
- .12 UL 203 - Pipe Hanger Equipment for Fire protection Service.

1.4 Submittals

- .1 Section 21 05 00: Procedures for submittals.
- .2 Shop Drawings: Indicate system layout with location and detail of trapeze hangers.
- .3 Product Data: Provide manufacturers catalogue data including load capacity.

- .4 Design Data: Indicate load carrying capacity of trapeze, multiple pipe, and riser support hangers.
- .5 Manufacturer's Installation Instructions: Indicate special procedures and assembly of components.

1.5 Regulatory Requirements

- .1 Conform to applicable code for support of plumbing, hydronic piping.
- .2 Supports for Sprinkler Piping: To NFPA 13.
- .3 Supports for Standpipes: To NFPA 14.

Part 2 Products

2.1 PIPE HANGERS AND SUPPORTS

- .1 Manufacturers:
 - .1 Anvil.
 - .2 Grinnel.
 - .3 Substitutions: Refer to Section 21 05 00.
- .2 Fire Protection Piping:
 - .1 Conform to NFPA 13.
 - .2 Hangers for Pipe Sizes 13 to 38 mm (1/2 to 1-1/2 inch): Carbon steel, adjustable swivel, split ring.
 - .3 Hangers for Pipe Sizes 50 mm (2 inches) and over: Carbon steel, adjustable, clevis.
 - .4 Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
 - .5 Wall Support for Pipe Sizes to 75 mm (3 inches): Cast iron hook.
 - .6 Wall Support for Pipe Sizes 100 mm (4 inches) and over: Welded steel bracket and wrought steel clamp.
 - .7 Vertical Support: Steel riser clamp.
 - .8 Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
 - .9 Copper Pipe Support: Carbon steel ring, adjustable, copper plated.
- .3 Plumbing Piping - DWV:
 - .1 Conform to ASME B31.9.
 - .2 Cast Iron DWV Piping:
 - .1 Hangers for Pipe Sizes 13 to 38 mm (1/2 to 1-1/2 inch): Carbon steel, adjustable swivel, split ring.
 - .2 Hangers for Pipe Sizes 50 mm (2 inches) and over: Carbon steel, adjustable, clevis.
 - .3 Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
 - .4 Wall Support for Pipe Sizes to 75 mm (3 inches): Cast iron hook.
 - .5 Wall Support for Pipe Sizes 100 mm (4 inches) and over: Welded steel bracket and wrought steel clamp.
 - .6 Vertical Support: Steel riser clamp.
 - .7 Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.

- .8 Clamping for MJ couplings: Socket-pipe clamps with washers, threaded rod, and nuts (Anvil Fig. 594 & 595 or equal).
- .3 Copper Pipe Support: Carbon steel ring, adjustable, copper plated.
- .4 PVC DWV Pipe Support: to manufacturer's requirements.
- .4 Plumbing Piping - Water:
 - .1 Conform to ASME B31.9.
 - .2 Perforated strap or wire hangers are not permitted.
 - .3 Hangers to be adjustable after pipe is in place.
 - .4 Clevis hangers shall be oversized to suit the outside diameter of insulation and jacket to maintain the integrity of insulation and vapour barrier.
 - .1 Protection Saddles
 - .1 On piping 2" and smaller, carry insulation over pipe hangers. On all domestic cold water piping over 1-1/4", use oversized clevis hangers and GSS insulation protection shield to maintain integrity of vapour barrier.
 - .2 On copper piping over 2", use at each hanger or support Grinnell Fig. 167 protection shield or equal. Shields shall have a minimum length of 12" (305mm) to spread weight. Rectangular solid wood blocks, cut to suit the insulation thickness, shall be installed at hanger locations. Wedges are not permitted.
 - .5 Hangers for Pipe Sizes 15 to 40 mm (1/2 to 1-1/2 inch): Carbon steel, adjustable swivel, split ring.
 - .6 Hangers for Cold Pipe Sizes 50 mm (2 inches) and over: Carbon steel, adjustable, clevis.
 - .7 Hangers for Hot Pipe Sizes 50 to 100 mm (2 to 4 inches): Carbon steel, adjustable, clevis.
 - .8 Hangers for Hot Pipe Sizes 150 mm (6 inches) and over: Adjustable steel yoke, cast iron pipe roll, double hanger.
 - .9 Multiple or Trapeze Hangers: Steel channels with welded supports or spacers and hanger rods.
 - .10 Multiple or Trapeze Hangers for Hot Pipe Sizes 150 mm (6 inches) and over: Steel channels with welded supports or spacers and hanger rods, cast iron roll.
 - .11 Wall Support for Pipe Sizes to 80 mm (3 inches): Cast iron hook.
 - .12 Wall Support for Pipe Sizes 100 mm (4 inches) and over: Welded steel bracket and wrought steel clamp.
 - .13 Wall Support for Hot Pipe Sizes 150 mm (6 inches) and over: Welded steel bracket and wrought steel clamp with adjustable steel yoke and cast iron pipe roll.
 - .14 Vertical Support: Steel riser clamp.
 - .15 Floor Support for Cold Pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
 - .16 Floor Support for Hot Pipe Sizes to 100 mm (4 inches): Cast iron adjustable pipe saddle, locknut, nipple, floor flange, and concrete pier or steel support.
 - .17 Floor Support for Hot Pipe Sizes 150 mm (6 inches) and over: Adjustable cast iron pipe roll and stand, steel screws, and concrete pier or steel support.
 - .18 Copper Pipe Support: Carbon steel ring, adjustable, copper plated.

.19 Isolation: Copper piping shall be isolated from steel supports by appropriate use of copper plated hangers, plastic coated hangers, tinning pipe at supports, or provision of suitable lead or copper isolators.

.5 Hydronic Piping:

.1 Conform to ASME B31.9.

.2 Perforated strap or wire hangers are not permitted.

.3 Hangers to be adjustable after pipe is in place.

.4 Clevis hangers shall be oversized to suit the outside diameter of insulation and jacket to maintain the integrity of insulation and vapour barrier.

.1 Protection Saddles

.1 On piping 2" and smaller, carry insulation over pipe hangers. On all chilled water piping, and domestic cold water piping over 1-1/4", use oversized clevis hangers and GSS insulation protection shield to maintain integrity of vapour barrier.

.2 On insulated steel pipe over 2" use at each hanger or support, Grinnell Fig. 160, 161 or 162 to suit pipe size and insulation thickness. Pack space between saddle and pipe with insulation.

.3 On copper piping over 2", use at each hanger or support Grinnell Fig. 167 protection shield or equal. Shields shall have a minimum length of 12" (305mm) to spread weight. Rectangular solid wood blocks, cut to suit the insulation thickness, shall be installed at hanger locations. Wedges are not permitted.

.5 Where pipe expansion in excess of 12mm (1/2") axially occurs or where indicated to be installed on the drawings, provide Grinnell Fig. 171 Adjustable Pipe Roll or Grinnell Fig. 271 Pipe Roll Stand.

.6 Hangers for Pipe Sizes 13 to 38 mm (1/2 to 1-1/2 inch): Carbon steel, adjustable swivel, split ring.

.7 Hangers for Cold Pipe Sizes 50 mm (2 inches) and over: Carbon steel, adjustable, clevis.

.8 Hangers for Hot Pipe Sizes 50 to 100 mm (2 to 4 inches): Carbon steel, adjustable, clevis.

.9 Hangers for Hot Pipe Sizes 150 mm (6 inches) and over: Adjustable steel yoke, cast iron roll, double hanger.

.10 Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.

.11 Multiple or Trapeze Hangers for Hot Pipe Sizes 150 mm (6 inches) and over: Steel channels with welded spacers and hanger rods, cast iron roll.

.12 Wall Support for Pipe Sizes to 76 mm (3 inches): Cast iron hook.

.13 Wall Support for Pipe Sizes 100 mm (4 inches) and over: Welded steel bracket and wrought steel clamp.

.14 Wall Support for Hot Pipe Sizes 150 mm (6 inches) and over: Welded steel bracket and wrought steel clamp with adjustable steel yoke and cast iron roll.

.15 Vertical Support: Steel riser clamp.

.16 Floor Support for Cold Pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.

.17 Floor Support for Hot Pipe Sizes to 100 mm (4 inches): Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.

- .18 Floor Support for Hot Pipe Sizes 150 mm (6 inches) and over: Adjustable cast iron roll and stand, steel screws, and concrete pier or steel support.
- .19 Copper Pipe Support: Carbon steel ring, adjustable, copper plated.
- .20 Isolation: Copper piping shall be isolated from steel supports by appropriate use of copper plated hangers, plastic coated hangers, tinning pipe at supports, or provision of suitable lead or copper isolators.
- .21 Hanger Rods: Mild steel threaded both ends, threaded one end, or continuous threaded.
- .22 Inserts: Malleable iron case of steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.
- .6 Refrigerant Piping:
 - .1 Conform to ASME B31.5.
 - .2 Hangers for Pipe Sizes 13 to 38 mm (1/2 to 1-1/2 inch): Carbon steel, adjustable swivel, split ring.
 - .3 Hangers for Pipe Sizes 50 mm (2 inches) and over: Carbon steel, adjustable, clevis.
 - .4 Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
 - .5 Wall Support for Pipe Sizes to 75 mm (3 inches): Cast iron hook.
 - .6 Wall Support for Pipe Sizes 100 mm (4 inches) and over: Welded steel bracket and wrought steel clamp.
 - .7 Vertical Support: Steel riser clamp.
 - .8 Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
 - .9 Copper Pipe Support: Carbon steel ring, adjustable, copper plated.
- .7 For roof mounted piping, provide supports equivalent to:
 - .1 Portable Pipe Hangers model PP 10 strut style with pipe clamp guides, Portable Pipe Hangers Model PSE-2-2 with clevis style hangers, or supports. Install to Manufacture's specifications. Supports to be aluminium with stainless steel clamps and rollers. Membrane pads to be close-cell extruded polystyrene insulation equal to Dow Chemical Roofmate. Pipe shall be a minimum of 8" above finished roof level.
 - .2 MIFAB C-Port Series. Minimum 6 1/2" in height, supports to be constructed of recycled rubber, UV resistant and designed to support rooftop equipment. Supports to be selected, sized, and configured to match equipment installation requirements and roof construction, with galvanized steel channel. All metal work including strut or pipe clamps to be stainless steel.

2.2 Accessories

- .1 Hanger Rods: Mild steel threaded both ends, threaded one end, or continuous threaded.

2.3 Inserts

- .1 Inserts: Malleable iron case of galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.

2.4 Flashing

- .1 Metal Flashing: 0.5 mm thick (26 gauge) galvanized steel.
- .2 Metal Counterflashing: 0.8 mm thick (22gauge) galvanized steel.
- .3 Flexible Flashing: 1.2mm (47 mil) thick sheet butyl; compatible with roofing.
- .4 Caps: Steel, 0.8 mm (22 gauge) minimum; 1.5 mm (16 gauge) at fire resistant elements.

2.5 Sleeves

- .1 Sleeves for Pipes Through Non-fire Rated Floors: 1.2 mm thick (18 gauge) galvanized steel.
- .2 Sleeves for Pipes Through Non-fire Rated Beams, Walls, Footings, and Potentially Wet Floors: Steel pipe or 1.2mm thick (18 gauge) galvanized steel.
- .3 Sleeves for Pipes Through Fire Rated and Fire Resistive Floors and Walls, and Fire Proofing: Prefabricated fire rated sleeves including seals, UL listed refer to Section 07 84 00.
- .4 Where pipes pass through floors, walls or ceilings, in finished areas and where exposed to view, supply and install chrome-plated pressed steel floor plates.
- .5 Sleeves for Round Ductwork: Galvanized steel.
- .6 Sleeves for Rectangular Ductwork: Galvanized steel or wood.
- .7 Firestopping Insulation: Glass fibre type, non-combustible; refer to Section 07 84 00.
- .8 Sealant: Acrylic; refer to Section 07 92 00.

Part 3 Execution

3.1 Installation

- .1 Install to manufacturer's written instructions.

3.2 Inserts

- .1 Provide inserts for placement in concrete formwork.
- .2 Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
- .3 Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 100 mm (4 inches).
- .4 Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
- .5 Install galvanized oversize pipe sleeves on all pipes passing through walls or partitions, for building into wall construction by other trades.
- .6 All sleeves are to be large enough to accommodate pipe insulation as specified.
- .7 The Mechanical Division shall include in tender price all cost of drilling for sleeves up to 175 mm (7") in precast sections relative to work under Mechanical Division. Prior to drilling all openings/locations must be checked by the Contract Administrator. Drilling shall be done using diamond core drilling machinery.

- .8 All sleeves in mechanical rooms, janitors closets and washrooms shall extend 100 mm (4") above the finished floor level to prevent water seeping down.
- .9 Caulk the space between pipes and floor sleeves or openings, to prevent water seeping down, with an approved caulking compound. The caulking compound and method of application shall be to the Contract Administrator's approval.
- .10 Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut flush with top of slab.

3.3 Pipe Hangers And Supports

- .1 Install to manufacturer's written instructions.
- .2 Install heating water, glycol, chilled water, condenser water, and engine exhaust piping to ASME B31.9.
- .3 Perforated strap or wire hangers will not be permitted.
- .4 Support horizontal piping as scheduled.
- .5 Support for buried pipe under a new slabs or existing shall be hung from the slab using epoxy coated or stainless steel hangers, hardware and hanger rod secured to the rebar.
- .6 Hangers in new concrete structural floor systems shall be supported by inserts placed prior to pouring of concrete. Inserts shall be Grinnell cast iron or wrought steel adjustable type.
- .7 Where hangers must be installed in existing concrete slabs, approved expansion type inserts shall be used, or if heavy weights must be supported, a hole shall be drilled through the slab and a 50 mm x 50 mm (2" x 2") washer and nut installed above rough slab before the floor finish is poured.
- .8 Where the structural system is open web steel joists, piping shall be supported by means of angles spanning the top chords of adjacent joists. The number of joists to be spanned in this way shall be determined by the incident load of piping.
- .9 In no case shall the hanging of piping directly from roof or ceiling decking be allowed, unless special permission is obtained from the Contract Administrator.
- .10 Copper hot water piping in long runs, where expansion may be significant and where hanger rods are less than 600 mm (2") in length may require roller hangers. Any such cases which cannot be avoided shall be referred to the Contract Administrator for a decision. If necessary, roller hangers shall be installed as directed with protection saddles as specified. Expansion and contractions of domestic H.W. piping should not be a problem, as wide fluctuations in temperature are not normal. Piping shall be hung from slabs, rather than from the bottom of beams, in order to keep hanger rods sufficiently long to take up any movement.
- .11 Install hangers to provide minimum 13 mm (1/2 inch) space between finished covering and adjacent work.
- .12 Place hangers within 300 mm (12 inches) of each horizontal elbow.
- .13 Use hangers with 38 mm (1-1/2 inch) minimum vertical adjustment.
- .14 Support horizontal cast iron pipe adjacent to each hub, with 1.5 m (5 feet) maximum spacing between hangers.

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- .15 Support all pipe with MJ couplings on both sides of the joint. At multiple fittings or short lengths, support every 300 mm (12").
 - .16 Support vertical piping at every floor. Support vertical cast iron pipe at each floor at hub or with pipe clamps on hubless pipe.
 - .17 Storm water piping:
 - .1 All pipe supports, anchors, clamping, and thrust supports shall support the weight of the pipe and its contents.
 - .2 Provide all necessary support to restrain thrust forces resulting from internal pipe pressures. Refer to CISPI 301 & 310.
 - .3 MJ couplings are not permitted on PVC storm water piping. All joints to be solvent-welded.
 - .4 For cast-iron systems, install restraint clamps across all no-hub MJ couplings on piping 125 mm (5") and larger for all horizontal piping, including elbows at the base of a vertical pipe. Clamps shall be socket clamps on either side of the coupling connected with suitably sized threaded rod.
 - .5 Restrain all joints on piping 125 mm (5") and larger to prevent horizontal movement. Use sway bracing as needed to restrain sideways movement of the system. Install blocks, rods, bracing or other suitable methods at each branch opening or change in direction.
 - .6 Storm water piping below grade including in the crawlspace shall be adequately supported with thrust blocks or suitable anchors to restrain all sideways movement and thrust forces.
 - .18 Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
 - .19 Support riser piping independently of connected horizontal piping.
 - .20 Provide copper plated hangers and supports for copper piping.
 - .21 Design hangers for pipe movement without disengagement of supported pipe.
 - .22 All hanger rods shall have sufficient threaded length to allow for vertical adjustment of hangers after pipe is in place. Use 2 nuts on each rod, one above the clevis or angle iron and one below.
 - .23 Where pipes or equipment are supported from floors or walls, structural steel supports shall be fabricated, using welded joints except where provision is made for adjustment. Where details of construction are not indicated, drawings shall be submitted to Contract Administrator for approval before fabrication.
 - .24 Clamps should be located immediately below a coupling if possible. Risers up to 50 mm (2") size shall be braced at intervals not over 2100 mm (7').
 - .25 Vertical piping other than risers through floors shall be provided with suitable supports, sway braces, etc.
 - .26 Vertical piping shall be supported at the base in an approved manner.

- .27 On insulated piping supported by roller supports or trapeze supports (angle iron) provide at each hanger or support a protection saddle of 16 ga. galvanized sheet steel, rolled to match the outside diameter of the insulation. The saddle shall cover approximately the bottom one third of the circumference of the insulation. The length shall be at least as long as that recommended by the insulation manufacturer as published in their data.
- .28 On insulated pipe up to and including 50 mm (2") pipe, clevis hangers shall be sized to suit the O.D. of the pipe. On insulated pipe of 63 mm (2½") and above, the hangers shall be sized to suit the O.D. of the insulation and protection saddles, as described above shall be installed.
- .29 Prime coat exposed steel hangers and supports. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

3.4 Equipment Bases And Supports

- .1 Provide housekeeping pads of concrete, minimum 100 mm (4 inches) thick and extending 150 mm (6 inches) beyond supported equipment. Refer to Section 03 30 00.
- .2 Provide templates, anchor bolts, and accessories for mounting and anchoring equipment.
- .3 Construct supports of steel members. Brace and fasten with flanges bolted to structure.
- .4 Provide rigid anchors for pipes after vibration isolation components are installed.

3.5 Flashing

- .1 Provide flexible flashing and metal counterflashing where piping and ductwork penetrate weather or waterproofed walls, floors, and roofs.
- .2 Provide copper flashing for sleeves passing through exterior surfaces or waterproof assemblies.
- .3 Flash floor drains in floors with topping over finished areas with lead, 250 mm (10 inches) clear on sides with minimum 910 x 910 mm (36 x 36 inch) sheet size. Fasten flashing to drain clamp device.
- .4 Seal floor, shower, & mop sink drains watertight to adjacent materials.
- .5 Provide acoustical lead flashing around ducts and pipes penetrating equipment rooms, installed to manufacturer's written instructions for sound control.
- .6 Provide curbs for mechanical roof installations 350 mm (14 inches) minimum high above roofing surface. Flash and counterflash with sheet metal; seal watertight. Attach counterflashing mechanical equipment and lap base flashing on roof curbs. Flatten and solder joints.
- .7 Adjust storm collars tight to pipe with bolts; caulk around top edge. Use storm collars above roof jacks. Screw vertical flange section to face of curb.

3.6 Sleeves

- .1 Set sleeves in position in formwork. Provide reinforcing around sleeves.
- .2 Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.

- .3 Extend sleeves through floors 25mm (1 inch) above finished floor level. Caulk sleeves.
- .4 All sleeves in mechanical rooms, janitors closets and washrooms shall extend 100 mm (4") above the finished floor level to prevent water seeping down.
- .5 Install galvanized oversize pipe sleeves on all pipes passing through walls or partitions, for building into wall construction by other trades.
- .6 All sleeves are to be large enough to accommodate pipe insulation as specified.
- .7 The Mechanical Division shall include in tender price all cost of drilling for sleeves up to 175 mm (7") in precast sections relative to work under Mechanical Division. Prior to drilling all openings/locations must be checked by the Contract Administrator. Drilling shall be done using diamond core drilling machinery.
- .8 Where piping or ductwork penetrates floor, ceiling, or wall, close off space between pipe or duct and adjacent work with insulation and caulk, air tight. Provide close fitting metal collar or escutcheon covers at both sides of penetration.
- .9 Install stainless steel escutcheons at finished surfaces.

3.7 Schedules

- .1 Maximum spacing between pipe supports:
 - .1 Hangers shall be installed not more than 12" (300mm) from each change in direction of pipes.
 - .2 Where there are concentrations of valves and fittings, closer spacing will be necessary.
 - .3 Steel Pipe:

.1	Up to 50mm (2")	2.4m (8 ft.)
.2	65mm (2½") to 150mm (6")	3.6m (12 ft.)
.3	200mm (8") to 300mm (12")	5.4m (18 ft.)
.4	350mm (14") to 450mm (18")	7.2m (24 ft.)
.5	500mm (20") to 600mm (24")	9.0m (30 ft.)
 - .4 Copper Tubing (Hard):

.1	Up to 25mm (1")	1.8m (6 ft.)
.2	32mm (1½") to 50mm (2")	2.4m (8 ft.)
.3	63mm (2 ½") to 75mm (3")	3.0m (10 ft.)
.4	100mm (4") to 150mm (6")	3.6m (12 ft.)
.5	200mm (8") to 300mm (12")	4.8m (16 ft.)
 - .5 Cast Iron Pipe
 - .1 Maximum spacing – maximum 5 ft. (1.5m)
 - .2 Support M.J. pipe on both sides of joint. Provide with sway braces and anchors to Contract Administrator's approval. At multiple fittings, or short lengths, support every 300mm (12").
 - .6 Plastic (PVC, CPVC, PEX)
 - .1 As recommended by manufacturer for corresponding sizes and materials.
 - .2 All sizes – do not exceed 1.2m (4 ft.)

END OF SECTION

Part 1

General

1.1 Section Includes

- .1 Vibration isolation.

1.2 Related Sections

- .1 Section 03 30 00 - Cast-in-place Concrete.
 - .1 Placement of isolators in floating floor slabs.
 - .2 Supply of concrete for placement by this section.
- .2 Section 23 05 16 - Piping Expansion Compensation.
- .3 Section 23 05 29 - Supports And Anchors.
- .4 Section 26 05 80 - Equipment Wiring: Electrical characteristics and wiring connections.

1.3 Performance Requirements

- .1 Provide vibration isolation on motor driven equipment over 0.35 kW (0.5 hp), plus connected piping and ductwork.
- .2 All outdoor mounted equipment shall be restrained for the highest wind speed as specified by the project's structural engineer, the governing building code(s) or the authority having jurisdiction.
- .3 Provide minimum static deflection of isolators for equipment as indicated.
 - .1 Upper Floors, Normal
 - .1 Under 400 rpm: 90 mm (3.5 inch)
 - .2 400 - 600 rpm: 90 mm (3.5 inch)
 - .3 600 - 800 rpm: 50 mm (2 inch)
 - .4 800 - 900 rpm: 25 mm (1 inch)
 - .5 1100 - 1500 rpm: 12 mm (0.5 inch)
 - .6 Over 1500 rpm: 5 mm (0.2 inch)
 - .2 Upper Floors, Critical
 - .1 400 - 600 rpm: 90 mm (3.5 inch)
 - .2 600 - 800 rpm: 90 mm (3.5 inch)
 - .3 800 - 900 rpm: 50 mm (2 inch)
 - .4 1100 - 1500 rpm: 25 mm (1 inch)
 - .5 Over 1500 rpm: 12 mm (0.5 inch)
- .4 Consider upper floor locations critical unless otherwise indicated.

1.4 Submittals

- .1 Section 21 05 00: Procedures for submittals.
- .2 Shop Drawings: Indicate inertia bases and locate vibration isolators, with static and dynamic load on each.
- .3 Product Data: Provide schedule of vibration isolator type with location and load on each.
- .4 Manufacturer's Installation Instructions: Indicate special procedures and setting dimensions.

- .5 Manufacturer's Certificate: Certify that isolators are properly installed and adjusted to meet or exceed specified requirements.

1.5 Project Record Documents

- .1 Section 21 05 00: Submittals for project closeout.
- .2 Record actual locations of hangers including attachment points.

Part 2 Products

2.1 Manufacturers

- .1 Vibro-Acoustics.
- .2 Amber/Booth.
- .3 California Dynamics
- .4 Substitutions: Refer to Section 21 05 00.

2.2 VIBRATION ISOLATORS

- .1 Open Spring Isolators:
 - .1 Spring Isolators:
 - .1 For Exterior and Humid Areas: Provide hot dipped galvanized housings and neoprene coated springs.
 - .2 Code: Colour code springs for load carrying capacity.
 - .2 Springs: Minimum horizontal stiffness equal to 75 percent vertical stiffness, with working deflection between 0.3 and 0.6 of maximum deflection.
 - .3 Spring Mounts: Provide with levelling devices, minimum 6 mm (0.25 inch) thick neoprene sound pads, and zinc chromate plated hardware.
 - .4 Sound Pads: Size for minimum deflection of 1.2 mm (0.05 inch); meet requirements for neoprene pad isolators.
- .2 Restrained Spring Isolators:
 - .1 Spring Isolators:
 - .1 For Exterior and Humid Areas: Provide hot dipped galvanized housings and neoprene coated springs.
 - .2 Code: Colour code springs for load carrying capacity.
 - .2 Springs: Minimum horizontal stiffness equal to 75 percent vertical stiffness, with working deflection between 0.3 and 0.6 of maximum deflection.
 - .3 Spring Mounts: Provide with levelling devices, minimum 6 mm (0.25 inch) thick neoprene sound pads, and zinc chromate plated hardware.
 - .4 Sound Pads: Size for minimum deflection of 1.2 mm (0.05 inch); meet requirements for neoprene pad isolators.
 - .5 Restraint: Provide heavy mounting frame and limit stops.
- .3 Closed Spring Isolators:
 - .1 Spring Isolators:
 - .1 For Exterior and Humid Areas: Provide hot dipped galvanized housings and neoprene coated springs.
 - .2 Code: Colour code springs for load carrying capacity.
 - .2 Type : Closed spring mount with top and bottom housing separated with neoprene rubber stabilizers.

- .3 Springs: Minimum horizontal stiffness equal to 75 percent vertical stiffness, with working deflection between 0.3 and 0.6 of maximum deflection.
- .4 Housings: Incorporate neoprene isolation pad meeting requirements for neoprene pad isolators, and neoprene side stabilizers with minimum 7 mm (0.25 inch) clearance.
- .4 Restrained Closed Spring Isolators:
 - .1 Spring Isolators:
 - .1 For Exterior and Humid Areas: Provide hot dipped galvanized housings and neoprene coated springs.
 - .2 Code: Colour code springs for load carrying capacity.
 - .2 Type : Closed spring mount with top and bottom housing separated with neoprene rubber stabilizers.
 - .3 Springs: Minimum horizontal stiffness equal to 75 percent vertical stiffness, with working deflection between 0.3 and 0.6 of maximum deflection.
 - .4 Housings: Incorporate neoprene isolation pad meeting requirements for neoprene pad isolators, and neoprene side stabilizers with minimum 7 mm (0.25 inch) clearance and limit stops.
- .5 Spring Hanger:
 - .1 Spring Isolators:
 - .1 For Exterior and Humid Areas: Provide hot dipped galvanized housings and neoprene coated springs.
 - .2 Code: Colour code springs for load carrying capacity.
 - .2 Springs: Minimum horizontal stiffness equal to 75 percent vertical stiffness, with working deflection between 0.3 and 0.6 of maximum deflection.
 - .3 Housings: Incorporate [neoprene isolation pad meeting requirements for neoprene pad isolators] [rubber hanger with threaded insert].
 - .4 Misalignment: Capable of 20 degree hanger rod misalignment.
- .6 Neoprene Pad Isolators:
 - .1 Rubber or neoprene waffle pads.
 - .1 30 durometer.
 - .2 Minimum 13 mm (1/2 inch) thick.
 - .3 Maximum loading 275 kPa (40 psi).
 - .4 Height of ribs: maximum 0.7 times width.
 - .2 Configuration: 13 mm (1/2 inch) thick waffle pads bonded each side of 6 mm (1/4 inch) thick galvanized steel plate.
- .7 Rubber Mount or Hanger: Moulded rubber designed for 13 mm (0.5 inches) deflection with threaded insert.
- .8 Glass Fibre Pads: Neoprene jacketed pre-compressed moulded glass fibre.

Part 3

Execution

3.1 Installation

- .1 Install to manufacturer's written instructions.
- .2 Install isolation for motor driven equipment.
- .3 Bases:
 - .1 Set steel bases for 25 mm (1 inch) clearance between housekeeping pad and base.

- .2 Set concrete inertia bases for 50 mm (2 inch) clearance between housekeeping pad and base.
- .3 Adjust equipment level.
- .4 Where recommended by the manufacturer, isolator base plates shall be bolted to the structure or foundation. Bolting shall incorporate neoprene bushings and washers.
- .5 Isolator hangers shall be installed with the housing a minimum of 1/4" (6 mm) below but as close to the structure as possible. Where isolator hangers would be concealed by non-accessible acoustical sub ceiling, install the hangers immediately below the sub ceiling for access.
- .6 Install spring hangers without binding.
- .7 On closed spring isolators, adjust so side stabilizers are clear under normal operating conditions.
- .8 Prior to making piping connections to equipment with operating weights substantially different from installed weights, block up equipment with temporary shims to final height. When full load is applied, adjust isolators to load to allow shim removal.
- .9 Provide pairs of horizontal limit springs on fans with more than 1.5 kPa (6.0 inch) static pressure, and on hanger supported, horizontally mounted axial fans.
- .10 Support piping connections to isolated equipment resiliently as follows or according to the schedule.
 - .1 Up to 100 mm (4 inch) Diameter: First three points of support.
 - .2 125 to 200 mm (5 to 8 inch) Diameter: First four points of support.
 - .3 250 mm (10 inch) Diameter and Over: First six points of support.
 - .4 Select three hangers closest to vibration source for minimum 25 mm (1.0 inch) static deflection or static deflection of isolated equipment. Select remaining isolators for minimum 25 mm (1.0 inch) static deflection or 1/2 static deflection of isolated equipment.
- .11 Connect wiring to isolated equipment with flexible hanging loop.
- .12 All piping and ductwork shall freely pass through walls and floors without rigid connections. Penetration points shall be sleeved or otherwise formed to allow passage of piping or ductwork, and maintain a minimum of 3/4" and maximum of 1 1/4" clearance around the outside surfaces. This clearance space shall be tightly packed with 1.58 P.C.F. glass fiber and shall be caulked airtight after installation of the piping or ductwork. Penetrations through fire rated walls and floors shall be sealed to maintain the rating.
- .13 All outdoor equipment, piping and ductwork shall be restrained to resist wind forces per the applicable building code(s) as a minimum. Restraint attachments shall be made by bolts, welds or a positive fastening method. Friction shall not be considered. All attachments shall be proven capable of accepting the required wind load by calculations.
- .14 Install wind restraint devices per the restraint manufacturer's submittals. Any deviation from the manufacturer's instructions shall be reviewed and approved by the manufacturer.

3.2 Manufacturer's Field Services

- .1 Examine systems to Section 01 45 00.

- .2 Inspect isolated equipment after installation and submit report. Include static deflections.

END OF SECTION

Part 1

General

1.1 Section Includes

- .1 Nameplates.
- .2 Tags.
- .3 Stencils.
- .4 Pipe Markers.

1.2 Related Sections

- .1 Section 09 90 00 - Painting: Identification painting.

1.3 References

- .1 ASME A13.1 - Scheme for the Identification of Piping Systems.
- .2 CSA/CGA B149.1, Natural Gas and Propane Installation Code.
- .3 NFPA 13, Standard for the Installation of Sprinkler Systems.

1.4 Submittals

- .1 Section 21 05 00: Procedures for submittals.
- .2 Submit list of wording, symbols, letter size, and colour coding for mechanical identification.
- .3 Submit valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.
- .4 Product Data: Provide manufacturers catalogue literature for each product required.
- .5 Manufacturer's Installation Instructions: Indicate special procedures, and installation.

1.5 Project Record Documents

- .1 Section 21 05 00: Submittals for project closeout.
- .2 Record actual locations of tagged valves.

Part 2

Products

2.1 NAMEPLATES

- .1 Description: Laminated three-layer plastic with engraved black letters on light contrasting background colour.

2.2 Tags

- .1 Plastic Tags: Laminated three-layer plastic with engraved black letters on light contrasting background colour. Tag size minimum 40 mm (1-1/2 inch) diameter.
- .2 Chart: Typewritten letter size list in anodized aluminum frame.

2.3 Stencils

- .1 Stencils: With clean cut symbols and letters of following size:

- .1 20-30 mm (3/4 to 1-1/4 inch) Outside Diameter of Insulation or Pipe: 200 mm (8 inch) long colour field, 15 mm (1/2 inch) high letters.
 - .2 40-50 mm (1-1/2 to 2 inch) Outside Diameter of Insulation or Pipe: 200 mm (8 inch) long colour field, 20 mm (3/4 inch) high letters.
 - .3 65-150 mm (2-1/2 to 6 inch) Outside Diameter of Insulation or Pipe: 300 mm (12 inch) long colour field, 30 mm (1-1/4 inch) high letters.
 - .4 200-250 mm (8 to 10 inch) Outside Diameter of Insulation or Pipe: 600 mm (24 inch) long colour field, 65 mm (2-1/2 inch) high letters.
 - .5 Over 250 mm (10 inch) Outside Diameter of Insulation or Pipe: 800 mm (32 inch) long colour field, 90 mm (3-1/2 inch) high letters.
 - .6 Ductwork and Equipment: 65 mm (2-1/2 inch) high letters.
- .2 Stencil Paint: As specified in Section 09 90 00, semi - Painting.1.

2.4 Pipe Markers

- .1 Colour: Conform to ASME A13.1.
- .2 Plastic Pipe Markers: Factory fabricated, flexible, semi- rigid plastic, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid being conveyed.
- .3 Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.
- .4 Underground Plastic Pipe Markers: Bright coloured continuously printed plastic ribbon tape, minimum 150 mm (6 inches) wide by 0.10 mm (4 mil) thick, manufactured for direct burial service.

2.5 Ceiling Tacks

- .1 Description: Steel with 20 mm (3/4 inch) diameter colour coded head.
- .2 Colour code as follows:
 - .1 Yellow - HVAC equipment
 - .2 Red - Fire dampers/smoke dampers
 - .3 Green - Plumbing valves
 - .4 Blue - Heating/cooling valves

Part 3 Execution

3.1 Preparation

- .1 Degrease and clean surfaces to receive adhesive for identification materials.
- .2 Prepare surfaces to Section 09 90 00 for stencil painting.

3.2 Installation

- .1 Install plastic nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.
- .2 Install tags with corrosion resistant chain.
- .3 Apply stencil painting to Section 09 90 00.
- .4 Install plastic pipe markers to manufacturer's written instructions.

- .5 Install plastic tape pipe markers complete around pipe to manufacturer's written instructions.
- .6 Install underground plastic pipe markers 150 to 200 mm (6 to 8 inches) below finished grade, directly above buried pipe.
- .7 Identify air handling units, pumps, heat transfer equipment, tanks, and water treatment devices with plastic nameplates. Small devices, such as in-line pumps, may be identified with tags.
- .8 Identify control panels and major control components outside panels with plastic nameplates.
- .9 Identify thermostats relating to terminal boxes or valves with nameplates.
- .10 Identify valves in main and branch piping with tags.
- .11 Identify air terminal units and with numbered tags.
- .12 Identify external heat tracing on insulated piping.
- .13 Tag automatic controls, instruments, and relays. Key to control schematic.
- .14 Identify piping, concealed or exposed, with plastic pipe markers. Use tags on piping 20 mm (3/4 inch) diameter and smaller. Identify service, flow direction, and pressure. Install in clear view and align with axis of piping. Locate identification not to exceed 6 m (20 feet) on straight runs including risers and drops, adjacent to each valve and Tee, at each side of penetration of structure or enclosure, and at each obstruction.
- .15 Identify ductwork with stencilled painting. Identify with air handling unit identification number and area served. Locate identification at air handling unit, at each side of penetration of structure or enclosure, and at each obstruction.
- .16 Provide ceiling tacks to locate valves or dampers above T-bar type panel ceilings. Locate in corner of panel closest to equipment.

END OF SECTION

Part 1

General

1.1

Section Includes

- .1 Testing, adjustment, and balancing of air systems.
- .2 Fire and smoke damper testing & verification.
- .3 Testing, adjustment, and balancing of hydronic systems.
- .4 Measurement of final operating condition of HVAC systems.

1.2

Related Sections

- .1 Section 01 11 00 – Summary of Work
- .2 Section 01 45 00 - Quality Assurance:
 - .1 Testing laboratory services.
 - .2 Employment of testing agency and payment for services.
 - .3 Inspection and testing allowances.
- .3 Section 21 05 00 - Closeout Submittals:
 - .1 Starting of Systems.
 - .2 Testing, Adjusting, and Balancing of Systems.
- .4 Section 23 31 00 - Duct Work
- .5 Section 23 33 00 - Duct Work Accessories

1.3

Allowances

- .1 Work is included in this section and is part of the Contract Sum/Price.

1.4

References

- .1 AABC - National Standards for Total System Balance.
- .2 CAABC – Canadian Associated Air Balance Council
- .3 ADC - Test Code for Grilles, Registers, and Diffusers.
- .4 ASHRAE 111 - Practices for Measurement, Testing, Adjusting, and Balancing of Building Heating, Ventilation, Air-conditioning, and Refrigeration Systems.
- .5 CSA B149.1 - Natural gas and propane installation code
- .6 NEBB - Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems.
- .7 SMACNA - HVAC Systems Testing, Adjusting, and Balancing.

1.5

Submittals

- .1 Section 21 05 00: Procedures for submittals.
- .2 Submit name of adjusting and balancing agency for approval within 30 days after award of Contract.
- .3 Submit draft copies of report for review prior to final acceptance of Project. Draft copies shall be submitted in electronic format (Adobe Acrobat PDF file). Provide final copies for Contract Administrator and for inclusion in operating and maintenance manuals.

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- .4 Provide final reports in letter size, soft cover or 3-ring binder manuals, complete with index page and indexing tabs, with cover identification at front and side. Also submit an electronic copy (PDF file) of the same. Include set of reduced drawings with air outlets and equipment identified to correspond with data sheets, and indicating thermostat locations.
 - .5 Test Reports: Indicate data on AABC National Standards for Total System Balance forms. Submit data in either S.I. Metric or IP units to match the primary units used on the drawings and schedules.

1.6 Project Record Documents

- .1 Section 21 05 00: Submittals for project closeout.
- .2 Record actual locations of flow measuring stations, balancing valves, balancing dampers, and fire dampers.

1.7 Quality Assurance

- .1 Perform total system balance to AABC National Standards for Field Measurement and Instrumentation, Total System Balance.

1.8 Qualifications

- .1 Agency: Company specializing in the testing, adjusting, and balancing of systems specified in this Section with minimum three years documented experience[, and certified by CAABC or NEBB.]
- .2 Perform Work under supervision of CAABC or NEBB Certified Test and Balance Supervisor.

1.9 Pre-balancing Conference

- .1 Convene one week prior to commencing work of this section, to Section 21 05 00.

1.10 Sequencing

- .1 Sequence work to Section 01 11 00.
- .2 Sequence work to commence after completion of systems and schedule completion of work before Substantial Completion of Project.

1.11 Scheduling

- .1 Schedule work to Section 21 05 00.
- .2 Schedule and provide assistance in final adjustment and test of life safety, smoke evacuation, and/or smoke control system with Fire Authority.

1.12 Project Close-out

- .1 The Testing, Adjusting and Balancing agency as part of its Contract shall act as authorized inspection agency, responsible to list all items that are installed incorrectly, require correction or have not been installed in accordance with Contract drawings and/or specifications, pertaining to the air distribution, cooling and heating systems. The Mechanical SubContractor shall make good these items.

- .2 Final payment on the building will not be issued until the final air balance report has been submitted to the Contract Administrator and has been approved by the Contract Administrator.

Part 2 Products

- .1 Not used

Part 3 Execution

3.1 Agencies

- .1 Air Movement Services Ltd.
- .2 Airdronics Inc.
- .3 D.F.C. Mechanical Testing & Balancing Ltd.
- .4 AHS Testing & Balancing.

3.2 Examination

- .1 Verify that systems are complete and operable before commencing work. Ensure the following conditions:
 - .1 Systems are started and operating in a safe and normal condition.
 - .2 Temperature control systems are installed complete and operable.
 - .3 Proper thermal overload protection is in place for electrical equipment.
 - .4 Final filters are clean and in place. If required, install temporary media in addition to final filters.
 - .5 Duct systems are clean of debris.
 - .6 Fans are rotating correctly.
 - .7 Fire and volume dampers are in place and open.
 - .8 Air coil fins are cleaned and combed.
 - .9 Access doors are closed and duct end caps are in place.
 - .10 Air outlets are installed and connected.
 - .11 Duct system leakage is minimized.
 - .12 Hydronic systems are flushed, filled, and vented.
 - .13 Pumps are rotating correctly.
 - .14 Proper strainer baskets are clean and in place.
 - .15 Service and balance valves are open.
- .2 Submit field reports. Report defects and deficiencies noted during performance of services which prevent system balance.
- .3 Beginning of work means acceptance of existing conditions.

3.3 Preparation

- .1 Provide instruments required for testing, adjusting, and balancing operations. Make instruments available to Contract Administrator to facilitate spot checks during testing.
- .2 Provide additional balancing devices as required.

3.4 Installation Tolerances

- .1 Air Handling Systems: Adjust to within plus or minus 5 percent of design for supply systems and plus or minus 10 percent of design for return and exhaust systems.

- .2 Air Outlets and Inlets: Adjust total to within plus 10 percent and minus 5 percent of design to space. Adjust outlets and inlets in space to within plus or minus 10 percent of design.
- .3 Hydronic Systems: Adjust to within plus or minus 10 percent of design.

3.5 Adjusting

- .1 Ensure recorded data represents actual measured or observed conditions.
- .2 Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.
- .3 Make any changes in pulleys and belts, and add any manual dampers as required for correct balance, at no additional cost to The City.
- .4 After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.
- .5 At final inspection, recheck random selections of data recorded in report. Recheck points or areas as selected and witnessed by The City.
- .6 Check and adjust systems approximately six months after final acceptance and submit report.

3.6 Air System Procedure

- .1 Adjust air handling and distribution systems to provide required or design supply, return, and exhaust air quantities at site altitude.
- .2 Test and record motor full load amperes.
- .3 Make air quantity measurements in ducts by Pitot tube traverse of entire cross sectional area of duct.
- .4 Measure air quantities at air inlets and outlets.
- .5 Adjust distribution system to obtain uniform space temperatures free from objectionable drafts and noise.
- .6 Use volume control devices to regulate air quantities only to extend that adjustments do not create objectionable air motion or sound levels. Effect volume control by duct internal devices such as dampers and splitters.
- .7 All outlets shall be adjusted to provide proper throw and directional distribution in accordance with the requirements on the drawings and/or schedules.
- .8 Vary total system air quantities by adjustment of fan speeds.
 - .1 Provide drive changes required to set airflows on belt driven units.
 - .2 Adjust fan motor speed using speed control, on electronic commutated (EC) motors and variable speed drives (VSD) serving AC motors. Indicate speed voltage (0-10 DC) on EC motors and hertz (Hz) on VSD
 - .3 Vary branch air quantities by damper regulation.
- .9 Provide system schematic with required and actual air quantities recorded at each outlet or inlet. Each grille, diffuser and register shall be identified as to location and area. Include locations of pitot tube traverse locations, fire damper locations and tags, and balance damper locations.

- .10 Measure static air pressure conditions on air supply units, including filter and coil pressure drops, and total pressure across the fan. Make allowances for 50 percent loading of filters.
- .11 Adjust outside air automatic dampers, outside air, return air, and exhaust dampers for design conditions. Any re-adjustments of controls as deemed necessary, shall be made in co-operation with the Control SubContractor.
- .12 Measure temperature conditions across outside air, return air, and exhaust dampers to check leakage.
 - .1 Test and record entering air temperatures (D.B. heating and cooling).
 - .2 Test and record entering air temperatures (W.B. cooling).
 - .3 Test and record leaving air temperatures (D.B. heating and cooling).
 - .4 Test and record leaving air temperatures (W.B. cooling).
- .13 Where modulating dampers are provided, take measurements and balance at extreme conditions. Balance variable volume systems at maximum air flow rate, full cooling, and at minimum air flow rate, full heating. Refer to the maximum and minimum rates on the drawings and schedules.
- .14 Measure building static pressure and adjust supply, return, and exhaust air systems to provide required relationship between each to maintain approximately 12.5 Pa (0.05 inches) positive static pressure near the building entries.
- .15 Check multi-zone units for motorized damper leakage. Adjust air quantities with mixing dampers set first for cooling, then heating, then modulating.
- .16 For variable air volume system powered units set volume controller to air flow setting indicated. Confirm connections properly made and confirm proper operation for automatic variable air volume temperature control.
- .17 On fan powered VAV boxes, adjust air flow switches for proper operation.
- .18 All pitot-tube openings shall have plastic plugs of proper size in uninsulated or internally insulated ductwork. Insulated ductwork shall be provided with rubber plugs that extend to the face of the insulation. Cover the plugs on insulated ductwork with strip of grey tape.
- .19 After completion of final balance, the Balance Contractor shall permanently fix the damper operator with a strip of contact tape and spray the quadrant with bright paint to permanently mark its balanced position.

3.7 Fire & Smoke Damper Testing & Verification

- .1 Testing of Fire Dampers, Ceiling Fire Stops and/or Fire/Smoke Dampers
 - .1 General
 - .1 The Testing, Adjusting and Balancing agency shall test this equipment after installation.
 - .2 Test and verify operation of all fire dampers and ceiling fire stops in this project.
 - .3 Test shall include manually releasing fusible link; allowing damper to close to ensure that it has tight-fit closing operation without binding; opening fire damper and/or closing ceiling fire stop and resetting fusible link connection.

- .4 Instruct Sections 23 31 00 and 23 33 00 to repair all fire dampers and/or ceiling fire stops that have been identified as being faulty.
- .2 Identification of Fire Dampers and Ceiling Fire Stops
 - .1 At all fire dampers and ceiling fire stops, supply and install tags as approved by the Contract Administrator.
 - .2 Tags shall be mechanically fastened to duct fire damper access door, or onto or on structure near fire dampers or ceiling fire stops which have no connecting ductwork.
 - .3 After each fire damper has been tested and has been proven to operate satisfactorily as noted in previous clause, a representative of the Testing, Adjusting and Balancing agency shall label unit number and mark date and signature on tag. Tags shall have space for minimum size further dates and signatures for future checking of damper operation by The City's staff.
- .3 Test Report for Fire Dampers and Ceiling Fire Stops
 - .1 The Testing, Adjusting and Balancing agency shall provide a Test Report.
 - .2 The report shall include following for each fire damper:
 - .1 Verification that the unit is fully accessible.
 - .2 Verification that the unit has been successfully tested.
 - .3 Verification that the unit has been reset.
 - .4 Name of tester.
 - .5 Date that the unit tested successfully.
 - .6 Location schedule of all dampers i.e. each damper must be labelled.
 - .3 Provide one copy of completed report to Contract Administrator. After the Contract Administrator has reviewed report, provide to the Mechanical Subtrade sufficient copies of report to insert one in each Maintenance/Operating Manual.
- .4 Testing of Fire/Smoke Dampers
 - .1 Provide all testing, tagging, and Test Report for all Fire/Smoke Dampers.
 - .2 Follow instruction noted in previous clause as noted for Fire Dampers and Ceiling fire stops.

3.8 Leak Testing of Air Ducts

- .1 Leak test all ductwork.
- .2 Co-ordinate with Section 23 31 00. Section 23 31 00 shall repair all leaks found in ductwork before and after testing of systems.
- .3 Witness above final leak tests and issue report to Consultant.
- .4 Test shall be performed by this Section.
- .5 Section 23 31 00 shall provide all necessary temporary connections, blank-offs and tees required for testing. This Section shall provide all test fans, equipment and labour required for testing.
- .6 Section 23 31 00 shall clean all ducts before testing.

- .7 During installation of ductwork include separate leakage air tests of each complete air riser; each completed horizontal distribution system, and after ductwork is installed and central station apparatus is erected, leakage testing of pressure side of whole system. Include testing of flexible run-outs (where applicable).
- .8 Perform preliminary tests and repair all leaks before notifying Consultant of final tests.
- .9 Maintain log lock of all tests showing dates, personnel observers' initials.
- .10 Be responsible for any damage resulting from failure of items under test.
- .11 Section 23 31 00 shall repair all leaks in duct systems.
- .12 Retest ductwork after leaks have been repaired.
- .13 Coordinate with Section 23 31 00 to ensure that all ductwork is tested:
 - .1 before ducts are insulated.
 - .2 before ducts are concealed.

3.9 Water System Procedure

- .1 Adjust water systems to provide required or design quantities.
- .2 Coordinate and work with controls contractor to balancing adjust flow of new pump systems and existing pump systems to accommodate added flow for new HVAC equipment. Existing pump systems include, Chilled water pumps P-3/4, glycol loop pumps, P-5/6, terminal unit coil pumps, P-7/8.
- .3 Use calibrated fittings and pressure gauges to determine flow rates for system balance. Where flow metering devices are not installed, base flow balance on temperature difference across various heat transfer elements in the system.
- .4 Adjust systems to provide specified pressure drops and flows through heat transfer elements prior to thermal testing. Perform balancing by measurement of temperature differential in conjunction with air balancing.
- .5 Effect system balance with automatic control valves fully open to heat transfer elements.
- .6 Effect adjustment of water distribution systems by means of balancing cocks, valves, and fittings. Do not use service or shut-off valves for balancing unless indexed for balance point.
- .7 Where available pump capacity is less than total flow requirements or individual system parts, full flow in one part may be simulated by temporary restriction of flow to other parts.

3.10 Schedules

- .1 Equipment requiring testing, adjusting and balancing:
 - .1 Sprinkler Air Compressor
 - .2 Plumbing Pumps
 - .3 Boiler Feedwater Pumps
 - .4 HVAC Pumps
 - .5 Boilers
 - .6 Reciprocating Water Chillers
 - .7 Air Cooled Water Chillers

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- .8 Air Cooled Refrigerant Condensers
 - .9 Computer Room Air Conditioning Units
 - .10 Air Coils
 - .11 Air Handling Units
 - .12 Fans
 - .13 Air Filters
 - .14 Air Terminal Units
 - .15 Air Inlets and Outlets

 - .2 Report Forms
 - .1 Title Page:
 - .1 Name of Testing, Adjusting, and Balancing Agency
 - .2 Address of Testing, Adjusting, and Balancing Agency
 - .3 Telephone number of Testing, Adjusting, and Balancing Agency
 - .4 Project name
 - .5 Project location
 - .6 Project Architect
 - .7 Project Engineer
 - .8 Project Contractor
 - .9 Project altitude
 - .10 Report date
 - .2 Summary Comments:
 - .1 Design versus final performance
 - .2 Notable characteristics of system
 - .3 Description of systems operation sequence
 - .4 Summary of outdoor and exhaust flows to indicate amount of building pressurization
 - .5 Nomenclature used throughout report
 - .6 Test conditions
 - .3 Instrument List:
 - .1 Instrument
 - .2 Manufacturer
 - .3 Model number
 - .4 Serial number
 - .5 Range
 - .6 Calibration date
 - .4 Electric Motors:
 - .1 Manufacturer
 - .2 Model/Frame
 - .3 HP/BHP
 - .4 Phase, voltage, amperage; nameplate, actual, no load
 - .5 RPM
 - .6 Service factor
 - .7 Starter size, rating, heater elements
 - .8 Sheave Make/Size/Bore
 - .5 V-Belt Drive:
 - .1 Identification/location
 - .2 Required driven RPM
 - .3 Driven sheave, diameter and RPM
 - .4 Belt, size and quantity

- .5 Motor sheave diameter and RPM
- .6 Centre to centre distance, maximum, minimum, and actual
- .6 Pump Data:
 - .1 Identification/number
 - .2 Manufacturer
 - .3 Size/model
 - .4 Impeller
 - .5 Service
 - .6 Design flow rate, pressure drop, BHP
 - .7 Actual flow rate, pressure drop, BHP
 - .8 Discharge pressure
 - .9 Suction pressure
 - .10 Total operating head pressure
 - .11 Shut off, discharge and suction pressures
 - .12 Shut off, total head pressure
- .7 Combustion Test:
 - .1 Boiler manufacturer
 - .2 Model number
 - .3 Serial number
 - .4 Firing rate
 - .5 Overfire draft
 - .6 Gas meter timing dial size
 - .7 Gas meter time per revolution
 - .8 Gas pressure at meter outlet
 - .9 Gas flow rate
 - .10 Heat input
 - .11 Burner manifold gas pressure
 - .12 Percent carbon monoxide (CO)
 - .13 Percent carbon dioxide (CO₂)
 - .14 Percent oxygen (O₂)
 - .15 Percent excess air
 - .16 Flue gas temperature at outlet
 - .17 Ambient temperature
 - .18 Net stack temperature
 - .19 Percent stack loss
 - .20 Percent combustion efficiency
 - .21 Heat output
- .8 Air Cooled Condenser:
 - .1 Identification/number
 - .2 Location
 - .3 Manufacturer
 - .4 Model number
 - .5 Serial number
 - .6 Entering DB air temperature, design and actual
 - .7 Leaving DB air temperature, design and actual
 - .8 Number of compressors
- .9 Chillers:
 - .1 Identification/number
 - .2 Manufacturer

- .3 Capacity
- .4 Model number
- .5 Serial number
- .6 Evaporator entering water temperature, design and actual
- .7 Evaporator leaving water temperature, design and actual
- .8 Evaporator pressure drop, design and actual
- .9 Evaporator water flow rate, design and actual
- .10 Condenser entering water temperature, design and actual
- .11 Condenser pressure drop, design and actual
- .12 Condenser water flow rate, design and actual
- .10 Heat Exchanger:
 - .1 Identification/number
 - .2 Location
 - .3 Service
 - .4 Manufacturer
 - .5 Model number
 - .6 Serial number
 - .7 Steam pressure, design and actual
 - .8 Primary water entering temperature, design and actual
 - .9 Primary water leaving temperature, design and actual
 - .10 Primary water flow, design and actual
 - .11 Primary water pressure drop, design and actual
 - .12 Secondary water leaving temperature, design and actual
 - .13 Secondary water leaving temperature, design and actual
 - .14 Secondary water flow, design and actual
 - .15 Secondary water pressure drop, design and actual
- .11 Cooling Coil Data:
 - .1 Identification/number
 - .2 Location
 - .3 Service
 - .4 Manufacturer
 - .5 Air flow, design and actual
 - .6 Entering air DB temperature, design and actual
 - .7 Entering air WB temperature, design and actual
 - .8 Leaving air DB temperature, design and actual
 - .9 Leaving air WB temperature, design and actual
 - .10 Water flow, design and actual
 - .11 Water pressure drop, design and actual
 - .12 Entering water temperature, design and actual
 - .13 Leaving water temperature, design and actual
 - .14 Saturated suction temperature, design and actual
 - .15 Air pressure drop, design and actual
- .12 Heating Coil Data:
 - .1 Identification/number
 - .2 Location
 - .3 Service
 - .4 Manufacturer
 - .5 Air flow, design and actual
 - .6 Water flow, design and actual

- .7 Water pressure drop, design and actual
- .8 Entering water temperature, design and actual
- .9 Leaving water temperature, design and actual
- .10 Entering air temperature, design and actual
- .11 Leaving air temperature, design and actual
- .12 Air pressure drop, design and actual
- .13
- .13 Air Moving Equipment
 - .1 Location
 - .2 Manufacturer
 - .3 Model number
 - .4 Serial number
 - .5 Arrangement/Class/Discharge
 - .6 Air flow, specified and actual
 - .7 Return air flow, specified and actual
 - .8 Outside air flow, specified and actual
 - .9 Total static pressure (total external), specified and actual
 - .10 Inlet pressure
 - .11 Discharge pressure
 - .12 Sheave Make/Size/Bore
 - .13 Number of Belts/Make/Size
 - .14 Fan RPM
- .14 Return Air/Outside Air Data:
 - .1 Identification/location
 - .2 Design air flow
 - .3 Actual air flow
 - .4 Design return air flow
 - .5 Actual return air flow
 - .6 Design outside air flow
 - .7 Actual outside air flow
 - .8 Return air temperature
 - .9 Outside air temperature
 - .10 Required mixed air temperature
 - .11 Actual mixed air temperature
 - .12 Design outside/return air ratio
 - .13 Actual outside/return air ratio
- .15 Exhaust Fan Data:
 - .1 Location
 - .2 Manufacturer
 - .3 Model number
 - .4 Serial number
 - .5 Air flow, specified and actual
 - .6 Total static pressure (total external), specified and actual
 - .7 Inlet pressure
 - .8 Discharge pressure
 - .9 Sheave Make/Size/Bore
 - .10 Number of Belts/Make/Size
 - .11 Fan RPM
- .16 Duct Traverse:

-
- .1 System zone/branch
 - .2 Duct size
 - .3 Area
 - .4 Design velocity
 - .5 Design air flow
 - .6 Test velocity
 - .7 Test air flow
 - .8 Duct static pressure
 - .9 Air temperature
 - .10 Air correction factor
 - .17 Duct Leak Test:
 - .1 Description of ductwork under test
 - .2 Duct design operating pressure
 - .3 Duct design test static pressure
 - .4 Duct capacity, air flow
 - .5 Maximum allowable leakage duct capacity times leak factor
 - .6 Test apparatus
 - .1 Blower
 - .2 Orifice, tube size
 - .3 Orifice size
 - .4 Calibrated
 - .7 Test static pressure
 - .8 Test orifice differential pressure
 - .9 Leakage
 - .18 Air Monitoring Station Data:
 - .1 Identification/location
 - .2 System
 - .3 Size
 - .4 Area
 - .5 Design velocity
 - .6 Design air flow
 - .7 Test velocity
 - .8 Test air flow
 - .19 Flow Measuring Station:
 - .1 Identification/number
 - .2 Location
 - .3 Size
 - .4 Manufacturer
 - .5 Model number
 - .6 Serial number
 - .7 Design Flow rate
 - .8 Design pressure drop
 - .9 Actual/final pressure drop
 - .10 Actual/final flow rate
 - .11 Station calibrated setting
 - .20 Terminal Unit Data:
 - .1 Manufacturer
 - .2 Type, constant, variable, single, dual duct

-
- .3 Identification/number
 - .4 Location
 - .5 Model number
 - .6 Size
 - .7 Minimum static pressure
 - .8 Minimum design air flow
 - .9 Maximum design air flow
 - .10 Maximum actual air flow
 - .11 Inlet static pressure
 - .21 Air Distribution Test Sheet:
 - .1 Air terminal number
 - .2 Room number/location
 - .3 Terminal type
 - .4 Terminal size
 - .5 Area factor
 - .6 Design velocity
 - .7 Design air flow
 - .8 Test (final) velocity
 - .9 Test (final) air flow
 - .10 Percent of design air flow

END OF SECTION

Part 1 General

1.1 Section Includes

- .1 Duct work insulation.
- .2 Duct Liner.
- .3 Insulation jackets.

1.2 Related Sections

- .1 Section - Roofing: Finishing outdoor insulation jacket.
- .2 Section 09 90 00 - Painting: Painting insulation jackets.
- .3 Section 23 05 53 - Mechanical Identification.
- .4 Section 23 31 00 - Duct Work: Glass fibre duct work.
- .5 Section 23 31 00 - Duct Work: Duct liner.
- .6 Section - Roofing: Installation and finishing of outdoor insulation jacket under roofing.

1.3 References

- .1 Section 01 45 00: Requirements for references and standards.
- .2 ASTM B209 - Aluminum and Aluminum-Alloy Sheet and Plate.
- .3 ASTM C518 - Steady-State Thermal Transmission Properties by Means of the Heat Flow Metre Apparatus.
- .4 ASTM C553 - Standard Specification for Mineral Fibre Blanket Thermal Insulation for Commercial and Industrial Applications.
- .5 ASTM C612 - Standard Specification for Mineral Fibre Block and Board Thermal Insulation.
- .6 ASTM C916 - Standard Specification for Adhesives for Duct Thermal Insulation
- .7 ASTM C921 - Properties of Jacketing Materials for Thermal Insulation.
- .8 ASTM C1071 - Fibrous Glass Duct Lining Insulation(Thermal Sound Absorbing Material).
- .9 ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
- .10 ASTM E96 - Water Vapour Transmission of Materials.
- .11 ASTM E162 - Standard Test Method for Surface Flammability of Materials Using a Radiant Heat Energy Source.
- .12 ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.
- .13 NAIMA National Insulation Standards.
- .14 NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials.
- .15 SMACNA - HVAC Duct Construction Standards - Metal and Flexible.

- .16 UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials.

1.4 Submittals For Review

- .1 Section 21 05 00: Procedures for submittals.
.2 Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

1.5 Quality Assurance

- .1 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.
.2 Applicator Qualifications: Company specializing in performing the work of this section minimum three years documented experience.

1.6 Regulatory Requirements

- .1 Materials: Flame spread/smoke developed rating of 25/50 to NFPA 255 / UL 723.

1.7 Delivery, Storage, And Protection

- .1 Section 21 05 00: Transport, handle, store, and protect products.
.2 Accept materials on site in original factory packaging, labelled with manufacturer's identification, including product density and thickness.
.3 Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

1.8 Environmental Requirements

- .1 Section 21 05 00: Environmental conditions affecting products on site.
.2 Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics, and insulation cements.
.3 Maintain temperature during and after installation for minimum period of 24 hours.

Part 2 Products

2.1

2.2 VAPOUR BARRIER EXTERNAL DUCT WRAP, GLASS FIBRE, FLEXIBLE

- .1 Manufacturers:
.1 Johns Manville Microlite XG
.2 Owens Corning SoftR Duct Wrap.
.3 Other acceptable manufacturers offering equivalent products.
.1 Knauf.
.2 Insulation: ASTM C553; flexible, noncombustible blanket.
.1 'ksi' ('K') value: ASTM C518, 0.045 W/m-K at 24 degrees C (0.31 Btu-in/(hr ft²-°F) at 75 degrees F).
.2 Maximum service temperature: 121 degrees C (250 degrees F).
.3 Maximum moisture absorption: 0.20 percent by volume.
.4 Density 12 kg/cu. meter (0.75 lb/cu. Foot).

- .3 Vapour Barrier Jacket:
 - .1 Kraft paper with glass fibre yarn and bonded to aluminized film (FRK).
 - .2 Moisture vapour transmission: ASTM E96; 0.02 perm.
 - .3 Secure with pressure sensitive tape.
- .4 Vapour Barrier Tape:
 - .1 Kraft paper reinforced with glass fibre yarn and bonded to aluminized film, with pressure sensitive rubber based adhesive.
- .5 Outdoor Vapour Barrier Mastic:
 - .1 Vinyl emulsion type acrylic or mastic, compatible with insulation, black colour.
- .6 Tie Wire: Annealed steel, 1.5 mm (16 gauge).

2.3 Vapour Barrier External Glass Fibre Rigid Insulation Board

- .1 Manufacturers:
 - .1 Johns Manville 800 Series
 - .2 Owens Corning Series 700
 - .3 Other acceptable manufacturers offering equivalent products.
 - .1 Knauf.
- .2 Insulation: ASTM C612; rigid, noncombustible blanket.
 - .1 'ksi' ('K') value : ASTM C518, 0.045 at 24 degrees C (0.31 at 75 degrees F).
 - .2 Maximum service temperature: 121 degrees C (250 degrees F).
 - .3 Maximum moisture absorption: 0.20 percent by volume.
 - .4 Density: 48 kg/cu m (3.0 lb/cu ft).
- .3 Vapour Barrier Jacket:
 - .1 Kraft paper with glass fibre yarn and bonded to aluminized film.
 - .2 Moisture vapour transmission: ASTM E96; 0.04 perm.
 - .3 Secure with pressure sensitive tape.
- .4 Vapour Barrier Tape:
 - .1 Kraft paper reinforced with glass fibre yarn and bonded to aluminized film, with pressure sensitive rubber based adhesive.
- .5 Indoor Vapour Barrier Finish:
 - .1 Cloth: Untreated; 305 g/sq m (9 oz/sq yd) weight, glass fabric.
 - .2 Vinyl emulsion type acrylic, compatible with insulation, black colour.

2.4 Jackets

- .1 Canvas Jacket: UL listed.
 - .1 Fabric: ASTM C921, 220 g/sq m (6 oz/sq yd), plain weave cotton treated with dilute fire retardant lagging adhesive.
 - .2 Lagging Adhesive:
 - .1 Compatible with insulation.
- .2 Aluminum Flexible Insulation Jacketing Tape: UL listed
 - .1 Manufacturers:
 - .1 VentureClad 1577CW
 - .2 Bakor Foilskin
 - .3 Polyguard Alumaguard
 - .2 Tensile Strength: 316.5 N/25 mm (70 lb/in)

- .3 Puncture: 111 N (25 lbs)
- .4 Service Temperature: -50 to 70°C (-58°C to 160°F)
- .5 Finish: Embossed [Flat/Smooth]
- .6 Aluminum foil exterior surface over multilayer laminate, vapour barrier jacket with pressure sensitive adhesive integral to jacket application surface with peel off release liner.
- .7 Permeation (ASTM E96): 0.05 perm (maximum)
- .8 UV resistant.
- .9 Flame based application not acceptable.
- .3 Aluminum Jacket: ASTM B209M.
 - .1 Thickness: 0.40 mm (0.016 inch) sheet.
 - .2 Finish: Smooth.
 - .3 Joining: Longitudinal slip joints and 50 mm (2 inch) laps.
 - .4 Fittings: 0.4mm (0.016 inch) thick die shaped fitting covers with factory attached protective liner.
 - .5 Metal Jacket Bands: 10 mm (3/8 inch) wide; 0.015 mm thick aluminum.

2.5 Glass Fibre Duct Liner, Flexible

- .1 Manufacturers:
 - .1 Johns Manville LinaTex
 - .2 Owens Corning QuietR Textile Duct Liner.
 - .3 Other acceptable manufacturers offering equivalent products.
 - .1 Knauf.
- .2 Insulation: ASTM C1071; flexible, noncombustible blanket with poly vinyl acetate polymer impregnated surface and edge coat, [with 28 Gauge Galvanized Steel Perforated Internal Cover.]
 - .1 'ksi' ('K') Value: ASTM C518, maximum 0.045 at 24 degrees C (0.31 at 75 degrees F).
 - .2 Maximum Service Temperature: 121 degrees C (250 degrees F).
 - .3 Maximum Velocity on Coated Air Side: 30.5 m/s (6,000 fpm).
 - .4 Minimum Noise Reduction Criteria: ASTM C1071 0.30 for 13 mm (1/2 inch) thickness; 0.45 for 25 mm (1 inch) thickness; 0.60 for 40 mm (1-1/2 inches) thickness; 0.70 for 50 mm (2 inch) thickness.
 - .5 Minimum 55% Certified Recycled Content.
- .3 Adhesive:
 - .1 Waterproof, ASTM E162 fire-retardant type.
- .4 Liner Fasteners: Galvanized steel, with press-on head.

2.6 GLASS FIBRE DUCT LINER, RIGID

- .1 Manufacturers:
 - .1 Johns Manville Linacoustic R-300
 - .2 Owens Corning QuietR Duct Liner Board
 - .3 Other acceptable manufacturers offering equivalent products.
 - .1 Knauf.

- .2 Insulation: ASTM C612; rigid, noncombustible board with acrylic polymer meeting ASTM G21 impregnated surface and edge coat. [with 28 Gauge Galvanized Steel Perforated Internal Cover.]
 - .1 'ksi ('K') value : ASTM C518, maximum 0.27 at at 24 degrees C (75 degrees F).
 - .2 Maximum service temperature: 121 degrees C (250 degrees F).
 - .3 Maximum Velocity on Coated Air Side: 24.5 m/s (5,000 fpm).
 - .4 Minimum Noise Reduction Criteria: ASTM C1071 0.55 for 25 mm (1 inch) thickness; 0.75 for 40 mm (1-1/2 inches) thickness; 0.90 for 50 mm (2 inch) thickness.
 - .5 Minimum 20% Certified Recycled Content.
- .3 Adhesive:
 - .1 Waterproof , ASTM E162 fire-retardant type.
- .4 Liner Fasteners: Galvanized steel, with press-on head.

2.7 Glass Fibre Round Duct Liner

- .1 Manufacturers:
 - .1 Johns Manville Spiracoustic Plus
 - .2 Owens Corning QuietZone Spiral Duct Liner.
 - .3 Other acceptable manufacturers offering equivalent products.
 - .1 Knauf.
- .2 Insulation: Round, preformed in cylindrical sections with acrylic polymer meeting ASTM G21 impregnated surface coat. [with 28 Gauge Galvanized Steel Perforated Internal Cover.]
 - .1 'ksi' ('K') value : ASTM C1071, 0.033 at 24 degrees C (0.23 at 75 degrees F).
 - .2 Maximum service temperature: 121 degrees C (250 degrees F).
 - .3 Maximum Velocity on Coated Air Side: 30.5 m/s (6,000 fpm).

2.8 Elastomeric Cellular Thermal Duct Liner

- .1 Manufacturers:
 - .1 Armacell AP Armaflex Sheets
 - .2 Other acceptable manufacturers offering equivalent products.
- .2 Insulation: Flexible, closed-cell elastomeric insulation in sheet form meeting ASTM C 534,
 - .1 'ksi' ('K') value : ASTM C177, 0.039 at 24 degrees C (0.25 at 75 degrees F).
 - .2 Maximum service temperature: 105 degrees C (220 degrees F).
 - .3 Maximum Velocity on Coated Air Side: 30.5 m/s (6,000 fpm).
 - .4 Minimum Noise Reduction Criteria: ASTM C423,
 - .1 0.35 for 25 mm (1 inches) thickness
 - .2 [0.20 for 10 mm (1/2 inch) thickness]
- .3 Elastomeric Foam Adhesive
 - .1 Manufacturers:
 - .1 Armstrong 520 adhesive.
 - .2 Air dried, contact adhesive, compatible with insulation.

2.9 Fire Wrap External Duct Flexible

- .1 Manufacturers:

- .1 3M Canada
- .2 Other acceptable manufacturers offering equivalent products.
- .2 Listing
 - .1 Underwriters' Laboratories of Canada (ULC)
 - .1 Grease Duct Enclosures – Fire Resistant Ducts Guide No. (40 U21) Design No. FRD 4
 - .2 Ventilation / Pressurization Duct Enclosures – ISO 6944 Fire Resistant Ducts Guide No. (40 U21) Design No. FRD 3 and FRD 5
 - .3 Insulation:
 - .1 'ksi' ('K') value: ASTM C518, 0.045 at 24 degrees C (0.31 at 75 degrees F).
 - .2 Density 96 kg/cu. meter (6 lb/cu. Foot).
 - .4 Flammability (ASTM E 84/UL 723)
 - .1 Foil:
 - .1 Flame spread 5 & Smoke developed 5
 - .2 Blanket:
 - .1 Flame spread & 0 Smoke Developed 0
 - .5 Application chart

Application	Fire Resistive Rating	Enclosure System	Through-Penetration System
Air Ventilation Duct Systems	1 hour	1 layer - 3" (7,6 cm) perimeter and longitudinal overlap or optional butt joint plus collar wrap method	ULC-FRD-3
Air Ventilation Duct Systems (2 or 3 Sides)	1 hour	1 layer - 3" (7,6 cm) perimeter and longitudinal overlap	ULC-FRD-5
Air Ventilation Duct Systems	2 hours	2 layers - 3" (7,6 cm) perimeter and longitudinal overlap or first layer butt joint with second layer overlap method	ULC-FRD-3
Air Ventilation Duct Systems (2 or 3 Sides)	2 hour	2 layers - 3" (7,6 cm) perimeter and longitudinal overlap OR first layer butt joint with second layer overlap 3" (7,6 cm)	ULC-FRD-5

Part 3 Execution

3.1 Examination

- .1 Section 01 70 00 - Examination and Preparation: Verification of existing conditions before starting work.
- .2 Verify that duct work has been tested before applying insulation materials.
- .3 Verify that surfaces are clean, foreign material removed, and dry.

3.2 Installation

- .1 Section 01 45 00 - Quality Assurance: Manufacturer's written instructions.
- .2 Install to NAIMA National Insulation Standards.
- .3 Use two layers with staggered joints when required nominal thickness exceeds 75 mm.

- .4 All duct sizes on the drawings refer to inside duct dimensions. On all acoustically lined ductwork, the external duct dimensions shall be increased by the thickness of the lining.
- .5 Insulated duct work conveying air below ambient temperature:
 - .1 Provide insulation with vapour barrier jackets.
 - .2 Finish with tape and vapour barrier jacket.
 - .3 Continue insulation through walls, sleeves, hangers, and other duct penetrations.
 - .4 Insulate entire system including fittings, joints, flanges, fire dampers, flexible connections, and expansion joints.
- .6 Insulated duct work conveying air above ambient temperature:
 - .1 Provide with or without standard vapour barrier jacket.
 - .2 Insulate fittings and joints. Where service access is required, bevel and seal ends of insulation.
- .7 External insulation on duct work exposed in Mechanical Equipment Rooms or Finished Spaces below 3 metres (10 feet) above finished floor: Provide canvas jacket ready for finish painting.
- .8 Exterior Applications: Provide insulation with vapour barrier jacket. Cover the insulation with caulked aluminum jacket with seams located on bottom side of horizontal duct section.
- .9 Where ducts are acoustically lined to the equivalent R-value, no exterior duct insulation is required, except where exposed to outside temperature and weather.
- .10 External Duct Insulation Application:
 - .1 Secure insulation with vapour barrier with wires and seal jacket joints with vapour barrier adhesive or tape to match jacket.
 - .2 Secure insulation without vapour barrier with staples, tape, or wires.
 - .3 Install without sag on underside of duct work. Use adhesive or mechanical fasteners where necessary to prevent sagging. Lift duct work off trapeze hangers and insert spacers.
 - .4 Seal vapour barrier penetrations by mechanical fasteners with vapour barrier adhesive.
 - .5 Stop and point insulation around access doors and damper operators to allow operation without disturbing wrapping.
- .11 Duct and Plenum Liner Application:
 - .1 Adhere insulation with adhesive for 90 percent coverage with adhesive complying with ASTM C916.
 - .2 Secure insulation with mechanical liner fasteners. Refer to SMACNA Standards for spacing.
 - .3 Seal and smooth joints. Seal and coat transverse joints.
 - .4 Seal liner surface penetrations with adhesive.
 - .5 Duct dimensions indicated are net inside dimensions required for air flow. Increase duct size to allow for insulation thickness.
- .12 Install Elastomeric Cellular Thermal Duct Liner as per manufacturer's recommendations.
- .13 External Fire Wrap Duct Insulation Application:
 - .1 Install in accordance to manufactures published installation manual.

3.3 Schedules

- .1 Duct insulation shall follow the Schedules below as a minimum requirement. These requirements shall apply regardless of whether or not duct insulation is shown on the drawings.
- .2 Where duct insulation is shown on the drawings (either with the hatching convention or by means of a key note) and exceeds the requirements of the schedules below, the additional insulation requirements shall be met.

3.4 EXTERNAL DUCT WRAP, GLASS FIBRE, FLEXIBLE

DUCT SERVICE	DUCT SIZE <Inch><mm>	THICKNESS <mm><Inch>
All conditioned air supply ductwork in return plenums or un-conditioned interior space or mechanical rooms or electrical rooms	=< 400 mm (16") per side, or round duct	29mm (1 1/8") Installed 38mm (1 1/2") Nominal
Combustion Air ductwork	all	38mm (1 1/2") Installed 50mm (2") Nominal
Round exhaust ducts, relief ducts from external wall or roof back for length of 3000mm (10 feet) or to insulated damper, whichever is greater	All	57mm (2 1/4") Installed 75mm (3") Nominal
Round duct from insulated damper for length of up the 3000mm (10 feet)	All	38mm (1 1/2") Installed 50mm (2") Nominal
Round outdoor air ducts located in conditioned space to the air handler or mixed air plenum.	All	95mm (3 3/4") Installed 125mm (5") Nominal
Round ducts located outdoors or where exposed to outdoor temperatures (eg. Attics).	Not Permitted	Not Permitted
Round ducting to centrifugal exhaust fans on roofs.	All	38mm (1 1/2") Installed 50mm (2") Nominal

3.5 External Glass Fibre Rigid Insulation Board

DUCT SERVICE	DUCT SIZE <Inch><mm>	THICKNESS <mm><Inch>
Air conditioning supply plenums, before, including, and after cooling coils	all	50mm (2")
All conditioned air supply ductwork in return plenums or un-conditioned interior space or mechanical rooms or electrical rooms	> 400 mm (16") per side	25mm (1")
Combustion Air ductwork	all	50mm (2")
Rectangular exhaust ducts, relief	All	75mm (3")

DUCT SERVICE	DUCT SIZE <Inch><mm>	THICKNESS <mm><Inch>
ducts from external wall or roof back for length of 3000mm (10 feet) or to insulated damper, whichever is greater		
Rectangular duct from insulated damper for length of up the 3000mm (10 feet)	All	50mm (2")
Outdoor air ducts located in conditioned space from the intake louver at outside wall or roof to the air handler or mixed air plenum	All	75mm (3")
Rectangular conditioned air ducts located outdoors or where exposed to outdoor temperatures (eg. Attics, roofs).	All	125mm (5") or R-value of wall, which ever is greater.
Rectangular ducting to centrifugal exhaust fans on roofs.	All	50mm (2")

3.6

3.7

3.8 Glass Fibre Duct Liner, Rigid

DUCT SERVICE	DUCT SIZE <Inch><mm>	THICKNESS <mm><Inch>
Rectangular air supply and return air ductwork where indicated on drawings by acoustic hatching symbol.	All	25mm (1")

3.9 Glass Fibre Duct Liner, Flexible

DUCT SERVICE	DUCT SIZE <Inch><mm>	THICKNESS <mm><Inch>
Rectangular air supply and return air ductwork where indicated on drawings by acoustic hatching symbol.	All	25mm (1")
Rooftop goosenecks – exhaust (not including laundry or kitchen exhaust)	All	50mm (2")

3.10

3.11

3.12 Elastomeric Cellular Thermal Duct Liner

DUCT SERVICE	DUCT SIZE <Inch><mm>	THICKNESS <mm><Inch>
Rectangular air supply and return air ductwork where indicated on drawings by acoustic hatching symbol.	All	25mm (1")
Rooftop goosenecks - exhaust	All	50mm (2")

3.13

3.14

END OF SECTION

Part 1

General

1.1 Section Includes

- .1 Equipment insulation.
- .2 Covering.

1.2 Related Sections

- .1 Section 09 90 00 - Painting: Painting insulation covering.
- .2 Section 23 05 53 - Mechanical Identification.
- .3 Section 22 10 00 - Plumbing Piping: Placement of hangers and hanger inserts.
- .4 Section 23 21 00 - Hydronic Piping: Placement of hangers and hanger inserts.

1.3 References

- .1 ASTM A167 - Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
- .2 ASTM B209 - Aluminum and Aluminum-Alloy Sheet and Plate.
- .3 ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus.
- .4 ASTM C195 - Mineral Fibre Thermal Insulating Cement.
- .5 ASTM C240 - Testing Cellular Glass Insulation Block.
- .6 ASTM C449/C449M - Mineral Fibre Hydraulic-Setting Thermal Insulating and Finishing Cement.
- .7 ASTM C518 - Steady-State Thermal Transmission Properties by Means of the Heat Flow Metre Apparatus.
- .8 ASTM C533 - Calcium Silicate Block and Pipe Thermal Insulation.
- .9 ASTM C534 - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.
- .10 ASTM C552 - Cellular Glass Thermal Insulation.
- .11 ASTM C553 - Mineral Fibre Blanket Thermal Insulation for Commercial and Industrial Applications.
- .12 ASTM C592 - Mineral Fibre Blanket Insulation and Blanket-Type Pipe Insulation (Metal-Mesh Covered) (Industrial Type).
- .13 ASTM C612 - Mineral Fibre Block and Board Thermal Insulation.
- .14 ASTM C921 - Properties of Jacketing Materials for Thermal Insulation.
- .15 ASTM D1056 - Standard Specification for Flexible Cellular Materials - Sponge or Expanded Rubber.
- .16 ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
- .17 ASTM E96 - Water Vapour Transmission of Materials.

- .18 NAIMA National Insulation Standards.
- .19 NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials.
- .20 UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials.

1.4 Submittals For Review

- .1 Section 21 05 00: Procedures for submittals.
- .2 Product Data: Provide product description, thermal characteristics, list of materials and thickness for equipment scheduled.

1.5 Submittals For Information

- .1 Section 21 05 00: Procedures for submittals.
- .2 Manufacturer's Instructions: Indicate installation procedures which ensure acceptable workmanship and installation standards will be achieved.

1.6 Quality Assurance

- .1 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.
- .2 Applicator Qualifications: Company specializing in performing the work of this section with minimum three years documented experience.

1.7 Regulatory Requirements

- .1 Materials: Flame spread/smoke developed rating of 25/50 to NFPA 255 //UL 723.

1.8 Delivery, Storage, And Protection

- .1 Section 21 05 00: Transport, handle, store, and protect products.
- .2 Accept materials on site in original factory packaging, labelled with manufacturer's identification, including product density and thickness.
- .3 Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

1.9 Environmental Requirements

- .1 Section 21 05 00: Environmental conditions affecting products on site.
- .2 Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics, and insulation cements.
- .3 Maintain temperature during and after installation for minimum period of 24 hours.

Part 2 Products

2.1 GLASS FIBRE, FLEXIBLE

- .1 Manufacturers:
 - .1 Johns Manville Microlite XG
 - .2 Owens Corning SoftR Duct Wrap.
 - .3 Other acceptable manufacturers offering equivalent products.

- .1 Knauf.
- .2 Insulation: ASTM C553; flexible, noncombustible blanket.
 - .1 'ksi' ('K') value: ASTM C518, 0.045 at 24 degrees C (0.31 at 75 degrees F).
 - .2 Maximum service temperature: 121 degrees C (250 degrees F).
 - .3 Maximum moisture absorption: 0.20 percent by volume.
 - .4 Density 72 kg/cu. meter (4.5 lb/cu. Foot).
- .3 Vapour Barrier Jacket:
 - .1 ASTM C921, Kraft paper reinforced with glass fibre yarn and bonded to aluminized film.
 - .2 Moisture vapour transmission: ASTM E96; 0.02 perm.
 - .3 Secure with self-sealing longitudinal laps and butt strips.
 - .4 Secure with outward clinch expanding staples and vapour barrier mastic.
- .4 Tie Wire: 1.22 mm (0.048 inch) stainless steel with twisted ends on maximum 300 mm (12 inch) centres.

2.2 GLASS FIBRE, RIGID

- .1 Manufacturers:
 - .1 Johns Manville 800 Series
 - .2 Owens Corning Series 700
 - .3 Other acceptable manufacturers offering equivalent products.
 - .1 Knauf.
- .2 Insulation: ASTM C612; rigid, noncombustible blanket.
 - .1 'ksi' ('K') value : ASTM C518, 0.045 at 24 degrees C (0.31 at 75 degrees F).
 - .2 Maximum service temperature: 121 degrees C (250 degrees F).
 - .3 Maximum moisture absorption: 0.20 percent by volume.
 - .4 Density: 72 kg/cu m (4.5 lb/cu ft).
- .3 Vapour Barrier Jacket:
 - .1 Kraft paper with glass fibre yarn and bonded to aluminized film.
 - .2 Moisture vapour transmission: ASTM E96; 0.04 perm.
 - .3 Secure with self-sealing longitudinal laps and butt strips.
 - .4 Secure with outward clinch expanding staples and vapour barrier mastic.
- .4 Facing: 25 mm (1 inch) galvanized steel hexagonal wire mesh stitched on one face of insulation.
- .5 Vapour Barrier Lap Adhesive:
 - .1 Compatible with insulation.
- .6 Insulating Cement/Mastic:
 - .1 ASTM C195; hydraulic setting on mineral wool.

2.3 Cellular Glass

- .1 Insulation: ASTM C552.
 - .1 'ksi' ('K') Value: 0.039 at 24 degrees C (0.35 at 75 degrees F).
 - .2 Maximum Service Temperature: 482 degrees C (900 degrees F).
 - .3 Maximum Water Vapour Transmission: 0.1 perm.
 - .4 Maximum Moisture Absorption: ASTM C240, 0.2 percent by volume.
 - .5 Density: 128 kg/cu m (8.0 lb/cu ft).

2.4 Cellular Foam

- .1 Insulation: ASTM C534; flexible, cellular elastomeric, moulded or sheet.
 - .1 'ksi' ('K') Value: ASTM C177; 0.032 at 24 degrees C (0.25 at 75 degrees F).
 - .2 Minimum Service Temperature: -40 degrees C (-40 degrees F).
 - .3 Maximum Service Temperature: 104 degrees C (220 degrees F).
 - .4 Maximum Moisture Absorption: ASTM D1056; 1.0 percent by volume.
 - .5 Moisture Vapour Transmission: ASTM E96; 0.05 perm-inches.
 - .6 Connection: Waterproof vapour barrier adhesive.
- .2 Elastomeric Foam Adhesive:
 - .1 Air dried, contact adhesive, compatible with insulation.

2.5 Jackets

- .1 PVC Plastic:
 - .1 Jacket: ASTM C921, Sheet material, off-white colour.
 - .1 Minimum Service Temperature: -40 degrees C (-40 degrees F).
 - .2 Maximum Service Temperature: 66 degrees C (150 degrees F).
 - .3 Moisture Vapour Transmission: ASTM E96; 0.002 perm-inches.
 - .4 Thickness: 0.25 mm (10 mil).
 - .5 Connections: Brush on welding adhesive.
 - .2 Covering Adhesive Mastic:
 - .1 Compatible with insulation.
- .2 Canvas Jacket: UL listed.
 - .1 Fabric: ASTM C921, 220 g/sq m (6 oz/sq yd), plain weave cotton treated with dilute fire retardant lagging adhesive.
 - .2 Lagging Adhesive:
 - .1 Compatible with insulation.
- .3 Aluminum Flexible Self Adhesive Insulation Jacket: UL listed
 - .1 Manufacturers:
 - .1 VentureClad 1577CW
 - .2 Bakor Foilskin
 - .3 Polyguard Alumaguard
 - .2 Tensile Strength: 316.5 N/25 mm (70 lb/in)
 - .3 Puncture: 111 N (25 lbs)
 - .4 Service Temperature: -50 to 70°C (-58°C to 160°F)
 - .5 Finish: Embossed [Flat/Smooth]
 - .6 Aluminum foil exterior surface over multilayer laminate, vapour barriered jacket with pressure sensitive adhesive integral to jacket application surface with peel off release liner.
 - .7 Permeation (ASTM E96): 0.05 perm (maximum)
 - .8 UV resistant.
 - .9 Flame based application not acceptable.
- .4 Aluminum Jacket: ASTM B209.
 - .1 Thickness: 0.40 mm (0.016 inch) sheet.
 - .2 Finish: Smooth.
 - .3 Joining: Longitudinal slip joints and 50 mm (2 inch) laps.

- .4 Fittings: 0.4mm (0.016 inch) thick die shaped fitting covers with factory attached protective liner.
- .5 Metal Jacket Bands: 10 mm (3/8 inch) wide; 0.015 mm thick aluminum.

- .5 Stainless Steel Jacket: ASTM A167 Type 304 stainless steel.
 - .1 Thickness: 0.25 mm (0.010inch).
 - .2 Finish: Smooth.
 - .3 Metal Jacket Bands: 10 mm (3/8 inch) wide; 0.015 mm thick stainless steel.

Part 3 Execution

3.1 Examination

- .1 Section 01 70 00 - Examination and Preparation: Verification of existing conditions before starting work.
- .2 Verify that equipment has been tested before applying insulation materials.
- .3 Verify that surfaces are clean and dry, with foreign material removed.

3.2 Installation

- .1 Section 01 45 00: Manufacturer's written instructions.
- .2 Factory Insulated Equipment: Do not insulate.
- .3 Exposed Equipment: Locate insulation and cover seams in least visible locations.
- .4 Apply insulation close to equipment by grooving, scoring, and bevelling insulation. Fasten insulation to equipment with studs, pins, clips, adhesive, wires, or bands.
- .5 Fill joints, cracks, seams, and depressions with bedding compound to form smooth surface. On cold equipment, use vapour barrier cement.
- .6 Insulated equipment containing fluids below ambient temperature: Insulate entire system.
- .7 Apply insulation to pump casings to match form of pump.
- .8 Fibre glass insulated equipment containing fluids below ambient temperature: Provide vapour barrier jackets, factory-applied or field-applied. Finish with glass cloth and vapour barrier adhesive.
- .9 For hot equipment containing fluids 60 degrees C (140 degrees F) or less, do not insulate flanges and unions, but bevel and seal ends of insulation.
- .10 For hot equipment containing fluids over 60 degrees C (140 degrees F), insulate flanges and unions with removable sections and jackets. Jackets to be suitable for the service temperature.
- .11 Fibre glass insulated equipment containing fluids above ambient temperature: Provide standard jackets, with or without vapour barrier, factory-applied or field-applied. Finish with glass cloth and adhesive.
- .12 Inserts and Shields:
 - .1 Application: Equipment 50 mm (2 inches) diameter or larger.
 - .2 Shields: Galvanized steel between hangers and inserts.

- .3 Insert location: Between support shield and equipment and under the finish jacket.
- .4 Insert configuration: Minimum 150 mm (6 inches) long, of same thickness and contour as adjoining insulation; may be factory fabricated.
- .5 Insert material: Hydrous calcium silicate insulation or other heavy density insulating material suitable for the planned temperature range.
- .13 Finish insulation at supports, protrusions, and interruptions.
- .14 Equipment in Mechanical Equipment Rooms or Finished Spaces: Finish with canvas jacket sized for finish unless otherwise indicated.
- .15 For exterior piping applications, provide vapour barrier jacket. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe, and finish with glass mesh reinforced vapour barrier cement. Cover with aluminum jacket with seams located on bottom side of horizontal piping.
- .16 Nameplates and ASME Stamps: Bevel and seal insulation around; do not insulate over.
- .17 Equipment Requiring Access for Maintenance, Repair, or Cleaning: Install insulation so it can be easily removed and replaced without damage.

3.3 Schedules

- .1 Plumbing Systems:
 - .1 Domestic Hot Water Storage Tanks: Glass Fibre, Flexible Insulation: 50 mm (2 inches) thick.
- .2 Domestic Cold Water Booster Pump Bodies: Cellular Foam Insulation: 12 mm (1/2 inch) thick. Heating Systems:
 - .1 Plate-type heat exchanger: not required.
 - .2 Air Separators: Glass Fibre, Flexible Insulation: 25 mm (1 inches) thick.
 - .3 Hot Thermal Storage Tanks: Glass Fibre, Flexible Insulation: 50 mm (2 inches) thick.
 - .4 Radiant Panels: See section 23 82 00 Terminal Heat Transfer Units for requirements.
- .3 Cooling Systems:
 - .1 Pump Bodies: Cellular Foam Insulation: 12 mm (1/2 inch) thick.
 - .2 Air Separators: Cellular Foam Insulation: 12 mm (1/2 inch) thick.
 - .3 Chiller Cold Surfaces (Not Factory Insulated): Cellular Foam Insulation: Minimum 19 mm (3/4 inch) thick, or match chiller supplier's specific requirements if more stringent.
 - .4 Cold Thermal Storage Tanks: Cellular Foam Insulation: 19 mm (3/4 inch) thick.
 - .5 Plate and Frame Heat exchangers: See section 23 57 00 Heat Exchangers for insulation requirements.

END OF SECTION

Part 1

General

1.1 Section Includes

- .1 Piping insulation.
- .2 Jackets and accessories.

1.2 Related Sections

- .1 Section 09 90 00 - Painting: Painting insulation jacket.
- .2 Section 22 10 00 - Plumbing Piping: Placement of hangers and hanger inserts.
- .3 Section 23 05 53 - Mechanical Identification.
- .4 Section 23 21 00 - Hydronic Piping: Placement of hangers and hanger inserts.

1.3 References

- .1 ASTM B209 - Aluminum and Aluminum-Alloy Sheet and Plate.
- .2 ASTM C177 - Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus.
- .3 ASTM C195 - Mineral Fibre Thermal Insulating Cement.
- .4 ASTM C335 - Steady-State Heat Transfer Properties of Horizontal Pipe Insulation.
- .5 ASTM C449/C449M - Mineral Fibre Hydraulic-setting Thermal Insulating and Finishing Cement.
- .6 ASTM C518 - Steady-State Thermal Transmission Properties by Means of the Heat Flow Metre Apparatus.
- .7 ASTM C533 - Calcium Silicate Block and Pipe Thermal Insulation.
- .8 ASTM C534 - Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.
- .9 ASTM C547 - Mineral Fibre Pipe Insulation.
- .10 ASTM C552 - Cellular Glass Thermal Insulation.
- .11 ASTM C578 - Rigid, Cellular Polystyrene Thermal Insulation.
- .12 ASTM C585 - Inner and Outer Diameters of Rigid Thermal Insulation for Nominal Sizes of Pipe and Tubing (NPS System).
- .13 ASTM C591 - Unfaced Preformed Cellular Polyisocyanurate Thermal Insulation.
- .14 ASTM C610 - Moulded Expanded Perlite Block and Pipe Thermal Insulation.
- .15 ASTM C921 - Properties of Jacketing Materials for Thermal Insulation.
- .16 ASTM D1056 - Flexible Cellular Materials - Sponge or Expanded Rubber.
- .17 ASTM D1667 - Flexible Cellular Materials - Vinyl Chloride Polymers and Copolymers (Closed Cell Foam).
- .18 ASTM D2842 - Water Absorption of Rigid Cellular Plastics.
- .19 ASTM E84 - Surface Burning Characteristics of Building Materials.

- .20 ASTM E96 - Water Vapour Transmission of Materials.
- .21 CAN/ULC-S102-M88 - Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.
- .22 NFPA 255 - Surface Burning Characteristics of Building Materials.
- .23 UL 723 - Surface Burning Characteristics of Building Materials.

1.4 Quality Assurance

- .1 Materials: Flame spread/smoke developed rating of 25/50 or less to ASTM E84: NFPA 255; UL 723.

1.5 Qualifications

- .1 Applicator: Company specializing in performing the work of this section with minimum three years documented experience.

1.6 Delivery, Storage, And Handling

- .1 Section 21 05 00: Transport, handle, store, and protect products.
- .2 Deliver materials to site in original factory packaging, labelled with manufacturer's identification, including product density and thickness.
- .3 Store insulation in original wrapping and protect from weather and construction traffic.
- .4 Protect insulation against dirt, water, chemical, and mechanical damage.

1.7 Environmental Requirements

- .1 Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics, and insulation cements.
- .2 Maintain temperature during and after installation for minimum period of 24 hours.

Part 2 Products

2.1 GLASS FIBRE PRE-FORMED PIPE INSULATION WITH ALL-SERVICE JACKET

- .1 Manufacturers:
 - .1 Johns Manville Micro-Lok.
 - .2 Knauf Earthwool 1000.
 - .3 Owens Corning FIBREGLAS.
 - .4 Substitutions: Refer to Section 21 05 00.
- .2 Insulation: ASTM C547; rigid moulded, non-combustible.
 - .1 'ksi' ('K') value : ASTM C335, 0.035 at 24 degrees C (0.24 at 75 degrees F).
 - .2 Minimum Service Temperature: -28.9 degrees C (-20 degrees F).
 - .3 Maximum Service Temperature: 454 degrees C (850 degrees F).
 - .4 Maximum Moisture Absorption: 0.2 percent by volume.
- .3 Vapour Barrier Jacket
 - .1 ASTM C921, White kraft paper reinforced with glass fibre yarn and bonded to aluminized film.
 - .2 Moisture Vapour Transmission: ASTM E96; 0.03 ng/(Pa s sq m) (0.02 perm inches).

- .3 Secure with self sealing longitudinal laps and butt strips.
- .4 Secure with outward clinch expanding staples and vapour barrier mastic.
- .4 Tie Wire: 1.3 mm (18 gauge) stainless steel with twisted ends on maximum 300 mm (12 inch) centres.
- .5 Vapour Barrier Lap Adhesive
 - .1 Compatible with insulation.

2.2 CELLULAR FOAM

- .1 Manufacturers:
 - .1 Armacell AP Armaflex.
 - .2 Substitutions: Refer to Section 21 05 00.
- .2 Insulation: ASTM C534; flexible, cellular elastomeric, moulded or sheet.
 - .1 'ksi' ('K') Value: ASTM C177 or C518; 0.04 at 24 degrees C (0.27 at 75 degrees F).
 - .2 Minimum Service Temperature: -40 degrees C (-40 degrees F).
 - .3 Maximum Service Temperature: 104 degrees C (220 degrees F).
 - .4 Maximum Moisture Absorption: ASTM D1056; 1.0 percent (pipe) by volume, 1.0 percent (sheet) by volume.
 - .5 Moisture Vapour Transmission: ASTM E96; 0.20 perm inches.
 - .6 Maximum Flame Spread: ASTM E84; 25.
 - .7 Maximum Smoke Developed: ASTM E84; 50.
 - .8 Connection: Waterproof vapour barrier adhesive.
- .3 Elastomeric Foam Adhesive
 - .1 Manufacturers:
 - .1 Armstrong 520 adhesive.
 - .2 Air dried, contact adhesive, compatible with insulation.
 - .3 Outdoor insulation shall be covered with Armstrong Armaflex finish.

2.3 Jackets

- .1 PVC Plastic
 - .1 Jacket: ASTM C921, One piece moulded type fitting covers and sheet material, off white colour.
 - .1 Minimum Service Temperature: -40 degrees C (-40 degrees F).
 - .2 Maximum Service Temperature: 66 degrees C (150 degrees F).
 - .3 Moisture Vapour Transmission: ASTM E96; 0.002 perm inches.
 - .4 Maximum Flame Spread: ASTM E84; 25.
 - .5 Maximum Smoke Developed: ASTM E84; 50.
 - .6 Connections: installed in accordance with manufacturer's recommendations using PVC adhesive to seal joints, and tape or butt strips where joined to adjacent pipe covering. Use staples and insulation coating as specified at circumferential joints.
 - .2 Covering Adhesive Mastic
 - .1 Compatible with insulation.
- .2 Canvas Jacket: UL listed

- .1 Fabric: ASTM C921, 220 g/sq m (6 oz/sq yd), plain weave cotton treated with dilute fire retardant lagging adhesive.
- .2 Lagging Adhesive
 - .1 Bakelite 120-18 white fire retardant lagging adhesive.
- .3 Coating
 - .1 Finish with two full brush coats of Bakelite 120-09 white fire retardant paint.
- .3 Aluminum Flexible Self Adhesive Insulation Jacket: UL listed
 - .1 Manufacturers:
 - .1 VentureClad 1577CW
 - .2 Bakor Foilskin
 - .3 Polyguard Alumaguard
 - .2 Tensile Strength: 316.5 N/25 mm (70 lb/in)
 - .3 Puncture: 111 N (25 lbs)
 - .4 Service Temperature: -50 to 70°C (-58°C to 160°F)
 - .5 Finish: Embossed
 - .6 Aluminum foil exterior surface over multilayer laminate, vapour barriered jacket with pressure sensitive adhesive integral to jacket application surface with peel off release liner.
 - .7 Permeation (ASTM E96): 0.05 perm (maximum)
 - .8 UV resistant.
 - .9 Flame based application not acceptable.
- .4 Aluminum Jacket: ASTM B209.
 - .1 Thickness: 0.40 mm (0.016 inch) sheet.
 - .2 Finish: Embossed.
 - .3 Joining: Longitudinal slip joints and 50 mm (2 inch) laps.
 - .4 Fittings: 0.4 mm (0.016 inch) thick die shaped fitting covers with factory attached protective liner.
 - .5 Metal Jacket Bands: 10 mm (3/8 inch) wide; 0.38 mm (0.015 inch) thick aluminum.
- .5 Stainless Steel Jacket: Type 304 stainless steel.
 - .1 Thickness: 0.25 mm (0.010 inch).
 - .2 Finish: Smooth.
 - .3 Metal Jacket Bands: 10 mm (3/8 inch) wide; 0.25 mm (0.010 inch) thick stainless steel.

Part 3 Execution

3.1 Examination

- .1 Verify that piping has been tested before applying insulation materials.
- .2 Verify that surfaces are clean, foreign material removed, and dry.

3.2 Installation

- .1 Install materials to manufacturer's written instructions.
- .2 On exposed piping, locate insulation and cover seams in least visible locations.

- .3 Use of aluminum self-adhering jacketing may be substituted for PVC, canvas and aluminum jacketing where the self-adhering jacketing performance meets the operating conditions of the installed condition.
- .4 Insulated dual temperature pipes or cold pipes conveying fluids below ambient temperature:
 - .1 Provide vapour barrier jackets, factory applied or field applied.
 - .2 Insulate fittings, joints, and valves with moulded insulation of like material and thickness as adjacent pipe.
 - .3 Finish with glass cloth and vapour barrier adhesive.
 - .4 PVC fitting covers may be used.
 - .5 Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations.
 - .6 Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, pump bodies, and expansion joints.
- .5 For insulated pipes conveying fluids above ambient temperature:
 - .1 Provide standard jackets, with or without vapour barrier, factory applied or field applied.
 - .2 Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe.
 - .3 Finish with glass cloth and adhesive.
 - .4 PVC fitting covers may be used, except on steam and condensate piping systems.
 - .5 For hot piping conveying fluids 60°C (140°F) or less, do not insulate flanges and unions at equipment, but bevel and seal ends of insulation.
 - .6 For hot piping conveying fluids over 60°C (140°F), insulate flanges and unions at equipment.
- .6 Inserts and Shields:
 - .1 Application: Piping 40 mm (1-1/2 inches) diameter or larger.
 - .2 Shields: Galvanized steel between pipe hangers or pipe hanger rolls and inserts.
 - .3 Insert Location: Between support shield and piping and under the finish jacket.
 - .4 Insert Configuration: Minimum 150 mm (6 inches) long, of same thickness and contour as adjoining insulation; may be factory fabricated.
 - .5 Insert Material: hydrous calcium silicate insulation or other heavy density insulating material suitable for the planned temperature range.
- .7 Finish insulation at supports, protrusions, and interruptions.
- .8 Pipe supports:
 - .1 All piping shall be supported in such a manner that neither the insulation nor the vapor/weather barrier is compromised by the hanger or the effects of the hanger. In all cases, hanger spacing shall be such that the circumferential joint may be made outside the hanger. On cold systems, vapor barrier shall be continuous, including material covered by the hanger saddle.
 - .2 Piping systems 3" (75 mm) in diameter or less may be supported by placing saddles of the proper length and spacing under the insulation as designated by the insulation manufacturer.

- .3 For hot or cold piping systems larger than 3" (75 mm) in diameter, operating at temperatures less than +200F (93C) and insulated with fiber glass, high density inserts such as fiberglass or foam with sufficient compressive strength shall be used to support the weight of the piping system. At temperatures exceeding +200F (93C), high temperature pipe insulation shall be used for high density inserts.
- .4 Where pipe shoes and roller supports are required, insulation shall be inserted in the pipe shoe to minimize pipe heat loss. Where possible, the pipe shoe shall be sized to be flush with the outer pipe insulation diameter.
- .5 On vertical runs, insulation support rings shall be used as required.
- .9 For pipe exposed in mechanical equipment rooms, finish with canvas jacket or self-adhering adhesive jacket sized for finish painting.
- .10 For all pipe in exposed in occupied areas, finish with canvas jacket or self-adhering adhesive jacket sized for finish painting. All piping to be painted.
- .11 For exterior piping applications, provide metal or self-adhering vapour barrier jacket. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe, and finish with glass mesh reinforced vapour barrier cement. Cover with aluminum jacket or self adhering jacket with seams located on bottom side of horizontal piping.
- .12 On outdoor chilled water and refrigerant lines, the insulation system shall be completely vapor sealed before the weather-resistant jacket is applied. The outer jacket shall not compromise the vapor barrier by penetration of fasteners, etc. Vapor stops at butt joints shall be applied at every fourth pipe section joint and at each fitting to provide isolation of water incursion. Piping 38mm (1-1/2 inches) and less shall have UV resistant PVC or self adhering jacket. Pipes larger than 38mm (1-1/2 inches) shall have aluminium or self adhering jacket.
- .13 For buried piping, provide factory fabricated assembly with inner all-purpose service jacket with self sealing lap, and asphalt impregnated open mesh glass fabric, with one mil (0.025 mm) thick aluminum foil sandwiched between three layers of bituminous compound; outer surface faced with a polyester film.
- .14 For heat traced piping, insulate fittings, joints, and valves with insulation of like material, thickness, and finish as adjoining pipe. Size large enough to enclose pipe and heat tracer. Cover with aluminum jacket with seams located on bottom side of horizontal piping.
- .15 Insulate all roof hoppers and storm drain pipe in ceiling spaces or walls of finished areas, and all vent piping and exposed horizontal and vertical storm drain pipe within 3000 mm (10'-0") developed length from roof opening or located in vented attics and soffits.
- .16 Where internal roof drains discharge to grade, insulate all piping within 3000 mm (10'-0") developed length from the exterior wall termination. If the pipe is exposed within the building, continue insulation for all exposed lengths of pipe.
- .17 Fittings and Valves
 - .1 Shall be insulated with pre-formed fiberglass fittings, fabricated sections of fiberglass pipe insulation. Thickness shall be equal to adjacent pipe insulation. Finish shall be with pre-formed PVC fitting covers or as otherwise specified on Contract drawings.

- .2 Flanges, couplings and valve bonnets shall be covered with an oversized pipe insulation section sized to provide the same insulation thickness as on the main pipe section. An oversized insulation section shall be used to form a collar between the two insulation sections with low-density blanket insulation being used to fill gaps. Jacketing shall match that used on straight pipe sections. Rough cut ends shall be coated with suitable weather or vapor resistant mastic as dictated by the system location and service. On hot systems where fittings are to be left exposed, insulation ends should be beveled away from bolts for easy access.
 - .3 On cold systems, particular care must be given to vapor sealing the fitting cover or finish to the pipe insulation vapor barrier. All valve stems shall be sealed with caulking to allow free movement of the stem but provide a seal against moisture incursion. Valve handle extensions are recommended.
- .18 **ACCESSORY MATERIALS**
- .1 All accessory materials shall be installed in accordance with project drawings and specifications, manufacturer's instructions, and/or in conformance with the current edition of the Midwest Insulation Contractors Association (MICA) "Commercial & Industrial Insulation Standards."

3.3 Tolerance

- .1 Substituted insulation materials: Thermal resistance within 10 percent at normal conditions, as materials indicated.

3.4 FIBROUS GLASS INSULATION SCHEDULE

	PIPING SYSTEMS	PIPE SIZE <Inch><mm>	THICKNESS <Inch><mm>
Plumbing Systems			
	Domestic Hot Water Supply & Domestic Hot Water Recirc	=< 2" (50mm)	1" (25mm)
	Domestic Hot Water Supply & Domestic Hot Water Recirc	> 2" (50mm)	1 ½" (38mm)
	Tempered Domestic Water Supply	=< 2" (50mm)	1" (25mm)
	Tempered Domestic Water Supply	> 2" (50mm)	1 ½" (38mm)
	Domestic Cold Water, medical gas piping	=< 2" (50mm)	1" (25mm)
	Domestic Cold Water, medical gas piping	> 2" (50mm)	1 ½" (38mm)
	Roof Drain Bodies	all	2" (50mm)
	Roof Drain piping above floor within 10 Feet (3 Metres) of the Exterior. Entire length of pipe where not trapped.	all	2" (50mm)

	PIPING SYSTEMS	PIPE SIZE <Inch><mm>	THICKNESS <Inch><mm>
	Plumbing Vents Within 10 Feet (3 Metres) of the Exterior	all	2" (50mm)
Heating Systems			
	Heating water & glycol supply and return	=< 2" (50mm)	1" (25mm)
	Heating water & glycol supply and return,	> 2" (50mm)	1-1/2" (38mm)
	High Pressure Steam	all	3" (75mm)
Cooling Systems			
	Chilled water & glycol	all	1" (25mm)
	Condenser water	all	1" (25mm)
	Heat Recovery Water	all	1" (25mm)
	Glycol Cooling Supply and Return	all	1" (25mm)
	Cold Condensate Drains	all	1" (25mm)
	Condensate Drains from Cooling Coils	all	1" (25mm)
	Refrigerant Liquid	all	3/4" (19mm)
	Refrigerant Hot Gas	all	3/4" (19mm)
Other Systems			
	Piping Exposed to Freezing with heat tracing	all	3" (75mm)

3.5

3.6

3.7 Cellular Foam Pipe Insulation Schedule

	PIPING SYSTEMS	PIPE SIZE <Inch><mm>	THICKNESS <Inch><mm>
	Refrigerant Liquid	all	3/4" (19mm)
	Refrigerant Hot Gas	all	3/4" (19mm)

3.8

3.9

END OF SECTION

Part 1 General

1.1 SUMMARY

- .1 Single air compressor station to support dust collector equipment and distribution to shop point of use stations.

1.2 SECTION INCLUDES

- .1 Pipe and Pipe Fittings.
- .2 Reciprocating air compressor.
- .3 Air receiver and accessories.
- .4 Aftercooler.
- .5 Refrigerated air dryer.
- .6 Pressure reducing station.
- .7 Compressed Air Hose Reels

1.3 RELATED SECTIONS

- .1 Section 03 30 00 - Cast-in-place Concrete.
- .2 Section 23 05 29 - Supports and Anchors.
- .3 Section 23 05 53 - Mechanical Identification: Identification of piping system.
- .4 Section 23 05 48 - Vibration Isolation.
- .5 Section 26 05 80 - Equipment Wiring: Electrical characteristics and wiring connections.

1.4 REFERENCES

- .1 ASME - Boiler and Pressure Vessel Code.
- .2 ASME B16.3 - Malleable Iron Threaded Fittings.
- .3 ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings.
- .4 ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
- .5 ASME B16.26 - Cast Copper Alloy Fittings for Flared Copper Tubes.
- .6 ASME B31.1 - Power Piping.
- .7 ASME B31.9 - Building Services Piping.
- .8 ASTM A53/A53M - Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
- .9 ASTM A234/A234M - Piping Fittings of Wrought-Carbon Steel and Alloy Steel for Moderate and High Temperature Service.
- .10 ASTM B32 - Solder Metal.
- .11 ASTM B88 - Seamless Copper Water Tube.
- .12 ASTM D2513 - Thermoplastic Gas Pressure Pipe, Tubing, and Fittings.

- .13 ASTM D2683 - Socket-Type Polyethylene Fillings for Outside Diameter-Controlled Polyethylene Pipe and Tubing.
- .14 MSS SP-80 - Bronze Gate, Globe, Angle and Check Valves.
- .15 MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.
- .16 CSA C22.1 – Canadian Electrical Code

1.5 SUBMITTALS FOR REVIEW

- .1 Section 21 05 00: Procedures for submittals.
- .2 Product Data: Provide manufacturers catalogue literature with capacity, weight, and electrical characteristics and connection requirements.
- .3 Shop Drawings: Indicate piping system schematic with electrical characteristics and connection requirements.

1.6 SUBMITTALS FOR INFORMATION

- .1 Section 21 05 00: Procedures for submittals.
- .2 Test Reports: Submit inspector's certificate for air receiver for inclusion in Operating and Maintenance Manuals.
- .3 Certificates: Provide certificate of compliance from authority having jurisdiction indicating approval of air receiver.
- .4 Manufacturer's Instructions: Indicate manufacturer's installation instructions, hoisting and setting requirements, starting procedures.

1.7 SUBMITTALS AT PROJECT CLOSEOUT

- .1 Section 21 05 00: Procedures for submittals.
- .2 Project Record Documents: Record actual locations of equipment and components. Modify shop drawings to indicate final locations.
- .3 Operation Data: Submit for air compressor, air receiver and accessories, after cooler, refrigerated air dryer, and pressure reducing station.
- .4 Maintenance Data: Submit for air compressor, air receiver and accessories, after cooler, refrigerated air dryer, and pressure reducing station.
- .5 Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.8 QUALITY ASSURANCE

- .1 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years experience.

1.9 REGULATORY REQUIREMENTS

- .1 Conform to ASME code for installation of pressure vessels.

- .2 Products Requiring Electrical Connection: Listed and classified by testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

1.10 DELIVERY, STORAGE, AND PROTECTION

- .1 Section 21 05 00: Transport, handle, store, and protect products.
- .2 Accept air compressors, refrigerated air dryer on site in factory fabricated containers with shipping skids and plastic pipe end protectors in place. Inspect for damage.
- .3 Protect piping and equipment from weather and construction traffic.

1.11 WARRANTY

- .1 Section 21 05 00.
- .2 Provide five year manufacturer

1.12 MAINTENANCE PRODUCTS

- .1 Section 21 05 00.
- .2 Provide two litre containers of compressor oil.

Part 2 Products

2.1 PIPE AND PIPE FITTINGS

- .1 Aluminum Pipe:
 - .1 Basis of design: Transair/Parker compressed air piping systems
 - .1 Standards: ASME B31 series; ASTM B241, AW-6060 T51 or AW-6063 T5; CRN;
 - .2 Materials
 - .1 Seamless aluminum, powder coated, silicone free
 - .2 Pipe 38 mm (NPS 1-1/2) and smaller
 - .1 Fittings: Plastic with fibre glass reinforcement, ULC94 listed
 - .2 Joints: Stainless steel grip ring system, NBR seals
 - .3 Colour: coordinate with interior design requirements.
 - .3 Pipe: 50 mm (NPS 2) to 63 mm (NPS 2-1/2)
 - .1 Fittings: Aluminum
 - .2 Joints: Aluminum, NBR seals
 - .3 Colour: coordinate with interior design requirements.
 - .3 Performance requirements:
 - .1 Vacuum: to 1 mbar (0.03 in Hg)
 - .2 Compressed air and inert gases:
 - .1 12 to 100 mm (NPS ½ to 4): 16 bar (232 psi) at -20 to 46°C (-4 to 115 °F)
 - .2 150 to 200 mm (NPS 6 to 8): 13 bar (190 psi) at -20 to 60°C (-4 to 140°F)
 - .3 Maximum operating: 85°C (185°F) at 7 bar (100 psi)

2.2 VALVES

- .1 Pipe manufacturer's standard valve is equivalent to valves indicated in specification

- .2 Gate Valves
 - .1 MSS SP-80, Class 125, bronze body, bronze trim, rising stem, handwheel, inside screw, solid wedge disc, solder or threaded ends.
- .3 Ball Valves
 - .1 MSS SP-110, Class 150, 2760 kPa (400 psi) CWP, bronze, two piece body, chrome plated brass ball, regular port, teflon seats and stuffing box ring, blow-out proof stem, lever handle, solder or threaded ends with union.
- .4 Swing Check Valves
 - .1 Manufacturers:
 - .2 MSS SP-80, Class 125, bronze body and cap, bronze swing disc with rubber seat, solder or threaded ends.
- .5 Air Outlets
 - .1 Quick Connector: brass, snap on connector with self closing valve, . Style to be determined by Owner.
 - .2 Provide with FRL at points of use as indicated on drawings and details.

2.3 UNIONS AND COUPLINGS

- .1 Unions
 - .1 Pipe manufacturer's standard fittings
- .2 Dielectric Connections: Union suitable for pipe manufacturer's requirements.
- .3 Flexible Connector: Neoprene with brass threaded connectors or to pipe manufacturer's requirements.

2.4 AIR COMPRESSOR ASSEMBLY

- .1 Basis of Design: DV Systems VAVV-5062 15 hp with receiver
- .2 Assembly integrating single compressor, receiver and after-cooler.
- .3 Single point power connection for assembly.

2.5 COMPRESSOR

- .1 Simplex compressor unit consisting of air cooled compressor, air receiver, after cooler, refrigerated air dryer, pressure reducing station, and operating controls.
- .2 Reciprocating Compressors:
 - .1 Unit: Reciprocating compressor with positive displacement oil pump lubrication system, suction inlet screen, discharge service valves, on welded steel base for motor and compressor with provision for V-belt adjustment.
 - .2 Integrated receiver with pressure gauge, drain valve, check valve at compressor connection, safety/relief valve and side wall valved connection.
 - .3 Motor: Constant speed with electronic overheating protection in each phase, full voltage starting.
 - .4 Controls:
 - .1 Control Panel: Factory wired, steel, containing power and control wiring, disconnect switch, factory wired for single point power connection.

- .2 Starter: Full with manual reset current overload protection, starter relay, control power transformer, terminal strip for connection to interface equipment.
- .3 Safety Controls: Manually reset low oil pressure cutout.
- .4 Pressure switch with adjustable setpoint.
- .5 Panel Face: Compressor run light, start-stop switch, elapsed time meter.
- .3 Capacity: refer to schedule
- .4 Electrical Characteristics:
 - .1 600 volts, three phase, 60 Hz.
 - .2 Refer to Section 26 05 80.
- .5 Motor: Refer to Section 23 05 13.
- .6 Controls:
 - .1 Pressure Switch: Line voltage contactor to break at 690 kPa (100 psi) (adjustable) with minimum differential of 138 kPa (20 psi).
- .7 Wiring Terminations: Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclose terminal lugs in terminal box sized to CSA C22.1.
- .8 Disconnect Switch: Factory mount disconnect switch [in control panel.] [on equipment to Section 26 05 80.]

2.6 AFTERCOOLER

- .1 Construction: Aluminum finned heat sink with polypropylene fan blades. Integrated to compressor assembly.

2.7 INLINE MOISTURE SEPARATOR

- .1 Cast aluminum housing, polyester coated. Construction to ISO 12500-4. Provided with condensate drain.

2.8 AIR DRYER

- .1 Type:
 - .1 Heatless modular desiccant.
 - .2 Class 2 air
- .2 Air Connections: Inlet and outlet connections at same level, factory insulated.
- .3 Moisture Separator: Centrifugal type located at discharge of heat exchanger.
- .4 Refrigeration Unit: Hermetically sealed type to operate continuously to maintain -40°C dew point. House unit in steel cabinet provided with access door and panel for maintenance and inspection.
- .5 Accessories: Pre-filter, air inlet temperature gauge, air inlet pressure gauge, on/off switch, high temperature light, power on light, refrigerant gauge, air outlet temperature gauge, air outlet pressure gauge.
- .6 Capacity: based on air compressor capacity

- .7 Electrical Characteristics:
 - .1 120-240 volts, single phase, 60 Hz.
 - .2 Refer to Section 26 05 80.
- .8 Motor: Refer to Section 23 05 13.
- .9 Controls: integrated controls with on-screen display
- .10 Wiring Terminations: Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclose terminal lugs in terminal box sized to CSA C22.1.
- .11 Disconnect Switch: Factory mount disconnect switch.

2.9 AIR RECEIVER

- .1 Receiver: Horizontal to suit installation requirements, built to ASME regulations for working pressure of 1380 kPa (200 psi). Flange or screw inlet and outlet connections.
- .2 Fittings: Adjustable pressure regulator, safety valve, pressure gauge, drain cock, and automatic float actuated condensate trap.
- .3 Tank Finish: Provide custom colour.
- .4 ASME BPVC Section VIII Div 1 compliant
- .5 Capacity: refer to compressed air schematic.
- .6 Steel shell with painted exterior, support feet with openings for floor mount fasteners, drain plug, pressure gauge plug, piped connections x2 for supply and distribution at pipe line size or greater as indicated on drawings.

2.10 DRAIN VALVES

- .1 Automated zero loss drain valves, electronically operated based on condensate level. Non-corroding materials of construction. Minimum MWP 13.8 bar (200 psi).

2.11 OIL/WATER SEPARATOR

- .1 Replaceable absorption media contained in housing constructed of non-corroding materials.

2.12 PRESSURE REGULATOR

- .1 Pressure Regulator: Consisting of automatic reducing valve and bypass, and low pressure side relief valve and gauge. Provide oil separator where indicated.
- .2 Valve Capacity: Reduce pressure from 1379 kPa (200 psi) to 207 kPa (30 psi) adjustable upwards from reduced pressure.

2.13 COMPRESSED AIR HOSE REEL (HR-1)

- .1 Basis of Design: Reelcraft 5635 OLP
- .2 All-steel construction
- .3 10mm (3/8") ID hose
- .4 11m (35 ft) hose length

- .5 300 psig max pressure
- .6 1/4" hose outlet, 3/8" hose inlet
- .7

Part 3 Execution

3.1 INSTALLATION

- .1 Install compressor unit on concrete housekeeping pad. Refer to Section 03 30 00.
- .2 Install compressor unit on vibration isolators. Level and bolt in place. Refer to Section 23 05 48.
- .3 Make air cock and drain connection on horizontal casing.
- .4 Install line size isolation valve and check valve on compressor discharge.
- .5 Install replaceable cartridge type filter silencer of adequate capacity for each compressor.
- .6 Connect condensate drains to nearest floor drain.
- .7 Install automated drain valves on all drainable equipment and components without integrated auto drains.
- .8 Install valved bypass around air dryer. Factory insulate inlet and outlet connections.
- .9 Install valved drip connections at low points of piping system.
- .10 Install take offs to outlets from top of main, with shut off valve after take off. Slope take off piping to outlets.
- .11 Install compressed air couplings, female quick connectors, and pressure gauges where outlets are indicated.
- .12 Install tees instead of elbows at changes in direction of piping. Fit open end of each tee with plug.
- .13 Identify piping system and components. Refer to Section 23 05 53.

3.2 FIELD QUALITY CONTROL

- .1 Compressed Air Piping Leak Test: Prior to initial operation, clean and test compressed air piping to ANSI B31.1.
- .2 Repair or replace compressed air piping as required to eliminate leaks, and retest to demonstrate compliance.
- .3 Cap and seal ends of piping when not connected to mechanical equipment.

END OF SECTION

Part 1 General

1.1 Section Includes

- .1 Pipe and pipe fittings for:
 - .1 Heating water piping system.
 - .2 Glycol water piping system.
 - .3 Chilled water piping system.
 - .4 Equipment drains and overflows.
- .2 Valves:
 - .1 Gate valves.
 - .2 Globe or angle valves.
 - .3 Ball valves.
 - .4 Plug valves.
 - .5 Butterfly valves.
 - .6 Check valves.

1.2 Related Sections

- .1 Section 08 31 00 - Access Doors And Frames.
- .2 Section 09 90 00 - Painting.
- .3 Section 23 05 16 – Piping Expansion Compensation.
- .4 Section 23 05 20 - Hydronic Specialties.
- .5 Section 23 05 29 – Supports and Anchors.
- .6 Section 23 05 48 - Vibration Isolation.
- .7 Section 23 05 53 - Mechanical Identification.
- .8 Section 23 07 19 - Piping Insulation.
- .9 Section 23 25 00 - Chemical Treatment For Piping.
- .10 Section 26 05 80 - Equipment Wiring: Electrical characteristics and wiring connections.

1.3 References

- .1 ASME -Welding and Brazing Qualifications.
- .2 ASME B16.3 - Malleable Iron Threaded Fittings Class 50 and 300.
- .3 ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings.
- .4 ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
- .5 ASME B31.5 - Refrigeration Piping and Heat Transfer Components.
- .6 ASME B31.9 - Building Services Piping.
- .7 ASTM A53/A53M - Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
- .8 ASTM A234/A234M - Piping Fittings of Wrought-Carbon Steel and Alloy Steel for Moderate and High Temperature Service.
- .9 ASTM B32 - Solder Metal.

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- .10 ASTM B88 - Seamless Copper Water Tube.
 - .11 ASTM F477 - Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
 - .12 AWS A5.8 - Filler Metals for Brazing and Braze Welding.
 - .13 AWS D1.1 - Structural Welding Code - Steel.
 - .14 AWWA C105 - Polyethylene Encasement for Ductile-Iron Pipe Systems.
 - .15 AWWA C110 - Ductile - Iron and Grey -Iron Fittings 3 inch - 48 inch (76 mm - 1219 mm), for Water and Other Liquids.
 - .16 AWWA C111 - Rubber-Gasket Joints for Ductile Iron and Pressure Pipe and Fittings.
 - .17 AWWA C151 - Ductile-Iron Pipe, Centrifugally Cast, for Water.

1.4 System Description

- .1 Where more than one piping system material is specified, ensure system components are compatible and joined to ensure the integrity of the system is not jeopardized. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.
- .2 All valves must be installed with stems upright or horizontal; not inverted.
- .3 Valve body materials shall be compatible with piping system materials. Valves shall meet all pressure, temperature, and fluid handling requirements of the system.
- .4 A valve drain shall be provided at the base of each riser and at the low points of the system. Manual air vents shall be provided at the top of each riser and at the high points of the system.
- .5 Supply and install check valves on condensate pump discharges and also where indicated on the drawings.
- .6 All valves installed in concealed locations, i.e., ceiling spaces, shall be compactly arranged so that they are easily accessible through common access plates or doors.
- .7 On cooling coils supply and install drain valves with hose end connections at the top of the coil header of headers to allow the coils to be filled with glycol.
- .8 Grooved mechanical couplings and fasteners may only be used in accessible locations outside of mechanical rooms.
- .9 All piping within mechanical rooms shall be welded or threaded pipe.
- .10 Use unions, flanges, and couplings downstream of valves and at equipment or apparatus connections. Do not use direct welded or threaded connections to valves, equipment or other apparatus.
- .11 Use non-conducting dielectric connections whenever jointing dissimilar metals in open systems.
- .12 Provide pipe hangers and supports to ASTM B31.9 unless indicated otherwise.
- .13 Use ball or butterfly valves for shut-off and to isolate equipment, part of systems, or vertical risers.
- .14 Use globe or butterfly valves for throttling, bypass, or manual flow control services.

- .15 Use spring loaded check valves on discharge of pumps.
- .16 Use plug cocks for throttling service. Use non-lubricated plug cocks only when shut-off or isolating valves are also provided.
- .17 Use butterfly valves in heating, chilled and condenser water systems interchangeably with gate and globe valves providing they meet the pressure, temperature, and fluid handling requirements of the system.
- .18 Use only butterfly valves in chilled and condenser water systems for throttling and isolation service.
- .19 Use lug end butterfly valves to isolate equipment.
- .20 Use 3/4 inch (20 mm) ball valves with cap for drains at main shut-off valves, low points of piping, bases of vertical risers, and at equipment. Pipe to nearest floor drain. NOTE: Piping containing glycol or other antifreeze solutions to be piped back to the tank.

1.5 Submittals

- .1 Section 21 05 00: Procedures for submittals.
- .2 Product Data: Include data on pipe materials, pipe fittings, valves, and accessories. Provide manufacturers catalogue information. Indicate valve data and ratings.
- .3 Welders Certificate: Include welders certification of compliance with ASME SEC 9 and applicable provincial labour regulations.
- .4 Manufacturer's Installation Instructions: Indicate hanging and support methods, joining procedures.

1.6 Project Record Documents

- .1 Section 21 05 00: Submittals for project closeout.
- .2 Record actual locations of valves.

1.7 Operation And Maintenance Data

- .1 Submit to Section 21 05 00.
- .2 Include valve schedule complete with valve tags, location, service, normally open/normally closed.
- .3 Maintenance Data: Include installation instructions, spare parts lists, exploded assembly views.

1.8 Qualifications

- .1 Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.
- .2 Carbon steel pipe and fittings manufactured in China or India will not be permitted.
- .3 Installer: Company specializing in performing the work of this section with minimum 5 years documented experience.
- .4 Welders: Certify to ASME SEC 9 and applicable provincial labour regulations.

1.9 Regulatory Requirements

- .1 All pressure piping systems for use in Manitoba shall be designed and constructed in accordance with the applicable ANSI/ASME Piping Codes and the Manitoba Labour and Immigration, Steam and Pressure Plants Act.
- .2 Conform to ASME B31.9 code for installation of piping system.
- .3 Welding Materials and Procedures: Conform to ASME SEC 9 and applicable provincial labour regulations.
- .4 Provide certificate of compliance from authority having jurisdiction indicating approval of welders.

1.10 Delivery, Storage, And Handling

- .1 Section 21 05 00: Transport, handle, store, and protect products.
- .2 Accept valves on site in shipping containers with labeling in place. Inspect for damage.
- .3 Provide temporary protective coating on cast iron and steel valves.
- .4 Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.
- .5 Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

1.11 Environmental Requirements

- .1 Do not install underground piping when bedding is wet or frozen.

1.12 EXTRA MATERIALS

- .1 Section 21 05 00: Submittals for project closeout.
- .2 Provide two repacking kits for each size and valve type.

Part 2 Products

2.1 HEATING WATER AND GLYCOL PIPING, ABOVE GROUND

- .1 Steel Pipe: ASTM A53, Schedule 40, black.
 - .1 Fittings: ASTM B16.3, malleable iron or ASTM A234, forged steel welding type fittings.
 - .2 Joints: Threaded, or AWS D1.1, welded.
 - .3 Mechanical Grooved Couplings: Malleable iron housing clamps to engage and lock, "C" shaped elastomeric sealing gasket, steel bolts, nuts, and washers; galvanized for galvanized pipe.
- .2 Copper Tubing: ASTM B88, Type L hard drawn. Up to 50mm (2") diameter only.
 - .1 Fittings: ASME B16.18, cast brass, or ASME B16.22, solder wrought copper.
 - .2 Joints: Up to 50mm (2") diameter: Solder, lead free, ASTM B32, 95-5 tin-antimony, or tin and silver, with melting range 220 to 280 degrees C (430 to 535 degrees F).
- .3 Hose: Composite hose with nitrile liner, braided fibre reinforcing, neoprene cover, 1034 kPa (150 psig) operating pressure at 96 degrees C (205 degrees F).
 - .1 Fittings: Copper.

- .2 Joints: Nipple with stainless steel clamp.

2.2 CHILLED WATER PIPING, ABOVE GRADE

- .1 Steel Pipe: ASTM A53, Schedule 40, black.
 - .1 Fittings: ASTM B16.3, malleable iron or ASTM A234, forged steel welding type fittings.
 - .2 Joints: Threaded, or AWS D1.1, welded.
 - .3 Mechanical Grooved Couplings: Malleable iron housing clamps to engage and lock, "C" shaped elastomeric sealing gasket, steel bolts, nuts, and washers; galvanized for galvanized pipe.
- .2 Copper Tubing: ASTM B88, Type L hard drawn.
 - .1 Fittings: ASME B16.18, cast brass, or ASME B16.22, solder wrought copper.
 - .2 Joints: Up to 50mm (2") diameter: Solder, lead free, ASTM B32, 95-5 tin-antimony, or tin and silver, with melting range 220 to 280 degrees C (430 to 535 degrees F). Diameters 63mm (2-1/2") to 100mm (4"): Braze, AWS A5.8 BCuP silver/phosphorus/copper alloy with melting range 640 - 805 degrees C (1190 - 1480 degrees F).

2.3 EQUIPMENT DRAINS AND OVERFLOWS

- .1 Steel Pipe: ASTM A53, Schedule 40 galvanized.
 - .1 Fittings: Galvanized cast iron, or ASTM B16.3 malleable iron.
 - .2 Joints: Threaded, or grooved mechanical couplings.
- .2 Copper Tubing: ASTM B88, Type L, annealed.
 - .1 Fittings: ASME B16.22, wrought copper.
 - .2 Joints: Solder, lead free, ASTM B32, 95-5 tin-antimony, or tin and silver, with melting range 220 to 280 degrees C (430 to 535 degrees F).

2.4 Unions, Flanges, And Couplings

- .1 Unions for Pipe 50 mm (2 inches) and Under:
 - .1 Ferrous Piping: 1034 kPa (150 psig) malleable iron, threaded.
 - .2 Copper Pipe: Bronze, soldered joints.
- .2 Flanges for Pipe Over 50 mm (2 inches):
 - .1 Ferrous Piping: 1034 kPa (150 psig) forged steel, slip-on.
 - .2 Copper Piping: Bronze.
 - .3 Gaskets: 1.6 mm (1/16 inch) thick preformed neoprene.
- .3 Grooved and Shouldered Pipe End Couplings:
 - .1 Housing Clamps: Malleable iron to engage and lock, designed to permit some angular deflection, contraction, and expansion.
 - .2 Sealing Gasket: C-shape elastomer composition for operating temperature range from -34 degrees C (-30 degrees F) to 110 degrees C (230 degrees F).
 - .3 Accessories: Steel bolts, nuts, and washers.
- .4 Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.

2.5 Gate Valves

- .1 Up To and Including 50 mm (2 inches):
 - .1 Manufacturers:
 - .1 Red-White/Toyo Rising Stem, Union Bonnet, Solid Wedge Disc
Class 125: Threaded: 293 Soldered: Use Adaptors
Class 150: Threaded: 298 Soldered: Use Adaptors
Class 300: Threaded: 318 Soldered: Use Adaptors
 - .2 Kitz Rising Stem, Screwed Bonnet, Solid Wedge Disc
Class 125: Threaded: 24 Soldered: 44
Class 150: Threaded: 25 Soldered: 45
Rising Stem, Union Bonnet, Solid Wedge Disc
150: Threaded: 42, 42T Soldered: 43
Threaded: 37 Soldered: Use Adaptors
Class 300: Kitz
 - .3 Red-White/Toyo Non-Rising Stem, Screwed Bonnet, Solid Wedge Disc
Class 125: Threaded: 280 Soldered: 281
Class 150: Threaded: 204 Soldered: Use Adaptors
 - .4 Kitz Non-Rising Stem, Screwed Bonnet, Solid Wedge Disc
Class 125: Threaded: 40 Soldered: 41
Class 150: Threaded: 46 Soldered: 64
 - .4 Substitutions: Refer to Section 21 05 00.
 - .2 Bronze body, bronze trim, bonnet, rising stem, handwheel, solid wedge disc, solder or threaded ends.
- .2 Over 50 mm (2 inches):
 - .1 Manufacturers:
 - .1 Red-White/Toyo 421 Rising Stem, Flanged Ends
 - .2 Kitz 72 Rising Stem, Flanged Ends
 - .3 Red-White/Toyo 415 Non-Rising Stem, Flanged Ends
 - .4 Kitz 75 Non-Rising Stem, Flanged Ends
 - .5 Substitutions: Refer to Section 21 05 00.
 - .2 Iron body, bronze trim, bolted bonnet, rising stem, handwheel, outside screw and yoke, solid wedge disc with bronze seat rings, flanged ends.

2.6 Globe Or Angle Valves

- .1 Up To and Including 50 mm (2 inches):
 - .1 Manufacturers:
 - .1 Red-White/Toyo
 - .2 Kitz
 - .3 Crane
 - .4 Substitutions: Refer to Section 21 05 00.
 - .2 Bronze body, bronze trim, union bonnet, rising stem and handwheel, renewable composition disc and bronze seat, solder ends.
- .2 Over 50 mm (2 inches):
 - .1 Manufacturers:
 - .1 Red-White/Toyo
 - .2 Kitz
 - .3 Crane
 - .4 Substitutions: Refer to Section 21 05 00.

- .2 Iron body, bronze trim, bolted bonnet, rising stem, handwheel, outside screw and yoke, rotating plug-type disc with renewable seat ring and disc, flanged ends.

2.7 Ball Valves

- .1 Up To and Including 50 mm (2 inches):
 - .1 Manufacturers:
 - .1 MAS
 - .2 Red-White/Toyo
 - .3 Kitz
 - .4 Crane
 - .5 Substitutions: Refer to Section 21 05 00.
 - .2 Bronze one piece body, stainless steel ball, teflon seats and stuffing box ring, lever handle solder ends.
- .2 Over 50 mm (2 inches):
 - .1 Manufacturers:
 - .1 Kitz
 - .2 MAS
 - .3 American 4001
 - .4 American 4000
 - .5 Crane
 - .6 Substitutions: Refer to Section 21 05 00.
 - .2 Cast steel body, chrome plated steel ball, teflon seat and stuffing box seals, lever handle, [or gear drive handwheel for sizes 250 mm (10 inches) and over,] flanged.

2.8 Plug Valves

- .1 Up To and Including 50 mm (2 inches):
 - .1 Manufacturers:
 - .1 Nordstrom Valves, Inc. MSS SP-78, Type II.
 - .2 Substitutions: Refer to Section 21 05 00.
 - .2 Cast-iron or bronze body, bronze tapered plug, [40 percent] [70 percent] [full] port opening, non-lubricated, teflon packing, threaded ends.
 - .3 Operator: One plug valve wrench for every ten plug valves minimum of one.
- .2 Over 50 mm (2 inches):
 - .1 Manufacturers:
 - .1 Nordstrom Valves, Inc. MSS SP-78, Type II.
 - .2 Substitutions: Refer to Section 21 05 00.
 - .2 Cast iron body and plug, [40 percent] [70 percent] [full] port opening, pressure lubricated, teflon packing, flanged ends.
 - .3 Operator: Each plug valve with a wrench with set screw.

2.9 Butterfly Valves

- .1 Manufacturers:
 - .1 Demco
 - .2 Kitz
 - .3 Mueller

- .4 Substitutions: Refer to Section 21 05 00.
- .2 Body: Cast or ductile iron with resilient replaceable EPDM seat, wafer or lug ends, extended neck.
- .3 Disc: Stainless Steel.
- .4 Operator: 10 position lever handle. Valves 8" and larger shall have gear operator with position indicator.

2.10 Swing Check Valves

- .1 Up To and Including 50 mm (2 inches):
 - .1 Manufacturers:
 - .1 Red-White/Toyo
 - .2 Kitz
 - .3 Substitutions: Refer to Section 21 05 00.
 - .2 Bronze body, bronze trim, bronze rotating swing disc, with composition disc, solder ends.
- .2 Over 50 mm (2 inches):
 - .1 Manufacturers:
 - .1 Red-White/Toyo
 - .2 Kitz
 - .3 Substitutions: Refer to Section 21 05 00.
 - .2 Iron body, bronze trim, bronze or bronze faced rotating swing disc, renewable disc and seat, flanged ends.

2.11 Spring Loaded Check Valves

- .1 Manufacturers:
 - .1 Mueller 71 Series
 - .2 M.A. Stewart & Sons Moygro W12A-I6V (single plate)
 - .3 Watts ICV
 - .4 Substitutions: Refer to Section 21 05 00.
- .2 Iron body, bronze trim, split plate, hinged with stainless steel spring, resilient seal bonded to body, wafer or threaded lug ends.

Part 3 Execution

3.1 Preparation

- .1 Ream pipe and tube ends. Remove burrs.
- .2 Remove scale and dirt on inside and outside before assembly.
- .3 Prepare piping connections to equipment with flanges or unions.
- .4 Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.
- .5 After completion, fill, clean, and treat systems. Refer to Section 23 25 00.

3.2 Installation

- .1 Install to manufacturer's written instructions.

- .2 Install heating water, glycol, chilled water, and condenser water piping to ASME B31.9.
- .3 Route piping in orderly manner, parallel to building structure, and maintain gradient. Grade hydronic piping up in flow direction or as noted.
- .4 Install piping to conserve building space, and not interfere with use of space.
- .5 Group piping whenever practical at common elevations.
- .6 Sleeve pipe passing through partitions, walls and floors.
- .7 Slope piping and arrange to drain at low points.
- .8 Provide piping on glycol systems from air vents to associated glycol fill tank.
- .9 Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment. Refer to Section 23 05 16.
- .10 Install drain valves (ball valves) c/w hose and cap and chain on each pump (pipe to nearest floor drain), at system low points so that entire system can be drained, and at each zone or branch / riser isolation valve so branch or riser can be drained down completely.
- .11 Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings. Refer to Section 23 07 19.
- .12 Overhead radiant panel branch connections:
 - .1 Copper soft temper tubing shall be used only for interconnecting panels in each individual room and for branch connections from valves to panels.
 - .2 Use 95-5 tin antimony solder at all joints. Fittings to be Emco smooth bore fittings.
- .13 Provide access where valves and fittings are not exposed. Coordinate size and location of access doors with Section 08 31 00.
- .14 Slope piping and arrange systems to drain at low points. Use eccentric reducers to maintain top of pipe level.
- .15 Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welds.
- .16 Prepare unfinished pipe, fittings, supports, and accessories, ready for finish painting. Refer to Section 09 90 00.
- .17 Install valves with stems upright or horizontal, not inverted.
- .18 All hydronic equipment, manifolds, and headers shall be provided with isolation valves at all connections, complete with unions or flanges.

3.3 Pressure Testing

- .1 Do not insulate pipe prior to pressure testing. Pressure test in sections if necessary before concealing or insulating pipe.
- .2 Do not introduce water for testing where freezing conditions exist or where piping systems being tested are located above sensitive areas or equipment that may be damaged or contaminated by water leakage.
- .3 Hydraulically test all pipe. Pneumatic testing not permitted without prior approval from the Contract Administrator and the Authority Having Jurisdiction.

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- .4 Hydronic pipe testing shall be in accordance with the applicable ASME piping code, the Contractor's registered Quality Assurance Program (for systems where applicable), and all requirements of the Department of Labour .
 - .5 Should leaks develop in any part of the piping system, remove and replace defective sections, fittings and equipment. Pipe dope, caulking, tape, lead wool, dresser couplings, etc. shall not be used to correct deficiencies. The contractor shall be responsible for all cleanup related to leakage during flushing, testing, and chemical treatment of piping, including original building piping if included in the testing.
 - .6 Test piping system in sections as required by the progress of work.
 - .7 Subject piping to a hydrostatic pressure of at least that 1-½ times the operating pressure of the system for a period of at least 12 hours. If leaks are detected, such leaks shall be repaired and the test started over. Record results and submit witnessed (by Contract Administrator or The City's representative) reports to the Contract Administrator.
 - .8 Register pressures at the highest system point.
 - .9 Provide at least 48 hours (during working days) notice to Contract Administrator or The City's Representative prior to testing to allow the tests to be witnessed.

END OF SECTION

Part 1

General

1.1

Section Includes

- .1 In-line circulators.
- .2 Vertical in-line pumps.
- .3 Close coupled pumps.
- .4 Side-stream filters.

1.2

Related Sections

- .1 Section 03 30 00 - Cast-in-place Concrete.
- .2 Section 23 05 13 - Motors.
- .3 Section 23 05 48 - Vibration Isolation.
- .4 Section 23 07 19 - Piping Insulation.
- .5 Section 23 07 16 - Equipment Insulation.
- .6 Section 23 21 00 - Hydronic Piping.
- .7 Section 23 05 20 - Hydronic Specialties.
- .8 Section 26 05 80 - Equipment Wiring: Electrical characteristics and wiring connections.

1.3

References

- .1 UL 778 - Motor-Operated Water Pumps.

1.4

Performance Requirements

- .1 Ensure pumps operate at specified system fluid temperatures without vapour binding and cavitation, are non-overloading in parallel or individual operation, and operate within 25 percent of midpoint of published maximum efficiency curve.

1.5

Submittals

- .1 Section 21 05 00: Procedures for submittals.
- .2 Product Data: Provide certified pump curves showing performance characteristics with pump and system operating point plotted. Include NPSH curve when applicable. Include electrical characteristics and connection requirements.
- .3 Manufacturer's Installation Instructions: Indicate hanging and support requirements and recommendations.
- .4 Millwright's Certificate: Certify that base mounted pumps have been aligned.

1.6

Project Record Documents

- .1 Section 21 05 00: Procedures for submittals.
- .2 Record actual locations of hydronic pumps.

1.7 Operation And Maintenance Data

- .1 Section 21 05 00: Procedures for submittals.
- .2 Operation and Maintenance Data: Include installation instructions, assembly views, lubrication instructions, and replacement parts list.

1.8 Quality Assurance

- .1 Manufacturer: Company specializing in manufacture, assembly, and field performance of pumps with minimum three (3) years documented experience.
- .2 Alignment: Align base mounted pumps by qualified millwright.
- .3 Impeller trimming: Trimming of impeller by qualified millwright

1.9 Regulatory Requirements

- .1 Products Requiring Electrical Connection: Listed and classified by UL or testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

1.10 Extra Materials

- .1 Section 21 05 00: Procedures for submittals.
- .2 Provide one set of mechanical seals for each pump.
- .3 Provide 2 sets of cartridges for each side-stream filter.

Part 2 Products

2.1 MANUFACTURERS

- .1 Bell & Gossett
- .2 Armstrong
- .3 Taco
- .4 Substitutions: Refer to Section 21 05 00.

2.2 SYSTEM LUBRICATED CIRCULATORS

- .1 Type: Horizontal shaft, single stage, direct connected with multiple speed wet rotor motor for in-line mounting, for 1035 kPa (150 psig) maximum working pressure, 107 degrees C (225 degrees F) maximum water temperature.
- .2 Casing: Cast iron with flanged pump connections.
- .3 Impeller: Noryl
- .4 Shaft : Ceramic.
- .5 Bearings: Metal Impregnated carbon (graphite) and ceramic.
- .6 Motor: Impedance protected, speed.
- .7 Performance:
 - .1 See Schedule

- .8 Wiring Terminations: Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclose terminal lugs in terminal box sized to code.

2.3 SYSTEM LUBRICATED CIRCULATORS (Cast Iron Heating and Cooling)

- .1 Type: Horizontal shaft, single stage, direct connected with speed controlled wet rotor motor for in-line mounting, for 1207 kPa (175 psig) maximum working pressure, 110 degrees C (230 degrees F) maximum water temperature.
- .2 Casing: Cast iron with flanged pump connections.
- .3 Impeller: Stainless Steel
- .4 Shaft : Stainless Steel
- .5 Bearings: Metal Impregnated carbon sleeve
- .6 Motor:
- .1 ECM
 - .2 Class F insulation
 - .3 Integrated motor protection shall be verified by UL to protect the pump against over/under voltage, over temperature of motor and/or electronics, over current, locked rotor and dry run (no load condition).
 - .4 On-board thermal overload protection.
- .7 Control
- BACnet
 - Analog inputs for pressure and temperature control
- .8 Performance:
- .1 See Schedule
- .9 Wiring Terminations: Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclose terminal lugs in terminal box sized to code.

2.4 Vertical In-line Pumps

- .1 Type: Vertical, single stage, close coupled, radially split casing, for in-line mounting, for 1200 kPa (175 psig) working pressure at 107 degrees C (225 degrees F).
- .2 Casing: Cast iron, with suction and discharge gauge port, casing wear ring, seal flush connection, drain plug, flanged suction and discharge.
- .3 Impeller: Bronze, fully enclosed, keyed directly to motor shaft or extension.
- .4 Shaft: Carbon steel with stainless steel impeller cap screw or nut and bronze sleeve.
- .5 Seal: Carbon rotating against a stationary ceramic seat, EPT Tungsten/Carbide seal, 120 degrees C (250 degrees F) maximum continuous operating temperature.
- .6 Wiring Terminations: Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclose terminal lugs in terminal box sized to code.
- .7 Each pump shall be factory tested and name-plated before shipment.

-
- .8 Pumps shall conform to ANSI/HI standard for Preferred Operating Region (POR) unless otherwise approved by the Contract Administrator. The pump NPSH shall conform to the ANSI/HI standards for Centrifugal and Vertical Pumps for NPSH Margin.
- .9 Close Coupled Pumps
- .1 Armstrong Design Envelope Sensorless 4380 Closed Coupled Type Vertical In-Line Centrifugal pumping unit. The pump shall be radially split, single stage centrifugal type with BF casing with equal size suction and discharge flanges and having separate tapped flush line and pressure gauge connections, Bronze (BS1400 Grade LG1) dynamically balanced impeller, 316SS shaft sleeve, inside type mechanical seal, with carbon rotating face, Sintered Silicon Carbide stationary seat, and EPDM secondary seal. The pump is to be fitted with a factory installed flush line.
 - .2 Supply in the flush line to the mechanical seal, a 50 micron cartridge filter alternatively, a cyclone separator when pump differential pressure exceeds 30 PSIG) and floating ball type sight flow indicator suitable for the working pressure encountered. The mechanical subcontractor shall change the filters after the system has been flushed and on a regular basis until the pumps are turned over to The City. The driving motor shall be an industry standard, vertical solid shaft, squirrel cage induction type with TEFC enclosure.
 - .3 Type: Horizontal shaft, single stage, close coupled, radially split casing, for vertical or horizontal installation, operations at 107 degrees C (225 degrees F) and 1205 kPa (175 psig) working pressure. Working pressures shall not be de-rated at temperatures up to 120 degrees C (250 degrees F).
 - .4 Casing: Cast iron, with suction and discharge gauge ports, renewable bronze casing wearing rings, seal flush connection, drain plug, flanged suction and discharge.
 - .5 Impeller: Bronze, fully enclosed, keyed to motor shaft extension.
 - .6 Furnished and installed with capacities as shown on plans. Pumps shall be in-line type, close-coupled single stage design, for installation in vertical or horizontal position, and capable of being serviced without disturbing piping connections.
 - .7 The pump internals shall be capable of being services without disturbing piping connections.
 - .8 Pump shall be of a maintainable design and for ease of maintenance should use machine fit parts and not press fit components.
 - .9 Pump should be designed to allow for true back pull-out access to the pump's working components for ease of maintenance.
 - .10 The pumps shall have a solid alloy stainless steel shaft that is integral to the motor. A non-ferrous shaft sleeve shall be employed to completely cover the wetted area under the seal.
 - .11 Pump shaft shall connect to a brass impeller. Impeller shall be hydraulically and dynamically balanced, keyed to the shaft and secured by a stainless steel locking capscrew or nut.
 - .12 The motor bearings shall support the shaft via heavy-duty grease lubricated ball bearings.

- .13 Seal: Pump shall be equipped with an internally flushed mechanical seal assembly installed in an enlarged tapered seal chamber. Application of an internally flushed mechanical seal shall be adequate for seal flushing without requiring external flushing lines. Seal assembly shall have a brass housing, Buna bellows and seat gasket, stainless steel spring, and be of a carbon ceramic design with the carbon face rotating against a stationary ceramic face. .
- .14 Wiring Terminations: Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclose terminal lugs in terminal box sized to code.
- .15 Pump volute: cast iron design, rated for 1205 kPa (175 psig) with integral cast iron flanges drilled for 125# ANSI companion flanges and shall include gauge ports at nozzles, and vent and drain ports.
- .16 Motor: Complete with integral VFD:
- .1 The driving motor shall be an industry standard, vertical solid shaft, squirrel cage induction type with TEFC enclosure. The variable frequency drive & controls shall be rated UL Type 12 or UL Type 4X and be an integral component of the pumping unit with a TEFC, 575/3/60, motor efficiency NEMA Prem (12.12).
 - .2 The integrated VFD shall be of the VVC-PWM type providing near unity displacement power factor ($\cos \phi$) without the need for external power factor correction capacitors at all loads and speeds. The VFD shall incorporate DC link chokes for the reduction of mains borne harmonic currents and to reduce the DC link ripple current thereby increasing the DC link capacitors lifetime. RFI filters will be fitted as standard to ensure the VFD meets low emission and immunity requirements.
 - .3 VFD and motor protection shall include: motor phase to phase fault, motor phase to ground fault, loss of supply phase, over-voltage, under-voltage, motor over-temperature, inverter overload, over-current.
 - .4 Where selected, VFD shall have Sensorless control software to provide automatic speed control in variable volume systems without the need for pump mounted (internal/external) or remotely mounted differential pressure sensor. The default operating mode under Sensorless control shall be Quadratic Pressure Control (QPC) whereby head reduction with reducing flow will be according to a quadratic control curve, the head at minimum flow being 40% of the design duty head. Control mode setting and minimum/maximum head setpoints shall be user adjustable via a built-in programming interface.
 - .5 If the quantity of pumps in a system is 2 to 4-maximum, including any standby, a Sensorless controller shall be added to a pumping unit and set up at the factory to operate in parallel Sensorless mode. The pump controls, which will be linked on site by the control contractor, will automatically stage the units, as appropriate, to maintain the best efficiency pumping and minimum operating cost. The standby unit will be brought into the rotation to exercise and equalize wear. The sequence of controls and staging points will be submitted to the Contract Administrator for approval at the time of order.
 - .6 The VFD shall have the following additional features:
 - .1 Sensorless override for BAS/BMS control signal
 - .2 Manual pump control or closed loop PID control

- .3 Programmable skip frequencies and adjustable switching frequency for noise and vibration control
- .4 Auto alarm reset
- .5 Four programmable digital inputs, two analog inputs, one programmable analog / digital output
- .6 One volt-free contact
- .7 One RS485 port for serial communications to building management systems
- .8 Standard serial communication protocols BACnet MS/TP
- .7 Environmental Ratings
 - .1 Temperature: 14°F to 113°F up to 3300 ft (-10°C to 45°C up to 1000 m)
 - .2 Max Relative Humidity: 0 to 95%
- .10 Split Coupled Pumps
 - .1 Supply and install as shown on plans and specifications, Armstrong Series 4300 Design Envelope IVS pumps. The pumps shall be single stage, single or double suction type, vertical inline design with integrated controls. The seal shall be serviceable without disturbing the motor or the piping connections. The capacities and characteristics shall be as outlined in the plans and specifications. The complete pump unit shall be labeled with ETL listing certification that the product conforms to UL Std 778 and is certified to CSA Std C22.2 No.108.
 - .2 Pump casing shall be constructed of ASTM A48 class 30 cast iron with ANSI 125 / PN16 flanges for working pressure below 175 psig (12 bar) at 150°F (66°C) and ASTM A536 ductile iron with ANSI 250 / PN25 flanges for working pressures to 375 psig (25 bar) at 150°F (66°C). The casing shall be hydrostatically tested to 150% maximum working pressure. The casing shall be radially split to allow removal of the rotating element without disturbing the pipe connections. The pump casing shall be drilled and tapped for gauge ports on both the suction and discharge connections and for a drain port at the bottom of the casing. The casing shall have an additional tapping on the discharge connection to allow for the installation of a seal flush line.
 - .3 The pump shall have a factory installed vent/flush line to insure removal of trapped air from the casing and mechanical seal cooling. The vent/flush line shall run from the seal chamber to the pump discharge.
 - .4 The impeller shall be bronze, fully enclosed type. The impeller shall be dynamically balanced to ANSI Grade G6.3 and shall be fitted to the shaft with a key. Two-plane balancing is required where installed impeller diameter is less than 6 times the impeller width.
 - .5 The pump shaft shall be stainless steel.
 - .6 The coupling is to be rigid spacer type constructed of high tensile aluminum alloy. The coupling is to be designed to be easily removed on site to reveal a space between the pump and motor shafts sufficient to remove all mechanical seal components for servicing and to be replaced without disturbing the pump or motor.

- .7 The pump shall be fitted with an outside balanced type mechanical seal, with Viton elastomers and antimony carbon (or resin-bonded carbon for potable water applications) vs. silicon carbide faces rated up to 250°F (121°C) A 316 stainless steel gland plate shall be provided with a factory installed flush line with manual vent.
- .8 All split coupled pumps shall be provided with a lower seal chamber throttle bushing to ensure seals maintain positively cooling and lubrication.
- .9 If required to improve seal chamber cleanliness, supply in the flush line to the mechanical seal a 50 micron cartridge filter and sight flow indicator, to suit the working pressure encountered.
- .10 Alternately, supply in the flush line to the mechanical seal a maintenance-free sediment separator, with sight flow indicator for pump differential pressures exceeding 30 psig (or 200 kPa).
- .11 The motor frame shall be NEMA TC type. Motor enclosure is to be ODP or TEFC with NEMA Premium Efficiency 12.12 rating. Acceptable motor insulation for variable speed operation is NEMA MG-1 Part 31.
- .12 The variable frequency drive & controls shall be rated UL Type 12 or UL Type 4X and be an integral component of the pumping unit with a 15 hp, TEFC, 575/3/60.
- .13 The integrated VFD shall be of the VVC-PWM type providing near unity displacement power factor ($\cos \phi$) without the need for external power factor correction capacitors at all loads and speeds. The VFD shall incorporate DC link chokes for the reduction of mains borne harmonic currents and to reduce the DC link ripple current thereby increasing the DC link capacitors lifetime. RFI filters will be fitted as standard to ensure the VFD meets low emission and immunity requirements.
- .14 VFD and motor protection shall include: motor phase to phase fault, motor phase to ground fault, loss of supply phase, over-voltage, under-voltage, motor over-temperature, inverter overload, over-current.
- .15 Where selected, VFD shall have Sensorless control software to provide automatic speed control in variable volume systems without the need for pump mounted (internal/external) or remotely mounted differential pressure sensor. The default operating mode under Sensorless control shall be Quadratic Pressure Control (QPC) whereby head reduction with reducing flow will be according to a quadratic control curve, the head at minimum flow being 40% of the design duty head. Control mode setting and minimum/maximum head setpoints shall be user adjustable via a built-in programming interface.
- .16 If the quantity of pumps in a system is 2 to 4-maximum, including any standby, a Sensorless controller shall be added to a pumping unit and set up at the factory to operate in parallel Sensorless mode. The pump controls which will be linked on site by the control contractor, will automatically stage the units, as appropriate, to maintain the best efficiency pumping and minimum operating cost. The standby unit will be brought into the rotation to exercise and equalize wear. The sequence of controls and staging points will be submitted to the Contract Administrator for approval at the time of order.
- .17 The VFD shall have the following additional features:
 - .1 Sensorless override for BAS/BMS control signal
 - .2 Manual pump control or closed loop PID control

- .3 Programmable skip frequencies and adjustable switching frequency for noise and vibration control
- .4 Auto alarm reset
- .5 Four programmable digital inputs, two analog inputs, one programmable analog / digital output
- .6 One volt-free contact
- .7 One RS485 port for serial communications to building management systems
- .8 Standard serial communication protocol BACnet Native (default)
- .18 Environmental Ratings
 - .1 Temperature: 14°F to 113°F up to 3300 ft (-10°C to 45°C up to 1000 m)
 - .2 Max Relative Humidity: 0 to 95%

- .11 Parallel Sensorless Pump Controller
 - .1 Mechanical and Electrical Details
 - .1 For Sensorless IVS pumping units, 4380 series operating in parallel, the pump logic controller shall be Armstrong Parallel Sensorless Pump Controller (PSPC). The PSPC pump logic controller shall be specifically designed for the control of multiple pumps in HVAC hot and/or chilled water systems that involve up to 4-variable speed pumps, with Sensorless Control, in parallel, staged, sequenced, and standby configurations.
 - .2 The PSPC pump logic controller shall allow field adjustments of control parameters as described below.
 - .1 The PSPC controller shall be capable of accepting, processing and displaying appropriate signals from the individual pump controls for the following values;
 - .1 System Status
 - .2 Total Sensorless flow
 - .3 Sensorless head
 - .4 Total power
 - .5 Pumps speed
 - .6 Alarm
 - .7 Wire to water efficiency (calculated)
 - .8 Number of pumps running
 - .9 Lead pump number
 - .2 Individual Pump Status
 - .1 Speed Ref (%)
 - .2 Speed (%) (rpm)
 - .3 Run time (hrs)
 - .4 Fault Nbr
 - .5 Run status (running/stopped)
 - .3 Individual Pump IVS-102 control status
 - .1 Current (Amps)

- .2 Volts (VAC)
- .3 Power (kW)
- .4 Head
- .5 Flow
- .3 The PSPC pump logic controller shall be suitable for indoor or outdoor applications and shall be capable of being integrated with Design Envelope IVS pumping units for pumping packages approved to UL 778 & CSA STD C22.2 No 108 standards and also suitable for wall mounting with separate Armstrong IVS pumping units and stand-alone IVS102 pump controls.
- .4 The PSPC controller shall have 3-levels of password security, first level to view only (No password required); the second level is for field adjustable parameters and the third level for factory/commissioning setup parameters.
- .5 The PSPC controller shall stage the pumping units to ensure optimum pumping energy usage and shall sequence the pumps starting order, including any standby unit.
- .6 The PSPC controller shall be fed with a power supply from each pumping unit controls in the control 'daisy-chain' so that a loss of power to any pump unit controls will not affect the PSPC controller pumping operation. Should the PSPC controller go off-line, all pumps in auto-mode will operate together to provide the correct system flow needs. Staging of the units will resume as the PSPC controller is brought back online.
- .7 The PSPC integrated controller shall be capable of being easily integrated on any other pumping unit should the need occur. Simple mounting in pre-designed location and wiring will be all that is required.
- .2 Performance and Operating Logic
 - .1 The PSPC pump logic controller shall determine the most efficient combination of operating pumps, and pump operating speed based from the individual pump controls input.
 - .2 The PSPC pump logic controller shall respond to the system load flow needs by adjusting either the number of operating pumps, or the speed of the operating pumps.
 - .3 The PSPC pump logic controller shall continuously monitor the system requirements and ensure that the operating point is maintained on the PSPC control curve to meet the system needs with optimized pumping energy usage.
 - .4 The PSPC pump logic controller shall sequence the pumps based on a field adjustable interval of operating hours. The controls shall incorporate embedded logic to prevent hunting, pump flow surge, and motor overloading. The controller logic shall incorporate an adjustable PID control loop.
 - .5 Should any pumping unit or pumping unit controller fail, the appropriate alarm signal shall be activated. In the place of the failed assembly, a standby pumping unit shall be operated in variable speed mode, or the next pump will start if there is no standby.

- .6 The PSPC controller shall have hand-off-automatic (H-O-A) control and should provide the option for a remote on/off signal by a BMS communication signal.
- .7 The PSPC pump logic controller shall be self-prompting. All messages shall be displayed in plain English. The operator interface shall have multi-fault memory and recall on-screen help functions, and separate user screens for overview, pump and setup.
- .8 The PSPC pump logic controller shall automatically disable any flow signals that are not within limits and alert the operator of a possible control failure.
- .9 The PSPC pump logic controller shall have the system design flow, system design head and minimum head limit entered as field adjustable parameters, factory loaded. The default for the minimum head is 40% of the design head.
- .3 Operator Screens
 - .1 Source of control: local or remote.
 - .2 PSPC status: on/off.
 - .3 Pump information: running/off/alarm, HOA status, pump ID 1, pump ID 2, stand-by, etc.
 - .4 Individual pump controls information: speed, amps, power, volts AC, flow and head
 - .5 Set point and error of flow and head
 - .6 Individual cumulative pump hours of operation
 - .7 System set-point and error
- .4 Alarm Screens
 - .1 Alarms with time stamp
 - .2 Alarm help
 - .3 Diagnostic indicating status (ok or bad) of PLC, memory, network and communication, PLC Software version
- .5 Setup Screens
 - .1 Level 0. No password, allows view only access
 - .2 Level 1. Allows modification of all parameters, except pump PID and BMS setup. Allows Restoring previously saved values
 - .3 Level 2. Allows modification of all parameters. Allows saving and restoring all parameters
 - .4 Levels 1 & 2 are password protected
- .6 BMS communication
 - .1 The PSPC shall be capable of serial communication with a BMS with the following protocol:
 - .1 BACnet MS/TP
 - .2 The following points will be available through the communication protocol:
 - .1 Total Sensorless flow
 - .2 Sensorless head
 - .3 Total real-time power consumption
 - .4 Pump speed
 - .5 Individual pump run status
 - .6 Alarm

- .7 Wire to water system efficiency
- .8 Number of pumps operating
- .9 Lead pump ID
- .10 Remote start/stop
- .11 PSPC on/off status
- .12 Pump controls information: running/off/alarm, HOA, duty 1, duty 2, stand-by, etc.
- .13 Pump controls information: speed, current, power, Volts AC, flow and head
- .14 Pump hours of operation
- .15 Head and flow Set point

2.5 Side-stream Filtration System

- .1 Manufacturers:
 - .1 General Filtration
 - .2 3M (Cuno).
 - .3 Sumco.
 - .4 Substitutions: Refer to Section 21 05 00.
- .2 System: Flow indicator, filter housing with cartridge filter, shut-off valves, and flow control valve.
- .3 Performance: Design flow 0.25 L/s (4 gal/min) with maximum pressure drop of 25.6 kPa (4 psig), based on water.
- .4 Hot Water and Glycol Filter Housing: Stainless steel housing suitable for 105 degrees C (220 degrees F) and 1380 kPa (200 psig) operating conditions.
- .5 Chilled Water Filter Housing: Stainless steel housing suitable for 52 degrees C (125 degrees F) and 860 kPa (125 psig) operating conditions.
- .6 Cartridges: Stringwound cartridge filters, 0.03 mm (30 micron) for start-up and 0.005 mm (5 micron) for system operation.

Part 3 Execution

3.1 Preparation

- .1 Verify that electric power is available and of the correct characteristics.

3.2 Installation

- .1 Install to manufacturer's written instructions.
- .2 Provide the necessary access space around components to allow for servicing, repair, replacement as well as for the balancing technician to take proper readings. Provide no less than minimum as recommended by manufacturer
- .3 Pumps shall be sized on the capacities, heads, motor sizes and RPM specified, impeller size selected shall not be greater than 85% of the maximum size impeller.

- .4 Decrease from line size with long radius reducing elbows or reducers. Support piping adjacent to pump such that no weight is carried on pump casings. For close coupled or base mounted pumps, provide supports under elbows on pump suction and discharge line sizes 102 mm (4 inches) and over.
- .5 Provide line sized shut-off valve, pump suction fitting and strainer on pump suction, and line sized soft seat check valve and balancing valve or combination pump discharge valve on pump discharge.
- .6 Provide a minimum of 5x suction diameter of pipe on pump suction of pipe size shown on drawings
- .7 Provide air cock and drain connection on horizontal pump casings.
- .8 Provide drains for bases and seals, piped to and discharging into floor drains or, in the case of glycol, to a suitable container.
- .9 Provide drain lines with ball valves from strainers and filters to nearest floor drain or, in the case of glycol, to a suitable container.
- .10 Manufacturer approved millwright or agent to check, align, and certify alignment of base mounted pumps prior to start-up.
- .11 Lubricate pumps before start-up.
- .12 Provide side-stream filtration system for systems as shown on schematic diagrams Install across pump with flow from pump discharge to pump suction from pump tapings. Refer to 23 25 00 – Chemical Treatment for Closed Systems.
- .13 Provide flow measurement ports as shown on drawings, on piping schematics, and in locations as directed by the water balancing specialist.
- .14 Provide any pump impeller modifications as recommended by Division 23 05 93 – Testing Adjusting and Balancing.

END OF SECTION

Part 1

General

1.1

Section Includes

- .1 Cleaning of pipe and fittings.
- .2 Chemical feed equipment.
- .3 Chemical treatment.

1.2

Related Sections

- .1 Section 25 30 00 - Instruments And Control Elements.
- .2 Section 23 21 00 - Hydronic Piping: Placement of water coupon rack, by-pass (pot) feeder.
- .3 Section 26 05 80 - Equipment Wiring: Electrical characteristics and wiring connections.

1.3

Submittals

- .1 Section 21 05 00: Procedures for submittals.
- .2 Shop Drawings: Indicate system schematic, equipment locations, and controls schematics, electrical characteristics and connection requirements.
- .3 Product Data: Provide chemical treatment materials, chemicals, and equipment including electrical characteristics and connection requirements.
- .4 Manufacturer's Installation Instructions: Indicate placement of equipment in systems, piping configuration, and connection requirements.
- .5 Manufacturer's Field Reports: Indicate start-up of treatment systems when completed and operating properly. Indicate analysis of system water after cleaning and after treatment.
- .6 Submit certificate of compliance from authority having jurisdiction indicating approval of chemicals and their proposed disposal.

1.4

Project Record Documents

- .1 Section 21 05 00: Submittals for project closeout.
- .2 Record actual locations of equipment and piping, including sampling points and location of chemical injectors.

1.5

Operation And Maintenance Data

- .1 Section 21 05 00: Submittals for project closeout.
- .2 Operation and Maintenance Data:
 - .1 Include data on chemical feed pumps, agitators, and other equipment including spare parts lists, procedures, and treatment programs.
 - .2 Include step by step instructions on test procedures including target concentrations. Provide with manufacturer's logging record book or sample sheet.
 - .3 Include record of water and glycol tests at building turn-over to The City.
 - .4 Provide all MSDS information for chemicals supplied.

1.6 Qualifications

- .1 Vendor: Specified Technical Sales
- .2 Company specializing in manufacturing the products specified in this Section with minimum three years documented experience. Company to have local representatives with water analysis laboratories and full time service personnel.
- .3 Installer: Company specializing in performing the work of this section with minimum three years documented experience and approved by manufacturer.

1.7 Regulatory Requirements

- .1 Conform to applicable code for addition of non-potable chemicals to building mechanical systems, and for to public sewage systems.
- .2 Products Requiring Electrical Connection: Listed and classified by testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

1.8 MAINTENANCE SERVICE

- .1 Provide service and maintenance of treatment systems for one year from Date of Substantial Completion.
- .2 Provide regular technical service visits to perform field inspections and make water analysis on site. Detail findings in writing on proper practices, chemical treating requirements, and corrective actions needed. Submit two copies of field service report after each visit.
- .3 Provide laboratory and technical assistance services during this maintenance period.
- .4 Include a training course for operating personnel, instructing them on installation, care, maintenance, testing, and operation of water treatment systems. Arrange course at start up of systems.
- .5 Provide on site inspections of equipment during scheduled or emergency shutdown to properly evaluate success of water treatment program, and make recommendations in writing based upon these inspections.

1.9 Maintenance Materials

- .1 Section 21 05 00: Submittals for project closeout.
- .2 Provide sufficient chemicals for treatment and testing during warranty period.

Part 2 Products

2.1 Manufacturers

- .1 GE Water and Process Technologies.
- .2 Substitutions: Refer to Section 21 05 00.

2.2 MATERIALS

- .1 Closed Hot Water, Chilled Water and Glycol Systems Cleaner:
 - .1 Ferroquest FQ7103 (neutral pH cleaner to remove oil, grease, rust and mill scale)

- .2 Closed System Treatment (Hot or Chilled Water):
 - .1 Corrshield MD4102 (molybdate based scale and corrosion inhibitor)

2.3 BY-PASS (POT) FEEDER

- .1 Manufacturers:
 - .1 Neptune
 - .2 Axiom
- .2 Closed Hot Water, Chilled Water and Glycol Systems:
 - .1 2 gallon chemical pot feeder

2.4 SIDE STREAM FILTER SYSTEM

- .1 Closed Hot Water, Chilled Water and Glycol Systems: Pal LMO-10 ¾" filter housing, STS ¾" Filtermate flow indicator, provide (40) 10 micron filter cartridges
- .2 Manufacturers:
 - .1 Pal
 - .2 Axiom
 - .3 General Filtration
 - .4 3M (Cuno).
 - .5 Sumco.
 - .6 Substitutions: Refer to Section 21 05 00.
- .3 System: Flow indicator, filter housing with cartridge filter, shut off valves, and flow control valve.
- .4 Performance: Design flow 0.25 L/s (4 gal/min) with maximum pressure drop of 25.6 kPa (4 psig), based on water.
- .5 Hot Water and Glycol Filter Housing: Stainless steel housing suitable for 105 degrees C (220 degrees F) and 1380 kPa (200 psig) operating conditions.
- .6 Chilled Water Filter Housing: Stainless steel housing suitable for 52 degrees C (125 degrees F) and 860 kPa (125 psig) operating conditions.
- .7 Cartridges: Stringwound cartridge filters, 0.03 mm (30 micron) for start up and 0.005 mm (5 micron) 0.010 mm (10 Micron) for system operation.
 - .1 Provide 20 40 cartridges to the project.

2.5 Test Equipment

- .1 Closed System (Hot or Chilled Water): Provide a L6213 molybdate test kit.

Part 3 Execution

3.1 Preparation

- .1 Systems to be operational, filled, started, and vented prior to cleaning. Use water meter to record capacity in each system.
- .2 Place terminal control valves in open position during cleaning.
- .3 Section 23 25 00 shall provide
- .4 Verify that electric power is available and of the correct characteristics.

3.2 Cleaning Sequence

- .1 Concentration:
 - .1 As recommended by manufacturer.
- .2 Hot Water, Chilled Water, Glycol Systems
 - .1 Isolate Existing hydronic systems.
 - .2 All systems must be chemically cleaned and flushed before water treatment is added. This includes partial or complete filling for pressure testing.
 - .3 After all components of the piping system have been pressure tested and proven to be in full operational condition and leak free, flush entire system with fresh clean make-up water to remove loose mill scale, sediment and construction debris.
 - .4 Provide drain connections to drain system in one hour. Install totalizing water meter to record capacity in each system
 - .5 All drains for chemical treatment shall be piped to the nearest floor drain.
 - .6 After initial flushing has been completed, clean all strainer screens.
 - .7 Add cleaner to closed systems at concentration levels recommended by the water treatment specialist.
 - .8 After cleaning, drain system as rapidly as possible. Flush system by opening drain valves and opening bypass valve on water make-up to system. Continue flushing until tests show pH, iron, TDS and chloride levels of water leaving system are the same as entering the system. Refill and immediately add water treatment to proper level.

3.3 Installation

- .1 Install to manufacturer's written instructions.

3.4 Closed System Treatment

- .1 Provide one bypass feeder and one side stream filter on each system. Install isolating and drain valves and necessary piping. Install around balancing valve downstream of circulating pumps unless indicated otherwise.
- .2 Introduce closed system treatment through bypass feeder when required or indicated by test.
- .3 Change side stream filter cartridges as required or indicated by the flow indicator.

END OF SECTION

Part 1

General

1.1

Section Includes

- .1 Metal duct work.
- .2 Casing and plenums.
- .3 Kitchen hood duct work.
- .4 Duct cleaning.

1.2

Related Sections

- .1 Section 01 11 00 - Summary of Work.
- .2 Section 03 30 00 - Cast-in-place Concrete.
- .3 Section 09 90 00 - Painting: Weld priming, weather resistant, paint or coating.
- .4 Section 11 40 00 - Food Service Equipment: Supply of kitchen range hoods for placement by this Section.
- .5 Section 23 05 29 - Supports And Anchors: Sleeves.
- .6 Section 23 05 93 - Testing, Adjusting, And Balancing.
- .7 Section 23 07 13 - Duct Insulation: External insulation and duct liner.
- .8 Section 23 33 00 - Duct Work Accessories.
- .9 Section 23 36 00 - Air Terminal Units.
- .10 Section 23 37 00 - Air Outlets And Inlets.

1.3

References

- .1 ASTM A36/A36M - Carbon Structural Steel.
- .2 ASTM A90/A90M - Weight (Mass) of Coating on Iron and Steel Articles with Zinc or Zinc-Alloy Coatings.
- .3 ASTM A167 - Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
- .4 ASTM A480/A480M - General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip.
- .5 ASTM A568/A568M - General Requirements for Steel Sheet, Carbon, and High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled.
- .6 ASTM A653/A653M - Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- .7 ASTM A1008/A1008M - Steel, Sheet, Cold-Rolled Carbon, Structural, High-Strength Low-Alloy and High Strength Low-Alloy with Improved Formability.
- .8 ASTM A1011/A1011M - Standard Specification for Steel, Sheet, and Strip Hot-Rolled, Carbon, Structural, High-Strength, Low-Alloy with Improved Formability.
- .9 ASTM B209 - Aluminum and Aluminum-Alloy Sheet and Plate.
- .10 AWS D9.1 - Sheet Metal Welding Code.

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- .11 NBS PS 15 - Voluntary Product Standard for Custom Contact-Moulded Reinforced-Polyester Chemical Resistant Process Equipment.
 - .12 NFPA 90A - Installation of Air Conditioning and Ventilating Systems.
 - .13 NFPA 90B - Installation of Warm Air Heating and Air-Conditioning Systems.
 - .14 NFPA 91 - Exhaust Systems for Air Conveying of Vapours, Gases, Mists, and Noncombustible Particulate Solids.
 - .15 NFPA 96 - Ventilation Control and Fire Protection of Commercial Cooking Operations.
 - .16 SMACNA - HVAC Air Duct Leakage Test Manual.
 - .17 SMACNA - HVAC Duct Construction Standards - Metal and Flexible.
 - .18 UL 181 - Factory-Made Air Ducts and Connectors.
 - .19 South Coast Air Quality Management District (SCAQMD)
- 1.4 Rule 1168 – Adhesive And Sealant Applicationsperformance Requirements**
- .1 No variation of duct configuration or sizes permitted except by written permission. Size round ducts installed in place of rectangular ducts to ASHRAE table of equivalent rectangular and round ducts.
- 1.5 Submittals**
- .1 Section 21 05 00: Procedures for submittals.
 - .2 Product Data: Provide data for kitchen hood ductwork including penetrations.
- 1.6 PROJECT RECORD DOCUMENTS**
- .1 Section 21 05 00: Submittals for project closeout.
 - .2 Record actual locations of ducts and duct fittings. Record changes in fitting location and type. Show additional fittings used.
- 1.7 Quality Assurance**
- .1 Perform Work to SMACNA - HVAC Duct Construction Standards - Metal and Flexible.
 - .2 Maintain one copy of document on site.
- 1.8 Qualifications**
- .1 Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years' experience.
 - .2 Installer: Company specializing in performing the work of this section with minimum three years documented experience.
- 1.9 Regulatory Requirements**
- .1 Construct commercial kitchen exhaust duct work to NFPA 96 standards.

1.10 Environmental Requirements

- .1 Do not install duct sealants when temperatures are less than those recommended by sealant manufacturers.
- .2 Maintain temperatures during and after installation of duct sealants.
- .3 All adhesives and sealants wet-applied on site must meet the applicable chemical content requirements of SCAQMD Rule 1168 Adhesive and Sealant Applications, as analyzed by the methods specified in Rule 1168. The provisions of SCAQMD Rule 1168 do not apply to adhesives and sealants subject to consumer product VOC regulations.

Part 2 Products

2.1 MATERIALS

- .1 Galvanized Steel Ducts: ASTM A653 galvanized steel sheet, lock-forming quality, having G60 zinc coating of to ASTM A90.
- .2 Steel Ducts: ASTM A1008, A568.
- .3 Aluminum Ducts: ASTM B209; aluminum sheet, alloy 3003-H14. Aluminum Connectors and Bar Stock: Alloy 6061- T6 or of equivalent strength.
- .4 Insulated Flexible Ducts:
 - .1 Manufacturers:
 - .1 Thermaflex G-KM
 - .2 Substitutions: Refer to Section 21 05 00.
 - .2 Thermally insulated flexible duct with acoustically rated black CPE core permanently bonded to a coated spring steel wire helix, with fibreglass insulation over fibreglass scrim and polyethelyne vapour barrier. Pressure rating of 6" W.G. (positive) for 4" – 20" I.D. Temperature range -20 °F to 200 °F continuous, R-value R-4.2.
 - .3 The ductwork shall meet NFPA Pamphlet 90A paragraph 113 (a) for flame spread and smoke rating and to meet Underwriter's Laboratories of Canada requirements.
 - .4 Flexible air ducts shall conform to UL-181 Standard and NFPA 90A. Flexible air ducts shall have a fire rating of at least one-half hour as measured by UL-181 Standard, paragraph No. 7, Flame Penetration Test.
- .5 Stainless Steel Ducts: ASTM A167, Type 304 and 316
- .6 Fasteners: Rivets, bolts, or sheet metal screws.
- .7 Sealant:
 - .1 Manufacturers:
 - .1 Duro-Dyne
 - .2 Substitutions: Refer to Section 21 05 00.
 - .2 Non-hardening, water resistant, fire resistive, compatible with mating materials; liquid used alone or with tape, or heavy mastic.
- .8 Hanger Rod: ASTM A36; steel, galvanized; threaded both ends, threaded one end, or continuously threaded.

2.2 Duct Work Fabrication

- .1 Fabricate and support to SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated. Unless otherwise indicated fabrication shall conform to standards for duct pressure class rating of +2" w.g. Provide duct material, gauges, reinforcing, and sealing for operating pressures indicated.
- .2 Construct T's, bends, and elbows with radius of not less than 1-1/2 times width of duct on centreline. Where not possible and where rectangular elbows are used, provide air-foil turning vanes. Where acoustical lining is indicated, provide turning vanes of perforated metal with glass fibre insulation.
- .3 Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.
- .4 Fabricate continuously welded round and oval duct fittings two gauges heavier than duct gauges indicated in SMACNA Standard. Joints: minimum 100 mm (4 inch) cemented slip joint, brazed or electric welded. Prime coat welded joints.
- .5 Provide standard 45 degree lateral wye takeoffs unless otherwise indicated where 90 degree conical tee connections may be used.
- .6 All rectangular ducts shall be constructed by breaking the corners and grooving the longitudinal seams using Pittsburgh seam or other approved airtight seam.
- .7 All elbows and transformation pieces shall be constructed using Pittsburgh corner seams or double seam corners. All transverse joints shall be constructed using S-slips, Bar Slips, Drive Slips, etc. where recommended in ASHRAE guide. All slips shall be not less than one gauge heavier than duct material. Open corners will not be accepted.

2.3 Manufactured Duct Work And Fittings

- .1 Manufacture to SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated. Provide duct material, gauges, reinforcing, and sealing for operating pressures indicated.

2.4 KITCHEN HOOD EXHAUST DUCT WORK

- .1 Fabricate to SMACNA HVAC Duct Construction Standards - Metal and Flexible and NFPA 96.
- .2 Construct of 1.37 mm (16 gauge) carbon steel or 1.09 mm (18 gauge) stainless steel, using continuous external welded joints to provide a watertight seal.
- .3 All ductwork exposed in the kitchen or servery areas shall be constructed of brushed stainless steel.
- .4 Cleanout doors of rigid construction using the same gauge of sheet metal as the duct and gaskets to provide a grease tight seal.
- .5 Horizontal ducting support systems for nonlisted grease duct systems 600 mm (24 inches) and larger in any cross-sectional dimension shall be designed for the weight of the ductwork plus 363 kg (800 lbs) at any point in the duct systems.

2.5 Kitchen Dishwasher Exhaust Duct Work

- .1 Fabricate to SMACNA HVAC Duct Construction Standards - Metal and Flexible and NFPA 96.
- .2 Constructed 0.80 mm (22 gauge) stainless steel, using continuous external welded joints to provide a watertight seal.

2.6 LABORATORY FUME HOOD EXHAUST DUCT WORK

- .1 All fume hood exhaust ductwork shall be constructed of 316 stainless steel ga. and shall be all welded construction. All welds shall be clean and watertight.

Part 3 Execution

3.1 Installation

- .1 Install to manufacturer's written instructions.
- .2 Install and seal ducts to SMACNA HVAC Duct Construction Standards - Metal and Flexible.
- .3 Duct sizes are inside clear dimensions. For lined ducts, maintain sizes inside lining.
- .4 No variation of duct sizes will be permitted except by written permission of the Contract Administrator. In the event that additional offsets and changes in direction are required in the duct system, these changes shall be made by the Sheet Metal Trade without additional cost to The City. All ductwork shall be to the recommended practices as laid down by the Sheet Metal and Air Conditioning Contractors National Association (SMACNA).
- .5 Where the width of the duct exceeds 450 mm (18") in its largest dimension such ductwork shall be suitably stiffened by breaking the sheets diagonally.
- .6 If ductwork is insulated, cross breaking may be omitted providing the ducts are 2 gauges heavier than shown on the above schedule.
- .7 All laps shall be in the direction of air flow. Rivets and bolts shall be used throughout. All edges and slips shall be hammered down to leave a smooth interior duct.
- .8 Where low pressure ductwork conflicts with mechanical and electrical piping and it is not possible to divert the ductwork or piping to stay within allowable space limitation, provide duct easements.
- .9 Easements are not required on pipes 100 mm (4") and smaller outside dimension, unless this exceeds 20% of the duct area. Any irregular or flat shaped intrusions require a duct easement. Hangers and straps in the ductwork shall be parallel to air flow. If this is not possible, provide an easement. If the easement exceeds 25% of the duct area, the duct shall be split into two ducts with the original duct area being maintained. All easements shall be approved by the Contract Administrator before installation.
- .10 Provide openings in duct work where required to accommodate thermometers and controllers. Provide pilot tube openings where required for testing of systems, complete with metal can with spring device or screw to ensure against air leakage. Where openings are provided in insulated duct work, install insulation material inside a metal ring.

- .11 Locate pitot tube test openings in ductwork at supply fan discharges, on intake of exhaust/and return air fans, in major duct branches and everywhere pitot tube openings are required for proper balancing of air conditioning, ventilation and exhaust systems. Do not place closer than 1829mm (72 inches) to elbows. Space every 150mm (6 inches) across air stream at each location. Refer to drawings for additional opening requirements.
- .12 Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.
- .13 Use crimp joints with or without bead for joining round duct sizes 200 mm (8 inch) and smaller with crimp in direction of air flow.
- .14 Use only threaded rod for duct support in exposed areas. Strapping not allowed.
- .15 Use double nuts and lock washers on threaded rod supports.
- .16 Insulated Flexible ductwork: Maximum installed horizontal length: One continuous length at 1500 mm (5'-0"). Use standard sheet-metal elbows at drop points to outlets. Use of the flexible duct in lieu of an elbow at the diffuser drop point is not permitted. Connect flexible ducts to metal ducts with adhesive plus sheet metal screws.
- .17 Connect fan powered terminal units to supply ducts with 300 mm (one foot) maximum length of flexible duct. Do not use flexible duct to change direction.
- .18 Connect diffuser boots or light troffer boots to low pressure ducts with 1.5 m (5 feet) maximum length of insulated flexible duct held in place with strap or clamp.
- .19 Where interior of duct is visible through grilles, registers or diffusers, paint interior of duct with flat black Tremco paint formulated for galvanized surfaces.
- .20 Set plenum doors 150 to 300 mm (6 to 12 inches) above floor. Arrange door swings so that fan static pressure holds door in closed position.
- .21 Provide residue traps in kitchen hood exhaust ducts at base of vertical risers with provisions for clean out. Use stainless steel for duct work exposed to view and stainless steel or carbon steel for ducts where concealed.
- .22 For kitchen hood exhaust ducts, access doors shall be installed at every change in direction in the ductwork, and at intervals not exceeding 3000 mm (10') along the duct run. Access doors shall be installed not less than 38 mm (1½") above the bottom of the duct.
- .23 During construction provide temporary closures of metal or taped polyethylene on open duct work to prevent construction dust from entering duct work system.
- .24 Open ductwork exposed to the outdoors during construction shall also be weather proofed c/w insulation at sealed ends for any ducts exposed to sub-zero temperatures.
- .25 Seal ductwork so that it is sufficiently airtight to ensure economical and quiet performance of the system. All ductwork, except where otherwise indicated, shall have seams and joints sealed with Duro-Dyne S-2 duct sealer. Apply duct sealer and duct tape in strict accordance with manufacturer's recommendations, to joints and seams to provide an airtight, watertight installation. Prior to application, ductwork to be dry and free of grease, etc. Use 6mm bead of material along joints. Material, when dry, to have 3.2mm depth extending 25mm on each side of joint or seam.

- .26 All ductwork located outdoors shall have seams and joints sealed with grey TREMCO 555 acrylic sealant applied with gun and levelled with putty knife. Use material in accordance with manufacturer’s printed recommendations.
- .27 Stainless steel ductwork exposed in finished rooms shall not have duct tape application.
- .28 Install ductwork free from pulsation, chatter, vibration or objectionable noises.
- .29 Should any of these defects appear after the system is in operation, correct problems by removing, replacing, or reinforcing the work as directed by the Contract Administrator.

3.2 Cleaning

- .1 Clean duct system and force air at high velocity through duct to remove accumulated dust. To obtain sufficient air, clean half the system at a time. Protect equipment which may be harmed by excessive dirt with temporary filters, or bypass during cleaning.
- .2 Clean duct systems with high power vacuum machines. Protect equipment which may be harmed by excessive dirt with filters, or bypass during cleaning. Provide adequate access into duct work for cleaning purposes.

3.3 Schedules

3.4 DUCT WORK MATERIAL SCHEDULE

AIR SYSTEM	MATERIAL
Low Pressure Supply (Heating Systems)	Steel
Low Pressure Supply (System with Cooling Coils)	Steel
Return and Relief	Steel
General Exhaust	Steel
Outside Air Intake	Steel
Combustion Air	Steel
Kitchen Hood Exhaust	Steel, 304 Stainless Steel
Dishwasher Exhaust	Steel, 304 Stainless Steel
Laboratory Fume Hood Exhaust	316 Stainless Steel
Clothes Dryer Exhaust	Aluminum

3.5 Duct Work Pressure Class Schedule

AIR SYSTEM	PRESSURE CLASS
Supply (Heating Systems)	250 Pa (1 inch)
Supply (System with Cooling Coils)	500 Pa (2 inch)
Return and Relief	250 Pa (1 inch)
General Exhaust	125 Pa (1/2 inch)
Outside Air Intake	125 Pa (1/2 inch)
Intake and Exhaust	250 Pa (1 inch)
Combustion Air	125 Pa (1/2 inch)
Dishwasher Exhaust	250 Pa (1 inch)
Kitchen Hood Exhaust	
Fume Hood Exhaust	750 Pa (3 inch)

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Duct silencers.
- .2 Cross-talk silencers.
- .3 Acoustic housings.
- .4 Duct work lagging.
- .5 Acoustical louvres.

1.2 RELATED SECTIONS

- .1 Section 07 92 00 - Joint Sealants.
- .2 Section 23 07 13 – Duct Insulation.
- .3 Section 23 31 00 - Duct Work: Connections to silencers.
- .4 Section 23 33 00 - Duct Work Accessories: Flexible duct connections.

1.3 References

- .1 AABC - National Standards for Total System Balance.
- .2 AMCA 300 - Reverberant Room Method for Sound Testing of Fans.
- .3 AMCA 301 - Methods for Calculating Fan Sound Ratings from Laboratory Test Data.
- .4 AMCA 302 - Application of Sone Ratings for Non-Ducted Air Moving Devices.
- .5 AMCA 303 - Application of Sound Power Level Ratings for Fans.
- .6 ANSI S1.1 - Acoustical Terminology.
- .7 ANSI S1.8 - Preferred Reference Quantities for Acoustical Levels.
- .8 ANSI S1.13 - Measurement of Sound Pressure Levels in Air.
- .9 ARI 270 - Sound Rating of Outdoor Unitary Equipment.
- .10 ARI 575 - Measuring Machinery Sound Within an Equipment Space.
- .11 ASA 16 (ANSI S1.36) - Survey Methods for Determination of Sound Power Levels of Noise Sources.
- .12 ASA 47 (ANSI S1.4) - Specification for Sound Level Meters.
- .13 ASA 49 (ANSI S12.1) - Preparation of Standard Procedures to Determine the Noise Emission from Sources.
- .14 ASHRAE 68 - Laboratory Method of Testing to Determine the Sound Power in a Duct.
- .15 ASHRAE Handbook - Systems Volume, Chapter "Sound and Vibration Control".
- .16 ASTM E90 - Method for Laboratory Measurement of Airborne Sound Transmission loss of Building Partitions and Elements.
- .17 ASTM E477 - Method of Measuring Acoustical and Airflow Performance of Duct Liner Materials and Prefabricated Silencers.

- .18 ASTM E596 - Method for Laboratory Measurement of Noise Reduction of Sound-Isolating Enclosures.
- .19 NEBB - Procedural Standards for Measuring Sound and Vibration.
- .20 SMACNA - HVAC Duct Construction Standards - Metal and Flexible.

1.4 Definitions

- .1 Submittals and Report: Conform to ANSI S1.1.

1.5 PERFORMANCE REQUIREMENTS

- .1 Maintain sound level of spaces at levels not to exceed those listed below by utilizing acoustical devices.
- .2 Maintain rooms at following maximum sound levels, in Noise Criteria (NC) as defined by ASHRAE Handbook.
 - .1 Offices
 - .1 Executive: 25
 - .2 Conference rooms: 25
 - .3 Private: 30
 - .4 Open-plan areas: 35
 - .5 Computer/business machine areas: 40
 - .6 Public circulation: 40
 - .2 Schools
 - .1 Lecture and classrooms: 25
 - .2 Open-plan classrooms: 30
 - .3 Libraries: 30
 - .4 Shop: 40

1.6 Submittals

- .1 Section 21 05 00: Procedures for submittals.
- .2 Shop Drawings: Indicate assembly, materials, thicknesses, dimensional data, pressure losses, acoustical performance, layout, and connection details.
- .3 Product Data: Provide catalogue information indicating, materials, dimensional data, pressure losses, and acoustical performance. Acoustical performance shall be obtained in accordance with ASTM E477.
- .4 Design Data: Provide engineering calculations, referenced to specifications and noted standards indicating that maximum room sound levels are not exceeded.
- .5 Manufacturer's Installation Instructions: Indicate installation requirements which maintain integrity of sound isolation.
- .6 Manufacturer's Field Reports: Indicate installation is complete and to instructions.

1.7 PROJECT RECORD DOCUMENTS

- .1 Section 21 05 00: Submittals for project closeout.
- .2 Record actual locations of acoustic housings. duct work lagging.

1.8 Quality Assurance

- .1 Perform Work to AMCA 300 standards and recommendations of ASHRAE 68.
- .2 Maintain one copy of each document on site.

1.9 Qualifications

- .1 Manufacturer: Company specializing in manufacturing the products specified in this section with minimum three years experience.

1.10 REGULATORY REQUIREMENTS

- .1 Conform to applicable code for sound levels at property line.

Part 2 Products

2.1 ABSORPTIVE DUCT SILENCERS

- .1 Manufacturers:
 - .1 Price.
 - .2 VAW Industries
 - .3 Vibro-Acoustics
 - .4 Vibron Limited
 - .5 Substitutions: Refer to Section 21 05 00.
- .2 Description: Duct section with sheet metal outer casing, sound absorbing fill material, and inner casing of perforated sheet metal; incorporating interior baffles of similar construction. Fabricate to SMACNA HVAC Duct Construction Standards - Metal and Flexible.
- .3 Configuration: Rectangular with lined splitters with radiused nose and contoured tails. Contour and radius to be designed for flow velocity requirements (low, medium, high velocity as noted in schedule).
- .4 Materials:
 - .1 Outer Casing: Minimum 0.8 mm (22 gauge) thick galvanized steel stiffened as required, with mastic filled lock formed seams, slip joints on both ends. Screws or other mechanical fastening systems not acceptable.
 - .2 Outer Casing: Minimum [1.6 mm (16 gauge)] [3.5 mm (10 gauge)] thick galvanized steel stiffened as required, with welded seams, slip joints on both ends. Screws or other mechanical fastening systems not acceptable.
 - .3 Inner Casing and Splitters: Minimum 0.5 mm (26 gauge) thick perforated galvanized steel.
 - .4 Fill: shot-free inorganic glass fibre with long, resilient fibers, bonded with thermosetting resin. Glass fibre shall be packed with a minimum 10% compression to eliminate voids and settling; 64 kg/cu m (4 lb/cu ft) density.
 - .5 Fill Liner: Bonded glass fibre matting. [0.0254 mm (1 mil) polymer film.]
- .5 Performance ratings as per the schedule. Provide, at a minimum, the following sample submittal information with manufacturer's data:

- .1 ASTM E477 Insertion Loss and Maximum Generated Noise for specific face velocity. Indicate the related pressure drop across silencer, Pa (inches w.g.):

	Octave Band Centre Frequency (Hz)
	63 125 250 500 1000 2000 4000 8000

Insertion Loss (dB)	[] [] [] [] [] [] [] []
Generated Noise (dB)	[] [] [] [] [] [] [] []

Part 3 Execution

3.1 Installation

- .1 Install to manufacturer's written instructions.
- .2 Support duct silencers independent of duct work with flexible duct connections, lagged with leaded vinyl sheet on inlet and outlet.

3.2 MANUFACTURER'S FIELD SERVICES

- .1 Prepare and start systems to Quality Assurance clauses in Section 21 05 00.
- .2 Inspect installation periodically to Quality Assurance clauses in Section 21 05 00.
- .3 Provide services of AABC testing agency to take noise measurement. Use meters meeting requirements of ASA 47 (ANSI S1.4).
- .4 After start-up, final corrections and balancing of systems take octave band sound measurements over full audio frequency range in areas adjacent to mechanical equipment rooms, duct and pipe shafts, and other critical locations, as directed.
- .5 Provide one-third octave band measurements of artificial sound sources in areas indicated as having critical requirements.
- .6 Submit complete report of test results including sound curves.

END OF SECTION

Part 1

General

1.1

Section Includes

- .1 Air turning devices/extractors.
- .2 Backdraft dampers.
- .3 Barometric relief dampers.
- .4 Fire Dampers
- .5 Combination fire and smoke dampers.
- .6 Duct access doors.
- .7 Duct test holes.
- .8 Flexible duct connections.
- .9 Volume control dampers.
- .10 Ceiling Fans
- .11 Dryer Vent Stack Jack

1.2

Related Sections

- .1 Section 23 05 48 - Vibration Isolation.
- .2 Section 23 31 00 - Duct Work.
- .3 Section 23 36 00 - Air Terminal Units: Pressure regulating damper assemblies.
- .4 Section 25 30 00 – Instrument and Control Elements
- .5 Section 26 05 80 - Equipment Wiring: Electrical characteristics and wiring connections.

1.3

References

- .1 NFPA 90A - Installation of Air Conditioning and Ventilating Systems.
- .2 NFPA 92A - Smoke-Control Systems.
- .3 NFPA 96 - Ventilation Control and Fire Protection of Commercial Cooking Operations.
- .4 SMACNA - HVAC Duct Construction Standards - Metal and Flexible.
- .5 CAN/ULC-S112 Standard Method of Fire Test of Fire-Damper Assemblies
- .6 UL 33 - Heat Responsive Links for Fire-Protection Service.
- .7 UL 555 - Fire Dampers.
- .8 UL 555S - Smoke Dampers.
- .9 CAN/ULC-S112.2, Standard Method of Fire Test of Ceiling Fire Stop Flap Assemblies.

1.4

Submittals

- .1 Section 21 05 00: Procedures for submittals.
- .2 Manufacturer's Installation Instructions: Indicate for fire dampers and combination fire and smoke dampers.

1.5 Project Record Documents

- .1 Section 21 05 00: Submittals for project closeout.
- .2 Record actual locations of access doors.

1.6 Qualifications

- .1 Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

1.7 Regulatory Requirements

- .1 Products Requiring Electrical Connection: Listed and classified by Underwriters' Laboratories Inc., and testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

1.8 Delivery, Storage, And Handling

- .1 Section 21 05 00: Transport, handle, store, and protect products.
- .2 Protect dampers from damage to operating linkages and blades.

Part 2 Products

2.1 AIR TURNING DEVICES/EXTRACTORS

- .1 Multi-blade device with radius blades attached to pivoting frame and bracket, steel construction, with push-pull operator strap.

2.2 Backdraft Dampers.

- .1 Gravity Backdraft Dampers, Size 450 x 450 mm (18 x 18 inches) or smaller, provided with Air Moving Equipment: Air moving equipment manufacturers standard construction.
- .2 Multi-Blade, Parallel Action Gravity Balanced Backdraft Dampers: 1.5 mm (16 gauge) thick galvanized steel, with centre pivoted blades of maximum 150 mm (6 inch) width, with felt or flexible vinyl sealed edges, linked together in rattle-free manner with 90 degree stop, steel ball bearings, and plated steel pivot pin; adjustment device to permit setting for varying differential static pressure.

2.3 Barometric Relief Dampers

- .1 Manufacturers:
 - .1 Greenheck
 - .2 Ruskin
 - .3 Nailor
- .2 Ratings
 - .1 Dampers shall have a maximum differential pressure rating of 2 in.wg (500Pa) and a maximum velocity rating of 2000 fpm (10m/s).
- .3 Construction
 - .1 Frame: Frame shall be 16ga. Galvanized steel.
 - .2 Blades: damper blades shall be .063in thick aluminium.
 - .3 Seals:
 - .1 Blades edge: Seals shall be Vinyl.

- .2 Jamb: Seals shall be EPDM.
- .4 Linkage: External, steel tie bars.
- .5 Axles: Plated steel stub axles.
- .6 Bearings: Galvanized Steel press fit.
- .7 Mill finish
- .8 Counterbalance: Blade mounted with adjustable weights
- .9 Mounting: Refer to drawings.

2.4 Duct Access Doors

- .1 Fabricate to SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated.
- .2 Fabrication: Rigid and close-fitting of galvanized steel with sealing gaskets and quick fastening locking devices. For insulated duct work, install minimum 25 mm (one inch) thick insulation with sheet metal cover.
 - .1 Less than 300 mm (12 inches) Square: Secure with sash locks.
 - .2 Up to 450 mm (18 inches) Square: Provide two hinges and two sash locks.
 - .3 Up to 600 x 1200 mm (24 x 48 inches): Three hinges and two compression latches.
 - .4 Larger Sizes: Provide an additional hinge.
- .3 Access doors shall be minimum 450 x 350 mm where space permits.
- .4 Access doors with sheet metal screw fasteners are not acceptable.
- .5 Doors in insulated ductwork to be double panel construction with a 25mm (1") insulating filler.
- .6 In certain locations where it is inconvenient to swing access doors, removable doors with 4 cam locks will be accepted. However, all such locations shall be approved by the Contract Administrator prior to installation.
- .7 Grease duct access doors shall match the materials used for the grease duct. Manufacture and installation of duct access doors on grease ducts shall comply with all requirements of NFPA 96.

2.5 Duct Test Holes

- .1 Temporary Test Holes: Cut or drill in ducts as required. Cap with neat patches, neoprene plugs, threaded plugs, or threaded or twist-on metal caps.
- .2 Permanent Test Holes: Factory fabricated, air tight flanged fittings with screw cap. Provide extended neck fittings to clear insulation;

2.6 Fire Dampers

- .1 Manufacturers:
 - .1 Price.
 - .2 Nailor.
 - .3 Ruskin.
 - .4 Substitutions: Refer to Section 21 05 00.
- .2 Depending on the rating of fire separation, rating, construction and testing of the fire damper will conform to most recent issue of all of following:

- .1 N.B.C.
 - .2 ULC S 112
 - .3 NFPA 252
 - .4 ULC or ULI 10(b)
- .3 Use type 'B' fire dampers, i.e. blades out of air stream, to be used in all ducts passing through fire separations. Combination fire damper-balancing damper, with blades in air stream shall be used on sidewall or return, or floor mounted supply, up to maximum size of 0.372 sq.m (576 sq.in.). For sidewall return above 0.372 sq.m (576 sq.in.) in size, use a type 'A' fire damper, i.e. blades in air stream.
- .4 Ceiling Dampers: Galvanized steel, 0.76 mm(22 gauge) frame and 1.5 mm (16 gauge) flap, two layers 3.2 mm (0.125 inch) ceramic fibre on top side with locking clip.
- .5 Horizontal Dampers: Galvanized steel, 0.76 mm (22 gauge) frame, stainless steel closure spring, and lightweight, heat retardant non-asbestos fabric blanket.
- .6 Curtain Type Dampers: Galvanized steel with interlocking blades. Provide stainless steel closure springs and latches for horizontal installations. Configure with blades out of air stream except at all locations unless otherwise indicated on the drawings, and for 250 Pa (1.0 inch) pressure class ducts up to 300 mm (12 inches) in height.
- .7 Multiple Blade Dampers: 1.5 mm (16 gauge) galvanized steel frame and blades, oil-impregnated bronze or stainless steel sleeve bearings and plated steel axles, 3.2 x 12.7 mm (1/8 x 1/2 inch) plated steel concealed linkage, stainless steel closure spring, blade stops, and lock.
- .8 Fusible Links: UL 33, separate at 71 [100] [____] degrees C, (160 [212] [____] degrees F) with adjustable link straps for combination fire/balancing dampers.
- .9 Fire dampers in stainless steel exhaust duct systems shall have #316 stainless steel blades, shafts, linkage and casing. Refer to clause 'Stainless Steel Exhaust Ductwork' in this section.

2.7 FLEXIBLE DUCT CONNECTIONS

- .1 Manufacturers:
- .1 Duro-Dyne.
 - .2 Substitutions: Refer to Section 21 05 00.
- .2 Fabricate to SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated.
- .3 Connector: Fabric crimped into metal edging strip.
- .1 Fabric: UL listed fire-retardant neoprene coated woven glass fibre fabric to NFPA 90A, minimum density 1.0 kg/sq m (30 oz per sq yd).
 - .2 Net Fabric Width: Approximately 75mm (3 inches) wide.
 - .3 Metal: 75 mm (3 inch) wide, 0.6 mm thick (24 gauge) galvanized steel.

2.8 COMBINATION FIRE SMOKE DAMPERS

- .1 Manufacturers:
- .1 Price.
 - .2 Nailor.
 - .3 Ruskin.

- .4 Substitutions: Refer to Section 21 05 00.
- .2 Fabricate to NFPA 90A and UL 5555, and ULC S 112.
- .3 Dampers: UL Class 1 multiple blade type fire damper, normally closed, automatically operated by electric actuator.
- .4 Electro Thermal Link: Fusible link melting at 74 degrees C (165 degrees F); 120 volts, single phase, 60 Hz; UL listed and labeled.
 - a. Provide position Indicator Switch Package to all smoke dampers to allow damper status be monitored at FACP.

2.9 Volume Control Dampers.

- .1 Fabricate to SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated.
- .2 Splitter Dampers:
 - .1 Material: Same gauge as duct to 600 mm (24 inches) size in either direction, and two gauges heavier for sizes over 600 mm(24 inches).
 - .2 Blade: Fabricate of double thickness sheet metal to streamline shape, secured with continuous hinge or rod.
 - .3 Operator: Minimum 6 mm (1/4 inch) diameter rod in self aligning, universal joint action, flanged bushing with set screw.
- .3 Single Blade Dampers: Fabricate for duct sizes up to 150 x 760 mm (6 x 30 inch).
- .4 Multi-Blade Damper: Fabricate of opposed blade pattern with maximum blade sizes 200 x 1825 mm (8 x 72 inch). Assemble centre and edge crimped blades in prime coated or galvanized channel frame with suitable hardware.
- .5 End Bearings: Except in round duct work 300 mm (12 inches) and smaller, provide end bearings. On multiple blade dampers, provide oil-impregnated nylon or sintered bronze bearings.
- .6 Quadrants:
 - .1 Provide locking, indicating quadrant regulators on single and multi-blade dampers.
 - .2 On insulated ducts mount quadrant regulators on stand-off mounting brackets, bases, or adapters.
 - .3 Where rod lengths exceed 750 mm (30 inches) provide regulator at both ends.

2.10 Remote Balancing Dampers

- .1 Manufacturer: Greenheck
 - .1 Model: RBDR-50
 - .2 Model: RBD-10
- .2 Dampers shall have a maximum differential pressure rating of 1 in.wg.
- .3 Dampers shall have a maximum velocity rating of 2,000 fpm.
- .4 Construction
 - .1 Frame and Sleeve:
 - .1 The damper frame and sleeve shall be one piece design, made with 20 ga. Galvanized steel, 6 3/8 inch depth, and a groove for added strength.
 - .2 Blades:

- .1 Galvanized steel 20 ga.
- .3 Axles: Minimum $\frac{3}{4}$ in. dia.
 - .1 Plated steel
- .4 Bearings:
 - .1 Axle bearings shall be synthetic (acetal) sleeve type
- .5 Actuator:
 - .1 Actuator shall be a 9 volt actuator
- .5 Accessories:
 - .1 Wall Plates
 - .1 Stainless Steel
 - .1 6 port
 - .2 Provide
- .6 Refer to HVAC floor plans for locations and quantities of dampers and wall plates.
- .7 EZ Balance Remote
- .8 Plenum Rated Cable
 - .1 Provide all cabling required to connect all dampers to appropriate wall plate as indicated.
- .9 Installation
 - .1 Install dampers in accordance with manufacturer's Installation Instructions.
 - .2 Install dampers square and free from racking.
 - .3 Do not compress or stretch the damper frame into the duct or opening.
 - .4 Handle dampers using the frame or sleeve. Do not lift or move dampers using blades, actuator or jackshaft.
 - .5 Install all cable and connections to actuators as specified in Division 23 as applicable.

2.11 Ceiling Fans

- .1 Canarm CP56 HPWP
- .2 56" blade sweep.
- .3 Variable speed motors (all motors are thermally protected PSC type variable speed with permanently lubricated bearings).
- .4 "MC" series speed controls Painted steel blades with curved ends deliver maximum airflow over wide areas.
- .5 Furnished with MC series speed controllers able to control multiple units.
- .6 Furnished with industrial fan guard.
- .7 Supplied by Division 23 installed by Division 26.

2.12 Dryer Vent Stack Jack

- .1 Thaler EVF-1, slotted collar for use with dryer vents
 - .1 Aluminum alloy
 - .2 Pre-molded urethane insulation collar
 - .3 Condensation free design
 - .4 Coordinate roof-tie in details with architectural.

Part 3 Execution

3.1 Preparation

- .1 Verify that electric power is available and of the correct characteristics.

3.2 Installation

- .1 Install accessories to manufacturer's written instructions, NFPA 90A, and follow SMACNA HVAC Duct Construction Standards - Metal and Flexible. Refer to Section 23 31 00 for duct construction and pressure class.
- .2 Provide backdraft dampers on exhaust fans or exhaust ducts nearest to outside and where indicated.
- .3 Provide duct access doors for inspection and cleaning before and after filters, coils, fans, automatic dampers, at fire dampers, combination fire and smoke dampers, and elsewhere as indicated. Provide for cleaning kitchen exhaust duct work to NFPA 96. Provide minimum 300 x 300 mm (12 x 12 inch) size for all fire dampers. Enlarge duct if necessary to accommodate properly sized access door.
- .4 Access doors shall be located:
 - .1 At the base of all main risers.
 - .2 In front of and behind turning vanes, silencers and duct mounted coils.
 - .3 At fire, smoke and motorized dampers.
 - .4 At locations having an internally mounted piece of equipment or device
 - .5 Such that any section of duct is not more than 15 m (50 ft) from a point of access.
 - .6 At not more than 3 m (10 ft) intervals on supply air ductwork installed downstream of a HEPA filter.
- .5 Generally access doors at heating coils shall approximate width of coil for ease of cleaning.
- .6 At smoke detectors, provide 450mm x 450mm (18 x 18 inch) access doors.
- .7 Provide duct test holes where indicated and required for testing and balancing purposes.
- .8 Provide fire dampers, combination fire and smoke dampers and smoke dampers at locations indicated, where ducts and outlets pass through fire rated components, and where required by authorities having jurisdiction. Install with required perimeter mounting angles, sleeves, breakaway duct connections, corrosion resistant springs, bearings, bushings and hinges.
- .9 Install smoke dampers and combination smoke and fire dampers to NFPA 92A. Coordinate electrical requirements with Electrical Division.
- .10 Demonstrate re-setting of fire dampers to The City's representative.
- .11 Provide flexible connections immediately adjacent to equipment in ducts associated with fans and motorized equipment, and supported by vibration isolators. Refer to Section 23 05 48. For fans developing static pressures of 1250 Pa (5.0 inches wg) and over, cover connections with leaded vinyl sheet, held in place with metal straps.
- .12 Use splitter dampers only where indicated.
- .13 Provide balancing dampers on high velocity systems where indicated. Refer to Section 23 36 00.

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- .14 Provide balancing dampers on duct take-off to diffusers, grilles, and registers, regardless of whether dampers are specified as part of the diffuser, grille, or register assembly.
 - .15 Do not locate single blade volume dampers immediately behind diffusers and grilles. This application does not allow uniform airflow across the outlet face.
 - .16 To minimize generated duct noise, locate volume dampers at least two duct diameters from a fitting and as far away as possible from the outlet or inlet.

END OF SECTION

Part 1 General

1.1 Section Includes

- .1 General Fan Components:
 - .1 Wheels and Inlets:
 - .2 Housings
 - .3 Bearings and Drives
 - .4 Electrical Components
- .2 Utility Set
- .3 Roof Exhauster/Ventilator
- .4 Cabinet and Ceiling Exhaust Fans
- .5 Inline Fans
- .6 Residential Range Hoods
- .7 Fan Accessories.

1.2 Related Work

- .1 Section 23 05 13 - Motors.
- .2 Section 23 05 48 - Vibration Isolation.
- .3 Section 23 05 53 - Mechanical Identification.
- .4 Section 23 05 93 – Testing, Adjusting, And Balancing.
- .5 Section 23 07 13 - Duct Insulation.
- .6 Section 23 07 16 – Equipment Insulation.
- .7 Section 23 31 00 - Duct Work.
- .8 Section 23 33 00 - Duct Work Accessories: Backdraft dampers.
- .9 Section 23 73 23 - Air Handling Units.
- .10 Section 25 50 02 - Digital Control Equipment.
- .11 Section 26 05 80 - Equipment Wiring: Electrical characteristics and wiring connections.

1.3 References

- .1 AFBMA 9 - Load Ratings and Fatigue Life for Ball Bearings.
- .2 AFBMA 11 - Load Ratings and Fatigue Life for Roller Bearings.
- .3 AMCA 99 - Standards Handbook.
- .4 AMCA 210 - Laboratory Methods of Testing Fans for Aerodynamic Performance Rating.
- .5 AMCA 300 - Reverberant Room Method for Sound Testing of Fans.
- .6 AMCA 301 - Method of Calculating Fan Sound Ratings from Laboratory Test Data.
- .7 ISO 1940 – Mechanical Vibration. Balance quality requirements for rotors in a constant (rigid) state.
- .8 SMACNA - HVAC Duct Construction Standards - Metal and Flexible.

- .9 UL/cUL 762 - Power Roof Ventilators For Restaurant Exhaust Appliances
- .10 UL/cUL 705 – Power Ventilators
- .11 UL/cUL 793 - Automatically Operated Roof Vents for Smoke and Heat

1.4 Submittals

- .1 Section 21 05 00: Procedures for submittals.
- .2 Shop Drawings: Indicate assembly of centrifugal fans and accessories including fan curves with specified operating point clearly plotted, sound power levels for both fan inlet and outlet at rated capacity, and electrical characteristics and connection requirements.
- .3 Product Data: Provide data on centrifugal fans and accessories including fan curves with specified operating point clearly plotted, sound power levels for both fan inlet and outlet at rated capacity, and electrical characteristics and connection requirements.
- .4 Manufacturer's Installation Instructions.

1.5 Operation And Maintenance Data

- .1 Section 21 05 00: Submittals for project closeout.
- .2 Maintenance Data: Include instructions for lubrication, motor and drive replacement, spare parts list, and wiring diagrams.

1.6 Delivery, Storage, And Handling

- .1 Section 21 05 00: Transport, handle, store, and protect products.
- .2 .Protect motors, shafts, and bearings from weather and construction dust.

1.7 Environmental Requirements

- .1 Do not operate fans for any purpose until ductwork is clean, filters in place, bearings lubricated, and fan has been test run under observation.

1.8 Extra Materials

- .1 Section 21 05 00: Submittals for project closeout.
- .2 Provide two sets of belts for each belt driven fan.

Part 2 Products

2.1 MANUFACTURERS

- .1 Greenheck
- .2 Loren Cook
- .3 Substitutions: Refer to Section 21 05 00

2.2 GENERAL FAN COMPONENTS

- .1 Performance Ratings: Conform to AMCA 210 and bear the AMCA Certified Rating Seal.
- .2 Sound Ratings: AMCA 301, tested to AMCA 300 ,and bear AMCA Certified Sound Rating Seal.

- .3 Fabrication: Conform to AMCA 99.
- .4 Performance Base: Sea level conditions.
- .5 Temperature Limit: Maximum 150 degrees C (300 degrees F).
- .6 Static and Dynamic Balance: Balance all wheels to balance grade G6.3 per ANSI S2.19 (ISO 1940). Eliminate vibration or noise transmission to occupied areas.
- .7 Performance Requirements on Schedules.
- .8 Wheel And Inlet: Refer to individual sections.
- .9 Housing
 - .1 Heavy gauge steel, spot welded for AMCA 99 Class I and II fans, and continuously welded for Class III, adequately braced, designed to minimize turbulence with spun inlet bell and shaped cut-off.
- .10 Bearings And Drives
 - .1 Shafts: Hot rolled steel, ground and polished, with key- way, protectively coated with lubricating oil, and shaft guard.
 - .2 V-Belt Drive: Cast iron or steel sheaves, dynamically balanced, keyed. Variable and adjustable pitch sheaves for motors 11.2 kW(15 hp) and under, selected so required rpm is obtained with sheaves set at mid-position. Fixed sheave for 15 kW(20 hp) and over, matched belts, and drive rated as recommended by manufacturer or minimum 1.5 times nameplate rating of the motor.
 - .3 Belt Guard: Fabricate to SMACNA Standard; of 2.8 mm(12 gauge) thick, 20 mm(3/4 inch) diamond mesh wire screen welded to steel angle frame or equivalent, prime coated. Secure to fan or fan supports without short circuiting vibration isolation, with provision for adjustment of belt tension, lubrication, and use of tachometer with guard in place.
- .11 Electrical Characteristics And Components
 - .1 Refer to schedule
 - .2 Motor: Refer to Section 23 05 13.

2.3 Utility Set

- .1 Manufacturers:
 - .1 Greenheck
 - .2 Loren Cook
 - .3 Substitutions: Refer to Section 21 05 00
- .2 General:
 - .1 Fans selected shall be capable of accommodating static pressure and flow variations of +/-15% of scheduled values.
 - .2 Each fan shall be belt drive in AMCA arrangement 3 only according to drawings.
 - .3 Fans are to be equipped with lifting lugs.
 - .4 After fabrication all carbon steel components shall be cleaned and chemically treated by a phosphatizing process to insure proper removal of grease, oil, scale, etc.
 - .5 Unit shall bear an engraved aluminum nameplate. Nameplate shall indicate design CFM, static pressure, and maximum fan RPM.
 - .6 Unit shall be equipped with extended exhaust for minimum 2100 mm discharge point above roof level and tapered cone discharge for all laboratory exhaust.

- .3 Wheel and inlet:
 - .1 The fan wheel shall be of the non-overloading double or single width centrifugal type. Wheels shall be statically and dynamically balanced to balance grade G6.3 per ANSI S2.19.
 - .2 The wheel and fan inlet shall be carefully matched and shall have precise running tolerances for maximum performance and operating efficiency
 - .3 Refer to schedule for wheel blade style:
 - .1 Backward Inclined: Steel or aluminum construction with smooth curved inlet flange, heavy back plate, backwardly curved blades welded to flange and back plate; cast iron or cast steel hub riveted to back plate and keyed to shaft with set screws.
 - .2 Forward Curved: Galvanized steel construction with inlet flange, back plate, shallow blades with inlet and tip curved forward in direction of airflow, welded to flange and back plate; steel hub swaged to back plate and keyed to shaft with set screw.
 - .3 Airfoil Wheel: Steel construction with smooth curved inlet flange, heavy back plate die formed hollow airfoil shaped blades continuously welded at tip flange, and back plate; cast iron or cast steel hub riveted to back plate and keyed to shaft with set screws.
- .4 Housing
 - .1 Fan housing shall be designed to accommodate the width wheel.
 - .2 Fan housing is to be aerodynamically designed with high-efficiency inlet, engineered to reduce incoming air turbulence.
 - .3 Housing and bearing support shall be constructed of welded structural steel members to prevent vibration and rigidly support the shaft and bearings.
 - .4 An OSHA compliant belt guard shall be included to completely cover the motor pulley and belt(s).
 - .5 Heavy gauge steel, spot welded for AMCA 99 Class I and II fans, and continuously welded for Class III, adequately braced, designed to minimize turbulence with spun inlet bell and shaped cut-off.
 - .6 Provide bolted construction with horizontal flanged split housing .
- .5 Bearings And Drives
 - .1 Bearings: AFBMA 9, L-10 life at 80,000 hours heavy duty pillow block type, self-aligning, grease-lubricated ball bearings, or AFBMA 11 L-10 life at 120,000 hours pillow block type, self-aligning, grease-lubricated roller bearings.
 - .2 Shafts: Hot rolled steel, ground and polished, with key- way, protectively coated with lubricating oil, and shaft guard and sized so the first critical speed is at least 25% over the maximum operating speed for each pressure class.
 - .3 Bearings shall be fixed to the fan shaft using concentric mounting locking collars, which reduce vibration, increase service life, and improve serviceability. Bearings that use set screws shall not be allowed.
 - .4 Drive belts and sheaves shall be sized for 150% of the fan operating brake horsepower, and shall be readily and easily accessible for service, if required.
 - .5 V-Belt Drive: Cast iron or steel sheaves, dynamically balanced, keyed. Variable and adjustable pitch sheaves for motors 11.2 kW(15 hp) and under, selected so required rpm is obtained with sheaves set at mid-position. Fixed sheave for 15 kW(20 hp) and over, matched belts, and drive rated as recommended by manufacturer or minimum 1.5 times nameplate rating of the motor.

- .6 Belt Guard: Fabricate to SMACNA Standard; of 2.8 mm(12 gauge) thick, 20 mm(3/4 inch) diamond mesh wire screen welded to steel angle frame or equivalent, prime coated. Secure to fan or fan supports without short circuiting vibration isolation, with provision for adjustment of belt tension, lubrication, and use of tachometer with guard in place.
- .7 Bearings shall have Zerk fittings to allow for lubrication.
- .6 Electrical Characteristics And Components
 - .1 Wiring Terminations: Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclose terminal lugs in terminal box sized to code.

2.4 Roof Exhausters

- .1 Manufacturers:
 - .1 Greenheck
 - .2 Loren Cook
 - .3 Delhi
 - .4 Substitutions: Refer to Section 21 05 00
- .2 Product Requirements:
 - .1 Performance Ratings: Conform to AMCA 210 and bear the AMCA Certified Rating Seal.
 - .2 Sound Ratings: AMCA 301, tested to AMCA 300 ,and bear AMCA Certified Sound Rating Seal.
 - .3 Fabrication: Conform to AMCA 99.
 - .4 UL Compliance: UL listed and labeled, designed, manufactured, and tested to UL 705.
 - .5 Kitchen hood exhaust fans:
 - .1 UL 762 compliance
 - .2 Grease trap spout with cleanable bucket
 - .3 Tiltable fan access for grease duct cleaning.
- .3 Fan Unit: V-belt or direct driven as indicated; forward curved galvanized steel wheel; painted galvanized steel cabinet; resilient mounted motor; 13 mm (1/2 inch) mesh, 2 mm(16 gauge) aluminum birdscreen; square base to suit roof curb with continuous curb gaskets.
- .4 Electrical Characteristics and Components
 - .1 Electrical Characteristics:
 - .1 See Schedule
 - .2 Motor: Refer to Section 23 05 13. Induction VFD rated motor where controlled by VFD operation.
 - .3 Wiring Terminations: Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclose terminal lugs in terminal box sized to code.
 - .4 Disconnect Switch: Factory wired, non-fusible, in housing for thermal overload protected motor solid state speed controller on all direct drive units with option for 0-10 V speed control input.
- .5 Backdraft Damper: Gravity actuated, aluminum multiple blade construction, felt edged with nylon bearings.

- .6 Sheaves: Cast iron or steel, dynamically balanced, bored to fit shafts and keyed; variable and adjustable pitch motor sheave selected so required rpm is obtained with sheaves set at mid-position; fan shaft with self aligning pre-lubricated ball bearings.

2.5 Inline Exhaust Fans

- .1 Manufacturers:
- .1 Greenheck
 - .2 Loren Cook
 - .3 Substitutions: Refer to Section 21 05 00
- .2 Centrifugal Fan Unit:
- .1 General Description:
 - .1 Fans selected shall be capable of accommodating static pressure and flow variations of +/-15% of scheduled values.
 - .2 Fans are to be equipped with lifting lugs.
 - .3 After fabrication all carbon steel components shall be cleaned and chemically treated by a phosphatizing process to insure proper removal of grease, oil, scale, etc.
 - .4 Unit shall bear an engraved aluminum nameplate. Nameplate shall indicate design CFM, static pressure, and maximum fan RPM.
 - .2 Wheel:
 - .1 Non-overloading, backward inclined centrifugal wheel
 - .2 Constructed of aluminum
 - .3 Statically and dynamically balanced in accordance to AMCA Standard 204-05
 - .4 The wheel cone and fan inlet will be matched and shall have precise running tolerances for maximum performance and operating efficiency
 - .5 Single thickness blades are securely riveted or welded to a heavy gauge back plate and wheel cone.
 - .3 Electronically Commutated Motor
 - .1 Motor enclosures: Open type
 - .2 Motor to be a DC electronic commutation type motor (ECM) specifically designed for fan applications. AC induction type motors are not acceptable. Examples of unacceptable motors are: Shaded Pole, Permanent Split Capacitor (PSC), Split Phase, Capacitor Start and 3 phase induction type motors.
 - .3 Motors are permanently lubricated, heavy duty ball bearing type to match with the fan load and pre-wired to the specific voltage and phase.
 - .4 Internal motor circuitry to convert AC power supplied to the fan to DC power to operate the motor.
 - .5 Motor shall be speed controllable down to 20% of full speed (80% turndown). Speed shall be controlled by a 0-10 VDC signal.
 - .6 Motor shall be a minimum of 85% efficient at all speeds.
 - .3 Bearings And Drives (fan drive)
 - .1 Bearings: AFBMA 9, L-10 life at 50,000 hours heavy duty pillow block type, self-aligning, grease-lubricated ball bearings, or AFBMA 11 L-10 life at 120,000 hours pillow block type, self-aligning, grease-lubricated roller bearings.

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- .2 Shafts: Hot rolled steel, ground and polished, with key- way, protectively coated with lubricating oil, and shaft guard and sized so the first critical speed is at least 25% over the maximum operating speed for each pressure class.
 - .3 Bearings shall be fixed to the fan shaft using concentric mounting locking collars, which reduce vibration, increase service life, and improve serviceability. Bearings that use set screws shall not be allowed.
 - .4 Drive belts and sheaves shall be sized for 150% of the fan operating brake horsepower, and shall be readily and easily accessible for service, if required.
 - .5 V-Belt Drive: Cast iron or steel sheaves, dynamically balanced, keyed. Variable and adjustable pitch sheaves for motors 11.2 kW(15 hp) and under, selected so required rpm is obtained with sheaves set at mid-position. Fixed sheave for 15 kW(20 hp) and over, matched belts, and drive rated as recommended by manufacturer or minimum 1.5 times nameplate rating of the motor.
 - .6 Belt Guard: Fabricate to SMACNA Standard; of 2.8 mm(12 gauge) thick, 20 mm(3/4 inch) diamond mesh wire screen welded to steel angle frame or equivalent, prime coated. Secure to fan or fan supports without short circuiting vibration isolation, with provision for adjustment of belt tension, lubrication, and use of tachometer with guard in place.
 - .7 Bearings shall have Zerk fittings to allow for lubrication.
 - .8 Housing/Cabinet Construction
 - .1 Construction material: Galvanized
 - .2 Square design constructed of heavy gauge galvanized steel and shall include square duct mounting collars
 - .3 Housing and bearing supports shall be constructed of heavy gauge bolted and welded steel construction to prevent vibration and to rigidly support the shaft and bearing assembly.
 - .9 Housing Supports and Drive Frame:
 - .1 Housing supports are constructed of structural steel with formed flanges
 - .2 Drive frame is welded steel which supports the motor
 - .10 Disconnect Switches:
 - .1 NEMA rated: 1
 - .2 Positive electrical shut-off
 - .3 Wired from fan motor to junction box
 - .11 Duct Collars:
 - .1 Square design to provide a large discharge area
 - .2 Inlet and discharge collars provide easy duct connection
 - .12 Access Panel:
 - .1 Two sided access panels, permit easy access to all internal components
 - .2 Located perpendicular to the motor mounting panel
 - .13 Options/Accessories:
 - .1 Dampers:
 - .1 Types: Gravity
 - .2 Galvanized frames with prepunched mounting holes

- .3 Balanced for minimal resistance to flow
- .2 Finishes:
 - .1 Coating type: Permatector
- .3 Inlet Guards:
 - .1 Constructed of expanded metal mounted in a steel frame to provide protection for non-ducted installations
- .4 Insulated Housing
 - .1 Thickness: 25mm (1 inches)
 - .2 For noise reduction and condensation control
 - .3 Constructed of fiberglass liner
- .5 Isolation:
 - .1 Type: Neoprene/Rubber Mount
 - .2 Sized to match the weight of each fan
- .6 Motor Cover:
 - .1 Constructed of galvanized steel
 - .2 Covers motor and drives for safety
 - .3 Standard on unit specified with UL
- .14 Wiring Pigtail:
 - .1 Direct hook-up to the power supply
- .4 Electrical Characteristics and Components
 - .1 See Schedule.

2.6 RANGE HOODS

- .1 Manufacturer Broan SahaleBKDF130SS
 - .1 Fan Tech
 - .2 Substitutions: Refer to Section 21 05 00
- .2 Performance
 - .1 Sound level to be no greater than 3 sones (at normal speed); 6 sones (high speed). Air and sound ratings to be certified by HVI. Unit shall be U.L. and c.U.L. listed.
- .3 Construction:
 - .1 Range hood shall no sharp edges.
 - .2 Stainless steel finish.
 - .3 Fully-enclosed bottom and dishwasher-safe full filters.
 - .4 Hood to be convertible between 3¼" x 10" and 7" round ducted (using washable aluminum filters). Duct connectors must be adjustable to accommodate off-center ductwork.
 - .5 Axial blade centrifugal blower
 - .6 Two level LED lights, lamps by mechanical subcontractor where not included.
 - .7 Unit complete with blower and light operation using an adjustable 3-speed rocker, located in face of hood.

2.7 ACCESSORIES

- .1 Belt automatic tensioner.

- .2 Fixed Inlet Vanes: Steel construction with fixed cantilevered inlet guide vanes welded to inlet bell.
- .3 Inlet/Outlet Screens: Expanded metal mounted in a welded steel frame..
- .4 Belt Guard: Factory produced painted steel belt guard designed to meet supplied fan belts and drives.
- .5 Access Doors: Shaped to conform to scroll, with quick opening latches and gaskets.
- .6 Shaft Seal: Aluminum, rub ring to seal the housing around the shaft.
- .7 Isolation Packages: Manufacturer standard for application.
- .8 Weatherhood: Constructed of painted steel. Shall completely cover motor and drive compartments, be provided with appropriate vents for motor cooling and meet UL 705 requirements.
- .9 Field installed factory supplied extended lubrication lines.

Part 3

Execution

3.1

Installation

- .1 Install to manufacturer's written instructions.
- .2 Install fans with resilient mountings and flexible electrical leads. Refer to Section 23 05 48.
- .3 Install flexible connections specified in Section 23 33 00 between fan inlet and discharge ductwork. Ensure metal bands of connectors are parallel with minimum 25 mm(one inch) flex between ductwork and fan while running.
- .4 Install fan restraining snubbers as required. Refer to Section 23 05 48. Adjust snubbers to prevent tension in flexible connectors when fan is operating.
- .5 Provide fixed sheaves required for final air balance. Speed controller on all direct drive fans.
- .6 Provide safety screen where inlet or outlet is exposed.
- .7 Provide backdraft dampers on discharge of exhaust fans and as indicated. Refer to Section 23 33 00.

END OF SECTION

Part 1

General

1.1 SECTION INCLUDES

- .1 Ceiling Fans
- .2 High Volume Low Velocity Ceiling Fans

1.2 RELATED WORK

- .1 Section 21 13 00 - Fire Suppression
- .2 Section 23 05 13 - Motors.
- .3 Section 23 05 48 - Vibration Isolation.
- .4 Section 23 05 53 - Mechanical Identification.
- .5 Section 25 50 02 - Digital Control Equipment.
- .6 Section 26 05 80 - Equipment Wiring: Electrical characteristics and wiring connections.

1.3 REFERENCES

- .1 AFBMA 9 - Load Ratings and Fatigue Life for Ball Bearings.
- .2 AFBMA 11 - Load Ratings and Fatigue Life for Roller Bearings.
- .3 AMCA 99 - Standards Handbook.
- .4 AMCA 210 - Laboratory Methods of Testing Fans for Aerodynamic Performance Rating.
- .5 AMCA 300 - Reverberant Room Method for Sound Testing of Fans.
- .6 AMCA 301 - Method of Publishing Sound Ratings for Air Moving Devices.
- .7 ISO 1940 – Mechanical Vibration. Balance quality requirements for rotors in a constant (rigid) state.

1.4 Submittals

- .1 Section 21 05 00: Procedures for submittals.
- .2 Shop Drawings: Drawings detailing product dimensions, weight, attachment methods, electrical and installation requirements, controls, air volume.
- .3 Manufacturer's Installation Instructions.

1.5 Operation And Maintenance Data

- .1 Section 21 05 00: Submittals for project closeout.
- .2 Maintenance Data: Include manufacturer's operation and instruction instructions for lubrication, motor and drive replacement, spare parts list, and wiring diagrams.

1.6 Quality Assurance

- .1 Certifications
 - .1 The fan assembly, as a system, shall be ETL-certified and built pursuant to the guidelines set forth by UL standard 507 and CSA standard 22.2.

- .2 The fan shall be compliant with NFPA 13—Standard for the Installation of Sprinkler Systems, NFPA 72—National Fire Alarm and Signaling Code, and Canadian Electrical Code as specified by Division 26.
- .3 Controllers shall comply with Canadian Electrical Code and Underwriters Laboratory (UL) standards and shall be labeled where required by code.

1.7 Delivery, Storage, And Handling

- .1 Section 21 05 00: Transport, handle, store, and protect products.
- .2 Protect motors, shafts, controls and bearings from weather and construction dust.

1.8 Extra Materials

- .1 Section 21 05 00: Submittals for project closeout.

Part 2 Products

2.1 CEILING FANS

- .1 Manufacturers:
 - .1 Canarm
- .2 Construction:
 - .1 Blade sweep as noted on schedules
 - .2 Painted steel blades with curved ends deliver maximum airflow over wide areas.
 - .3 Furnished with industrial fan guard.
 - .4 Variable speed reversible motors
 - .1 All motors thermally protected PSC type variable speed with permanently lubricated bearings.
- .3 Controls
 - .1 Manual speed controls complete with forward/reverse switch.
 - .2 Speed controllers able to control multiple units.
- .4 Supplied by Division 23 installed by Division 26.

Part 3 Execution

3.1 Ceiling Fan Installation

- .1 Install on structural members noted on drawings to manufacturer's instructions.

END OF SECTION

Part 1

General

1.1

Section Includes

- .1 Industrial exhaust fans.
- .2 Ductwork and duct fittings.
- .3 Inlet fittings.
- .4 Dust elimination and collection devices.
- .5 Accessories.

1.2

Related Sections

- .1 Section 01 11 00 - Summary of Work: The City provided dust collection inlet fittings.
- .2 Section 23 05 13 - Motors: Fan motors.
- .3 Section 23 05 48 - Vibration Isolation: Vibration isolators.
- .4 Section 23 34 16 - Centrifugal Fans: Supply of centrifugal exhaust fans for placement by this Section.
- .5 Section 26 05 80 - Equipment Wiring: Electrical characteristics and wiring connections.

1.3

References

- .1 ACGIH - Industrial Ventilation, A Manual of Recommended Practice.
- .2 AMCA 99 - Standards Handbook.
- .3 AMCA 210 - Laboratory Methods of Testing Fans for Aerodynamic Performance Rating.
- .4 AMCA 300 - Reverberant Room Method for Sound Testing of Fans.
- .5 AMCA 301 - Method of Calculating Fan Sound Ratings from Laboratory Test Data.
- .6 ASTM A90/A90M - Weight (Mass) of Coating on Iron and Steel Articles with Zinc or Zinc-Alloy Coatings.
- .7 ASTM A167 - Stainless and Heat-resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
- .8 ASTM A653/A653M - Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- .9 ASTM A1011/A1011M - Standard Specification for Steel, Sheet, and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy With Improved Formability.
- .10 AWS D9.1 - Sheet Metal Welding Code.
- .11 NBS PS 15 - Voluntary Product Standard for Custom Contact-Moulded Reinforced-Polyester Chemical-Resistant Process Equipment.
- .12 NFPA 91 - Exhaust Systems for Air Conveying or Vapours, Gases, Mists, and Noncombustible Particulate Solids.
- .13 SMACNA - HVAC Duct Construction Standards - Metal and Flexible.
- .14 SMACNA - Round Industrial Duct Construction Standard.

- .15 SMACNA - Rectangular Industrial Duct Construction Standard.
- .16 UL 181 - Factory-Made Air Ducts and Air Connectors.
- .17 UL 214 - Test for Flame Propagation of Fabrics and Films.

1.4 Submittals

- .1 Section 21 05 00: Procedures for submittals.
- .2 Shop Drawings: Indicate dimensions, sizes, weights and point loadings, material thickness, and locations and sizes of field connections. [Submit construction layout and details for inlet fittings.]
- .3 Product Data: Provide manufacturers literature and data indicating rated capacities, dimensions, weights and point loadings, accessories, electrical characteristics and connection requirements, wiring diagrams, and location and sizes of field connections.
- .4 Provide fan curves with specified operating point clearly plotted.
- .5 Submit sound power levels for both fan inlet and outlet at rated capacity.
- .6 Manufacturer's Installation Instructions: Indicate assembly and installation instructions.

1.5 Operation And Maintenance Data

- .1 Section 21 05 00: Submittals for project closeout.
- .2 Operation and Maintenance Data: Include instructions for lubrication, motor and drive replacement, spare parts list, and wiring diagrams.

1.6 Quality Assurance

- .1 Fans:
 - .1 Performance Ratings: Conform to AMCA 210
 - .2 Sound Ratings: AMCA 301, tested to AMCA 300
 - .3 Fabrication: Confirm to AMCA 99.

1.7 Regulatory Requirements

- .1 Products Requiring Electrical Connection: Listed and classified by [Underwriters' Laboratories Inc.,] [testing firm acceptable to the authority having jurisdiction] as suitable for the purpose specified and indicated.

1.8 Extra Materials

- .1 Section 21 05 00: Submittals for project closeout.

Part 2 Products

2.1 SYSTEMS MANUFACTURERS

- .1 Manufacturers:
 - .1 Donaldson Torit Model: Downflo Evolution.
 - .2 Other acceptable manufacturers offering equivalent products.
 - .1 Substitutions: Refer to Section 21 05 00.

2.2 CENTRIFUGAL FANS

- .1 Manufacturers:
 - .1 Airpro Centrifugal Blower Model BCHS Size 270 Class 4.
 - .2 Other acceptable manufacturers offering equivalent products.
 - .1 Substitutions: Refer to Section 21 05 00.
- .2 Performance
 - .1 As Scheduled
- .3 Wheel and inlet.
 - .1 Backward Inclined: Steel construction with smooth curved inlet flange, heavy back plate, backwardly curved blades welded or riveted to flange and back plate; cast iron hub riveted to back plate and keyed to shaft with set screws.
 - .2 Radial: Steel construction with inlet flange, heavy reinforced back plate, plate blades with reinforcing gussets and wearing strips welded or riveted to back plate and flange; cast iron hub riveted to back plate and keyed to shaft with set screws.
- .4 Housing: Heavy gauge steel, continuously welded with inlet bell and shaped cut-off, factory finished with enamel or prime coat.
- .5 Motors and Drives:
 - .1 Motors: As indicated, in compliance with Section 23 05 13.
 - .2 Electrical Characteristics: Refer to Section 26 05 80.
 - .3 Bearings: Heavy duty pillow block type, self aligning, grease-lubricated ball bearings or roller bearings.
 - .4 Shafts: Hot rolled steel, ground and polished, with key-way, protectively coated with lubricating oil.
 - .5 V-Belt Drive: Cast iron or steel sheaves, dynamically balanced, keyed; variable and adjustable pitch for motors 11.2 kW(15 hp) and under; fixed sheaves for motors 15 KW(20 hp) and over, matched belts, and rated minimum 1.5 times nameplate rating of motor.
 - .6 Belt Guard: Fabricate to SMACNA HVAC Duct Construction Standards - Metal and Flexible; of 2.8 mm(12 gauge), 20 mm(3/4 inch) diamond mesh wire screen welded to steel angle frame or equivalent, prime coated.
- .6 Accessories
 - .1 Fixed Inlet Vanes: Steel construction with fixed cantilevered inlet guide vanes welded to inlet bell.
 - .2 Inlet/Outlet Screens: Galvanized steel welded grid.

2.3 Duct Work And Duct Accessories

- .1 Materials:
 - .1 Galvanized Steel Ducts: ASTM A653 galvanized steel sheet, lock-forming quality, having G90 zinc coating to ASTM A 90.
 - .2 Steel Ducts: ASTM A 1011 carbon steel.
- .2 Duct Work
 - .1 Fabricate and support to SMACNA, Round Industrial Duct Construction Standard and Rectangular Industrial Duct Construction Standard and ACGIH Industrial Ventilation Manual except as indicated.

- .2 Construct T's, bends, and elbows with radius of not less than 1-1/2 times width of duct on centreline.
 - .3 Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.
 - .4 Fabricate continuously welded round and oval duct fittings two gauges heavier than duct gauges indicated in SMACNA Standard. Prime coat welded joints.
 - .5 Use crimp joints with or without bead for joining round duct sizes 200mm (8 inch) and smaller with crimp in direction of air flow, with liquid adhesive plus sheet metal screws.
 - .6 Joints: Minimum 100 mm (4 inch) cemented slip type, brazed, or electric welded to AWS D9.1.
 - .7 Provide standard 45 degree lateral wye branch fittings unless otherwise indicated.
 - .8 Use double nuts and lock washers on threaded rod supports.
- .3 Flexible Connectors: UL 214 listed, fire-retardant chloroprene or chlorosulfonated polyethylene impregnated fabric, minimum density 1.22 kg/sq m (36 oz per sq yd), approximately 75mm (3 inches) wide, crimped into metal edging strip.
 - .4 Angle rings: Carbon Steel, unpainted, leg out, drilled with bolt holes.
 - .5 Blast Gates: Full collar of steel, with galvanized steel slide, set screw.
 - .6 Flat Back Elbows: Long radius rectangular elbow at duct material with heavy gauge, removable, stainless steel back strip.
 - .7 Ball Joints: [Cast iron] [Spun galvanized steel] with tubular studs for connecting ducts, allowing 25 degree angle off centre.

2.4 Inlet Fittings

- .1 Fabricate of minimum 16 gauge galvanized steel.
- .2 Fabricate inlet to detail indicated on drawings and ACGIH Industrial Ventilation Manual.
- .3 Fabricate with hemmed edges, closed corners, and reinforced for span and attachment; with duct connection.

2.5 Dust Collector Schedule

Donaldson DownFlo Evolution Cartridge Dust Collector

- Torit DFE 3-24
- Standard Hopper, Leg Pack, Standard Torit Blue Paint Finish.
- Intelligent Drop Out Zone.
- Engineered and tested to provide outlet isolation as required by NFPA 654 and NFPA 69.
- (2) Standard Inlets, 18"Ø
- Housing reinforced for -25" w.g.
- Housing Pred. .4 bar, 5.8psig.
- (24) Ultra Web NL 1.5" Pleat High Efficiency filter cartridges. Merv 15 Rating.
- Max Pulse jet cleaning system.

- Nema 4 pulse timer and Dwyer Photohelic Gauge---integrated into control panel. Heated NEMA 4 solenoid enclosure.
- 13,680cfm @ 2.2:1 AMR.
- Ladder and Platform pack.
- Top Mount Explosion NFPA 68 Compliant Vents c/w Weather Covers.
- Two (2) Optional Torit SDK Sealed Drum Kits to provide combustible dust hopper isolation as per NFPA.

Airpro Centrifugal Blower

- BCHS Size 270 Class 4, 49.9bhp, 2,504rpm.
- Arrangement 1, c/w unitary base
- 60hp 575v TEFC 1800rpm premium efficiency motor.
- Belt drive with min 1.5sf and OSHA guards.
- 13,530cfm @ 16.2”w.g. TSP.
- 75dbA @ 3’ outlet silencer.
- Fan esp: 8.2”

ATEX Inlet Isolation Valve

- Boss NRV model EF-VF24
- Micro switch for shutdown enunciation.
- Dust build up sensor, requires intrinsically safe circuit
- Max Kst 225 bar m/s. (Min Kst 50 bar m/s)
- Installation allows for up to (2) elbows between valve and protected vessel.
- Ex IID
- Installation distance from collector inlet: Min 5M. (Min 6M with elbows or vertical mount)
- Temperature Range: -20C to +60C. (insulation and heat tracing required for operation below -20C)

Control Panel

- Nema 12 575v
- Soft Start for 60 hp fan.
- Safety interlocks for high-speed abort gate and isolation damper.
- Isolated barrier relay for NRV dust build up sensor.
- Integration of pulse timer and Dwyer Photohelic gauge.
- Fused disconnect.
- OK to run remote equipment relay.
- Fire alarm shutdown input.
- E Stop button.
- CSA or equivalent certification.

Hansentek AN104 Single Zone Spark Detection System

- FM Approved.
- Designed to protect (1) 24” duct, DETECT AND SPRAY
- Designed to activate high-speed abort gate.
- 110v Nema 12 Control Panel—requires separate circuit.
- C/w (2) infrared detectors with sensitivity checking and (1) spray assy.
- Requires ‘clean’ 110v 15amp power circuit and 19USGPM @ 50psig water supply.

Conquest High Speed Abort Gate

- Model EM26
- 26" X 26" Flanges
- Weather cowl with screen.
- CSA or equivalent approved 110v NEMA 4 Control Box with indicator lights and electromagnetic mechanism.
- Manual Reset lever.

Part 3 Execution

3.1 Field Measurements

- .1 Verify that field measurements are as instructed by the manufacturer.

3.2 Installation

- .1 Install equipment to manufacturers written instructions.
- .2 Install to NFPA 91, SMACNA, Round Industrial Duct Construction Standard and Rectangular Industrial Duct Construction Standard and ACGIH Industrial Ventilation Manual except as indicated.
- .3 Do not operate fans for any purpose until ductwork is clean, filters are in place, bearings lubricated, and fan has been test run under observation.
- .4 Install fans with resilient mountings and flexible electrical leads. Refer to Section 23 05 48.
- .5 Install flexible connections at fan inlet and discharge. Ensure metal bands of connectors are parallel with minimum 25 mm (one inch) flex between ductwork and fan while running.
- .6 Provide pitot tube openings where required for testing of systems, complete with metal cap with spring device or screw to ensure against air leakage.
- .7 Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.

END OF SECTION

Part 1 General

1.1 Section Includes

- .1 Constant volume terminal units.
- .2 Variable volume terminal units.
- .3 Integral sound attenuator.
- .4 Integral heating coils.
- .5 Integral damper motor operators.
- .6 Integral controls.

1.2 Related Sections

- .1 Section 01 11 00 - Summary of Work: The City provided air terminal units (excess stock).
- .2 Section 23 05 13 - Motors.
- .3 Section 23 05 20 - Hydronic Specialties: Connections to heating coils.
- .4 Section 23 21 00 - Hydronic Piping: Connections to heating coils.
- .5 Section 23 31 00 - Duct Work.
- .6 Section 23 33 00 - Duct Work Accessories.
- .7 Section 23 37 00 - Air Outlets And Inlets.
- .8 Section 23 82 16 - Air Coils.
- .9 Section 25 50 02 - Digital Control Equipment: Thermostats and Actuators.
- .10 Section 26 05 80 - Equipment Wiring: Electrical characteristics and wiring connections.

1.3 References

- .1 ADC 1062 - Air Distribution and Control Device Test Code.
- .2 NFPA 90A - Installation of Air Conditioning and Ventilation Systems.
- .3 UL 181 - Factory-Made Air Ducts and Connectors.
- .4 UL 1995 / CSA 236 - Standard of Safety for Heating and Cooling Equipment
- .5 AHRI 880 – Performance Rating of Air Terminals
- .6 AHRI 885 - Procedure for Estimating Occupied Space Sound Levels in the Application of Air Terminals and Air Outlets
- .7 ASHRAE 130 - Methods of Testing Air Terminal Units
- .8 AHRI 410 Air Cooling and Heating Coils

1.4 Performance Tolerances

- .1 Base performance on tests conducted to ADC 1062.
- .2 AHRI 880 – Performance Rating of Air Terminals

-
- .3 AHRI 885 - Procedure for Estimating Occupied Space Sound Levels in the Application of Air Terminals and Air Outlets

1.5 Submittals

- .1 Section 21 05 00: Procedures for submittals.
- .2 Shop Drawings: Indicate configuration, general assembly, and materials used in fabrication, and electrical characteristics and connection requirements.
- .3 Product Data: Provide data indicating configuration, general assembly, and materials used in fabrication. Include catalogue performance ratings which indicate air flow, static pressure, and NC designation. Include electrical characteristics and connection requirements.
- .4 Include schedules listing discharge and radiated sound power level for each of second through seventh octave bands at inlet static pressures of 125 to 750 Pa (.05 to 3 inch wg).
- .5 Manufacturer's Installation Instructions: Indicate support and hanging details, and service clearances required.

1.6 Project Record Documents

- .1 Section 21 05 00: Submittals for project closeout.
- .2 Record actual locations of units.

1.7 Operation And Maintenance Data

- .1 Section 21 05 00: Submittals for project closeout.
- .2 Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, maintenance and repair data, and parts lists. Include directions for resetting constant volume regulators.

1.8 Qualifications

- .1 Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

1.9 Regulatory Requirements

- .1 Products Requiring Electrical Connection: Listed and classified by Underwriters' Laboratories Inc., or testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

1.10 Warranty

- .1 Section 21 05 00: Submittals for project closeout.
- .2 Provide one year warranty.
- .3 Warranty: Include coverage of system powered control systems, operating controls, and electric motors.

1.11 Extra Materials

- .1 Section 21 05 00: Submittals for project closeout.

Part 2 Products

2.1 MANUFACTURERS

- .1 Price Industries
- .2 Other acceptable manufacturers offering equivalent products.
 - .1 Nailor Industries
 - .2 Titus
- .3 Substitutions: Refer to Section 21 05 00.

2.2 MANUFACTURED UNITS

- .1 Ceiling mounted variable air volume supply air control terminals for connection to single duct, central air systems, with digital controls.
- .2 Identify each terminal unit with clearly marked identification label and air flow indicator. Include unit nominal air flow, maximum factory set airflow, minimum factory set air flow, and coil type.

2.3 Single Duct Variable Volume Units

- .1 Basic Assembly:
 - .1 Casings: Minimum 0.8 mm (22 gauge) galvanized steel.
 - .2 Lining: Minimum 13 mm thick neoprene or vinyl coated fibrous glass insulation, 24 g/L(1.5 lb/cu ft) density, meeting NFPA 90A requirements and UL 181 erosion requirements..
 - .3 Plenum Air Inlets: Round stub connections for duct attachment.
 - .4 Plenum Air Outlets: S slip and drive connections.
 - .5 Face liner: Refer to schedule
- .2 Basic Unit:
 - .1 Configuration: Air volume damper assembly inside unit casing. Locate control component inside protective metal shroud.
 - .2 Volume Damper: Construct of galvanized steel with peripheral gasket and self lubricating bearings; maximum damper leakage: 2 percent of design air flow at 0.75 kPa (3 inches) inlet static pressure.
 - .3 Mount damper operator to position damper normally open.
- .3 Attenuator Section: Line attenuator sections with matching air terminal liner. Refer to schedule for individual unit requirements.
- .4 Round Outlet: Discharge collar to match where scheduled.
- .5 Automatic Damper Operator:
 - .1 Electric Actuator: 24 volt with high limit

Part 3 Execution

3.1 Installation

- .1 Install to manufacturer's written instructions.

-
- .2 Provide a minimum of three duct diameters of straight inlet duct, the same size as the inlet, between the inlet and any transition, takeoff or fitting.
 - .3 Provide ceiling access doors or locate units above easily removable ceiling components.
 - .4 Support units individually from structure. Do not support from adjacent ductwork.
 - .5 Connect to ductwork to Section 23 31 00.
 - .6 Provide minimum of 1.5 m (5 ft) of lined ductwork, matching the air terminal liner, directly downstream of units.
 - .7 Install heating coils to Section 23 82 16.
 - .8 Verify that electric power is available and of the correct characteristics.

3.2 Adjusting

- .1 Adjust work to Section 21 05 00.
- .2 Reset volume with damper operator attached to assembly allowing flow range modulation from 100 percent of design flow to scheduled minimum flow. Set units with heating coils for minimum 40 percent full flow.

3.3 Schedules

- .1 Refer to the drawing for air terminal schedules.

END OF SECTION

Part 1

General

1.1 Section Includes

- .1 Diffusers.
- .2 Registers/grilles.
- .3 Louvers.
- .4 Louvered penthouses.
- .5 Roof hoods.
- .6 Goosenecks.

1.2 Related Sections

- .1 Section 09 90 00 - Painting: Painting of duct work visible behind outlets and inlets.
- .2 Section 08 71 00: Placement of door grilles.

1.3 References

- .1 ADC 1062 - Air Distribution and Control Device Test Code.
- .2 AMCA 500 - Method of Testing Louvers for Ratings.
- .3 AMCA 511 – Certified Ratings Program
- .4 AMCA 5000 - Method of Testing Dampers for Ratings.
- .5 ARI 650 - Air Outlets and Inlets.
- .6 ASHRAE 70 - Method of Testing for Rating the Performance of Outlets and Inlets.
- .7 SMACNA - HVAC Duct Construction Standard - Metal and Flexible.
- .8 NFPA 90A - Installation of Air Conditioning and Ventilating Systems.

1.4 Submittals

- .1 Section 21 05 00: Procedures for submittals.
- .2 Product Data: Provide data for equipment required for this project. Review outlets and inlets as to size, finish, and type of mounting prior to submission. Submit schedule of outlets and inlets showing type, size, location, application, and noise level.

1.5 Project Record Documents

- .1 Section 21 05 00: Submittals for project closeout.
- .2 Record actual locations of air outlets and inlets.

1.6 Quality Assurance

- .1 Test and rate air outlet and inlet performance to ADC Equipment Test Code 1062 and ASHRAE 70.
- .2 Test and rate louver performance to AMCA 500
- .3 Certified AMCA 511 – Certified Ratings Program

1.7 Qualifications

- .1 Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

Part 2 Products

2.1 MANUFACTURERS

- .1 Unless otherwise listed:
 - .1 Price Industries.
 - .2 Nailor Industries
 - .3 Titus
 - .4 Ventex.
- .2 Substitutions: Refer to Section 21 05 00.

2.2 SQUARE CEILING DIFFUSERS

- .1 Type: Square, stamped diffuser to discharge air in 360 degree pattern.
- .2 Refer to the schedule for frame, materials of fabrication, finishes, and accessories.

2.3 CEILING GRID CORE EXHAUST AND RETURN REGISTERS/GRILLES

- .1 Type: Fixed grilles of 13 x 13 x 13 mm (1/2 x 1/2 x 1/2 inch) louvers.
- .2 Refer to the schedule for frame, materials of fabrication, finishes, and accessories.

2.4 Ceiling Slot Diffusers

- .1 Type: Continuous slot, with adjustable vanes for left, right, or vertical discharge. Refer to schedule for slot width and number of slots.
- .2 Refer to the schedule for frame, materials of fabrication, finishes, and accessories.

2.5 Nozzle Diffuser

- .1 Construction:
 - .1 Diffusers shall be aluminum construction with a durable powder coat finish.
 - .2 The diffuser shall have a curved intake featuring superior aerodynamic and acoustical properties, and shall be housed in a hemispheric casing with opposite swivel bearings.
 - .3 The nozzle shall be manually adjustable from the diffuser face to produce a swivel range of +/- 35 degrees and rotatable 360 degrees.
- .2 Finish: Refer to schedule
 - .1 Mounting Frame:
 - .2 The diffuser shall be supplied with a frame suitable for installation shown on the schedule.
- .3 Damper: The diffuser shall be supplied with an aperture style volume flow damper. The damper shall be manually adjustable from the diffuser face.

2.6 Wall Supply Registers/grilles

- .1 Type: Streamlined and individually adjustable blades, 19 mm (3/4 inch) minimum depth, 19 mm (3/4 inch) maximum spacing with spring or other device to set blades.

- .2 Refer to the schedule for frame, materials of fabrication, finishes, and accessories.

2.7 Wall Exhaust And Return Registers/grilles

- .1 Type: Streamlined blades, 19 mm (3/4 inch) minimum depth, 19 mm (3/4 inch) maximum spacing, horizontal face.
- .2 Refer to the schedule for frame, materials of fabrication, finishes, and accessories.

2.8 Linear Wall Registers/grilles

- .1 Type: Narrow Spacing Streamlined blades with 3.2 x 19 mm (1/8 x 3/4 inch) on 6 mm (1/4 inch) centres. Refer to schedule for deflection angle.
- .2 Type: Wide Spacing Streamlined blades, 3.2 x 19 mm (1/8 x 3/4 inch) on 12 mm (1/2 inch) centres. Refer to schedule for deflection angle.
- .3 Refer to the schedule for frame, materials of fabrication, finishes, and accessories.

2.9 Linear Floor Supply Registers/grilles

- .1 Type: Narrow Spacing Streamlined blades, 3.2 x 19 mm (1/8 x 3/4 inch) on 6 mm (1/4 inch) centres. Refer to schedule for deflection angle.
- .2 Type: Wide Spacing Streamlined blades, 3.2 x 19 mm (1/8 x 3/4 inch) on 12 mm (1/2 inch) centres. Refer to schedule for deflection angle.
- .3 Type: Pencil-proof Spacing Streamlined blades, 3.2 x 19 mm (1/8 x 3/4 inch) on 11 mm (7/16 inch) centres. Refer to schedule for deflection angle.
- .4 Refer to the schedule for frame, materials of fabrication, finishes, and accessories.

2.10 Door Grilles

- .1 Type: V-shaped louvers of 0.90 mm (20 gauge) thick steel, 25 mm (one inch) deep on 13 mm (1/2 inch) centres.
- .2 Frame: 0.90 mm (20 gauge) steel with auxiliary frame to give finished appearance on both sides of door, with factory prime coat finish.
- .3 Refer to the schedule for frame, materials of fabrication, finishes, and accessories.

2.11 Louvers

- .1 100 mm (4 inch) Fixed Blade Louver:
.1 Type: 100 mm (4 inch) deep with blades on 39 degree slope with centre baffle and return bend, heavy channel frame, aluminum birdscreen with 13 mm (1/2 inch) square mesh for exhaust and 19 mm (3/4 inch) for intake.
.2 Fabrication: 2.1 mm (0.081 inch) extruded aluminum, welded assembly, with factory baked enamel finish - custom colour to be selected by the architect.
.3 Mounting: Refer to schedules for mounting options.
- .2 150 mm (6 inch) Fixed Blade Louver:
.1 Type: 150 mm (6 inch) deep with blades on 45 degree slope with centre baffle and return bend, heavy channel frame, aluminum birdscreen with 13 mm (1/2 inch) square mesh for exhaust and 19 mm (3/4 inch) for intake.

- .2 Fabrication: 2.1 mm (0.081 inch) extruded aluminum, welded assembly, with factory baked enamel finish - custom colour to be selected by the architect.
- .3 Mounting: Refer to schedules for mounting options.

2.12 Penthouse Louver

- .1 100 mm (4 inch) Fixed Blade Louver:
 - .1 Type: All welded assembly with 100 mm (4 inch) deep with blades on 39 degree slope, mitred or boxed corners, sheet aluminum roof, with factory baked enamel finish - custom colour to be selected by the architect.
 - .2 Birdscreen with 13 mm (1/2 inch) square mesh for exhaust and 19 mm (3/4 inch) for intake.
- .2 150 mm (6 inch) Fixed Blade Louver:
 - .1 Type: All welded assembly with 150 mm (6 inch) deep with blades on 45 degree slope, mitred corners, sheet aluminum roof, with factory baked enamel finish - custom colour to be selected by the architect.
 - .2 Birdscreen with 13 mm (1/2 inch) square mesh for exhaust and 19 mm (3/4 inch) for intake.

2.13 Roof Intake Or Relief Hoods

- .1 Manufacturers:
 - .1 Cook
 - .2 Greenheck
- .2 Substitutions: Refer to Section 21 05 00.
- .2 Manufactured air inlet or exhaust hoods to meet SMACNA HVAC Duct Construction Standards - Metal and Flexible.
- .3 Product Requirements:
 - .1 Bolted and welded construction utilizing corrosion resistant fasteners.
 - .2 Hood construction: minimum 18 gauge aluminum, bolted to a minimum 8 gauge aluminum support structure.
 - .3 A radius throat must be provided for optimum performance.
 - .4 Lifting lugs shall be provided to help prevent damage from improper lifting.
 - .5 A rain gutter shall be provided to prevent rain infiltration.
 - .6 The base shall have continuously welded curb cap corners for maximum leak protection. Birdscreen constructed of 1/2" galvanized mesh shall be mounted in the hood.
- .4 Curb:
 - .1 Factory-supplied or field-constructed roof curb to match.
 - .2 Minimum 18 gauge galvanized steel or 0.080 aluminum, c/w wood nailers, continuously welded corners, 75 mm (3 inch) cant, 38 mm (1-1/2 inches) thermal insulation.
- .5 Mount unit on minimum 300 mm (12 inch) high curb base with insulation between duct and curb. Curb height to ensure minimum 450 mm (18") clear from roof surface to intake. Refer to drawings for additional curb height requirements.

2.14 Goosenecks

- .1 Fabricate to SMACNA HVAC Duct Construction Standards - Metal and Flexible, of minimum 1.20 mm (18 gauge) galvanized steel.
- .2 Mount on minimum 300 mm (12 inch) high curb base.
- .3 Provide internally insulated liner except on kitchen and dryer exhausts.
- .4 Provide backdraft dampers on all exhausts where no motorized damper is indicated on drawing.

Part 3 Execution

3.1 Installation

- .1 Install to manufacturer's written instructions.
- .2 Check location of outlets and inlets and make necessary adjustments in position to conform with architectural features, symmetry, and lighting arrangement.
- .3 Install diffusers to duct work with air tight connection.
- .4 All diffusers, grilles and registers shall be free of fluttering, chattering and vibration. A felt or sponge rubber gasket shall be provided behind each outlet or inlet and adequate fastenings provided to prevent leakage between the outlet and duct, wall or ceiling.
- .5 In all cases where linear diffusers are required to run continuous from one wall to another or between bulkheads, beams or other fascia the schedule size of the diffuser shall be confirmed by site measurements prior to final assembly.
- .6 Floor grilles to be set flush with floor coverings except carpet. Frame to lap over carpet.
- .7 Provide balancing dampers on duct take-off to diffusers, and grilles and registers, despite whether dampers are specified as part of the diffuser, or grille and register assembly.
- .8 Paint ductwork visible behind air outlets and inlets matte black.
- .9 Care should be taken to install diffusers as per the reflected ceiling plans where available so that the diffusers will fit properly in the ceiling suspension system. The sheet metal subcontractor shall co-ordinate this work with the General Contractor, the suspended ceiling subtrade and electrical subtrade.
- .10 Should there be any conflict in the location of grilles, registers and diffusers with lights, etc. the matter shall be referred to the Contract Administrator for directive. If requested by the Contract Administrator, the subcontractor shall relocate grilles, diffusers and registers and ductwork attached, within two feet of locations as indicated on the drawings, without extra cost to The City.

END OF SECTION

Part 1 General

1.1 RELATED WORK SPECIFIED IN OTHER SECTIONS

- .1 Division 23 –HVAC.
- .2 Division 26 – Electrical.

1.2 RELATED WORK SPECIFIED IN FOOD SERVICE SECTIONS.

- .1 Section 23 38 – 13 – Fire Suppression

1.3 SHOP DRAWINGS AND PRODUCT DATA

- .1 Submit shop drawings and product data in accordance with and 11 40 00.

1.4 REFERENCE STANDARDS

- .1 All major equipment units shall comply with the Canadian Standards Association, Canadian Gas Association, Underwriters' Laboratories Inc. regulations and standards where applicable.

1.5 WARRANTY/GUARANTEE

- .1 Where the warranty/guarantee period which is furnished by the manufacturer is for a shorter period than one (1) year, then the cost for an extended warranty/guarantee shall be included in the pricing structure.
- .2 Where the warranty/guarantee cards are furnished with the units of major equipment, they shall be collected, information filled in, and mailed to the manufacturer as part of this section. A written report shall be furnished to the Contractor advising that this procedure has been followed.
- .3 Installation date, for the purpose of determining the warranty/guarantee period, shall be deemed to start from the date of the final acceptance of the total installation.
- .4 Warranty/guarantee cards, equipment brochures or installation manuals accompanying the major equipment units shall not be considered as part of or in lieu of the Operating and Maintenance Manuals called for under Section 11 40 00.

1.6 EXHAUST CANOPY

- .1 The canopy ventilator(s) shall bear the Intertek E.T.L. label, E.T.L. listed range hood without exhaust fire damper per standard 710 and be fabricated in compliance with NFPA–96–2001, and shall bear the National Sanitation Foundation seal of approval. The installation shall be in accordance with the manufacturer's recommendations and conform to NFPA–96 guidelines and all applicable local codes. The size shall be as indicated on drawings and/or equipment schedule.
- .2 The canopy inner liner shall be 18–gauge stainless steel where exposed, type 304 with #4 finish. The canopy shall have an integral exhaust duct collar. All seams of the inner liner shall have grease tight joints. Each canopy shall have a filter housing of the same material

as the canopy inner liner. The filter housing shall be equipped with a concealed drip tray the full length of the backshelf and with a grease cup for easy removal and daily cleaning.

- .3 The outer shell shall be 18-gauge stainless steel, where exposed, type 304 with #4 finish. Canopy ends shall be double sidewall construction (no single wall hoods permitted). All exterior joints shall be continuously welded liquid tight, ground smooth, and polished to a #4 finish, or tack welded and cap seamed jointed. Where exhaust canopies have exposed backs, finish w/ SS.
- .4 The exhaust airflow will be based on the convective heat generated by the appliances underneath each canopy. Submittal shall include convective heat calculations based on the input power of the appliance served. Exhaust air volumes cannot exceed the specified values. Exhaust plenums must be oriented to the rear of the hood except in the case of single island cooking lines where a center plenum is appropriate. The airflows through the extractors are to be determined through the integral T.A.B. (Testing and Balancing) ports mounted in the hood. The airflows are to be determined by the pressure vs. Airflow curves supplied by the manufacturer.

1.7 INSTALLATION

- .1 All exhaust canopies and control panels are to be installed level and plumb; exhaust canopies supported from building components above, either in whole or in part, are to have weights verified by Construction Manager and are to be installed in accordance with manufacturer's printed instructions.
 - .1 Canopies may need to be further supported to the building floor if any work above by any trades is being done; coordinate with KEC and Construction Manager.
- .2 Refer to Foodservice Equipment Mechanical drawings and details for all duct take-off and/or connection locations – it is the sub-trades responsibility to coordinate and verify locations notifying the Contract Administrator of any changes to the tender documents.
- .3 All electrical services / conduit to be concealed or enclosed in a SS Chase.

1.8 START-UP AND COMMISSIONING

- .1 Upon completion of the "system installation", provide air balance report; air balancer and exhaust canopy manufacturer to work together in providing a properly operating ventilation system, per design intent.
- .2 Field start-up to be performed by Authorized Service Agency.
- .3 Refer to 1.7 Demand Control System (above), Foodservice Equipment Electrical drawings and details for all field wiring requirements at the exhaust canopies, between canopies and their components as well control wiring between panels and various canopy and mechanical equipment, including exhaust fan and make-up air units.

1.9 ITEMIZED EQUIPMENT

<u>ITEM #44</u>	<u>EXHAUST CANOPY</u>
QUANTITY	- One (1) each required.

MANUFACTURER	-	Halton
MODEL	-	KVE (CaptureJet)
SIZE	-	Approx.3965 mm x 1830mm x 610mm high
SPECIFICATIONS	-	Five (5) LED lamps c/w bulbs.
	-	1.6mm upper enclosures from top of canopy to finished room ceilings; refer to drawing detail

ITEM #98

QUANTITY
MANUFACTURER
MODEL
SIZE
SPECIFICATIONS

EXHAUST CANOPY

- Two (2) each required.
- Halton
- KVE (CaptureJet Island)
- Approx.1370mm x 1220mm x 610mm high
- Two (2) each LED lamps c/w bulbs.
- Finished SS back
- 1.6mm upper enclosures from top of canopy to finished room ceilings; full perimeter; refer to drawing detail

ITEM #108

QUANTITY
MANUFACTURER
MODEL
SIZE
SPECIFICATIONS

EXHAUST CANOPY

- Four (4) each required.
- Halton
- KVW (CaptureJet Island)
- Approx.1370mm x 2590mm x 610mm high
- Six (6) each LED lamps c/w bulbs.
- 1.6mm upper enclosures from top of canopy to finished room ceilings; full perimeter; refer to drawing detail

ITEM #113

QUANTITY
MANUFACTURER
MODEL
SIZE
SPECIFICATIONS

EXHAUST CANOPY

- One (1) each required.
- Halton
- KVE (CaptureJet)
- Approx. 2750mm x 1830mm x 610mm high
- Three (3) LED lamps c/w bulbs.
- Continuous right end
- 1.6mm upper enclosures from top of canopy to finished room ceilings; refer to drawing detail

ITEM #121

QUANTITY
MANUFACTURER
MODEL
SIZE
SPECIFICATIONS

EXHAUST CANOPY

- One (1) each required.
- Halton
- KVE (CaptureJet)
- Approx. 2750mm x 1830mm x 610mm high
- Three (3) LED lamps c/w bulbs.
- Continuous right and left ends
- 1.6mm upper enclosures from top of canopy to finished room ceilings; refer to drawing detail

ITEM #127

QUANTITY
MANUFACTURER
MODEL
SIZE
SPECIFICATIONS

EXHAUST CANOPY

- One (1) each required.
- Halton
- KVE (CaptureJet)
- Approx. 3185mm x 1830mm x 610mm high
- Three (3) LED lamps c/w bulbs.
- Continuous left end
- 1.6mm upper enclosures from top of canopy to finished room ceilings; refer to drawing detail

END OF SECTION

Part 1 General

1.1 RELATED WORK SPECIFIED IN OTHER SECTIONS.

- .1 Division 23 – HVAC.
- .2 Division 26 – Electrical.

1.2 RELATED WORK SPECIFIED IN FOOD SERVICE SECTIONS.

- .1 Section 23 38 00 – Exhaust Hoods.

1.3 DRAWINGS AND PRODUCT DATA

- .1 Submit shop drawings and product data in accordance with Sections 01 33 00 and 11 40 00.

1.4 REFERENCE STANDARDS

- .1 All major equipment units shall comply with the Canadian Standards Association, Canadian Gas Association, Underwriters' Laboratories Inc. regulations and standards where applicable.

1.5 WARRANTY/GUARANTEE

- .1 Where the warranty/guarantee period which is furnished by the manufacturer is for a shorter period than one (1) year, then the cost for an extended warranty/guarantee shall be included in the pricing structure.
- .2 Where the warranty/guarantee cards are furnished with the units of major equipment, they shall be collected, information filled in, and mailed to the manufacturer as part of this section. A written report shall be furnished to the Contractor advising that this procedure has been followed.
- .3 Installation date, for the purpose of determining the warranty/guarantee period, shall be deemed to start from the date of the final acceptance of the total installation.
- .4 Warranty/guarantee cards, equipment brochures or installation manuals accompanying the major equipment units shall not be considered as part of or in lieu of the Operating and Maintenance Manuals called for under Section 114000

1.6 MATERIALS/PARTS SUPPLIED BUT NOT INSTALLED

- .1 Mechanically operated gas shut-off valve for installation on main gas line to the cooking equipment – to be installed in gas feed lines by Mechanical Subcontractor.

1.7 FIRE SUPPRESSION SYSTEMS

- .1 To be supplied and installed in accordance with NFPA 96, NFPA 17A and to meet the standards set by UL300.
- .2 The system shall be a pre-engineered, fixed pipe, automatic wet agent fire suppression system covering the canopy, plenum, ductwork and cooking appliances that require protection.

- .3 The system control equipment shall be capable of all functions associated with automatically and manually discharging the wet agent from all cylinder and valve assemblies, including automatically shutting off the fuel to all protected cooking appliances upon system discharge.
 - .1 Fuel to include both gas (natural or propane) as well as electrically operated equipment.
 - .2 Electrical equipment must be shut down by means of either contactors, or shunt breaker.
 - .1 If an annunciation panel is within the premises, a double switch is required.
 - .3 Division 11 to confirm with local authorities whether all electrical equipment is to be shut down within the kitchen or only equipment covered by the fire suppression system.
- .4 System detection shall be fusible link.
- .5 Provide manual remote actuator in path of exit (refer to tender drawings for location placement). Contact authorities via fax should any changes be required.
- .6 All wiring and services to be concealed.
- .7 Cylinder shall be located in the control cabinet or its own SS enclosure (refer to tender drawings for location placement). Contact Contract Administrator should any changes be required.
- .8 Provide energy shut-off(s) (electrical and gas) as per NFPA 96 Code.
- .9 Combination of extinguished system and canopy shall be approved by ULC.
- .10 Piping to be concealed above exhaust canopies with only drops and nozzles exposed. All exposed piping to be chrome or stainless steel finish.
- .11 Micro switch at control head for tie-in, by Division 26, to building fire alarm system.

1.8 INSTALLATION

- .1 Install equipment in accordance with manufacturer's printed instructions and 1.7.
- .2 Coordinate connection of mechanical and electrical services.
- .3 Adjust equipment for smooth and proper operation.

1.1 ITEMIZED EQUIPMENT

ITEM #46

QUANTITY

FIRE SUPPRESSION SYSTEM

- One (1) lot required.

MANUFACTURER

- Ansul

MODEL

- Wet Agent

ACCESSORIES

- As per 1.5.

- Mechanical and electrical emergency fuel shutdown devices as required.

- Provide electrical contactors at system control heads (for tie in to building fire alarm system by Electrical Division).

- NOTE
- One remote pull station. Refer to drawing location
 - One (1) each “K-Guard” fire extinguisher; refer to drawing location
 - 1.6mm SS enclosure, from top of Fire Suppression box to ceiling, to fully enclose all services and conduit.
 - System to be ULC approved and designed to cover all cooking appliances covered under cooking exhaust canopy #44.
 - Refer to 1.6.1 for installation.
 - All fire suppression systems to be fully interconnected as required to allow all gas / electrical services to be shut down in the event of a fire covered under a separate fire suppression system without the unaffected systems discharging.

ITEM #101

QUANTITY
MANUFACTURER
MODEL
ACCESSORIES

FIRE SUPPRESSION SYSTEM

- One (1) lot required.
- Ansul
- Wet Agent
- As per 1.5.
- Mechanical and electrical emergency fuel shutdown devices as required.
- Provide electrical contactors at system control heads (for tie in to building fire alarm system by Electrical Division).
- One remote pull station. Refer to drawing location
- One (1) each “K-Guard” fire extinguisher; refer to drawing location
- 1.6mm SS enclosure, from top of Fire Suppression box to ceiling, to fully enclose all services and conduit.
- System to be ULC approved and designed to cover all cooking appliances covered under cooking exhaust canopies #98.
- Refer to 1.6.1 for installation.
- All fire suppression systems to be fully interconnected as required to allow all gas / electrical services to be shut down in the event of a fire covered under a separate fire suppression system without the unaffected systems discharging.

NOTE

ITEM #109

QUANTITY
MANUFACTURER
MODEL
ACCESSORIES

FIRE SUPPRESSION SYSTEM

- One (1) lot required.
- Ansul
- Wet Agent
- As per 1.5.
- Mechanical and electrical emergency fuel shutdown devices as required.

- NOTE
- Provide electrical contactors at system control heads (for tie in to building fire alarm system by Electrical Division).
 - One remote pull station. Refer to drawing location
 - One (1) each “K-Guard” fire extinguisher; refer to drawing location
 - 1.6mm SS enclosure, from top of Fire Suppression box to ceiling, to fully enclose all services and conduit.
 - System to be ULC approved and designed to cover all cooking appliances covered under cooking exhaust canopies #108.
 - Refer to 1.6.1 for installation.
 - All fire suppression systems to be fully interconnected as required to allow all gas / electrical services to be shut down in the event of a fire covered under a separate fire suppression system without the unaffected systems discharging.

ITEM #110

QUANTITY
MANUFACTURER
MODEL
ACCESSORIES

FIRE SUPPRESSION SYSTEM

- One (1) lot required.
- Ansul
- Wet Agent
- As per 1.5.
- Mechanical and electrical emergency fuel shutdown devices as required.
- Provide electrical contactors at system control heads (for tie in to building fire alarm system by Electrical Division).
- One remote pull station. Refer to drawing location
- One (1) each “K-Guard” fire extinguisher; refer to drawing location
- 1.6mm SS enclosure, from top of Fire Suppression box to ceiling, to fully enclose all services and conduit.
- System to be ULC approved and designed to cover all cooking appliances covered under cooking exhaust canopies #108.
- Refer to 1.6.1 for installation.
- All fire suppression systems to be fully interconnected as required to allow all gas / electrical services to be shut down in the event of a fire covered under a separate fire suppression system without the unaffected systems discharging.

NOTE

ITEM #115

QUANTITY
MANUFACTURER
MODEL
ACCESSORIES

FIRE SUPPRESSION SYSTEM

- One (1) lot required.
- Ansul
- Wet Agent
- As per 1.5.

NOTE

- Mechanical and electrical emergency fuel shutdown devices as required.
- Provide electrical contactors at system control heads (for tie in to building fire alarm system by Electrical Division).
- One remote pull station. Refer to drawing location
- One (1) each “K-Guard” fire extinguisher; refer to drawing location
- 1.6mm SS enclosure, from top of Fire Suppression box to ceiling, to fully enclose all services and conduit.
- System to be ULC approved and designed to cover all cooking appliances covered under cooking exhaust canopies #113, 121 & 127.
- Refer to 1.6.1 for installation.
- All fire suppression systems to be fully interconnected as required to allow all gas / electrical services to be shut down in the event of a fire covered under a separate fire suppression system without the unaffected systems discharging

END OF SECTION

Part 1 General

1.1 Section Includes

- .1 Indirect fired make-up air heater.
- .2 Cooling coil section and compressor-condenser unit.
- .3 Service platform.
- .4 Controls.

1.2 Related Sections

- .1 Section 22 10 00 - Plumbing Piping: Natural gas connections.
- .2 Section 23 33 00 - Duct Work Accessories.
- .3 Section 23 34 16 - Centrifugal Fans: Supply Fans.
- .4 Section 25 50 02 - Digital Control Equipment: Control components, time clocks.
- .5 Section 26 05 80 - Equipment Wiring: Electrical characteristics and wiring connections.

1.3 References

- .1 ARI 210/240 - Unitary Air-Conditioning and Air-Source Heat Pump Equipment.
- .2 ARI 270 - Sound Rating of Outdoor Unitary Equipment.
- .3 ARI 520 - Positive Displacement Condensing Units.
- .4 ASHRAE 14 - Methods of Testing for Rating Positive Displacement Condensing Units.
- .5 ASHRAE - 90A - Energy Conservation in New Building Design.
- .6 CSA B149.1 – Natural Gas and Propane Code
- .7 NFPA 90A - Installation of Air Conditioning and Ventilating Systems.
- .8 UL 207 - Refrigerant - Containing Components and Accessories, Non-electrical.
- .9 UL 303 - Refrigeration and Air-Conditioning Condensing, and Air-Source Heat Pump Equipment.

1.4 Submittals For Review

- .1 Section 21 05 00: Procedures for submittals.
- .2 Product Data: Provide data with dimensions, duct and service connections, accessories, controls, electrical nameplate data, and wiring diagrams.
- .3 Shop Drawings: Indicate dimensions, duct and service connections, accessories, controls, electrical nameplate data, and wiring diagrams.

1.5 Submittals For Information

- .1 Section 21 05 00: Procedures for submittals.
- .2 Manufacturer's Instructions: Indicate rigging, assembly, and installation instructions.

1.6 Submittals At Project Closeout

- .1 Section 21 05 00: Submittals for project closeout.
- .2 Project Record Documents: Record actual locations of components.
- .3 Operation And Maintenance Data: Include manufacturer's descriptive literature, operating instructions, installation instructions, maintenance and repair data, and parts listing.
- .4 Warranty: Submit manufacturers warranty and ensure forms have been filled out in The City's name and registered with manufacturer.

1.7 Quality Assurance

- .1 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

1.8 Regulatory Requirements

- .1 Conform to CSA B149.1
- .2 Entire unit shall be ETL Certified per ANSI Z83.4 or ANSI Z83.18 and bear an ETL mark. Alternate certifiers recognized by the AHJ are acceptable.
- .3 Coils shall be Recognized Components for ANSI/UL 1995, CAN / CSA C22.2 No 236.05. DX and water coils shall be AHRI Certified per standard 410-2001.
- .4 Indirect gas-fired heaters shall be ETL Certified as a component of the unit.

1.9 Warranty

- .1 Section 21 05 00: Submittals for project closeout.

1.10 Maintenance Service

- .1 Section 21 05 00: Submittals for project closeout.
- .2 Provide service and maintenance of units for one year from Date of Substantial Completion.

1.11 Extra Materials

- .1 Section 21 05 00: Submittals for project closeout.
- .2 Provide two sets of filters.

Part 2 Products

2.1 MANUFACTURERS

- .1 Greenheck
- .2 Engineered Air
- .3 Bousquet
- .4 Substitutions: Refer to Section 21 05 00.

2.2 MANUFACTURED UNITS

- .1 Unit: Outdoor unit with refrigeration package.
- .2 Construction and Ratings: To ARI 210/240 , and UL 207 and UL 303. Testing: ASHRAE 14.

2.3 Fabrication

- .1 Casing and Components:
 - .1 Materials: Formed, double wall insulated metal cabinet, fabricated to permit access to internal components for maintenance. Underside of unit shall have formed metal panels covering base panel insulation.
 - .2 Outside casing: 1.27 mm (18 ga.), galvanized (G90) steel meeting ASTM A653 for components that do not receive a painted finish. Pre-painted components as supplied by the factory shall have polyester urethane paint on 18 gauge G60 galvaneal steel. Base rail is 2.75 mm (12 ga.), galvanized (G90) steel. Components that receive a painted finish per A/E specification shall be painted with a polyester urethane powder coat.
 - .3 Internal assemblies: 0.70 mm (24 ga.), galvanized (G90) steel except for motor supports which shall be minimum 2.0mm (14 ga.) galvanized (G90) steel.
- .2 Observation Port: On burner section for observing main and pilot flames.
- .3 Insulation:
 - .1 Fiberglass insulation. If insulation other than fiberglass is used, it must also meet the Fire Hazard Classification shown below.
 - .2 Thickness: 25 mm (1 inches).
 - .3 Fire Hazard Classification: Maximum flame spread of 25 and smoke developed of 50, when tested in accordance with ASTM C 411.
 - .4 Location and application: Floor of each unit shall be insulated with 1 inch thick rigid fiberglass insulation, covered on one surface with integral aluminum foil. Full interior coverage of entire cabinet to include walls and roof of unit shall be semi-rigid type and installed between inner and outer shells of all cabinet exterior components when double walls are specified
- .4 Suspended Installations: Service platforms complete with handrails and access ladder.
- .5 Outdoor Installation: Weatherproofed casing, with intake louvre or hood.
- .6 Access panels:
 - .1 Unit shall be equipped with insulated removable and hinged access panels to provide easy access to all major components.
 - .2 Access panels shall be fabricated of 1.27 mm (18 ga.) galvanized G90 steel.
 - .3 Removable access panels shall incorporate a formed drip edge.

2.4 Filters

- .1 Filter: Removable 50 mm(2 inches) thick high velocity glass fibre disposable filters in metal frames.

2.5 Indirect Gas-fired Furnace:

- .1 Shall be ETL Certified or other certifier as recognized by the AHJ as a component of the unit.

- .2 Shall have an integral combustion gas blower.
- .3 Shall be ETL Certified for installation downstream of a cooling coil.
- .4 Shall be designed for natural gas
- .5 Shall have fault sensors to provide fault conditions to optional digital controller or building controls.
- .6 Shall have 4-pass tubular heat exchangers, constructed of type 409 stainless steel. Heat exchanger tubes shall be installed on the vest plate by means of swaged assembly, welded connections are not acceptable. Heat exchanger tubes shall be supported by a minimum of two fabricated assemblies that support the tubes and also permit expansion and contraction of the tubes.
- .7 Heat exchanger shall have a 5 year extended warranty.
- .8 Furnace control shall be single furnace 4:1 electronic modulating.
- .9 Shall be encased in a weather-tight metal housing with intake air vents. Large, metal lift-off or hinged door shall provide easy access to the enclosed vest plate, control circuitry, gas train, burner assembly and exhaust blower.
- .10 Shall have solid state controls permitting stand-alone operation or control by building controllers.

2.6 Fan

- .1 General:
 - .1 Fans selected shall be capable of accommodating static pressure and flow variations of +/-15% of scheduled values.
 - .2 Each fan shall be belt drive in AMCA arrangement 3 only according to drawings.
 - .3 Fans are to be equipped with lifting lugs.
 - .4 After fabrication all carbon steel components shall be cleaned and chemically treated by a phosphatizing process to insure proper removal of grease, oil, scale, etc.
 - .5 Unit shall bear an engraved aluminum nameplate. Nameplate shall indicate design CFM, static pressure, and maximum fan RPM.
- .2 Wheel and inlet:
 - .1 The fan wheel shall be of the non-overloading double or single width centrifugal type. Wheels shall be statically and dynamically balanced to balance grade G6.3 per ANSI S2.19.
 - .2 The wheel and fan inlet shall be carefully matched and shall have precise running tolerances for maximum performance and operating efficiency
 - .3 Refer to schedule for wheel blade style:
 - .1 Backward Inclined: Steel [or aluminum] construction with smooth curved inlet flange, heavy back plate, backwardly curved blades welded to flange and back plate; cast iron [or cast steel] hub riveted to back plate and keyed to shaft with set screws.
 - .2 Forward Curved: Galvanized [enameled] steel construction with inlet flange, back plate, shallow blades with inlet and tip curved forward in direction of airflow, welded to flange and back plate; steel hub swaged to back plate and keyed to shaft with set screw.

- .3 Airfoil Wheel: Steel construction with smooth curved inlet flange, heavy back plate die formed hollow airfoil shaped blades continuously welded at tip flange, and back plate; cast iron [or cast steel] hub riveted to back plate and keyed to shaft with set screws.
- .3 Housing
 - .1 Fan housing shall be designed to accommodate the width wheel.
 - .2 Fan housing is to be aerodynamically designed with high-efficiency inlet, engineered to reduce incoming air turbulence.
 - .3 Housing and bearing support shall be constructed of welded structural steel members to prevent vibration and rigidly support the shaft and bearings.
 - .4 An OSHA compliant belt guard shall be included to completely cover the motor pulley and belt(s).
 - .5 Heavy gauge steel, spot welded [for AMCA 99 Class I and II fans, and continuously welded for Class III], adequately braced, designed to minimize turbulence with spun inlet bell and shaped cut-off.
- .4 Bearings and Drives:
 - .1 Bearings: AFBMA 9, [L-10 life at 50,000 hours] [L-50 life at 100,000 hours] heavy duty pillow block type, self-aligning, grease-lubricated ball bearings, or AFBMA 11 [L-10 life at 120,000 hours] [L-50 life at 400,000 hours] pillow block type, self-aligning, grease-lubricated roller bearings.
 - .2 Shafts: Hot rolled steel, ground and polished, with key- way, protectively coated with lubricating oil, and shaft guard and sized so the first critical speed is at least 25% over the maximum operating speed for each pressure class.
 - .3 Bearings shall be fixed to the fan shaft using concentric mounting locking collars, which reduce vibration, increase service life, and improve serviceability. Bearings that use set screws shall not be allowed.
 - .4 Drive belts and sheaves shall be sized for 150% of the fan operating brake horsepower, and shall be readily and easily accessible for service, if required.
 - .5 V-Belt Drive: Cast iron or steel sheaves, dynamically balanced, keyed. Variable and adjustable pitch sheaves for motors 11.2 kW(15 hp) and under, selected so required rpm is obtained with sheaves set at mid-position. Fixed sheave for 15 kW(20 hp) and over, matched belts, and drive rated as recommended by manufacturer or minimum 1.5 times nameplate rating of the motor.
 - .6 Belt Guard: Fabricate to SMACNA Standard; of 2.8 mm(12 gauge) thick, 20 mm(3/4 inch) diamond mesh wire screen welded to steel angle frame or equivalent, prime coated. Secure to fan or fan supports without short circuiting vibration isolation, with provision for adjustment of belt tension, lubrication, and use of tachometer with guard in place.
 - .7 Bearings shall have Zerk fittings to allow for lubrication.
- .5 Electrical Characteristics:
 - .1 Refer to schedule.
 - .2 Refer to Section 26 05 80.
- .6 Motor: Refer to Section 23 05 13.

2.7 Controls

- .1 Controls: Pre-wire unit for connection of power supply. Field wiring from unit to remote control panel makes unit operative. Control integration to be provided for BMS system operation including but not limited to enable/disable, temperature reset, heat/cool changeover, fan enable/disable. Refer to DIV 25 control sequences.
- .2 Remote Control Panel: On-off -auto switch, indicating lights for supply fan, exhaust fan, pilot operation, burner operation, clogged filter indication and lockout indication.
- .3 Interlocks: Unit to start when exhaust fan is running. Burner to operate when flow switch located in exhaust duct proves flow.
- .4 Fan Discharge Thermostat: Controls modulating gas valve to maintain supply air temperature. Thermostat by DIV 25, manufacturer to provide output in coordination with DIV 25 requirements. Timer: Operates fan system off or at low volume at night. Safety Controls: Sense correct air flow before energizing pilot and sense pilot ignition before activating main gas valve.
- .5 Manual Reset Low and High Limit Controls: Maintain supply air temperature between set points and shut fan down if temperatures are exceeded.
- .6 Sensors to be provided with the unit
 - .1 Room / Space Temperature Sensors
 - .2 Heating Inlet Air Sensor
 - .3 Cooling Inlet Air Sensor
 - .4 Dirty Filter Sensor
 - .5 Fire Stat Type III
 - .6 Freeze Stat
 - .7 120V/24V Smoke Detector

2.8 Condensate Drainage

- .1 Condensate drain pan: Drain Pan shall be an integral part of the unit whenever a cooling option is included. Pan shall be formed of welded austenitic stainless steel sheet material and provided with a welded stainless steel drain connection at the front for connection to a P trap. Drain pan shall be sloped in two directions to provide positive draining and drain connector shall be sealed at penetration through cabinet wall.
- .2 P trap: If the unit is equipped with a condensate drain pan, contractor shall provide, or fabricate, and install an appropriate P trap, in accordance with all local and area codes and Best Practices. Route to nearest to discharge onto roof.

2.9 Cooling Coil

- .1 Direct Expansion Cooling Coil (DX Coil):
 - .1 Coil shall be AHRI Certified and shall be (silver) soldered or brazed into the compressed refrigerant system.
 - .2 Coil shall be constructed of copper tubing, permanently bonded to aluminum fins and enclosed in a galvanized steel frame.
 - .3 If two The City-supplied compressors are used as components of the MAU, then the DX coil shall be of "interlaced" configuration, permitting independent operation of either compressor without conflict with the other compressor.

- .4 DX coil shall be optimized for refrigerant type: R-410A.
- .5 Suction line(s) are to be stubbed through the side of the MAU.
- .6 Liquid Line(s) are to be capped and readily accessible behind an access panel.
- .7 Provide Thermal Expansion Valve.

2.10 Refrigeration Package

- .1 Packaged DX: Unit shall be equipped with a Packaged DX system to include compressor(s), evaporator and condenser coil(s), condenser fans and all appurtenant controls as specified elsewhere in this section. The Packaged DX system is to be an integral module, incorporated into the unit. Stand-alone Packaged DX systems that are connected to the unit or systems that require hardware or equipment that is not integral to the unit are not acceptable.

2.11 Factory Provided Curb Assembly

- .1 Engineered curb assembly in lieu of an The City-supplied rail system shall be provided by the factory for assembly and installation as part of this division.
- .2 Constructed of 14 gauge galvanized steel, complete with insulation of 50 mm (2 inches).
- .3 The curb assembly shall provide perimeter support of the entire unit and shall have duct adapter(s) for supply air and return air.
- .4 Curb assembly shall enclose the underside of the unit and shall be sized to fit into a recess in the bottom of the unit.
- .5 Contractor shall be responsible for coordinating with roofing contractor to ensure curb unit is properly flashed to provide protection against weather/moisture penetration
- .6 Contractor shall provide and install appropriate insulation for the curb assembly.

2.12 Dampers

- .1 Motorized dampers / Intake Air: Motorized damper of insulated low leakage type shall be factory installed.

2.13 PERFORMANCE

- .1 Performance Ratings: Energy Efficiency Rating (EER) not less than requirements of Canadian National Energy Code for Buildings.
- .2 Heating and Cooling Capacity:
 - .1 Refer to schedule

Part 3 Execution

3.1 Installation

- .1 Install to manufacturer's written instructions.
- .2 Install to NFPA 90A.
- .3 Install to CSA B149.1 Natural Gas Code. Provide connection to fuel gas system; refer to Section 22 10 00.
- .4 Provide flexible duct connections on inlet and outlet from unit; refer to Section 23 33 00.

END OF SECTION

Part 1

General

1.1

Section Includes

- .1 Plate type heat exchangers.
- .2 Accessories and trim.

1.2

Related Sections

- .1 Section 23 05 20 - Hydronic Specialties.
- .2 Section 23 21 00 - Hydronic Piping.
- .3 Section 25 50 02 - Digital Control Equipment
- .4 Section 26 05 80 - Equipment Wiring: Electrical characteristics and wiring connections.

1.3

References

- .1 ASME SEC 8 - Boilers and Pressure Vessels Code.

1.4

Submittals For Review

- .1 Section 21 05 00: Submittal procedures.
- .2 Product Data: Provide data with dimensions, locations, and size of tappings and performance data.
- .3 Shop Drawings: Indicate dimensions, locations, and size of tappings and performance data.

1.5

Submittals For Information

- .1 Section 21 05 00: Submittals for information.
- .2 Design Data: Indicate in sufficient detail to verify that heat exchangers meet or exceed specified requirements.
- .3 Test Reports: Indicate tube bundle pressure tests.
- .4 Certificates: Certify that Products meet or exceed specified requirements.
- .5 Manufacturer's Instructions: Indicate installation and support requirements.

1.6

Submittals At Project Closeout

- .1 Section 21 05 00: Submittals for project closeout.
- .2 Operation and Maintenance Data: Include start up and shut down instructions, assembly drawings, and spare parts lists.
- .3 Warranty: Submit manufacturer warranty and ensure forms have been completed in The City's name and registered with manufacturer.

1.7

Regulatory Requirements

- .1 Conform to ASME Boilers and Pressure Vessels Code, SEC 8 for manufacture of tubular heat exchangers and heat exchanger shells and plate and frame type heat exchangers.

1.8 Delivery, Storage, And Handling

- .1 Section 21 05 00: Transport, handle, store, and protect products.
- .2 Protect internals from entry of foreign material by temporary caps on flanged openings.

1.9 Warranty

- .1 Section 21 05 00: Submittals for project closeout.
- .2 Provide five year manufacturer warranty on all heat exchangers.

1.10 Extra Materials

- .1 Section 21 05 00: Submittals for project closeout.
- .2 Provide two sets of replacement gaskets.
- .3 Provide one set of wrenches for disassembly of plate type heat exchangers.

Part 2 Products

2.1 PLATE AND FRAME TYPE HEAT EXCHANGER

- .1 Manufacturer:
 - .1 Bell & Gossett
 - .2 Armstrong
 - .3 Taco
- .2 Other acceptable manufacturers offering equivalent products.
 - .1 Substitutions: Refer to Section 21 05 00.
- .3 Frames: Carbon steel with baked epoxy enamel paint, zinc plated carbon steel side bolts and aluminum shroud/splash guard.
- .4 Plates: Stainless steel Type 304 stainless steel, plate thickness 0.4 mm.
- .5 Gaskets: Nitrile rubber. Ethylene propylene diene monomer (EPDM).
- .6 Nozzles: 860 kPa (125 psi) rated lined flange type.
- .7 Fouling Factor: 1.39×10^{-3} hr,ft²,°F/Btu
- .8 Unless otherwise noted connections shall be flanged type.
- .9 Performance:
 - .1 Refer to schedule on drawings.

Part 3 Execution

3.1 Installation

- .1 Install to manufacturers written instructions.
- .2 Install to permit removal of tube bundle or plates with minimum disturbance to installed equipment and piping.
- .3 Support heat exchangers on welded steel pipe and angle floor stand on concrete housekeeping pad.
- .4 Pipe relief valves as noted in 23 05 20..
- .5 Pipe drain valves to nearest floor drain, not applicable to glycol fluids.

3.2 Water To Water Heat Exchanger Trim

- .1 Water Inlets and Outlets: Thermometer wells, pressure gauge tappings.
- .2 Heated Water Outlet: Thermometer well for temperature regulator sensor, ASME rated pressure and temperature relief valve, valved drain; refer to Section 23 05 20.

END OF SECTION

Part 1 General

1.1 Section Includes

- .1 Reversing core energy recovery ventilators

1.2 Related Work

- .1 Section 23 05 13 - Motors.
- .2 Section 23 05 29 – Supports and Anchors.
- .3 Section 23 05 48 - Vibration Isolation.
- .4 Section 23 05 53 – Mechanical Identification.
- .5 Section 23 05 93 – Testing, Adjusting, And Balancing.
- .6 Section 23 07 13 - Duct Insulation.
- .7 Section 23 31 00 - Duct Work.
- .8 Section 23 33 00 - Duct Work Accessories.
- .9 Section 23 34 16 – Centrifugal Fans.
- .10 Section 23 73 23 - Air Handling Units.
- .11 Section 26 05 80 - Equipment Wiring: Electrical characteristics and wiring connections.

1.3 References

- .1 AFBMA 9 - Load Ratings and Fatigue Life for Ball Bearings.
- .2 AFBMA 11 - Load Ratings and Fatigue Life for Roller Bearings.
- .3 AHRI 260 - Sound Rating of Ducted Air Moving and Conditioning Equipment
- .4 AHRI 1060 - Performance rating of Air-to-Air Heat Exchangers for Energy Recovery Equipment.
- .5 AMCA 99 - Standards Handbook.
- .6 AMCA 210 - Laboratory Methods of Testing Fans for Aerodynamic Performance Rating.
- .7 AMCA 300 - Reverberant Room Method for Sound Testing of Fans.
- .8 AMCA 301 - Method of Calculating Fan Sound Ratings from Laboratory Test Data.
- .9 CAN/CSA C439 - Standard laboratory methods of test for rating the performance of heat/energy-recovery ventilators
- .10 SMACNA - HVAC Duct Construction Standards - Metal and Flexible.
- .11 UL 723 – Test for Burning Characteristics of Building Materials (ASTM E84/NFPA 255)

1.4 Submittals

- .1 Section 21 05 00: Common Work for Mechanical.

- .2 Shop Drawings: Indicate assembly of heat recovery units and accessories including fan curves with specified operating point clearly plotted, sound power levels for both fan inlet and outlet at rated capacity, and electrical characteristics and connection requirements.
- .3 Manufacturer's Installation Instructions.

1.5 Operation And Maintenance Data

- .1 Section 21 05 00: Common Work for Mechanical.
- .2 Maintenance Data: Include instructions for lubrication, motor and drive replacement, spare parts list, and wiring diagrams.

1.6 QUALITY ASSURANCE

- .1 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years experience.

1.7 Delivery, Storage And Handling

- .1 Section 21 05 00: Common Work for Mechanical.
- .2 Protect motors, shafts, and bearings from weather and construction dust.

1.8 Environmental Requirements

- .1 Do not operate equipment for any purpose until ductwork is clean, filters in place, bearings lubricated, and fan has been test run under observation.

1.9 Extra Materials

- .1 Section 21 05 00: Common Work for Mechanical.
- .2 Provide two sets of filters.

Part 2 Products

2.1 REVERSING CORE ENERGY RECOVERY VENTILATORS

- .1 Manufacturers
 - .1 Tempeff
 - .2 Southampton
 - .3 Price
- .2 Substitutions: Not Permitted
- .3 General
 - .1 Configuration: Fabricate as detailed on drawings.
 - .2 Performance:
 - .1 Conform to ARI 430. Refer to schedules on drawings.
 - .2 Performance shall be based on a maximum 450 fpm face velocity across the heat exchanger.
 - .3 Acoustics: Sound power levels (dB) for the unit shall not exceed levels specified in the schedule. The manufacturer shall provide the necessary sound treatment to meet these levels if required.

-
- .4 Where the unit arrangement differs from the drawings, the mechanical subcontractor is responsible for any additional structural, architectural, electrical and mechanical work that may be required and ensuring that intakes and outlets are arranged to meet code requirements.

 - .4 Unit Construction
 - .1 Fabricate unit with extruded aluminum channel posts and galvanized panels secured with mechanical fasteners.
 - .2 Fabricate curb mounted unit with frameless construction with insulated galvanized panels secured with mechanical fasteners.
 - .3 Unit shall be capable of having all panels remove simultaneously for servicing without affecting the structural integrity of the unit.
 - .4 The unit structure shall be self-supporting.
 - .5 All access doors shall be sealed with permanently applied gaskets.
 - .6 Panels and access doors shall be constructed as a 2-inch (50-mm) nominal thick; thermal broke double wall assembly, with $U=0.154$ Btu in/(hr ft² °F) (USI=0.0222 W/mK) equivalent insulation.
 - .7 The outer panel shall be constructed of 24 gauge G90 galvanized steel. The inner liner shall be constructed of 24 gauge G90 galvanized steel.
 - .8 Panel deflection shall not exceed L/240 ratio at 125% of design static pressure, maximum 6 inches of negative static pressure or 5 inches of positive static pressure. Deflection shall be measured at the midpoint of the panel height.
 - .9 Module to module assembly shall be accomplished with gaskets.
 - .10 Access Doors shall be flush mounted to cabinetry, with minimum of two hinges, locking latch and full size handle assembly.
 - .11 Unit shall be provided with base. Base of unit shall be designed to support the weight of the unit.
 - .12 Where the unit is mounted on the room the base shall be fully insulated where used as curb. Minimum height of base to be 600mm (24 inches).

 - .5 Fans
 - .1 Provide direct-drive airfoil plenum supply and exhaust fan(s). Fan assemblies including fan, motor 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. Grease fittings shall be attached to the fan base assembly near access door.
 - .3 Fan and motor shall be mounted internally on a steel base. Factory mount motor on slide base that can be slid out the side of unit if removal is required. Provide access to motor, drive, and bearings through hinged access door. Fan and motor assembly shall be mounted on spring vibration type isolators inside cabinetry.

 - .6 Bearings And Drives
 - .1 Bearings: Basic load rating computed in accordance with AFBMA - ANSI Standards, L-50 life at 200,000 hours – 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.

 - .7 Electrical

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- .1 Single point power connection.
 - .2 The ventilators(s) components shall be CSA, UL or CE listed as applicable.
 - .3 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.
 - .4 Fan motors shall be 1800 rpm, open drip-proof (ODP) type. Motors shall be high efficiency to meet EPC requirements. Electrical characteristics shall be as shown in schedule.
 - .5 Motors shall be rated for use with variable frequency drives (VFD)
 - .6 Wherever possible controls shall be located on the side of the unit for ease of servicing. Units which come with controls on roof must come with a permanently installed ladder to access controls, meeting all applicable codes.
 - .7 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.
 - .8 Air handler manufacturer shall provide and mount a damper hand-off-auto (HOA) switch.
- .8 Particulate Filters
- .1 Filter section with filter racks and guides with hinged and latching access doors on either, or both sides, for side loading and removal of filters.
 - .2 Filter media shall be UL 900 listed, Class I or Class II.
 - .3 Flat arrangement with 2", 50mm deep pleated disposable panel filters.
 - .4 See schedule for pre-filter and final filter requirements.
- .9 Energy Recovery
- .1 Reverse Flow Energy Recovery
 - .1 Unit shall be equipped with high mass reverse flow energy recovery technology. The unit shall be 87% temperature efficient (+5%) in winter and up to 80% in summer. Recovery effectiveness based on equal supply and exhaust airflow rates. 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.
 - .2 Devices employing defrost cycles that bypass the heat recovery device, or reduce the effectiveness are not acceptable. Heat recovery device shall not require frost protection in applications down to -40 degrees F.
 - .3 Cores shall be comprised of precisely corrugated high grade aluminum.
 - .4 Recovery cycles shall be controlled by internal programmed thermostats measuring both supply and exhaust air, and optimizing performance of both heat recovery and free cooling modes.
 - .2 Dampers
 - .1 Switchover damper section shall be comprised of low leakage dampers with EPDM seals operated by electric damper motors complete with DC braking.
 - .2 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.
 - .3 Dampers of other arrangements need to receive approval from Contract Administrator.

- .4 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.
 - .5 Damper blades, rods and axles shall be galvanized for long life expectancy.
- .10 Coils
- .1 Heating and cooling coils shall be provided as scheduled.
 - .2 Provide access to coils from both sides of unit for service and cleaning. Enclose coil headers and return bends fully within unit casing. Unit shall be provided with coil connections that extend a minimum of 5" beyond unit casing for ease of installation. Drain and vent connections shall be provided exterior to unit casing. Coil connections must be factory sealed with grommets on interior and exterior and gasket sleeve between outer wall and liner where each pipe extends through the unit casing to minimize air leakage and condensation inside panel assembly. If not factory packaged, Contractor must supply all coil connection grommets and sleeves. Coils shall be removable through side and/or top panels of unit without the need to remove and disassemble the entire section from the unit.
 - .1 Identify fin, tube & casing material type and thickness.
 - .2 Show coil weights (shipping & operating).
 - .3 State air and fluid flow amounts with its associated pressure drops. For steam coils, indicate steam pressure and condensate load.
 - .4 Indicate entering & leaving air and water temperatures. For refrigerant coils, indicate saturated suction temperature (SST).
 - .3 Coil construction shall meet the requirements listed in Specification Section 23 82 16 – Air Coils
 - .4 Below cooling coils and where noted provide drain pans. Pans shall be continuously welded and water tight and shall be constructed of stainless steel.
- .11 Hoods
- .1 When unit is exposed to the elements the intake and exhaust hoods shall be supplied by the mechanical subcontractor and field installed.
- .12 Options
- .1 Integral VFD's
 - .2 Single Point Power Connections
 - .3 Roof Curbs
 - .4 Drain Pans
 - .5 Cross core thermometers.
 - .6 Custom factory-applied white finish.

Part 3 Execution

3.1 Installation

- .1 Install to manufacturer's written instructions.
- .2 Where units are mounted on roof they shall be installed on manufacturer supplied insulated roof curbs.

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- .3 Install flexible connections specified in Section 23 33 00 between fan inlet and discharge ductwork. Ensure metal bands of connectors are parallel with minimum 25 mm (one inch) flex between ductwork and fan while running.
 - .4 Provide backdraft dampers on discharge of exhaust fans and as indicated. Refer to Section 23 33 00.
 - .5 Provide sheaves required for final air balance.
 - .6 Pipe condensate drains to roof.
 - .7 All heat recovery system to be tested as noted in Specification Section 23 05 93 – Testing, Adjusting, And Balancing.

END OF SECTION

Part 4

Part 5

Part 1

General

1.1 Section Includes

- .1 Packaged air handling units.

1.2 Related Sections

- .1 Section 22 10 00 - Plumbing Piping: Equipment drains.
- .2 Section 23 05 13 - Motors.
- .3 Section 23 05 16 - Piping Expansion Compensation.
- .4 Section 23 05 48 - Vibration Isolation.
- .5 Section 23 07 13 - Duct Insulation.
- .6 Section 23 31 00 - Duct Work.
- .7 Section 23 33 00 - Duct Work Accessories: Flexible duct connections.
- .8 Section 23 34 16 - Centrifugal Fans.
- .9 Section 23 82 16 - Air Coils.
- .10 Section 26 05 80 - Equipment Wiring: Electrical characteristics and wiring connections.

1.3 References

- .1 AFBMA 9 - Load Ratings and Fatigue Life for Ball Bearings.
- .2 AFBMA 11 - Load Ratings and Fatigue Life for Roller Bearings.
- .3 AMCA 99 - Standards Handbook.
- .4 AMCA 210 - Laboratory Methods of Testing Fans for Aerodynamic Performance Rating.
- .5 AMCA 300 - Reverberant Room Method for Sound Testing of Fans.
- .6 AMCA 301 - Method of Publishing Sound Ratings for Air Moving Devices.
- .7 AMCA 500 - Method of Testing Louvres for Ratings.
- .8 AMCA 5000 - Method of Testing Dampers for Ratings.
- .9 ARI 410 - Forced-Circulation Air-Cooling and Air-Heating Coils.
- .10 ARI 430 - Fabrication of Central Station Air Handling Units.
- .11 ARI 435 - Application of Central-Station Air-Handling Units.
- .12 ARI 610 - Central System Humidifiers for Residential Applications.
- .13 SMACNA - HVAC Duct Construction Standards - Metal and Flexible.
- .14 UL 900 - Air Filter Units.
- .15 Manitoba Energy Code for Buildings
- .16 NFPA 90A - Standard for the Installation of Air Conditioning and Ventilating Systems.
- .17 ASHRAE 90.1 Energy Code.
- .18 ASTM B117 - Standard Practice for Operating Salt Spray Apparatus.

- .19 NEMA MG1 - Motors and Generators.
- .20 UL 723 - Test for Surface Burning Characteristics of Building Materials.
- .21 UL 900 - Test Performance of Air Filter Units.
- .22 UL 94 - Test for Flammability of Plastic Materials for Parts in Devices and Appliances.
- .23 AHRI Standard 1060 - Rating Air-to-Air Heat Exchangers for Energy Recovery Ventilation Equipment.

1.4 Submittals

- .1 Section 21 05 00: Procedures for submittals.
- .2 Shop Drawings: Indicate assembly, unit dimensions, weight loading, required clearances, construction details, field connection details, and electrical characteristics and connection requirements. Computer generated fan curves for each air handling unit shall be submitted with specific design operating point noted. A computer generated psychometric chart shall be submitted for each cooling coil with design points and final operating point clearly noted. Sound data for discharge, radiated and return positions shall be submitted by octave band for each unit. Calculations for required baserail heights to satisfy condensate trapping requirements of cooling coil shall be included..
- .3 Product Data:
 - .1 Provide literature which indicates dimensions, weights, capacities, ratings, fan performance, gauges and finishes of materials, and electrical characteristics and connection requirements.
 - .2 Provide data of filter media, filter performance data, filter assembly, and filter frames.
 - .3 Provide fan curves with specified operating point clearly plotted.
 - .4 Submit sound power level data for both fan outlet and casing radiation at rated capacity.
 - .5 Submit electrical requirements for power supply wiring including wiring diagrams for interlock and control wiring, clearly indicating factory-installed and field-installed wiring.
- .4 Manufacturer's Installation Instructions.

1.5 Operation And Maintenance Data

- .1 Section 21 05 00: Submittals for project closeout.
- .2 Maintenance Data: Include instructions for lubrication, filter replacement, motor and drive replacement, spare parts lists, and wiring diagrams.

1.6 Delivery, Storage, And Handling

- .1 Section 21 05 00: Transport, handle, store, and protect products.
- .2 Accept products on site in factory-fabricated protective containers, with factory-installed shipping skids and lifting lugs. Inspect for damage.
- .3 Store in clean dry place and protect from weather and construction traffic. Handle carefully to avoid damage to components, enclosures, and finish.

1.7 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.

1.8 Extra Materials

- .1 Section 21 05 00: Submittals for project closeout.
- .2 Provide one set for each unit of fan belts and filters.

Part 2 Products

2.1 MANUFACTURERS

- .1 Daikin – Vision
- .2 Substitutions: Refer to Section 21 05 00

2.2 General Description

- .1 Configuration: Fabricate with fan and coil section plus accessories, including:
 - .1 Heating coil.
 - .2 Mixing box section.
 - .3 Combination filter/mixing box section.
 - .4 Filter section.
 - .5 Cooling coil section.
- .2 Performance Base: Sea level conditions.
- .3 Fabrication: Conform to AHRI 430.
- .4 Performance: Refer to schedules on plans.

2.3 Casing

- .1 Fabricate unit with heavy gauge channel posts and panels secured with mechanical fasteners. All panels, access doors, and ship sections shall be sealed with permanently applied bulb-type gasket. Shipped loose gasketing is not allowed.
 - .1 Outside Casing:
 - .1 G90 Galvanized Steel: 1.2 mm (18 gauge).
 - .2 Inside Casing:
 - .1 G90 Galvanized Steel: 1.2 mm (18 gauge).
 - .3 Floor Plate:
 - .1 G90 Galvanized Steel: 3.3 mm (10 gauge).
- .2 Panels and access doors shall be constructed as a 50mm (2-inches) nominal thick; thermal broke double wall assembly, injected with foam insulation with an R-value of not less than R-13
- .3 Finish: Baked enamel.
- .4 Panel deflection shall not exceed L/240 ratio at 125% of design static pressure, maximum 1245 Pa (5 inches water gauge) of positive or 1450 Pa (6 inches water gauge) of negative static pressure. Deflection shall be measured at the panel midpoint.

- .5 The casing leakage rate shall not exceed .024 L/s per square meter (5 cfm per square foot) of cabinet area at 1245 Pa (5 inches water gauge) of positive static pressure or 1450 Pa (6 inches water gauge) of negative static pressure.
- .6 Module to module field assembly shall be accomplished with an overlapping, full perimeter internal splice joint that is sealed with bulb type gasketing on both mating modules to minimize on-site labor and meet indoor air quality standards.
- .7 Access doors shall be flush mounted to cabinetry, with minimum of two six inch long stainless steel piano-type hinges, latch and full size handle assembly. Access doors shall swing outward for unit sections under negative pressure. Access doors on positive pressure sections, shall have a secondary latch to relieve pressure and prevent injury upon access.
- .8 A 6-inch formed G60 galvanized steel base rail shall be provided by the unit manufacturer for structural rigidity and condensate trapping. The base rail shall be constructed with 12-gauge nominal for unit sizes 003 - 035 and 10-gauge nominal for unit sizes 040 - 090. The following calculation shall determine the required height of the base rail to allow for adequate drainage. Should the unit base rail not be factory supplied at this height, the contractor is required to supply a concrete housekeeping pad to make up the difference.
- .9 Lights: Provide in accessible sections suitable for damp locations with wire guards, factory wired to weatherproof switch and pilot light and duplex outlet mounted on casing exterior.
- .10 Drain Pans: refer to coils.
- .11 Weatherproof Casing Finish: Seal fixed joints with flexible weather tight sealer. Seal removable joints with closed-cell foam gasket. Provide cap strips over roof flanges. Provide rain caps and gaskets on access doors.

2.4 Fans

- .1 Type: Acceptable fan assembly shall be a double width, double inlet, class II, belt-drive type housed airfoil fan dynamically balanced as an assembly, as shown in schedule. Maximum fan RPM shall be below first critical fan speed. Fan assemblies shall be dynamically balanced by the manufacturer on all three planes and at all bearing supports. Copper lubrication lines shall be provided and extend from the bearings and attached with grease fittings to the fan base assembly near access door. If not supplied at the factory, contractor shall mount copper lube lines in the field. Fan and motor shall be mounted internally on a steel base. Provide access to motor, drive, and bearings through hinged access door.
- .2 Performance Ratings: Conform to AMCA 210
- .3 Sound Ratings: AMCA 301; tested to AMCA 300
- .4 Bearings: Self-aligning, grease lubricated, ball or roller bearings with lubrication fittings extended to exterior of casing with copper tube and grease fitting rigidly attached to casing.

- .5 Fan and motor shall be mounted internally on a steel base. Factory mount motor on slide base that can be slid out the side of the unit if removal is required. Provide access to motor, drive, and bearings through hinged access door. Fan and motor assembly shall be mounted on 50mm (2 inches) deflection spring vibration type isolators inside cabinetry; refer to Section 23 05 48.
- .6 Fan Accessories: Refer to Section 23 34 16 and 23 34 13.
- .7 Flexible Connection: Separate fan and coil sections; refer to Section 23 33 00].

2.5 Bearings And Drives

- .1 Bearings: Basic load rating computed in accordance with AFBMA - ANSI Standards. The bearings shall be designed for service with an L-50 life of 200,000 hours and shall be a heavy duty pillow block, self-aligning, grease-lubricated ball or spherical roller bearing type.
- .2 Shafts: Solid, hot rolled steel, ground and polished, with key-way, and protectively coated with lubricating oil. Hollow shafts are unacceptable.
- .3 Drives: V-Belt drives shall be cast iron or steel sheaves, dynamically balanced, bored to fit shafts and keyed. Fixed sheaves, matched belts, and drive rated based on motor horsepower. Minimum of 2 belts shall be provided on all fans with 10 HP motors and above. Standard drive service factor minimum shall be 1.1 S.F. for 1/4 HP – 7.5 HP, 1.3 S.F. for 10 HP and larger, calculated based on fan brake horsepower
- .4 Belt Guard: Fabricate to SMACNA Standard; 2.8 mm (12 gauge) thick, 20 mm (3/4 inches) diamond mesh wire screen welded to steel angle frame or equivalent, prime coated. Secure to fan or fan supports without short circuiting vibration isolation, with provision for adjustment of belt tension, lubrication, and use of tachometer with guard in place.

2.6 Electrical Characteristics And Components

- .1 Motor:
 - .1 TEFC, refer to 23 05 13 Motors for additional information
 - .2 Refer to schedules for motor sizes
- .2 Wiring Terminations: Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated.

2.7 Coils

- .1 Water cooling, water heating, steam, and refrigerant coils shall be certified in accordance with AHRI Standard 410 and bear the AHRI label. Coils exceeding the scope of the manufacturer's certification and/or the range of AHRI's standard rating conditions will be considered provided the manufacturer is a current member of the AHRI Forced Circulation Air-Cooling and Air-Heating Coils certification programs and that the coils have been rated in accordance with AHRI Standard 410

- .2 Casing: Provide access to [both sides of] coils. Enclose heating coils with headers and return bends exposed outside and cooling coils fully contained within casing. Unit shall be provided with coil connections that extend a minimum of 125mm (5 inches) beyond unit casing for ease of installation. Drain and vent connections shall be provided exterior to unit casing. Coil connections must be factory sealed with grommets on interior and exterior panel liners to minimize air leakage and condensation inside panel assembly. If not factory packaged, Contractor must supply all coil connection grommets and sleeves. Coils shall be removable through side and/or top panels of unit without the need to remove and disassemble the entire section from the unit.
- .3 Drain Pans: Stainless steel with cross break and double sloping pitch to drain connection. Provide drain pans under cooling coil section [and humidifier sections]. Drain connection centerline shall be a minimum of 75mm (3 inches) above the base rail to aid in proper condensate trapping. Drain connections that protrude from the base rail are not acceptable. There must be a full 50mm (2 inches) thickness of insulation under drain pan.
- .4 Eliminators: Three break of [galvanized steel,] [Type 304 stainless steel,] [PVC,] mounted over drain pan.
- .5 Fabrication:
 - .1 Tubes: 16 mm (5/8 inches) OD seamless copper, nominal 0.5mm (0.020 inches) tube wall thickness, expanded into fins, brazed joints.
 - .2 Fins: Aluminum, 0.19mm (0.0075 inches) thickness. Fins shall have full drawn collars to provide a continuous surface cover over the entire tube for maximum heat transfer. Tubes shall be mechanically expanded into the fins to provide a continuous primary to secondary compression bond over the entire finned length for maximum heat transfer rates. Bare copper tubes shall not be visible between fins.
 - .3 Casing: Die formed channel frame of galvanized steel.
- .6 Water Heating Coils:
 - .1 Headers: Seamless copper tubing to assure compatibility with primary surface. Headers to have intruded tube holes to provide maximum brazing surface for tube to header joint, strength, and inherent flexibility. Header diameter should vary with fluid flow requirements.
 - .2 Configuration: Fully drainable, with threaded plugs for drain located at the bottom of the header and vent at the top of the header; serpentine type with return bends on smaller sizes and return headers on larger sizes.
- .7 Water Cooling Coils:
 - .1 Headers: Seamless copper tubing to assure compatibility with primary surface. Headers to have intruded tube holes to provide maximum brazing surface for tube to header joint, strength, and inherent flexibility. Header diameter should vary with fluid flow requirements.
 - .2 Configuration: Fully drainable, with threaded plugs for drain located at the bottom of the header and vent at the top of the header; serpentine type with return bends on smaller sizes and return headers on larger sizes.

2.8 Filters

- .1 Filter Box: Section with filter guides, access doors from both sides, for side loading.

-
- .2 Filter Media: UL 900 listed, Class I or Class II.
 - .3 Furnish combination filter section with 50mm (2 inches) pleated MERV 8 flat pre-filter with microbial resistant coating and 300mm (12 inches) SH cartridge 95% efficient (MERV 15) final filter.
 - .4 Furnish flat panel filter section with 2-inch pleated (MERV 8) filter with microbial resistant coating.
 - .5 Filter Gauges: 90 mm (3-1/2 inches) diameter diaphragm actuated dial in metal case, with static pressure tips. Refer to 23 05 16 Gages and Meters.

2.9 Dampers

- .1 Mixing Boxes/Economizer: Section with factory mounted outside, return air, relief air dampers of parallel low leak airfoil damper blades. Dampers shall be hollow core galvanized steel airfoil blades, fully gasketed and have continuous vinyl seals between damper blades in a galvanized steel frame. Dampers shall have stainless steel jamb seals along end of dampers. Linkage and ABS plastic end caps shall be provided when return and outside air dampers sized for full airflow. Return and outside air dampers of different sizes or very large dampers and exhaust dampers must be driven separately.]
- .2 Damper Leakage: Maximum 2 percent at 0.5 kPa (2 inch wg) differential pressure in accordance with AMCA Standard 500.

Part 3 Execution

3.1 Installation

- .1 Install to manufacturer's written instructions.
- .2 Install to ARI 435.
- .3 Install assembled unit on vibration isolators. Refer to Section 23 05 48.

END OF SECTION

Part 1 General

1.1 Section Includes

- .1 Unit heaters.
- .2 Fan-coil units.
- .3 Fan-coil units – horizontal
- .4 Hydronic Radiant Panels

1.2 Related Sections

- .1 Section 23 05 13 - Motors.
- .2 Section 23 05 20 - Hydronic Specialties.
- .3 Section 23 21 00 - Hydronic Piping.
- .4 Section 25 90 00 - Sequence Of Operation.
- .5 Section 26 05 80 - Equipment Wiring:
 - .1 Electrical characteristics and wiring connections.
 - .2 Installation of room thermostats.
 - .3 Electrical supply to units.

1.3 References

- .1 AFBMA 9—Load Ratings and Fatigue Life for Ball Bearings
- .2 AMCA 99—Standards Handbook
- .3 AMCA 210—Laboratory Methods of Testing Fans for Rating Purposes
- .4 AMCA 300—Test Code for Sound Rating Air Moving Devices
- .5 AMCA 500—Test Methods for Louver, Dampers, and Shutters
- .6 AHRI 430—Central-Station Air-Handling Units.
- .7 AHRI 435—Application of Central-Station Air-Handling Units
- .8 ASTM B117—Standard Practice for Operating Salt Spray Apparatus
- .9 NEMA MG1—Motors and Generators
- .10 CSA C22.1 – Canadian Electrical Code
- .11 SMACNA—HVAC Duct Construction Standards - Metal and Flexible
- .12 UL 723—Test for Surface Burning Characteristics of Building Materials
- .13 UL 900—Test Performance of Air Filter Units
- .14 UL 1995—Standard for Heating and Cooling Equipment
- .15 UL 94—Test for Flammability of Plastic Materials for Parts in Devices and Appliances

1.4 Submittals For Review

- .1 Section 21 05 00: Procedures for submittals.
- .2 Product Data: Provide typical catalogue of information including arrangements.

- .3 Shop Drawings:
 - .1 Indicate cross sections of cabinets, grilles, bracing and reinforcing, and typical elevations.
 - .2 Submit schedules of equipment and enclosures typically indicating length and number of pieces of element and enclosure, corner pieces, end caps, cap strips, access doors, pilaster covers, and comparison of specified heat required to actual heat output provided.
 - .3 Indicate mechanical and electrical service locations and requirements.,

1.5 SUBMITTALS FOR INFORMATION

- .1 Section 21 05 00: Submittals for information.
- .2 Manufacturer's Instructions: Indicate installation instructions and recommendations.

1.6 Submittals At Project Closeout

- .1 Section 21 05 00: Submittals for project closeout.
- .2 Project Record Documents: Record actual locations of components and locations of access doors in radiation cabinets required for access or valving.
- .3 Operation and Maintenance Data: Include manufacturers descriptive literature, operating instructions, installation instructions, maintenance and repair data, and parts listings.
- .4 Warranty: Submit manufacturer warranty and ensure forms have been completed in The City's name and registered with manufacturer.

1.7 Quality Assurance

- .1 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

1.8 Regulatory Requirements

- .1 Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., and testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

1.9 Warranty

- .1 Section 21 05 00: Submittals for project closeout.

1.10 Extra Materials

- .1 Section 21 05 00: Submittals for project closeout.

Part 2 Products

2.1 UNIT HEATERS

- .1 Manufacturer: Rittling Model Regency RH/RV series.
 - .1
- .2 Coils: Seamless copper tubing, silver brazed to steel headers, and with evenly spaced aluminum fins mechanically bonded to tubing.

- .3 Casing: 1.2 mm (0.0478 inch) steel with threaded pipe connections for hanger rods.
- .4 Finish: Factory applied textured gray epoxy powder coating.
- .5 Fan: Direct drive propeller type, statically and dynamically balanced, with fan guard; horizontal models with permanently lubricated sleeve bearings; vertical models with grease lubricated ball bearings.
- .6 Air Outlet: Adjustable pattern diffuser on projection models and two way louvres on horizontal throw models.
- .7 Motor: Permanently lubricated sleeve bearings on horizontal models, grease lubricated ball bearings on vertical models.
- .8 Control:
 - .1 BMS on/off control via BMS thermostat signal, coordinate with DIV 25.
- .9 Capacity: As scheduled
- .10 Electrical Characteristics:
 - .1 As scheduled.
 - .2 Refer to Section 26 05 80.

2.2 Fan-coil Units

- .1 Manufacturer: Refer to schedule
- .2 Other acceptable manufacturers offering equivalent products.
 - .1 Substitutions: Refer to Section 21 05 00.
- .3 Carrier Fan Coils
 - .1 Coils: Evenly spaced aluminum fins mechanically bonded to copper tubes, designed for 1380 kPa (200 psi) and 104 degrees C (220 degrees F). Provide drain pan under cooling coil, easily removable for cleaning, with drain connection.
 - .2 Cabinet: 1.5 mm(0.0598 inch) steel with exposed corners and edges rounded, easily removed panels, glass fibre insulation [and integral air outlet] [and integral air outlet and inlet grilles].
 - .3 Finish: Factory apply baked enamel, manufacturer's standard colour on visible surfaces of enclosure where located in non-visible locations. Manufacturer's standard colour selection by architect for visible applications.
 - .4 Fans: Centrifugal forward-curved double-width wheels, statically and dynamically balanced, direct driven.
 - .5 Motor: Tap wound multiple speed permanent split capacitor with sleeve bearings, resiliently mounted.
 - .6 Control: Multiple speed switch, factory wired, located in cabinet.
 - .7 Filter: Easily removed 25 mm(1 inch) thick glass fibre throw-away type, located to filter air before coil.
 - .8 Mixing Dampers: Where indicated, mixing sections with dampers. Refer to Section 25 90 00 for operating sequence.
 - .9 Capacity: As Scheduled, based on 18°C (65°F) entering air temperature
 - .10 Electrical Characteristics:
 - .1 Refer to schedules.
 - .2 Refer to Section 26 05 80.

-
- .4 Jaga Fan Coils
 - .1 Provide Jaga BRIZA 22 units where heating and cooling is shown.
 - .2 Description: Pre-mounted air conditioning unit, the same version in five models for installation in wall or ceiling, recessed or exposed with cabinet.
 - .3 Versions: 2 pipe pipe connection.
 - .4 Heating/Cooling Crossover coil: standard equipped for connection to 6-way valve (by contractor) to provide heating or chilled fluid to the coil.
 - .5 Ventilation: connecting to mechanical ventilation (via ducting, if desired on return side)
 - .6 Casing:
 - .1 The internal casing consists of a reinforced galvanized steel plate (18ga) and a condensate drain pan (for vertical and horizontal installation) with gravity drainage, complete with self-evaporating anti-condensation insulation on the side, back and front panels of the unit.
 - .2 Internal casing to be no deeper than 220mm (8.7").
 - .7 Exposed cabinet:
 - .1 The cabinet shall be fabricated with 16 gauge electrolytic galvanized steel and will be coated epoxy polyester baked at 392°F. Provide custom colour, confirm colour with architectural during submittal process.
 - .2 The Top grille shall provide supply air and bottom shall provide return.
 - .3 The Cabinet front face shall be constructed of a single uniform piece seamless in construction.
 - .4 The Cabinet shall be fabricated such that there are no exposed corners or gaps. All corners shall be joined to form one solid piece – gaps are not permitted.
 - .5 The Cabinet shall be factory Parts Warranted for 10 Years
 - .8 Dynamic Low-H₂O heat exchanger:
 - .1 The heat exchanger consists of a coil with three round rows seamless circulation tubes of pure red copper, connected with pure aluminum fins brass 2.08 mm spaced, and cast collectors equipped with a patented low pressure loss hydraulic distributor.
 - .2 The Heat exchanger shall be rated for 290PSI working pressure.
 - .3 The Heat exchanger shall be easily removable from cabinet if required.
 - .4 The Heat exchanger shall be coated with dirt repellent and dust proof lacquer in blue.
 - .5 The Heat exchanger shall have ASTM G53 certification.
 - .6 Each individual heat exchanger shall have EN442/EN16430 certification. Output Correction factors will not be considered equivalent to establish output capacities.
 - .7 The Heat exchanger shall include NPT connections.
 - .9 Hydraulic connection:
 - .1 Standard heat exchanger ¾" connection on the left. Also available with hydraulic connection to the right. With an air vent, drain valve and anti-rotation lock for quick connection, no key or lock key is required. Provide appropriate connection to suit layout.
 - .10 Fan(s):

- .1 An electronically commutated (EC motor) centrifugal fan with double intake, with static and dynamically balanced aluminum or ABS fan units. An electronic brushless synchronous motor with permanent magnets, controlled by a frequency and amplitude modulated inverter which generates a sinus-shaped voltage. The inverter is driven by a single-phase voltage 120Vac 60Hz and is controllable via a 0-10Vdc analog signal. The motor is provided with internal protection.
- .2 Electrical connection: By means of terminals (three wire terminals: ground, - / + 120V, 0 ... 10 V), standard on the right side of the unit.
- .3 Soft filter: Renewable polypropylene synthetic filter (filter class MERV 8), removable from the front or bottom of the unit.
- .4 Supply Voltage 120V
- .5 Fan operation at 5.8V allows for significant air throw with sound pressure under 35dBA, without any connection to duct work.
- .6 Terms of use: Air-conditioning Unit for indoor use, to provide in the summer and during the winter the required heating and cooling (summer and winter, air conditioning). For indoor spaces with domestic or similar use. The device is not intended for installation or use in damp areas, such as laundry rooms (IEC EN 60335-2-40).
- .7 Operating Limits: Temperature supply water: $3 > 90^{\circ}\text{C}$
- .8 Maximum pressure heat exchanger: 290PSI
- .9 Supply Voltage: $120\text{ V} \pm 10\%$, 60Hz
- .10 Max static pressure, up to 80 Pa ESP for the largest model

2.3 Hydronic Radiant Heaters

- .1 Manufacturers:
 - .1 TWA
 - .2 Price Industries
 - .3 Engineered Air
- .2 Other acceptable manufacturers offering equivalent products.
 - .1 Substitutions: Refer to Section 21 05 00
- .3 Extruded Ceiling Panels:
 - .1 Constructed of modular 150 mm (6 inch) wide aluminum extruded planks with interlocking edges;
 - .1 Planks are to be manufactured and assembled to configurations indicated on plans, exact dimensions to be confirmed with Contract Administrator prior to shop drawings;
 - .2 Some panels may be special, requiring field cutting. Manufacturer shall cut back tubing to accommodate field cutting but allow maximum heating output from remaining section of panel;
 - .3 Some sections may be filler panels without piping;
 - .2 Tube saddle incorporated into plank extrusion;
 - .3 Tubing to be clipped to saddle, clips to be non-conducting, dielectric;
 - .4 Cross brace entire assembly with structural members, aluminium support channel to be provided from factory;
 - .5 Provide with extruded frame for installation in drywall or suspended ceiling application.

- .4 Pipe Coil:
 - .1 16 mm (5/8 inch) O.D. copper tube
 - .2 Tubing to be thermally bonded to extrusion with non-hardening heat conductive thermal paste
 - .3 Provide return bends for two water connections to each panel. Provide coil setup and prepared conditions for interconnected panels where indicated.
- .5 Insulation
 - .1 Insulation is to be supplied by mechanical subcontractor;
 - .2 Minimum 25mm (1.0 inches) thick;
 - .3 ASTM C1071; flexible, inorganic glass fibre bonded by a thermosetting binder, non-combustible blanket, with no edge coating;
 - .1 'C' Value: ASTM C177, maximum 1.42 at 24 degrees C (0.24 at 75 degrees F).
 - .2 Maximum Service Temperature: 121 degrees C (250 degrees F).
 - .3 Minimum 50% Certified Recycled Content.
 - .4 Does not exceed 25 Flame and 50 Smoke spread ratings when tested in accordance with ASTM E 84, CAN/ULC S102-M88, NFPA 255 and UL 723
 - .5 Adhesive:
 - .1 ASMT C916 compliant
 - .2 Waterproof, ASTM E162 fire-retardant type.
- .6 Configure panels within T-bar ceiling module
- .7 Configure panels within dry wall as per drawings.
- .8 Heating Capacity: As scheduled, based on 60°C supply water temperature, 21 degrees C (70 degrees F) space temperature.
- .9 Accessories:
 - .1 Provide with hose kits, 450 mm (18") minimum length:
 - .1 Return side hose: control valve, shutoff valve, manual air vent, and automatic balancing valve;
 - .2 Supply side hose: shutoff valve, and strainer with blowdown and pressure tap.
 - .3 Connection to radiant panel by threaded or sweat connections.
 - .2 Provide "pig tail" looped connection or other flexible connection between radiant panels.
 - .3 Provide access panel sections to conceal and provide access to isolation and control valves in all zones.

Part 3 Execution

3.1 Installation

- .1 Install to manufacturer's written instructions.
- .2 Install equipment exposed to finished areas after walls and ceiling are finished and painted. Avoid damage.
- .3 Unit Heaters: Hang from building structure, with pipe hangers anchored to building, not from piping. Mount as high as possible to maintain greatest headroom unless otherwise indicated.

- .4 Fan-Coil Units: Install as indicated. Coordinate to assure correct recess size for recessed units.
- .5 Hydronic Units: Provide with shut-off valve on supply and lockshield balancing valve on return piping. If not easily accessible, extend vent to exterior surface of cabinet for easy servicing. For cabinet unit heaters, fan coil units, and unit heaters, provide float operated automatic air vents with stop valve.
- .6 Hydronic Radiant Panels:
 - .1 Install with hose kits to supply/return piping.
 - .2 Install radiant panel level and plumb. Maintain sufficient clearance for normal services, maintenance, or in accordance with construction drawings.
 - .3 Complete installation and startup checks according to manufacturer's written instructions and perform pressure testing.
 - .4 Coordinate installation with acoustic tile ceiling grid. Where panel is installed against wall surfaces, provided with grid track.
 - .5 Completely cover exposed topside of panel with insulation blanket. Cut insulation around upturned piping connectors.
 - .6 Suspend panels with hanger wire from deck above.
- .7 Units with Cooling Coils: Connect drain pan to condensate drain.

3.2 Cleaning

- .1 After construction is completed, including painting, clean exposed surfaces of units. Vacuum clean coils and inside of cabinets.
- .2 Touch-up marred or scratched surfaces of factory-finished cabinets, using finish materials provided by manufacturer.
- .3 Install new filters.

3.3 Schedules

- .1 Refer to schedules on drawings.

END OF SECTION

Part 1

General

1.1 Section Includes

- .1 Water coils.
- .2 Glycol coils.
- .3 Refrigerant coils.

1.2 Related Sections

- .1 Section 23 05 20 - Hydronic Specialties.
- .2 Section 23 07 19 - Piping Insulation.
- .3 Section 23 31 00 - Duct Work: Installation of duct coils.
- .4 Section 26 05 80 - Equipment Wiring: Electrical characteristics and wiring connections.

1.3 References

- .1 ARI 410 - Forced-Circulation Air-Cooling and Air- Heating Coils.
- .2 SMACNA - HVAC Duct Construction Standards, Metal and Flexible.

1.4 Submittals For Review

- .1 Section 21 05 00: Procedures for submittals.
- .2 Product Data: Provide coil and frame configurations, dimensions, materials, rows, connections, and rough-in dimensions.
- .3 Shop Drawings: Indicate coil and frame configurations, dimensions, materials, rows, connections, and rough-in dimensions.

1.5 Submittals For Information

- .1 Section 21 05 00: Submittals for information.
- .2 Certificates: Certify that coil capacities, pressure drops, and selection procedures meet or exceed specified requirements and that the coils are tested and rated to ARI 410.

1.6 Submittals At Project Closeout

- .1 Section 21 05 00: Submittals for project closeout.
- .2 Warranty: Submit manufacturer warranty and ensure forms have been completed in The City's name and registered with manufacturer.

1.7 Quality Assurance

- .1 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years experience.

1.8 Regulatory Requirements

- .1 Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., CSA, and/or any testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

1.9 Delivery, Storage, And Handling

- .1 Section 21 05 00: Transport, handle, store, and protect products.
- .2 Protect coil fins from crushing and bending by leaving in shipping cases until installation, and by storing indoors.
- .3 Protect coils from entry of dirt and debris with pipe caps or plugs.

1.10 Warranty

- .1 Section 21 05 00: Submittals for project closeout.
- .2 Provide five (5) year manufacturer warranty for all coils.

Part 2 Products

2.1 WATER HEATING COILS

- .1 Manufacturer:
 - .1 Engineered Air
 - .2 Carrier
 - .3 Daikin
- .2 Tubes: 5/8 inch (16 mm) OD seamless copper arranged in parallel or staggered pattern, expanded into fins, brazed joints.
- .3 Fins: Aluminum continuous plate type with full fin collars.
- .4 Casing: Die formed channel frame of 1.6 mm (16 gauge) galvanized steel with 9.5 mm (3/8 inch) mounting holes on 150 mm (6 inch) centres. Provide tube supports for coils longer than 900 mm (36 inches).
- .5 Headers: Seamless copper tube with silver brazed joints.
- .6 Testing: Air test under water to 2200 kPa (320 psig) for working pressure of 1725 kPa (250 psig) and 149 degrees C (300 degrees F)
- .7 Configuration: Drainable, with threaded plugs in headers for drain and vent. Refer to Coil Schedule for further detail.
- .8 Fin Spacing: Fin Spacing to meet or exceed performance requirements. Refer to Coil Schedule.

2.2 Glycol Heating Coils

- .1 Manufacturer:
 - .1 Trane
 - .2 Carrier
 - .3 Daikin
 - .4 Greenheck.
- .2 Other acceptable manufacturers offering equivalent products.
- .3 Tubes: 5/8 inch (16 mm) OD seamless copper arranged in parallel or staggered pattern, expanded into fins, brazed joints.
- .4 Fins: Aluminum [or copper] continuous plate type with full fin collars.

- .5 Casing: Die formed channel frame of 1.6 mm (16 gauge) galvanized steel with 9.5 mm (3/8 inch) mounting holes on 150 mm (6 inch) centres. Provide tube supports for coils longer than 900 mm (36 inches).
- .6 Headers: Seamless copper tube with silver brazed joints.
- .7 Testing: Air test under water to 2200 kPa (320 psig) for working pressure of 1725 kPa (250 psig) and 149 degrees C (300 degrees F)
- .8 Configuration: Drainable, with threaded plugs in headers for drain and vent. Refer to Coil Schedule for further detail.
- .9 Fin Spacing: Fin Spacing to meet or exceed performance requirements. Refer to Coil Schedule.

2.3 Water Cooling Coils

- .1 Engineered Air
- .2 Carrier
- .3 Daikin
- .2 Other acceptable manufacturers offering equivalent products.
 - .1 Substitutions: Refer to Section 21 05 00
- .3 Tubes: 16 mm (5/8 inch) OD seamless copper arranged in parallel or staggered pattern, expanded into fins, brazed joints.
- .4 Fins: Aluminum [continuous plate type with full fin collars] [or] [individual helical finned tube type wound under tension]. [Solder coat copper fin coils.]
- .5 Casing: Die formed channel frame of 1.6 mm (16 gauge) galvanized steel with 9.5 mm (3/8 inch) mounting holes on 75 mm (3 inch) centres. Provide tube supports for coils longer than 900 mm (36 inches).
- .6 Headers: Seamless copper tube with silver brazed joints.
- .7 Testing: Air test under water to 1380 kPa 200 psig) for working pressure of 1380 kPa 200 psig) and 104 degrees C (220 degrees F).
- .8 Configuration: Drainable, with threaded plugs [in headers] for drain and vent; threaded plugs in return bends and in headers opposite each tube.
- .9 Fin Spacing: 3.1 mm on centre (8 fins per inch)

Part 3 Execution

3.1 Installation

- .1 Install to manufacturers written instructions.
- .2 Install in ducts and casings to SMACNA HVAC Duct Construction Standards, Metal and Flexible.
 - .1 Support coil sections independent of piping on steel channel or double angle frames and secure to casings.
 - .2 Provide frames for maximum three coil sections.
 - .3 Arrange supports to avoid piercing drain pans.
 - .4 Provide airtight seal between coil and duct or casing.
 - .5 Refer to Section 23 31 00.
- .3 Protect coils to prevent damage to fins and flanges. Comb out bent fins.

-
- .4 Install coils level. Make connections to coils with unions and flanges.
 - .5 Hydronic Coils:
 - .1 Hydronic Coils: Connect water supply to leaving air side of coil (counterflow arrangement).
 - .2 Provide shut-off valve on supply and return pipe.
 - .3 Locate water supply at bottom of supply header and return water connection at top.
 - .4 Provide manual air vents at high points complete with stop valve.
 - .5 Ensure water coils are drainable and provide drain connection at low points.
 - .6 Refer to Section 23 05 20.
 - .6 Cooling Coils:
 - .1 Provide drain pan and drain connection. Pipe drain pans individually to floor drain [with water seal trap].
 - .7 Insulate headers located outside air flow as specified for piping. Refer to Section 23 07 19.

3.2 Schedules

- .1 Refer to drawings.

END OF SECTION

Part 1

General

1.1

Section Includes

- .1 Air supply system
- .2 Thermostats.
- .3 Humidistats.
- .4 Control valves.
- .5 Combination Control and Automatic Flow Valves
- .6 Dampers Motorized
- .7 Flow Sensing Dampers Motorized
- .8 Damper operators.
- .9 Time clocks.
- .10 Miscellaneous accessories.
- .11 Gas Detection and Control System

1.2

Related Sections

- .1 Section 23 05 19 - Gages And Meters: Thermometer sockets, gauge taps.
- .2 Section 23 05 48 - Vibration Isolation.
- .3 Section 23 21 00 - Hydronic Piping: Installation of control valves, flow switches, temperature sensor sockets, gauge taps.
- .4 Section 23 33 00 - Duct Work Accessories: Installation of automatic dampers.
- .5 Section 25 50 02 - Digital Control Equipment.
- .6 Section 25 90 00 - Sequence Of Operation.
- .7 Section 26 27 26 - Wiring Devices: Elevation of exposed components.
- .8 Section 26 05 80 - Equipment Wiring: Electrical characteristics and wiring connections.

1.3

References

- .1 AMCA 500 - Test Methods for Louvres, Dampers and Shutters.
- .2 ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
- .3 ASTM B32 - Solder Metal.
- .4 ASTM B280 - Seamless Copper Tube for Air Conditioning and Refrigeration Field Service.
- .5 ASTM D1693 - Environmental Stress - Cracking of Ethylene Plastics.
- .6 NFPA 90A - Installation of Air Conditioning and Ventilation Systems.

1.4

Submittals For Review

- .1 Section 21 05 00: Procedures for submittals.

-
- .2 Product Data: Provide description and engineering data for each control system component. Include sizing as requested. Provide data for each system component and software module.
 - .3 Shop Drawings: Indicate complete operating data, system drawings, wiring diagrams, and written detailed operational description of sequences. Submit schedule of valves indicating size, flow, and pressure drop for each valve. For automatic dampers indicate arrangement, velocities, and static pressure drops for each system.

1.5 Submittals For Information

- .1 Section 21 05 00: Submittals for information.
- .2 Manufacturer's Instructions: Provide for all manufactured components.

1.6 Submittals At Project Closeout

- .1 Section 21 05 00: Submittals for project closeout.
- .2 Project Record Documents: Record actual locations of control components, including panels, thermostats, and sensors. Accurately record actual location of control components, including panels, thermostats, and sensors.
- .3 Revise shop drawings to reflect actual installation and operating sequences.
- .4 Operation and Maintenance Data: Include inspection period, cleaning methods, recommended cleaning materials, and calibration tolerances.
- .5 Warranty: Submit manufacturer's warranty and ensure forms have been filled out in The City's name and registered with manufacturer.

1.7 Quality Assurance

- .1 Manufacturer Qualifications: Manufacturer shall be compatible with that listed in section 25 50 02.
- .2 Installer Qualifications: Company specializing in performing the work of this section shall be pre-approved by The City.
- .3 The Installer shall have an established working relationship with the Control System Manufacturer, and be the authorized representative of the Manufacturer at bid time.
- .4 The Installer shall have successfully completed Control System Manufacturer's classes on the control system. The Installer shall present for review the certification of completed training, including the hours of instruction and course outlines upon request.
- .5 All products used in this installation shall be new, currently under manufacture, and shall be applied in standard off-the-shelf products. This installation shall not be used as a test site for any new products unless explicitly approved by the Contract Administrator in writing. Spare parts shall be available for at least 5 years after completion of this Contract.

1.8 REGULATORY REQUIREMENTS

- .1 All work, materials, and equipment shall comply with the rules and regulations of all codes and ordinances of the local, provincial, and national authorities. Such codes, when more restrictive, shall take precedence over these plans and specifications. As a minimum, the installation shall comply with the current editions in effect 30 days prior to receipt of bids of the following codes:
 - .1 Canadian Electric Code (CEC)
 - .2 National Building Code (NBC)
 - .3 ASHRAE 135
 - .4 Underwriters Laboratories UL916

1.9 Warranty

- .1 Section 21 05 00: Submittals for project closeout.
- .2 Labor and materials for the control system specified shall be warranted free from defects for a period of 12 months after final completion and acceptance. Control system failures during the warranty period shall be adjusted, repaired, or replaced at no additional cost or reduction in service to The City. The Contractor shall respond to The City's request for warranty service within 24 hours during normal business hours.
- .3 All work shall have a single warranty date, even when The City has received beneficial use due to an early system start-up. If the work specified is split into multiple Contracts or a multi-phase Contract, then each Contract or phase shall have a separate warranty start date and period
- .4 At the end of the final start-up, testing, and commissioning phase, if equipment and systems are operating satisfactorily to the Contract Administrator, the Contract Administrator shall sign certificates certifying that the control system's operation has been tested and accepted in accordance with the terms of this specification. The date of acceptance shall be the start of warranty.
- .5 Operator workstation software, project-specific software, graphic software, database software, and firmware updates which resolve known software deficiencies as identified by the Contractor shall be provided at no charge during the warranty period. Any upgrades or functional enhancements associated with the above mentioned items also can be provided during the warranty period for an additional charge to The City by purchasing an in-warrant technical support agreement from the Contractor. Written authorization by The City must, however, be granted prior to the installation of any of the above-mentioned items.
- .6 Exception: The Contractor shall not be required to warrant reused devices, except for those that have been rebuilt and/or repaired. The Contractor shall warrant all installation labour and materials, however, and shall demonstrate that all reused devices are in operable condition at the time of Contract Administrator review.

1.10 Maintenance Service

- .1 Section 21 05 00: Submittals for project closeout.
- .2 Provide service and maintenance of control system from Date of Substantial Completion.

- .3 Provide complete service of controls systems, including call backs. Make minimum of two complete normal inspections of approximately four (4) hours duration in addition to normal service calls to inspect, calibrate, and adjust controls, and submit written reports.

1.11 SYSTEM AND COMPONENT PERFORMANCE

- .1 Reporting Accuracy. System shall report values with minimum end-to-end accuracy listed in Table 1.
- .2 Control Stability and Accuracy. Control loops shall maintain measured variable at setpoint within tolerances listed in Table 2.

1.12

Table 1
Reporting Accuracy

Measured Variable	Reported Accuracy
Space Temperature	±0.5°C (±1°F)
Ducted Air	±0.5°C (±1°F)
Outside Air	±1.0°C (±2°F)
Dew Point	±1.5°C (±3°F)
Water Temperature	±0.5°C (±1°F)
Delta-T	±0.15°C (±0.25°F)
Relative Humidity	±5% RH
Water Flow	±2% of full scale
Airflow (terminal)	±10% of full scale (see Note 1)
Airflow (measuring stations)	±5% of full scale
Airflow (pressurized spaces)	±3% of full scale
Air Pressure (ducts)	±25 Pa (±0.1 in. w.g.)
Air Pressure (space)	±3 Pa (±0.01 in. w.g.)
Water Pressure	±2% of full scale (see Note 2)
Carbon Monoxide (CO)	±5% of reading
Carbon Dioxide (CO 2)	±30 ppm

Table 2
Control Stability and Accuracy

Controlled Variable	Control Accuracy	Range of Medium
Air Pressure	±50 Pa (±0.2 in. w.g.) ±3 Pa (±0.01 in. w.g.)	0-1.5 kPa (0-6 in. w.g.) -25 to 25 Pa (-0.1 to 0.1 in. w.g.)
Airflow	±10% of full scale	
Space Temperature	±1.0°C (±2.0°F)	
Duct Temperature	±1.5°C (±3°F)	
Humidity	±5% RH	
Fluid Pressure	±10 kPa (±1.5 psi) ±250 Pa (±1.0 in. w.g.)	MPa (1-150 psi) 0-12.5 kPa (0-50 in. w.g.) differential

Part 2 Products

2.1 CARBON DIOXIDE SENSOR

- .1 Acceptable manufacturers.
 - .1 DCS Airsense
 - .2 Substitutions: Refer to Section 21 05 00.
- .2 Non-dispersive infrared (NDIR), Diffusion with a Measurement Range 0-2000 ppm
 - .1 Repeatability ± 20 ppm CO₂ Measurement Accuracy ± 30 ppm $\pm 2\%$ of reading,
 - .2 Power Requirements 18 - 30 VDC or 18 - 28 Vrms AC
 - .3 Operating Temperature Range 0 - 50 OC
 - .4 Operating Humidity Range 0 - 99% RH, non-condensing
 - .5 Voltage Output (linear) 0 - 10 VDC full-scale standard
 - .6 Optional Current Output (linear) 4-20 mA RLOOP < 600 Ω
 - .7 Dimensions 4.5 x 2.8 x 0.9 inches
- .3 Model 308 – Wall or Duct Mount – No display
- .4 Model 350 – Wall or Duct Mount – With display

2.2 CONTROL PANELS

- .1 Unitized cabinet type for each system under automatic control with relays and controls mounted in cabinet and temperature indicators, pressure gauges, pilot lights, push buttons and switches flush on cabinet panel face.
- .2 NEMA 250, general purpose utility enclosures with enamelled finished face panel.
- .3 Provide common keying for all panels.

2.3 Control Valves

- .1 Acceptable manufacturers.
 - .1 Belimo
 - .2 Siemens
 - .3 Honeywell
 - .4 Schneider Electric
 - .5 Johnson Controls
 - .6 Substitutions: Refer to Section 21 05 00.
- .2 Ball Valves:
 - .1 Bronze body, Stainless Steel trim, 2 or 3 port as indicated, replaceable plugs and seats, union and threaded ends.
 - .2 Rate for service pressure exceeding 860 kPa at 121 degrees C (125 psig at 250 degrees F).
 - .3 Two way valves with equal percentage characteristics, three way valves with linear characteristics. Size two way valve operators to close valves against pump shut off head.
 - .4 Size for 20 kPa (3 psig) maximum pressure drop at design flow rate unless otherwise noted.
- .1 Globe Pattern:
 - .1 Manufacturer: Siemens Model Powermite/Flowrite 599.
 - .2 Other acceptable manufacturers offering equivalent products.
 - .1 Substitutions: Refer to Section 21 05 00.

- .3 Up to 2 inch (50 mm): Bronze body, brass trim, stainless steel rising stem, all metal plug and seat, EDPM packing, screwed ends.
- .4 Over 2 inches (50 mm): Cast Iron body, stainless steel trim, rising stem, plug-type disc, EDPM packing, flanged ends, renewable seat and disc.
- .5 Hydronic Systems:
 - .1 Rate for service pressure of 860 kPa at 121 degrees C (125 psig at 250 degrees F).
 - .2 Replaceable plugs and seats of brass.
 - .3 Size for 20 kPa (3 psig) maximum pressure drop at design flow rate unless otherwise noted.
 - .4 Two way valves with equal percentage characteristics, three way valves with linear characteristics. Size two way valve operators to close valves against pump shut off head.
- .2 Butterfly Pattern:
 - .1 Body: Cast or ductile iron with resilient replaceable EPDM seat, wafer or lug ends, extended neck.
 - .2 Disc: Stainless Steel.
 - .3 Hydronic Systems:
 - .1 Rate for service pressure of 860 kPa at 121 degrees C (125 psig at 250 degrees F).
 - .2 Size for 20 kPa (3 psig) maximum pressure drop at design flow rate unless otherwise noted.
- .3 Valve Operators:
 - .1 General: Provide smooth proportional control with sufficient power for full shut off at maximum pump differential pressure or maximum head pressure development from the pump, elevation and system pressure.
 - .2 Spring return to normal position as indicated on freeze, fire, or temperature protection.
 - .3 Number: Sufficient to achieve unrestricted movement throughout actuation range.
 - .4 Operators (2 Position): Synchronous motor with enclosed gear train, dual return springs, valve position indicator; 24 v DC. Valves: spring return to normal position for temperature protection.
 - .5 Operators (Modulating): Self contained, linear motorized actuator with approximately 19 mm(3/4 inch) stroke, 60 second full travel with transformer and SPDT contacts: 24 v DC,.
- .4 Combination Control and Automatic Flow Control Valve:
 - .1 Griswold Model Automizer.
 - .2 Other Acceptable Manufacturers:
 - .1 Hays Fluid Control.
 - .3 Substitutions: Not permitted.
 - .4 Integral Control / Flow Rate Limiting Valve
 - .1 Valve shall consist of a dynamic flow limiting device, an integral, electrically actuated two-way control valve, and manual isolation ball valve.
 - .5 Actuated Ball Valve
 - .1 Valve housing shall consist of forged brass, rated at no less than 360 psi at 250°F.

- .2 Flow Control: equal percentage.
- .3 Valve ball shall consist of Stainless steel.
- .4 Stem shall be removable/replaceable without removing valve from line and shall include both teflon seals and EPDM O-ring.
- .5 Valve shall have EPDM O-Rings behind ball seals to allow for a minimum close-off pressure of 100 psi with 35 in-lbs of torque for 1/2" to 1-1/2" sizes.
- .6 Valve shall be available with unique Cv values.
- .7 Valve shall be available with fixed end female or fixed end sweat connections.
- .6 Flow Limiting Valve
 - .1 Flow regulation cartridge assembly shall be precision ground, all AISI 300 series stainless steel; shall be available in four PSID control ranges; minimum range shall be capable of being actuated by less than 1.5 PSID; and shall be capable of controlling flow to within $\pm 5\%$ of rated flow.
 - .2 Flow regulation unit shall be readily accessible, for changeout or maintenance.
- .7 Valve Actuator
 - .1 Control valve actuator shall be analog modulating (4-10 mA or 2-10 V), floating (tri-state), Pulse Width Modulation, or two position as indicated in control sequence.
 - .2 Actuator shall provide minimum torque required for full valve shutoff position.
 - .3 Actuators shall be supplied with on-board terminal strip and conduit connection.
 - .4 A universal mounting plate shall allow installation of actuators meeting the system electrical requirements and valve torque requirements The control valve actuator furnished by the controls Contractor under this section.
- .8 Accessories
 - .1 Identification tags shall be available for all valves; tags shall be indelibly marked with Cv, model number, location; tags shall be 3" x 3" aluminum.

2.4 DAMPERS - MOTORIZED

- .1 Tamco Model 1500 or 9000 BF (Insulated, thermally broken frame).
- .2 Other Acceptable Manufacturers:
 - .1 Alumavent
- .3 Performance: Test to AMCA 500.
- .4 Frames: Extruded aluminum, welded or riveted with corner reinforcement, minimum 2.0 mm (0.081 inch) thick. Damper frame is 100mm (4 inch) deep.
- .5 All dampers for duct sizes with a dimension (either width or height) 300 mm (12 inches) or less shall be flanged to the duct. In-duct frames not allowed.
- .6 Blades: Extruded aluminum air foil profile, maximum blade size 150 mm (6 inches) wide, maximum blade length section 1200 mm (48 inches).

- .7 Entire frame shall be thermally broken by means of polyurethane resin pockets complete with thermal cuts.
- .8 Insulation : Internally insulated with expanded polyurethane foam and are thermally broken. Complete blade has an insulating factor of R-2.29 and a temperature index of 55.
- .9 Blade Seals: Extruded silicone mechanically attached, field replaceable.
- .10 Frame/Jamb Seals: Extruded silicone mechanically attached, field replaceable.
- .11 Bearings: Celcon inner bearing fixed to a 7/16" (11.11 mm) aluminum hexagon blade pivot pin, rotating within a polycarbonate outer bearing inserted in the frame,
- .12 Linkage: Installed in frame side and constructed of aluminum and corrosion-resistant, zinc-plated steel, complete with cup-point trunnion screws for a slip-proof grip.
- .13 Leakage: Class 1A at 0.25 kPa (1 in. w.g.) static pressure differential. Class 1 at 1 kPa (4 in. w.g.) static pressure differential. Standard air leakage data is certified under the AMCA Certified Ratings Program.
- .14 Maximum blade length Static Pressure: 1.0 kPa (4 inches wg)
- .15 Temperature Limits: -40 to 100 degrees C (-40 to 212 degrees F).

2.5 Dampers – Motorized Flow Sensing

- .1 TAMCO/EBTRON Series 2100 AIR-IQ2 or Series 2900 AIR-IQ2
 - .1 General
 - .1 Provide one AMD for each measurement location provided on the plans, schedules and/or control diagrams to determine the average airflow rate and temperature at each measurement location.
 - .2 Each AMD shall be provided with a microprocessor-based transmitter and two more sensor nodes mounted in a probe. The sensor node distribution pattern is based on a modified log Tchebycheff method.
 - .1 Devices that have electronic signal processing components on or in the sensor probe are not acceptable.
 - .3 Airflow measurement shall be field configurable to determine the average actual or standard mass airflow rate.
 - .1 Actual airflow rate calculations shall have the capability of being adjusted automatically by the transmitter for altitudes other than sea level.
 - .4 Temperature measurement shall be field configurable to determine the velocity weighted temperate or simple arithmetic average temperature.
 - .2 Sensor Probes
 - .1 Sensor probes shall be constructed of gold anodized, 6063 aluminum alloy tube.
 - .2 Sensor probe mounting brackets shall be constructed of type 304 stainless steel.
 - .3 Probe internal wiring between the connecting cable and sensor nodes shall be Kynar coated copper.
 - .1 PVC jacketed internal wiring is not acceptable.

- .4 Probe internal wiring connections shall consist of solder joints and spot welds.
 - .1 Internal wiring connections shall be sealed and protected from the elements and suitable for direct exposure to water.
 - .2 Connectors of any type within the probe are not acceptable.
 - .3 Printed circuit boards within the probe are not acceptable.
- .5 Probe internal wiring connections shall be sealed and protected from the elements and suitable for direct exposure to water.
- .6 Each sensor probe shall be provided with an integral, FEP jacket, plenum rated CMP/CL2P, UL/cUL Listed cable rated for exposures from -67°F to 392 °F (-55° C to 200° C) and continuous and direct UV exposure.
 - .1 Plenum rated PVC jacket cables are not acceptable.
- .7 Each sensor probe cable shall be provided with a connector plug with gold plated pins for connection to the transmitter.
- .8 Each sensor probe shall contain one or more independently wired sensing nodes.
- .9 Sensor node airflow and temperature calibration data shall be stored in a serial memory chip in the cable connecting plug and not require matching or adjustments to the transmitter.
- .10 Each sensor node shall be provided with two bead-in-glass, hermetically sealed thermistors potted in a marine grade waterproof epoxy. Upon request, the manufacture shall provide a written independent laboratory test result of 100% survival rate in a 30 day saltwater and acid vapor test.
 - .1 Devices that use epoxy or glass encapsulated chip thermistors are not acceptable.
- .11 Each thermistor sensor shall be individually calibrated at a minimum of 3 temperatures to NIST-traceable temperature standards.
- .12 Each sensor node shall be individually calibrated at 16 measurement points to airflow standards directly calibrated at NIST to the NIST Laser Doppler Anemometer (LDA) primary velocity standard.
 - .1 Submissions for AMD approval shall include a copy of the actual NIST report of calibration for the reference standard used.
 - .1 Devices claiming NIST traceability to third party laboratories and not directly to NIST are not acceptable
 - .2 Devices calibrated against standards other than the NIST LDA are not acceptable.
 - .3 Devices with sensors calibrated against NIST temperature standards only are not acceptable.
- .13 The number of independent sensor nodes provided shall be as follows:

Damper Area (ft2)	Total # Nodes / Location	Damper Area (m2)
≤ 1	2	≤ 0.092
> 1 & ≤ 2	4	> 0.092 & ≤ 0.185
> 2 & ≤ 4	6	> 0.185 & ≤ 0.371
> 4 & ≤ 8	8	> 0.371 & ≤ 0.743
> 8 & ≤ 12	12	> 0.743 & ≤ 1.11
> 12 & ≤ 14	14	> 1.11 & ≤ 1.30

> 14

16

> 1.30

- .14 Submittal documents shall include schedules indicating the number of sensors per location, the damper area and the equivalent density (#/area) for approval.
- .3 Transmitter
 - .1 A remotely located microprocessor-based transmitter shall be provided for each measurement location.
 - .2 The transmitter shall be comprised of a main circuit board and an interchangeable interface card.
 - .3 All printed circuit board interconnects, edge fingers, receptacle plug pins and PCB test points shall be gold plated.
 - .4 All printed circuit boards shall be electroless nickel immersion gold (ENIG) plated.
 - .5 The transmitter shall be capable of determining the airflow rate and temperature average of all connected sensor nodes in an array for a single location.
 - .1 Separate integration buffers shall be provided for display airflow output, airflow signal output (analog and network) and individual sensor output (Bluetooth).
 - .6 The transmitter shall be capable of providing a high and/or low airflow alarm.
 - .7 The transmitter shall be capable of identifying an AMD malfunction via the system status alarm and ignore any sensor node that is in a fault condition.
 - .8 The transmitter shall be provided with a 16-character, alpha-numeric, LCD display.
 - .1 The airflow rate, temperature, Hi-Lo airflow alarm and system status alarm shall be visible on the display.
 - .9 The transmitter shall be provided one of the following output options:
 - .1 two field selectable (0-5/0-10 VDC or 4-20mA), scalable, isolated and over-current protected analog output signals (AO1=airflow, AO2=temperature or alarm) and one RS-485 BACnet/Modbus connection, or
 - .2 two field selectable (0-5/0-10 VDC or 4-20mA), scalable, isolated and over-current protected analog output signals (AO1=airflow, AO2=temperature or alarm) and one Ethernet BACnet/Modbus connection, or one isolated RS-485 (field selectable BACnet MS/TP or Modbus RTU) network connection, or
 - .3 two field selectable (0-5/0-10 VDC or 4-20mA), scalable, isolated and over-current protected analog output signals (AO1=airflow, AO2=temperature or alarm) and one proprietary wireless connection to EBTRON "Commissioner" based devices, or
 - .4 One RS 485 BACnet/Modbus network connection and one Ethernet BACnet/Modbus or
 - .5 One Lonworks Free Topology network connection, or
 - .6 One thumb drive data logger (no output).

- .10 The analog output signals shall provide the total average airflow rate (AO1) and be field configurable (AO2) to output one of the following:
 - .11 temperature
 - .12 Hi-Lo airflow set point alarm, or
 - .13 system status alarm
- .14 The transmitter shall also be available with a single isolated LonWorks Free Topology network interface or alternatively with one USB connection for thumb-drive data logging of sensor data. Neither of these alternatives includes analog output signals.
- .15 Network communications shall provide: the average airflow rate, temperature, Hi-Lo airflow set point alarm, system status alarm, individual sensor node airflow rates and individual sensor node temperatures.
- .16 The transmitter shall be provided with a Bluetooth low energy interface card to interface with Android or iOS devices. Provide free Android or iOS software that allows real-time airflow and temperature monitoring and airflow and temperature traverses. Software shall capture, save or e-mail airflow and temperature data, transmitter settings and diagnostics information.
- .17 The transmitter shall be powered by 24 VAC (22.8 to 26.4 under load) @20 V-A maximum and use a switching power supply that is over-current and over-voltage protected.
- .18 The transmitter shall use a “watchdog” timer circuit to ensure continuous operation in the event of brown-out or power failure.
- .4 Performance
 - .1 Each sensing node shall have an airflow accuracy of $\pm 2\%$ of reading over an operating range of 0 to 5,000 FPM (25.4 m/s).
 - .1 Accuracy shall include the combined uncertainty of the sensor nodes and transmitter.
 - .1 Devices whose overall accuracy is based on individual accuracy specifications of the sensor probes and transmitter shall demonstrate compliance with this requirement over the entire operating range.
 - .2 Each sensing node shall have a temperature accuracy of $\pm 0.15^\circ \text{ F}$ (0.1° C) over an operating range of -20° F to 160° F . (-28.9° C to 71° C).
- .5 Listings and Certifications
 - .1 The AMD shall be UL/cUL873 Listed as an assembly.
 - .1 Devices claiming compliance with the UL Listing based on individual UL component listing are not acceptable.
 - .2 The AMD shall be BTL Listed.
 - .3 The AMD shall be tested for compliance with EMC Directive’s requirements and be certified to carry the CE Mark for European Union Shipments.
- .2 INTEGRAL CONTROL DAMPER and SLEEVE
 - .1 Provide one or more damper sections for each location indicated on the plans. Damper section(s) shall be integral to sleeve assembly.

- .2 Provide a factory-assembled, extruded aluminum (6063T5) sleeve, not less than .080" (2.03 mm) thick for each damper section. The sleeve length in the direction of airflow, including damper frame, shall be 13" (330 mm) for all applications. The sleeve shall include a 1" (25.4 mm) radius aluminum entry flare, not less than .060" (1.52 mm) thick. Provide an additional 7" (178 mm) between the downstream edge of an intake louver and the leading edge of the sleeve for outside air intake applications that are close-coupled to intake louvers.
- .3 Provide extruded aluminum (6063T5) damper frames, not less than .080" (2.03 mm) thick and 4" (102 mm) deep. Frame to be assembled using mounting fasteners. Welded frames shall not be acceptable.
- .4 Provide extruded aluminum (6063T5) damper blade profiles. Blade seals shall be extruded silicone. Frame seals shall be extruded silicone. Seals shall be mechanically fastened to prevent shrinkage and movement over the life of the damper. Adhesive or clip-on type blade seals will not be approved.
- .5 Bearings shall be a dual bearing system composed of a Celcon inner bearing, fixed around a 7/16" (11.1 mm) aluminum hexagon blade pivot pin, rotating within a polycarbonate outer bearing inserted in the frame. Single axle bearing, rotating in an extruded or punched hole shall not be acceptable.
- .6 Hexagonal control shaft shall be 7/16" (11.1 mm). It shall have an adjustable length and shall be an integral part of the blade axle. A field-applied control shaft shall not be acceptable.
- .7 Linkage hardware shall be installed in the frame side and constructed of aluminum and corrosion resistant, zinc-plated steel, complete with cup-point trunnion screws for a slip-proof grip.
- .8 Dampers shall be AMCA rated for Leakage Class 1A at 1 in w.g. (0.25 kPa) static pressure differential. Standard air leakage data to be certified under the AMCA Certified Ratings Program.
- .9 Dampers shall be available with either opposed blade action or parallel blade action and shall be custom made to required size, with blade stops not exceeding 1¼" (31.7 mm) in height.
- .10 Dampers shall be designed for operation in temperatures ranging between -72 °F (-57.8 °C) and 212 °F (100 °C). Note that the temperature range for the airflow measuring device differs.

2.6 Damper Operators

- .1 General: Provide smooth proportional control with sufficient power for air velocities 20 percent greater than maximum design velocity and to provide tight seal against maximum system pressures. Provide spring return for two position control and for fail safe operation.
- .2 Electric Operators:
- .3 Acceptable manufacturers.
 - .1 Belimo
 - .2 Siemens
 - .3 Honeywell
 - .4 Schneider Electric
 - .5 Johnson Controls

- .4 Substitutions: Refer to Section 21 05 00.
- .5 Spring return, adjustable stroke motor having oil immersed gear train, with auxiliary end switch minimum position potentiometer
- .6 Number: Sufficient to achieve unrestricted movement throughout damper range.

2.7 Humidistats

- .1 Humidistats: (Crawlspace)
 - .1 Manufacturer: Honeywell Model H46.
 - .1 Substitutions: Refer to Section 21 05 00.
 - .2 Line voltage, wall mounted
 - .3 Throttling range: Adjustable 4-6 percent relative humidity.
 - .4 Operating range: 20 to 80 percent.
 - .5 Maximum temperature: 43 degrees C (110 degrees F).
 - .6 Cover: Set point indication.

2.8 INPUT/OUTPUT SENSORS

- .1 Temperature:
 - .1 Resistance temperature detectors with resistance tolerance of plus or minus 0.1 percent at 21 degrees C (70 degrees F), interchangeability less than plus or minus 0.2 percent, time constant of 13 seconds maximum for fluids and 200 seconds maximum for air.
 - .2 Measuring current maximum 5 mA with maximum self-heat of 0.017 degrees C/mW(0.031 degrees F/mW) in fluids and 0.008 degrees C/mW(0.014 degrees F/mW) in air.
 - .3 Provide 3 lead wires and shield for input bridge circuit.
 - .4 Use insertion elements in ducts not affected by temperature stratification or smaller than one square metre. Use averaging elements where larger or prone to stratification sensor length 2.5 m(8 feet) or 5 m(16 feet) as required.
 - .5 Insertion elements for liquids: with brass socket, minimum insertion length of 60 mm(2-1/2 inches).
 - .6 Room sensors: Locking cover.
 - .7 Outside air sensors: Watertight inlet fitting, shielded from direct rays of sun.
 - .8 Room security sensors: Stainless steel cover plate with insulated back and security screws.
- .2 Humidity Sensors:
 - .1 Elements: Accurate within 5 percent full range with linear output.
 - .2 Room Sensors: With locking cover, span of 10 to 80 percent relative humidity
 - .3 Duct and Outside Air Sensors: With element guard and mounting plate, range of 0 100 percent relative humidity.
- .3 Static Pressure Sensors:
 - .1 Unidirectional with ranges not exceeding 150 percent of maximum expected input.
 - .2 Temperature compensate with typical thermal error or 0.06 percent of full scale in temperature range of 5 to 40 degrees C (40 to 100 degrees F).
 - .3 Accuracy: One percent of full scale with repeatability 0.3 percent.
 - .4 Output: 0 - 5 vdc with power at 12 to 28 vdc.

- .4 Equipment Operation Sensors:
 - .1 Status Inputs for Fans: Differential pressure switch with adjustable range of 0 to 1250 Pa (0 to 5 inches wg).
 - .2 Status Inputs for Pumps: Differential pressure switch piped across pump with adjustable pressure differential range of 50 to 400 kPa (8 to 60 psi).
 - .3 Status Inputs for Electric Motors: Current sensing relay with current transformers, adjustable and set to 175 percent of rated motor current.
- .5 Damper Position Indication: Potentiometer mounted in enclosure with adjustable crank arm assembly connected to damper to transmit 0 - 100 percent damper travel.

2.9 GAS DETECTION AND CONTROL SYSTEM

- .1 Products:
 - .1 Detectors: E3Point transmitter for detection sensors for carbon monoxide and methane.
 - .2 Transmitter will be powered by 24 V AC/DC (E3SA) The gas transmitter must be capable of monitoring a second gas when equipped with an E3SRM remote sensor. The gas transmitter will incorporate an electrochemical cell for toxic gas monitoring and catalytic bead sensor for combustible gases. Unit sensing cell must compensate for variations in relative humidity and temperature to maintain high levels of accuracy.
 - .3 The transmitter will be capable of transmitting gas concentrations to a DDC system through its 4-20 mA output. For local activation of fans or louvers (or other equipment), two on-board DPDT relays 5 A, 30 Vdc or 250 Vac (resistive load) will be activated at programmable set points (and programmable time delays). An LCD display will provide local gas concentration readings.
 - .4 Transmitter will be capable of operating within relative humidity ranges of 5-95% non-condensing and temperature ranges of -4° F to 104° F (-20° C to 40° C).
 - .5 Unit will be certified to ANSI/UL 61010-1 label and CAN/CSA-C22.2 No. 61010-1. Transmitter must be manufactured in an ISO 9001-2000 production environment.
 - .6 The transmitter should have a plug-in capability for a gas cartridge with a smart sensor capable of self-testing.
 - .7 For local activation of audible alarms, the transmitter shall have an on-board device able to generate an audible output of 85 dBA @ 10 ft (3m).
 - .8 Strobe & Horn unit will be capable of operating within relative humidity ranges of 0-100% and temperature ranges of -30° F to 150° F (-35° C to 66° C). Rating of horn will be no less than 72dBA at 10 feet. Intensity of light will be no less than 40W and will flash at a frequency of 1 per second. Unit will be certified by CSA. Honeywell Analytics.

Detector alarm levels are to be activated and the unit is to be installed in accordance with the following parameters:

GASES	1st ALARM SET POINT (TLV-TWA)	2nd ALARM SET POINT (TLV-STEL)	3rd ALARM SET POINT	MOUNTING HEIGHT	COVERAGE RADIUS
Carbon Monoxide (CO)	25 PPM	100 PPM	200 PPM	5 ft (150 cm)above finished floor	50 ft (15 m)

Methane (CH4)	25% LEL	50% LEL	90% LEL	1 ft (30 cm) from ceiling	23ft (7m)
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- .2 Accessories
 - .1 Strobe and Horn type STAS for 24Vac, FHS-240 for 24 Vdc or STACKSTAS for 120 Vac
 - .1 Strobe & Horn unit will be capable of operating within relative humidity ranges of 0-100% and temperature ranges of -30° F to 150° F (-35° C to 66° C). Rating of horn will be no less than 72dBA at 10 feet. Intensity of light will be no less than 40W and will flash at a frequency of 1 per second. Unit will be certified by CSA. Honeywell Analytics.
 - .2 Power Transformer type T100VA, T200VA, T300VA or Class 2 device type T100VAC2, T200VAC2 or T300VAC2
 - .1 Transformer shall have an input voltage of 120 V AC and an output voltage of 24 Vac with a VA range of 50-300. Operating frequency shall be 60 Hz. Unit will provide insulation systems up to 130° C (50-1300 VA). Unit will operate at sound levels of less than 40 dBA. Transformers shall be of fused type.
 - .3 Detector Guards
 - .1 Detector Guards E3PT- GUARD
 - .1 The grid is made of a 9-gauge steel wire. The guard must be designed to allow calibration without removing the guards.
 - .2 Splash Guards ECLAB
 - .1 Metal protective enclosure with clear plastic removable cover.

2.10 THERMOSTATS (DDC)

- .1 Digital Room Thermostats (Commercial):
 - .1 Digital display
 - .2 Humidity Sensing
 - .3 CO2 Sensing

2.11 Time Clocks

- .1 Seven day programming switch timer with synchronous timing motor and seven day dial, continuously charged Ni-cad battery driven power failure 8 hour carry over and multiple switch trippers to control systems for minimum of two and maximum of eight signals per day with two normally open and two normally closed output switches.
- .2 Solid state programmable time control with multiple separate programs, 24 hour battery carry over duty cycling, individual on/off/auto switches for each program, 7 day programming, 365 day calendar with 20 programmable holidays choice of fail safe operation for each program, system fault alarm.

2.12 Transmitters

- .1 Building Static Pressure Transmitter:

- .1 One pipe, differential type with temperature compensation, scale range 2.5 to 1500 kPa (0.01 to 6.0 inch wg) positive or negative, and sensitivity of 0.125 kPa (0.0005 inch wg). Transmit electronic pneumatic signal to receiver with matching scale range.
- .2 Pressure Transmitters:
 - .1 One pipe direct acting for gas, liquid, or steam service, range suitable for system, proportional electronic output.
- .3 Temperature Transmitters:
 - .1 One pipe, directly proportional output signal to measured variable, linearity within plus or minus 1/2 percent of range for 93 degrees C (200 degree F) span and plus or minus 1 percent for 10 degrees C (50 degree F) span, with 10 degree C (50 degrees F) 38 degree C (100 degrees F), 93 degree C (200 degrees F) temperature range, compensated bulb, averaging capillary, or rod and tube operation on 138 kPa (20 psig) input pressure and 20 to 100 kPa (3 to 15 psig) output.
- .4 Humidity Transmitters:
 - .1 One pipe, directly proportioned output signal to measured variable, linearity within plus or minus 1 percent for 70 percent relative humidity span, capable of withstanding 95 percent relative humidity without loss of calibration.

2.13 Relays.

- .1 Control Relays. Control relays shall be plug-in type, ULC/CSA listed, and shall have dust cover and LED "energized" indicator. Contact rating, configuration, and coil voltage shall be suitable for application.
- .2 Time Delay Relays. Time delay relays shall be solid-state plug-in type, UL listed, and shall have adjustable time delay. Delay shall be adjustable $\pm 100\%$ from setpoint shown. Contact rating, configuration, and coil voltage shall be suitable for application. Provide NEMA 1 enclosure for relays not installed in local control panel.

2.14 Current Transformers.

- .1 AC current transformers shall be UL/CSA recognized and shall be completely encased (except for terminals) in approved plastic material.
- .2 Transformers shall be available in various current ratios and shall be selected for $\pm 1\%$ accuracy at 5 A full-scale output.
- .3 Use fixed-core transformers for new wiring installation and split-core transformers for existing wiring installation.

2.15 Voltage Transformers.

- .1 AC voltage transformers shall be UL/CSA recognized, 600 Vac rated, and shall have built-in fuse protection.
- .2 Transformers shall be suitable for ambient temperatures of 4°C-55°C (40°F-130°F) and shall provide $\pm 0.5\%$ accuracy at 24 Vac and 5 VA load.
- .3 Windings (except for terminals) shall be completely enclosed with metal or plastic.

2.16 Current Switches.

- .1 Current-operated switches shall be self-powered, solid-state with adjustable trip current. Select switches to match application current and DDC system output requirements.

Part 3 Execution

3.1 Examination

- .1 Verify that systems are ready to receive work.
- .2 Beginning of installation means installer accepts existing conditions.
- .3 Sequence work to ensure installation of components is complementary to installation of similar components in other systems.
- .4 Coordinate installation of system components with installation of mechanical systems equipment such as air handling units and air terminal units.
- .5 Ensure installation components are complementary to installation of similar components.
- .6 Coordinate installation of system components with installation of mechanical systems equipment such as air handling units and air terminal units.
- .7 The Contractor shall examine the drawings and specifications for other parts of the work. If head room or space conditions appear inadequate — or if any discrepancies occur between the plans and the Contractor's work, and the plans and the work of others — the Contractor shall report these discrepancies to the Contract Administrator and shall obtain written instructions for any changes necessary to accommodate the Contractor's work with the work of others. Any changes in the work covered by this specification made necessary by the failure or neglect of the Contractor to report such discrepancies shall be made by — and at the expense of — this Contractor.

3.2 Installation

- .1 Install to manufacturers written instructions.
- .2 Check and verify location of thermostats humidistats CO2 Detectors and other exposed control sensors with plans and room details before installation. Locate 1 200 mm (47 inches) above floor. Align with lighting switches and humidistats.
- .3 Mount freeze protection thermostats using flanges and element holders.
- .4 Mount outdoor reset thermostats and outdoor sensors indoors, with sensing elements outdoors with sun and wind shield.
- .5 Provide separable sockets for liquids and flanges for air bulb elements. Refer to Section 23 05 19.
- .6 Provide thermostats in aspirating boxes in front entrances gymnasiums and corridors.
- .7 Provide guards or password protection on thermostats in entrances and other public areas.
- .8 Provide valves with position indicators and with pilot positioners where sequenced with other controls.

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- .9 Provide isolation (two position) dampers of parallel blade construction.
 - .10 Provide control (modulating position) dampers of opposed blade construction.
 - .11 Install damper motors on outside of duct in warm areas. Do not install motors in locations at outdoor temperatures.
 - .12 Coordinate location of the differential pressure sensor as shown on the drawings. If not shown on the drawings locate the pressure sensor at the furthest and most flow demanding pipe branch in the system. Show location on shop drawings and on GUI.
 - .13 Mount control panels adjacent to associated equipment on vibration free walls or free standing angle iron supports. One cabinet may accommodate more than one system in same equipment room. Provide engraved plastic nameplates for instruments and controls inside cabinet and engraved plastic nameplates on cabinet face.
 - .14 Install "hand/off/auto" selector switches to override automatic interlock controls when switch is in "hand" position.
 - .15 Provide conduit and electrical wiring to Section 26 05 80. Electrical material and installation to appropriate requirements of Division 16.
 - .16 Gas detection installation
 - .1 After installation of gas detection, test and calibrate equipment to demonstrate operation of functions described above under sequence of operation by manufactures certified service technician or authorized agent complete with commissioning reports

3.3 Manufacturer's Field Services

- .1 Section 21 05 00: Prepare and start systems.
- .2 Start and commission systems. Allow sufficient time for start-up and commissioning prior to placing control systems in permanent operation.

3.4 Demonstration And Instructions

- .1 Section 21 05 00: Demonstrating installed work.
- .2 Demonstrate complete and operating system to The City.

END OF SECTION

Part 1

General

1.1 Section Includes

- .1 Control equipment.
- .2 Software.

1.2 Related Sections

- .1 Section 25 30 00 - Instruments And Control Elements.
- .2 Section 25 90 00 - Sequence Of Operation.
- .3 Section 26 05 80 - Equipment Wiring: Electrical characteristics and wiring connections.
- .4 REFERENCES
- .5 NEMA EMC1 - Energy Management Systems Definitions.
- .6 NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).
- .7 NFPA 90A - Installation of Air Conditioning and Ventilation Systems.
- .8 ASHRAE Standard 135-2012 -- BACnet®--A Data Communication Protocol for Building Automation and Control Networks

1.3 System Description

- .1 Automatic temperature control field monitoring and control system using field programmable micro-processor based units with communications to Building Management System specified in Section 25 30 00.
- .2 Base system on distributed system of fully intelligent, stand-alone controllers, operating in a multi-tasking, multi-user environment on token passing network, with central and remote hardware, software, and interconnecting wire and conduit.
- .3 Include computer software and hardware, operator input/output devices, control units, local area networks (LAN), sensors, control devices, actuators.
- .4 Controls for variable air volume terminals, radiation, reheat coils, unit heaters, fan coils, and the like when directly connected to the control units. Individual terminal unit control is specified in Section 23 36 00.
- .5 Provide control systems consisting of thermostats, control valves, dampers and operators, indicating devices, interface equipment and other apparatus and accessories required to operate mechanical systems, and to perform functions specified.
- .6 Include installation and calibration, supervision, adjustments, and fine tuning necessary for complete and fully operational system.

1.4 Submittals For Review

- .1 Section 21 05 00: Procedures for submittals.
- .2 Product Data: Provide data for each system component and software module.
- .3 Shop Drawings:
 - .1 Indicate trunk cable schematic showing programmable control unit locations, and trunk data conductors.

- .2 List connected data points, including connected control unit and input device.
- .3 Indicate system graphics indicating monitored systems, data (connected and calculated) point addresses, and operator notations.
- .4 Show system configuration with peripheral devices, batteries, power supplies, diagrams, modems, and interconnections.
- .5 Indicate description and sequence of operation of operating, user, and application software.
- .6 Ensure terminology used in submittals conforms to [NEMA EMC1].

1.5 Submittals For Information

- .1 Section 21 05 00: Submittals for information.
- .2 Manufacturer's Instructions: Indicate manufacturer's installation instructions for all manufactured components.

1.6 Submittals At Project Closeout

- .1 Section 21 05 00: Submittals for project closeout.
- .2 Project Record Documents: Record actual locations of control components, including control units, thermostats, and sensors.
 - .1 Revise shop drawings to reflect actual installation and operating sequences.
 - .2 Include data specified in "Submittals" in final "Record Documents" form.
- .3 Operation and Maintenance Data:
 - .1 Include interconnection wiring diagrams complete field installed systems with identified and numbered, system components and devices.
 - .2 Include keyboard illustrations and step-by-step procedures indexed for each operator function.
 - .3 Include inspection period, cleaning methods, cleaning materials recommended, and calibration tolerances.
- .4 Warranty: Submit manufacturers warranty and ensure forms have been filled out in The City's name and registered with manufacturer.

1.7 Quality Assurance

- .1 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented install experience.
- .2 Installer Qualifications: Company specializing in performing the work of this section with documented experience and approved by manufacturer.
- .3

1.8 Regulatory Requirements

- .1 Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. or testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

1.9 WARRANTY

- .1 Section 21 05 00: Submittals for project closeout.

.2 Correct defective Work within one year period after Substantial Completion.

.3 Provide five year manufacturer's warranty for field programmable micro-processor based units.

1.10 Extra Materials

.1 Section 21 05 00: Submittals for project closeout.

1.11 Protection Of Software Rights

.1 Prior to delivery of software, The City and the party providing the software will enter into a software license agreement with provisions for the following:

.1 Limiting use of software to equipment provided under these specifications.

.2 Limiting copying.

.3 Preserving confidentiality.

.4 Prohibiting transfer to a third party.

Part 2 Products

2.1 APPROVED AGENCIES

.1 Automated Logic - Integrated Control Systems Inc. to match existing building system.

2.2 Operator Station

.1 All workstations shall be new. The requirements below are a minimum standard.

.2 Work Station: Minimum Requirements

.1 Configuration: PC with Intel iCore based microcomputer system or better.

.2 Minimum memory: 4 Gb RAM.

.3 Display: (22 inch) LED monitor

.4 Keyboard: Low profile, detachable, having Qwerty layout plus a 10 key numeric keypad, dedicated function keys.

.5 CD/DVD Drive:

.6 USB 2.0 & 3.0: Minimum two in front, two in back

.7 Hard disk drive: 500 Gb.

.8 Mouse: Software supported mouse with support software including self building menus and displays of system operations and functions.

.9 Network: Internal type 1000 Mbps

.10 Modem: Internal type modem or proprietary data modem with cables and communication interfaces required to provide the specified functions, minimum 56,000 bps rate.

.11 Printer: Support colour printer.

.12 Operating System: Windows 7 or later.

.3 Printer:

.1 Ink jet type, colour, capable of printing portrait or landscape, A3(11 x 17 inch) maximum paper size.

.2 Paper: Minimum 50 sheets.

.4 System Support: Minimum ten (10) work stations connected to multi-user, multi-tasking environment with concurrent capability to:

.1 Access DDC network.

.2 Access or control same control unit.

- .3 Access or modify same control unit data base.
- .4 Archive data, alarms, and network actions to hard disk regardless of what application programs are being currently executed.
- .5 Develop and edit data base.
- .6 Implement and tune DDC control.
- .7 Develop graphics.
- .8 Control facility.

2.3 Control Units

- .1 Units: Modular in design and consisting of processor board with programmable RAM memory, local operator access and display panel, and integral interface equipment.
- .2 Battery Backup: For minimum of 48 hours for complete system including RAM without interruption, with automatic battery charger.
- .3 Control Units Functions:
 - .1 Monitor or control each input/output point.
 - .2 Completely independent with hardware clock/calendar and software to maintain control independently.
 - .3 Acquire, process, and transfer information to operator station or other control units on network.
 - .4 Accept, process, and execute commands from other control unit's or devices or operator stations.
 - .5 Access both data base and control functions simultaneously.
 - .6 Record, evaluate, and report changes of state or value that occur among associated points. Continue to perform associated control functions regardless of status of network.
 - .7 Perform in stand-alone mode:
 - .1 Start/stop.
 - .2 Duty cycling.
 - .3 Automatic Temperature Control.
 - .4 Demand control via a sliding window, predictive algorithm.
 - .5 Event initiated control.
 - .6 Calculated point.
 - .7 Scanning and alarm processing.
 - .8 Full direct digital control.
 - .9 Trend logging.
 - .10 Global communications.
 - .11 Maintenance scheduling.
- .4 Data Communication Protocol
 - .1 BACnet
- .5 Global Communications:
 - .1 Broadcast point data onto network, making that information available to all other system control units.
 - .2 Transmit any or all input/output points onto network for use by other control units and utilize data from other control units.
- .6 Input/Output Capability:
 - .1 Discrete/digital input (contact status).

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- .2 Discrete/digital output.
 - .3 Analog input.
 - .4 Analog output.
 - .5 Pulse input (5 pulses/second).
 - .6 Pulse output (0-655 seconds in duration with 0.01 second resolution).
 - .7 Monitor, control, or address data points. Include analog inputs, analog outputs, pulse inputs, pulse outputs and discrete inputs/outputs, as required. Install control unit's with minimum 30 percent spare capacity.
 - .8 Point Scanning: Set scan or execution speed of each point to operator selected time from 1 to 250 seconds.
 - .9 Upload/Download Capability: Download from or upload to operator station. Upload/Download time for entire control unit database maximum 10 seconds on hard wired LAN, or 60 seconds over voice grade phone lines.
 - .10 Test Mode Operation: Place input/output points in test mode to allow testing and developing of control algorithms on line without disrupting field hardware and controlled environment. In test mode:
 - .1 Inhibit scanning and calculation of input points. Issue manual control to input points (set analog or digital input point to operator determined test value) from work station.
 - .2 Control output points but change only data base state or value; leave external field hardware unchanged.
 - .3 (1) Enable control actions on output points but change only data base state or value.
 - .11 Local display and adjustment panel: Portable control unit, containing digital display, and numerical keyboard. Display and adjust:
 - .1 Input/output point information and status.
 - .2 Controller set points.
 - .3 Controller tuning constants.
 - .4 Program execution times.
 - .5 High and low limit values.
 - .6 Limit differential.
 - .7 Set/display date and time.
 - .8 Control outputs connected to the network.
 - .9 Automatic control outputs.
 - .10 Perform control unit diagnostic testing.
 - .11 Points in "Test" mode.

2.4 Local Area Networks (lan):

- .1 Provide communication between control units over local area network (LAN).
- .2 LAN Capacity: Not less than the require stations or nodes to complete the installation.
- .3 Break in Communication Path: Alarm and automatically initiate LAN reconfiguration.
- .4 LAN Data Speed: Minimum 1000 Mbps.
- .5 Communication Techniques: Allow interface into network by multiple operation stations and by auto-answer/auto-dial modems. Support communication over telephone lines utilizing modems.

- .6 Transmission Median: Fibre optic. Ethernet Cat 6 or single pair of solid 24 gauge twisted, shielded copper cable(MS/TP).
 - .1 MS/TP
 - .1 Daisy chain maximum, 20 nodes/controls
 - .2 Baud Rate: Minimum of 57600 bps 115200 bps
- .7 Network Support: Less than 3 seconds for global point to be received by any station. Automatically reconfigure if any station is added or lost. If transmission cable is cut, reconfigure two sections with no disruption to system's operation, without operator intervention.

2.5 Operating System Software

- .1 Input/Output Capability From Operator Station:
 - .1 Request display of current values or status in tabular or graphic format.
 - .2 Command selected equipment to specified state.
 - .3 Initiate logs and reports.
 - .4 Change analog limits.
 - .5 Add, delete, or change points within each control unit or application routine.
 - .6 Change point input/output descriptors, status, alarm descriptors, and engineering unit descriptors.
 - .7 Add new control units to system.
 - .8 Modify and set up maintenance scheduling parameters.
 - .9 Develop, modify, delete or display full range of colour graphic displays.
 - .10 Automatically archive select data even when running third party software.
 - .11 Provide capability to sort and extract data from archived files and to generate custom reports.
 - .12 Support two printer operations.
 - .1 Alarm printer: Print alarms, operator acknowledgements, action messages, system alarms, operator sign-on and sign-off.
 - .2 Data printer: Print reports, page prints, and data base prints.
 - .13 Select daily, weekly or monthly as scheduled frequency to synchronize time and date in digital control units. Accommodate daylight savings time adjustments.
 - .14 Print selected control unit data base.
- .2 Operator System Access: Via software password with minimum 30 access levels at work station and minimum 3 access levels at each control unit.
- .3 Data Base Creation and Support: Use standard procedures for changes. Automatically check work station data base files upon connection and verify data base match.
Minimum capability:
 - .1 Add and delete points.
 - .2 Modify any point parameter.
 - .3 Change, add, or delete English language descriptors.
 - .4 Add, modify, or delete alarm limits.
 - .5 Add, modify, or delete points in start/stop programs, trend logs, etc.
 - .6 Create custom relationship between points.
 - .7 Create or modify DDC loops and parameters.
 - .8 Create or modify override parameters.
 - .9 Add, modify, and delete any applications program.
 - .10 Add, delete, develop, or modify dynamic colour graphic displays.

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- .4 Dynamic Colour Graphic Displays:
 - .1 Utilizes custom symbols or system supported library of symbols.
 - .2 Sixteen (16) colours.
 - .3 Sixty (60) outputs of real time, live dynamic data per graphic.
 - .4 Dynamic graphic data.
 - .5 1,000 separate graphic pages.
 - .6 Modify graphic screen refresh rate between 1 and 60 seconds.

 - .5 Operator Station:
 - .1 Accept data from LAN as needed without scanning entire network for updated point data.
 - .2 Interrogate LAN for updated point data when requested.
 - .3 Allow operator command of devices.
 - .4 Allow operator to place specific control units in or out of service.
 - .5 Allow parameter editing of control units.
 - .6 Store duplicate data base for every control unit and allow down loading while system is on line.
 - .7 Control or modify specific programs.
 - .8 Develop, store and modify dynamic colour graphics.
 - .9 Provide data archiving of assigned points and support overlay graphing of this data utilizing up to four (4) variables.

 - .6 Alarm Processing:
 - .1 Off normal condition: Cause alarm and appropriate message, including time, system, point descriptor, and alarm condition. Select alarm state/value and determine which alarms cause automatic dial-out.
 - .2 Critical alarm or change-of-state: Display message, stored on disk for review and sort, or print.
 - .3 Print on line changeable message, up to 60 characters minimum in length, for each alarm point specified.
 - .4 Display alarm reports on video. Display multiple alarms in order of occurrence.
 - .5 Define time delay for equipment start-up or shutdown.
 - .6 Allow unique routing of specific alarms.
 - .7 Operator specifies if alarm requires acknowledgement.
 - .8 Continue to indicate unacknowledged alarms after return to normal.
 - .9 Alarm notification:
 - .1 Automatic print.
 - .2 Display indicating alarm condition.
 - .3 Selectable audible alarm indication.

 - .7 Event Processing: Automatically initiate commands, user defined messages, take specific control actions or change control strategy and application programs resulting from event condition. Event condition may be value crossing operator defined limit, change-of-state, specified state, or alarm occurrence or return to normal.

 - .8 Automatic Restart: Automatically restart field equipment on restoration of power. Provide time delay between individual equipment restart and time of day start/stop.

 - .9 Messages:
 - .1 Automatically display or print user-defined message subsequent to occurrence of selected events.
 - .2 Compose, change, or delete any message.

- .3 Display or log any message at any time.
- .4 Assign any message to any event.
- .10 Reports:
 - .1 Manually requested with time and date.
 - .2 Long term data archiving to hard disk.
 - .3 Automatic directives to download to transportable media such as floppy diskettes for storage.
 - .4 Data selection methods to include data base search and manipulation.
 - .5 Data extraction with mathematical manipulation.
 - .6 Allow development of XY curve plotting, tabular reports (both statistical and summary), and multi-point timed based plots with not less than four (4) variables displayed.
 - .7 Generating reports either normally at operator direction, or automatically under work station direction.
 - .8 Reports may either manually displayed or printed, or may be printed automatically on daily, weekly, monthly, yearly or scheduled basis.
 - .9 Include capability for statistical data manipulation and extraction.
 - .10 Provide capability to generate four types of reports: Statistical detail reports, summary reports, trend graphic plots, x-y graphic plots.
- .11 Parameter Save/Restore: Store most current operating system, parameter changes, and modifications on disk or diskette.
- .12 Data Collection:
 - .1 Automatically collect and store in disk files.
 - .2 Daily electrical energy consumption, peak demand, and time of peak demand for up to 30 electrical meters over 2 year period.
 - .3 Daily consumption for up to 30 meters over a 2 year period.
 - .4 Daily billable electrical energy consumption and time for up to 1024 zones over a 10 year period.
 - .5 Provide archiving of stored data for use with system supplied custom reports.
- .13 Graphic Display: Support graphic development on work station with software features:
 - .1 Page linking.
 - .2 Generate, store, and retrieve library symbols.
 - .3 Single or double height characters.
 - .4 Sixty (60) dynamic points of data per graphic page.
 - .5 Pixel level resolution.
 - .6 Animated graphics for discrete points.
 - .7 Analog bar graphs.
 - .8 Display real time value of each input or output line diagram fashion.
- .14 Maintenance Management:
 - .1 Run time monitoring, per point.
 - .2 Maintenance scheduling targets with automatic annunciation, scheduling and shutdown.
 - .3 Equipment safety targets.
 - .4 Display of maintenance material and estimated labour.
 - .5 Target point reset, per point.
- .15 Advisories:

- .1 Summary which contains status of points in locked out condition.
- .2 Continuous operational or not operational report of interrogation of system hardware and programmable control units for failure.
- .3 Report of power failure detection, time and date.
- .4 Report of communication failure with operator device, field interface unit, point, programmable control unit.

2.6 Load Control Programs

- .1 General: Support inch-pounds and S.I. metric units of measurement.
- .2 Duty Cycling:
 - .1 Periodically stop and start loads, based on space temperature, and according to various On/Off patterns.
 - .2 Modify off portion of cycle based on operator specified comfort parameters. Maintain total cycle time by increasing on portion of cycle by same amount that off portion is reduced.
 - .3 Set and modify following parameters for each individual load.
 - .1 Minimum and maximum Off time.
 - .2 On/Off time in one minute increments.
 - .3 Time period from beginning of interval until load can be cycled.
 - .4 Manually override the DCC program and place a load in an On or Off state.
 - .5 Cooling Target Temperature and Differential.
 - .6 Heating Target Temperature and Differential.
 - .7 Cycle off adjustment.
- .3 Automatic Time Scheduling:
 - .1 Self-contained programs for automatic start/stop/scheduling of building loads.
 - .2 Support up to seven (7) normal day schedules, seven (7) "special day" schedules and two (2) temporary day schedules.
 - .3 Provide capacity for 30 unique date/duration special days schedule.
 - .4 Any number of loads assigned to any time program; each load can have individual time program.
 - .5 Each load assigned at least 16 control actions per day with 1 minute resolution.
 - .6 Time schedule operations may be:
 - .1 Start.
 - .2 Optimized Start.
 - .3 Stop.
 - .4 Optimized Stop.
 - .5 Cycle.
 - .6 Optimized Cycle.
 - .7 Minimum of 30 holiday periods up to 100 days in length may be specified for the year.
 - .8 Create temporary schedules.
 - .9 Broadcast temporary "special day" date and duration.
- .4 Start/Stop Time Optimization:
 - .1 Perform optimized start/stop as function of outside conditions, inside conditions, or both.
 - .2 Adaptive and self-tuning, adjusting to changing conditions unattended.

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- .3 For each point under control, establish and modify:
 - .1 Occupancy period.
 - .2 Desired temperature at beginning of occupancy period.
 - .3 Desired temperature at end of occupancy period.
 - .5 Night Setback/Setup Program: Reduce heating space temperature set point or raise cooling space temperature set point during unoccupied hours; in conjunction with scheduled start/stop and optimum start/stop programs.
 - .6 Calculated Points: Define calculations and totalization computed from monitored points (analog/digital points), constants, or other calculated points.
 - .1 Employ arithmetic, algebraic, Boolean, and special function operations.
 - .2 Treat calculated values like any other analog value, use for any function that a "hard wired point" might be used.
 - .7 Event Initiated Programming: Event may be initiated by any data point, causing series of controls in a sequence.
 - .1 Define time interval between each control action between 0 to 3600 seconds.
 - .2 Output may be analog value.
 - .3 Provide for "skip" logic.
 - .4 Verify completion of one action before proceeding to next. If not verified, skip to next action.
 - .8 Direct Digital Control: Provide each control unit with Direct Digital Control software so that the operator may customize control strategies and sequences of operation by defining the appropriate control loop algorithms and choosing the optimum loop parameters.
 - .1 Control loops: Defined using "modules" that are analogous to standard control devices.
 - .2 Output: Paired or individual digital outputs for pulse-width modulation, and analog outputs, as required.
 - .3 Firmware:
 - .1 PID with analog or pulse-width modulation output.
 - .2 Floating control with pulse-width modulated outputs.
 - .3 Two-position control.
 - .4 Primary and secondary reset schedule selector.
 - .5 Hi/Lo signal selector.
 - .6 Single pole double throw relay.
 - .7 Single pole double throw time delay relay with delay before break, delay before make and interval time capabilities.
 - .4 Direct Digital Control loops: Downloaded upon creation or on operator request. On sensor failure, execute user defined failsafe output.
 - .5 Display: Value or state of each of the lines which interconnect DDC modules.
 - .9 Fine Tuning Direct Digital Control PID or floating loops:
 - .1 Display information:
 - .1 Control loop being tuned
 - .2 Input (process) variable
 - .3 Output (control) variable
 - .4 Set point of loop
 - .5 Proportional band
 - .6 Integral (reset) Interval

- .7 Derivative (rate) Interval
- .2 Display format: Graphic, with automatic scaling; with input and output variable superimposed on graph of "time" vs "variable".
- .10 Trend logging:
 - .1 Each control unit will store samples of control unit's data points.
 - .2 Update file continuously at discretely assignable intervals.
 - .3 Automatically initiate upload request and then store data on hard disk.
 - .4 Time synchronize sampling at operator specified times and intervals with sample resolution of one minute.
 - .5 Co-ordinate sampling with on/off state of specified point.
 - .6 Display trend samples on work station in graphic format. Automatically scale trend graph with minimum 60 samples of data in plot of time vs data.

2.7 HVAC CONTROL PROGRAMS

- .1 General:
 - .1 Support Inch-pounds and S.I. metric units of measurement.
 - .2 Identify each HVAC Control system.
- .2 Optimal Run Time:
 - .1 Control start-up and shutdown times of HVAC equipment for both heating and cooling.
 - .2 Base on occupancy schedules, outside air temperature, seasonal requirements, and interior room mass temperature.
 - .3 Start-up systems by using outside air temperature, room mass temperatures, and adaptive model prediction for how long building takes to warm up or cool down under different conditions.
 - .4 Use outside air temperature to determine early shut down with ventilation override.
 - .5 Analyze multiple building mass sensors to determine seasonal mode and worse case condition for each day.
 - .6 Operator commands:
 - .1 Define term schedule
 - .2 Add/delete fan status point.
 - .3 Add/delete outside air temperature point.
 - .4 Add/delete mass temperature point.
 - .5 Define heating/cooling parameters.
 - .6 Define mass sensor heating/cooling parameters.
 - .7 Lock/unlock program.
 - .8 Request optimal run time control summary.
 - .9 Request optimal run time mass temperature summary.
 - .10 Request HVAC point summary.
 - .11 Request HVAC saving profile summary.
 - .7 Control Summary:
 - .1 HVAC Control system begin/end status.
 - .2 Optimal run time lock/unlock control status.
 - .3 Heating/cooling mode status.
 - .4 Optimal run time schedule.
 - .5 Start/Stop times.
 - .6 Selected mass temperature point ID.

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- .7 Optimal run time system normal start times.
 - .8 Occupancy and vacancy times.
 - .9 Optimal run time system heating/cooling mode parameters.
 - .8 Mass temperature summary:
 - .1 Mass temperature point type and ID.
 - .2 Desired and current mass temperature values.
 - .3 Calculated warm-up/cool-down time for each mass temperature.
 - .4 Heating/cooling season limits.
 - .5 Break point temperature for cooling mode analysis.
 - .9 HVAC point summary:
 - .1 Control system identifier and status.
 - .2 Point ID and status.
 - .3 Outside air temperature point ID and status.
 - .4 Mass temperature point ID and status.
 - .5 Calculated optimal start and stop times.
 - .6 Period start.
 - .3 Supply Air Reset:
 - .1 Monitor heating and cooling loads in building spaces, terminal reheat systems, both hot deck and cold deck temperatures on dual duct and multizone systems, single zone unit discharge temperatures.
 - .2 Adjust discharge temperatures to most energy efficient levels satisfying measured load by:
 - .1 Raising cooling temperatures to highest possible value.
 - .2 Reducing heating temperatures to lowest possible level.
 - .3 Operator commands:
 - .1 Add/delete fan status point.
 - .2 Lock/unlock program.
 - .3 Request HVAC point summary.
 - .4 Add/Delete discharge controller point.
 - .5 Define discharge controller parameters.
 - .6 Add/delete air flow rate.
 - .7 Define space load and load parameters.
 - .8 Request space load summary.
 - .4 Control summary:
 - .1 HVAC control system status (begin/end).
 - .2 Supply air reset system status.
 - .3 Optimal run time system status.
 - .4 Heating and cooling loop.
 - .5 High/low limits.
 - .6 Deadband.
 - .7 Response timer.
 - .8 Reset times.
 - .5 Space load summary:
 - .1 HVAC system status.
 - .2 Optimal run time status.
 - .3 Heating/cooling loop status.
 - .4 Space load point ID.
 - .5 Current space load point value.
 - .6 Control heat/cool limited.

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- .7 Gain factor.
 - .8 Calculated reset values.
 - .9 Fan status point ID and status.
 - .10 Control discharge temperature point ID and status.
 - .11 Space load point ID and status.
 - .12 Air flow rate point ID and status.
- .4 Enthalpy Switch over:
- .1 Calculate outside and return air enthalpy using measured temperature and relative humidity; determine energy expended and control outside and return air dampers.
 - .2 Operator commands:
 - .1 Add/delete fan status point.
 - .2 Add/delete outside air temperature point.
 - .3 Add/delete discharge controller point.
 - .4 Define discharge controller parameters.
 - .5 Add/delete return air temperature point.
 - .6 Add/delete outside air dewpoint/humidity point.
 - .7 Add/delete return air dewpoint/humidity point.
 - .8 Add/delete damper switch.
 - .9 Add/delete minimum outside air.
 - .10 Add/delete atmospheric pressure.
 - .11 Add/delete heating override switch.
 - .12 Add/delete evaporative cooling switch.
 - .13 Add/delete air flow rate.
 - .14 Define enthalpy deadband.
 - .15 Lock/unlock program.
 - .16 Request control summary.
 - .17 Request HVAC point summary.
 - .3 Control summary:
 - .1 HVAC control system begin/end status.
 - .2 Enthalpy switch over optimal system status.
 - .3 Optimal return time system status.
 - .4 Current outside air enthalpy.
 - .5 Calculated mixed air enthalpy.
 - .6 Calculated cooling cool enthalpy using outside air.
 - .7 Calculated cooling cool enthalpy using mixed air.
 - .8 Calculated enthalpy difference.
 - .9 Enthalpy switch over deadband.
 - .10 Status of damper mode switch.
- .5 Energy Monitoring (Electrical, Air and Hydronic)
- .1 Airside energy measurements are calculated in the DDC system using air temperature and flow rate measurements.
 - .2 Waterside energy is to be calculated in the DDC system using fluid entering and leaving temperature and known constant flow rate measurements.

- .1 An energy measuring devices (BTU meters) will be used when the flow is variable, using a microprocessor-based computer with flow and temperature inputs, and analog output to the DDC system representing totalized energy consumption in BTU or ton-hours, or energy flow in BTU per hour, tons, or similar units. (refer to Section 25 30 00)
- .3 Electrical energy measurements can be calculated in the DDC system or with Power Monitoring Devices.

2.8 CHILLER CONTROL PROGRAMS

- .1 Control function of condenser water reset, chilled water reset, and chiller sequencing. Support inch-pounds and S.I. metric units of measurement.
- .2 Chilled Water Reset: Automatically reset controlled chilled water temperature satisfying cooling coil requiring greatest cooling.
- .3 Chiller Sequencing: Determine which combination of chillers will most efficiently satisfy chilled water load, by cycling chillers, based on comparing load to switch over limits defined for each chiller.

2.9 Programming Application Features

- .1 Trend Point:
 - .1 Sample points, real or computed, with each point capable of collecting samples at intervals specified in minutes, hours, days, or month.
 - .2 Output trend logs as line graphs or bar graphs. Output graphic on terminal, with each point for line and bar graphs designated with a unique pattern and colour, vertical scale either actual values or percent of range, and horizontal scale time base. Print trend logs up to 12 columns of one point/column.
- .2 Alarm Messages:
 - .1 Allow definition messages.
 - .2 Assign alarm messages to system messages including point's alarm condition, point's off-normal condition, totalized point's warning limit, hardware elements advisories.
 - .3 Output assigned alarm with "message requiring acknowledgement".
 - .4 Operator commands include define, modify, or delete; output summary listing current alarms and assignments; output summary defining assigned points.
- .3 Weekly Scheduling:
 - .1 Automatically initiate equipment or system commands, based on preselected time schedule for points specified.
 - .2 Provide program times for each day of week, per point, with one minute resolution.
 - .3 Automatically generate alarm output for points not responding to command.
 - .4 Provide for holidays.
 - .5 Operator commands:
 - .1 System logs and summaries.
 - .2 Start of stop point.
 - .3 Lock or unlock control or alarm input.
 - .4 Add, delete, or modify analog limits and differentials.
 - .5 Adjust point operation position.
 - .6 Change point operational mode.

- .7 Open or close point.
- .8 Enable/disable, lock/unlock, or execute interlock sequence or computation profile.
- .9 Begin or end point totalization.
- .10 Modify totalization values and limits.
- .11 Access or secure point.
- .12 Begin or end HVAC or load control system.
- .13 Modify load parameter.
- .14 Modify demand limiting and duty cycle targets.
- .6 Output summary: Listing of programmed function points, associated program times, and respective day of week programmed points by software groups or time of day.
- .4 Interlocking:
 - .1 Permit events to occur, based on changing condition of one or more associated master points.
 - .2 Binary contact, high/low limit of analog point or computed point are capable of being utilized as master. Same master may monitor or command multiple slaves.
 - .3 Operator commands:
 - .1 Define single master/multiple master interlock process.
 - .2 Define logic interlock process.
 - .3 Lock/unlock program.
 - .4 Enable/disable interlock process.
 - .5 Execute terminate interlock process.
 - .6 Request interlock type summary.

Part 3 Execution

3.1 Examination

- .1 Section 21 05 00: Verification of existing conditions before starting work.
- .2 Verify that conditioned power supply is available to the control units and to the operator work station. Verify that field end devices, wiring, and pneumatic tubing is installed prior to installation proceeding.

3.2 Installation

- .1 Install control units and other hardware in position on permanent walls where not subject to excessive vibration.
- .2 Install software in control units and in operator work station. Implement all features of programs to specified requirements and appropriate to sequence of operation.
- .3 Provide with 120v AC, 15 amp dedicated emergency power circuit to each programmable control unit.
- .4 Provide conduit and electrical wiring to Section 26 05 80. Electrical material and installation to appropriate requirements of Division 26.

3.3 Manufacturer's Field Services

- .1 Section 21 05 00: Prepare and start systems.

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- .2 Start and commission systems. Allow sufficient time for start-up and commissioning prior to placing control systems in permanent operation.
 - .3 Provide service technician to instruct The City's representative in operation of systems plant and equipment. Provide sign off sheets; refer to section 21 05 00.
 - .4 Provide basic operator training for the operators on data display, alarm and status descriptors, requesting data, execution of commands and request of logs. Include the required number of hours of dedicated instructor time to ensure the user is satisfied and sufficiently trained. Provide training on site.

3.4 Demonstration And Instructions

- .1 Section 21 05 00: Demonstrating installed work.
- .2 Demonstrate complete and operating system to The City.

END OF SECTION

PART 1-GENERAL

1.1 RELATED WORK

- .1 The General Conditions and General Specifications form an integral part of this specification and must be read in conjunction herewith. Read also and be fully cognizant of all Mechanical Sections.

1.2 DESCRIPTION

- .1 Refer to section 23 & 25 for further detail and scope of work.
- .2 This specification is to cover a complete Adjustable Frequency motor Drive (AFD) consisting of a pulse width modulated (PWM) inverter designed for use on a standard NEMA Design B induction motor. It is required that the drive manufacturer have an existing:
 - .1 Sales representative exclusively for HVAC products, with expertise in HVAC systems and controls.
 - .2 An independent service organization.
- .3 The drive manufacturer shall supply the drive and all necessary controls as herein specified. The manufacturer shall have been engaged in the production of this type of equipment for a minimum of twenty years.
- .4 VFD harmonic mitigation equipment shall be included, as part of the integrated VFD package to meet the THD levels required in the section titled "Harmonic Distortion Requirements".

1.3 QUALITY ASSURANCE

- .1 Referenced Standards:
 - .1 Institute of Electrical and Electronic Engineers (IEEE)
 - .1 Standard 519-1992, IEEE Guide for Harmonic Content and Control.
 - .2 Underwriters laboratories
 - .1 UL508C
 - .3 National Electrical Manufacturer's Association (NEMA)
 - .1 ICS 7.0, AC Adjustable Speed Drives
 - .4 IEC 16800 Parts 1 and 2
- .2 Qualifications:
 - .1 AFDs and options shall be ULC listed as a complete assembly. AFD's that require the customer to supply external fuses for the AFD to be ULC listed are not acceptable. The base AFD shall be ULC listed for 100 KAIC without the need for input fuses.
 - .2 CE Mark – The AFD shall conform to the European Union ElectroMagnetic Compatibility directive, a requirement for CE marking. The AFD shall meet product standard EN 61800-3 for the First Environment restricted level.
 - .3 Acceptable Manufactures
 - .1 ABB ACH 550 Series.
 - .2 Contract Administrator approved within 2 weeks of bid. Approval does not relieve supplier of specification requirements.
 - .3 AFDs that are manufactured by a third party and "brand labeled" shall not be acceptable.
 - .4 The AFD manufacturer shall have available a comprehensive, HVAC Drive Computer Based Training (CBT) product. The CBT product shall include detailed, interactive sections covering AFD unpacking, proper mechanical and electrical installation, and programming. The CBT product shall allow the user to provide just-in-time training to new personnel or refresher training for maintenance and repair personnel on the user's site. The CBT product shall be repeatable, precise and shall include record keeping capability. The CBT product shall record answers to simulations and tests by student ID. The CBT product must be

professionally produced and have interactive sections, student tests, and include video clips of proper wiring and installation.

- .5 The following vendors/manufacturers have demonstrated the ability to meet the requirements of these specifications including the passive harmonic mitigating equipment & integrated active harmonic mitigating equipment and commissioning requirements included herein: Energy Management Corporation - Utilizing Motor Drives International packaged VFD systems with optimized integrated harmonic filters. (See Appendix B) Vendors requesting approval by addendum must submit a point by point certification to these specifications at least 10 days prior to the bid. Information must include proposed integrated harmonic mitigating equipment with sample waveforms from a minimum of three local installations, which have been in operation for a minimum of three years. Only vendors listed, or approved in writing by addendum, are approved to bid the project.

1.4 SUBMITTALS

- .1 Submittals shall include the following information:
 - .1 Outline dimensions, conduit entry locations and weight.
 - .2 Customer connection and power wiring diagrams.
 - .3 Complete technical product description include a complete list of options provided
 - .4 Submit sample input current waveforms that are to be expected. This should include examples from previous installations with similar integrated harmonic mitigating equipment VFD packages. The data submitted shall meet the levels required in the "Harmonic Distortion Requirements" section.
 - .5 Compliance to IEEE 519 – harmonic analysis for particular jobsite including total harmonic voltage distortion and total harmonic current distortion (TDD).
 - .1 The AFD manufacturer shall provide calculations; specific to this installation, showing total harmonic voltage distortion is less than 5%. Input line filters shall be sized and provided as required by the AFD manufacturer to ensure compliance with IEEE standard 519. All AFD's shall include a minimum of 5% impedance reactors, no exceptions.

1.5 PRODUCTS

- .1 Manufacturer:
 - .1 ABB

1.6 ADJUSTABLE FREQUENCY DRIVES

- .2 The AFD package as specified herein shall be enclosed in a UL Listed NEMA Type 12 enclosure, completely assembled and tested by the manufacturer in an ISO9001 facility. The AFD tolerated voltage window shall allow the AFD to operate from a line of +30% nominal, and -35% nominal voltage as a minimum.
 - .1 Environmental operating conditions: 0 to 40°C continuous. AFD's that can operate at 40° C intermittently (during a 24 hour period) are not acceptable and must be oversized. Altitude 0 to 3300 feet above sea level, less than 95% humidity, non-condensing.
 - .2 Enclosure shall be rated UL type 12 and shall be UL listed as a plenum rated AFD. AFD's without these ratings are not acceptable.
- .3 All AFDs shall have the following standard features:
 - .1 All AFDs shall have the same customer interface, including digital display, and keypad, regardless of horsepower rating. The keypad shall be removable, capable of remote mounting and allow for uploading and downloading of parameter settings as an aid for start-up of multiple AFDs.

- .2 The keypad shall include Hand-Off-Auto selections and manual speed control. The drive shall incorporate "bumpless transfer" of speed reference when switching between "Hand" and "Auto" modes. There shall be fault reset and "Help" buttons on the keypad. The Help button shall include "on-line" assistance for programming and troubleshooting.
- .3 There shall be a built-in time clock in the AFD keypad. The clock shall have a battery back up with 10 years minimum life span. The clock shall be used to date and time stamp faults and record operating parameters at the time of fault. If the battery fails, the AFD shall automatically revert to hours of operation since initial power up. The clock shall also be programmable to control start/stop functions, constant speeds, PID parameter sets and output relays. The AFD shall have a digital input that allows an override to the time clock (when in the off mode) for a programmable time frame. There shall be four (4) separate, independent timer functions that have both weekday and weekend settings.
- .4 The AFD's shall utilize pre-programmed application macro's specifically designed to facilitate start-up. The Application Macros shall provide one command to reprogram all parameters and customer interfaces for a particular application to reduce programming time. The AFD shall have two user macros to allow the end-user to create and save custom settings.
- .5 The AFD shall have cooling fans that are designed for easy replacement. The fans shall be designed for replacement without requiring removing the AFD from the wall or removal of circuit boards. The AFD cooling fans shall operate only when required. To extend the fan and bearing operating life, operating temperature will be monitored and used to cycle the fans on and off as required.
- .6 The AFD shall be capable of starting into a coasting load (forward or reverse) up to full speed and accelerate or decelerate to setpoint without safety tripping or component damage (flying start).
- .7 The AFD shall have the ability to automatically restart after an over-current, over-voltage, under-voltage, or loss of input signal protective trip. The number of restart attempts, trial time, and time between attempts shall be programmable.
- .8 The overload rating of the drive shall be 110% of its normal duty current rating for 1 minute every 10 minutes, 130% overload for 2 seconds. The minimum FLA rating shall meet or exceed the values in the NEC/UL table 430-150 for 4-pole motors.
- .9 The AFD shall have an integral 5% impedance line reactors to reduce the harmonics to the power line and to add protection from AC line transients. The 5% impedance may be from dual (positive and negative DC bus) reactors, or 5% AC line reactors. AFD's with only one DC reactor shall add AC line reactors.
- .10 The input current rating of the AFD shall be no more than 3% greater than the output current rating. AFD's with higher input current ratings require the upstream wiring, protection devices and source transformers to be oversized per NEC 430-2.
- .11 The AFD shall include a coordinated AC transient protection system consisting of 4-120 joule rated MOV's (phase to phase and phase to ground), a capacitor clamp, and 5% impedance reactors.
- .12 The AFD shall be capable of sensing a loss of load (broken belt / broken coupling) and signal the loss of load condition. The drive shall be programmable to signal this condition via a keypad warning, relay output and/or over the serial communications bus. Relay outputs shall include programmable time delays that will allow for drive acceleration from zero speed without signaling a false underload condition.
- .13 If the input reference (4-20mA or 2-10V) is lost, the AFD shall give the user the option of either (1) stopping and displaying a fault, (2) running at a programmable preset speed, (3) hold the AFD speed based on the last good reference received, or (4) cause a warning to be issued, as selected by the user. The drive shall be programmable to signal this condition via a keypad warning, relay output and/or over the serial communication bus.

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- .14 The AFD shall have programmable "Sleep" and "Wake up" functions to allow the drive to be started and stopped from the level of a process feedback signal.
 - .4 All AFDs to have the following adjustments:
 - .1 Three (3) programmable critical frequency lockout ranges to prevent the AFD from operating the load continuously at an unstable speed.
 - .2 Two (2) PID Setpoint controllers shall be standard in the drive, allowing pressure or flow signals to be connected to the AFD, using the microprocessor in the AFD for the closed loop control. The AFD shall have 250 ma of 24 VDC auxiliary power and be capable of loop powering a transmitter supplied by others. The PID setpoint shall be adjustable from the AFD keypad, analog inputs, or over the communications bus. There shall be two parameter sets for the first PID that allow the sets to be switched via a digital input, serial communications or from the keypad for night setback, summer/winter setpoints, etc. There shall be an independent, second PID loop that can utilize the second analog input and modulate one of the analog outputs to maintain setpoint of an independent process (ie. valves, dampers, etc.). All setpoints, process variables, etc. to be accessible from the serial communication network. The setpoints shall be set in Engineering units and not require a percentage of the transducer input.
 - .3 Two (2) programmable analog inputs shall accept current or voltage signals.
 - .4 Two (2) programmable analog outputs (0-20ma or 4-20 ma). The outputs may be programmed to output proportional to Frequency, Motor Speed, Output Voltage, Output Current, Motor Torque, Motor Power (kW), DC Bus voltage, Active Reference, and other data.
 - .5 Six (6) programmable digital inputs for maximum flexibility in interfacing with external devices, typically programmed as follows:
 - .1 There shall be a run permissive circuit for damper or valve control. Regardless of the source of a run command (keypad, input contact closure, time-clock control, or serial communications) the AFD shall provide a dry contact closure that will signal the damper to open (AFD motor does not operate). When the damper is fully open, a normally open dry contact (end-switch) shall close. The closed end-switch is wired to an AFD digital input and allows AFD motor operation. Two separate safety interlock inputs shall be provided. When either safety is opened, the motor shall be commanded to coast to stop, and the damper shall be commanded to close. The keypad shall display "start enable 1 (or 2) missing". The safety status shall also be transmitted over the serial communications bus. All digital inputs shall be programmable to initiate upon an application or removal of 24VDC.
 - .6 Three (3) programmable digital Form-C relay outputs. The relays shall include programmable on and off delay times and adjustable hysteresis. Default settings shall be for run, not faulted (fail safe), and run permissive. The relays shall be rated for maximum switching current 8 amps at 24 VDC and 0.4 A at 250 VAC; Maximum voltage 300 VDC and 250 VAC; continuous current rating 2 amps RMS. Outputs shall be true form C type contacts; open collector outputs are not acceptable.
 - .7 Seven (7) programmable preset speeds.
 - .8 Two independently adjustable accel and decel ramps with 1 – 1800 seconds adjustable time ramps.
 - .9 The AFD shall include a motor flux optimization circuit that will automatically reduce applied motor voltage to the motor to optimize energy consumption and audible motor noise.
 - .10 The AFD shall include a carrier frequency control circuit that reduces the carrier frequency based on actual AFD temperature that allows the highest carrier frequency without derating the AFD or operating at high carrier frequency only at low speeds.
 - .11 The AFD shall include password protection against parameter changes.

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- .5 The Keypad shall include a backlit LCD display. The display shall be in complete English words for programming and fault diagnostics (alpha-numeric codes are not acceptable). The keypad shall utilize the following assistants:
 - .1 Start-up assistants.
 - .2 Parameter assistants
 - .3 Maintenance assistant
 - .4 Troubleshooting assistant
 - .6 All applicable operating values shall be capable of being displayed in engineering (user) units. A minimum of three operating values from the list below shall be capable of being displayed at all times. The display shall be in complete English words (alpha-numeric codes are not acceptable):
 - .1 Output Frequency
 - .2 Motor Speed (RPM, %, or Engineering units)
 - .3 Motor Current
 - .4 Calculated Motor Torque
 - .5 Calculated Motor Power (kW)
 - .6 DC Bus Voltage
 - .7 Output Voltage
 - .7 The AFD shall include a fireman's override input. Upon receipt of a contact closure from the fireman's control station, the AFD shall operate at an adjustable preset speed. The mode shall override all other inputs (analog/digital, serial communication, and all keypad commands) and force the motor to run at the adjustable, preset speed. "Override Mode" shall be displayed on the keypad. Upon removal of the override signal, the AFD shall resume normal operation.
 - .8 Serial Communications
 - .1 The AFD shall have an RS-485 port as standard. The standard protocols shall be Modbus, Johnson Controls N2 bus, and Siemens Building Technologies FLN. Optional protocols for LonWorks, BACnet, Profibus, Ethernet, and DeviceNet shall be available. Each individual drive shall have the protocol in the base AFD. The use of third party gateways and multiplexers is not acceptable. All protocols shall be "certified" by the governing authority. Use of non-certified protocols is not allowed.
 - .2 The BACnet connection shall be an RS485, MSTP interface operating at 9.6, 19.2, 38.4, or 76.8 Kbps. The connection shall be tested by the BACnet Testing Labs (BTL) and be BTL Listed. The BACnet interface shall conform to the BACnet standard device type of an Applications Specific Controller (B-ASC). The interface shall support all BIBBs defined by the BACnet standard profile for a B-ASC including, but not limited to:
 - .1 Data Sharing – Read Property – B.
 - .2 Data Sharing – Write Property – B.
 - .3 Device Management – Dynamic Device Binding (Who-Is; I-AM).
 - .4 Device Management – Dynamic Object Binding (Who-Has; I-Have).
 - .5 Device Management – Communication Control – B.
 - .3 If additional hardware is required to obtain the BACnet interface, the AFD manufacturer shall supply one BACnet gateway per drive. Multiple AFDs sharing one gateway shall not be acceptable.
 - .4 Serial communication capabilities shall include, but not be limited to; run-stop control, speed set adjustment, proportional/integral/derivative PID control adjustments, current limit, accel/decel time adjustments, and lock and unlock the keypad. The drive shall have the capability of allowing the DDC to monitor feedback such as process variable feedback, output speed / frequency, current (in amps), % torque, power (kW), kilowatt hours (resettable), operating hours (resettable), and drive temperature. The DDC shall also be capable of monitoring the AFD relay output status, digital input status, and all analog input and analog output values. All diagnostic warning and fault information shall be transmitted over the serial communications bus. Remote AFD fault reset shall be possible. The following additional status indications and settings shall be transmitted over

- the serial communications bus – keypad “Hand” or “Auto” selected, bypass selected, the ability to change the PID setpoint, and the ability to force the unit to bypass (if bypass is specified). The DDC system shall also be able to monitor if the motor is running in the AFD mode or bypass mode (if bypass is specified) over serial communications. A minimum of 15 field parameters shall be capable of being monitored.
- .5 The AFD shall allow the DDC to control the drive’s digital and analog outputs via the serial interface. This control shall be independent of any AFD function. For example, the analog outputs may be used for modulating chilled water valves or cooling tower bypass valves. The drive’s digital (relay) outputs may be used to actuate a damper, open a valve or control any other device that requires a maintained contact for operation. In addition, all of the drive’s digital and analog inputs shall be capable of being monitored by the DDC system.
- .6 The AFD shall include an independent PID loop for customer use. The independent PID loop may be used for cooling tower bypass value control, chilled water value control, etc. Both the AFD control PID loop and the independent PID loop shall continue functioning even if the serial communications connection is lost. The AFD shall keep the last good set-point command and last good DO & AO commands in memory in the event the serial communications connection is lost.
- .9 EMI / RFI filters. All AFD’s shall include EMI/RFI filters. The onboard filters shall allow the AFD assemble to be CE Marked and the AFD shall meet product standard EN 61800-3 for the First Environment restricted level.
- .10 All AFD’s through 50HP shall be protected from input and output power mis-wiring. The AFD shall sense this condition and display an alarm on the keypad.
- .11 The VFD system and associated active harmonic mitigating equipment shall be supplied as a complete, pre-integrated, stand-alone package produced by a single manufacturer regularly engaged in the production of same and maintains full system support responsibility. The VFD system manufacturer shall integrate all components and equipment required to meet these specification features and functions as a single UL (or equivalent) labeled system. Vendors supplying non-integrated active harmonic mitigation equipment (or which require contractor mounting or wiring of separate components) is not allowed. Vendors supplying equipment, which is not warranted by a single manufacturer, is not allowed. Optional - Front door mounted, blown fuse indicators, shall be included for all phases for all fuses associated with harmonic filter capacitors.
- .12 **OPTIONAL FEATURES** – Optional features to be furnished and mounted by the drive manufacturer. All optional features shall be UL Listed by the drive manufacturer as a complete assembly and carry a UL508 label.
- .1 A complete factory wired and tested bypass system consisting of an output contactor and bypass contactor. Overload protection shall be provided in both drive and bypass modes.
- .2 Door interlocked, padlockable circuit breaker that will disconnect all input power from the drive and all internally mounted options.
- .3 Fused AFD only disconnect (service switch). Fast acting fuses exclusive to the AFD – fast acting fuses allow the AFD to disconnect from the line prior to clearing upstream branch circuit protection, maintaining bypass capability. Bypass designs, which have no such fuses, or that incorporate fuses common to both the AFD and the bypass will not be accepted. Three contactor bypass schemes are not acceptable.
- .4 The following operators shall be provided:
- .1 Bypass Hand-Off-Auto
- .2 Drive mode selector
- .3 Bypass mode selector
- .4 Bypass fault reset
- .5 The following indicating lights (LED type) shall be provided. A test mode or push to test feature shall be provided.
- .1 Power-on (Ready)

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- .2 Run enable (safeties) open
 - .3 Drive mode select damper opening
 - .4 Bypass mode selected
 - .5 Drive running
 - .6 Bypass running
 - .7 Drive fault
 - .8 Bypass fault
 - .9 Bypass H-O-A mode
 - .10 Automatic transfer to bypass selected
 - .11 Safety open
 - .12 Damper opening
 - .13 Damper end-switch made
 - .6 The following relay (form C) outputs from the bypass shall be provided:
 - .1 System started
 - .2 System running
 - .3 Bypass override enabled
 - .4 Drive fault
 - .5 Bypass fault (motor overload or underload (broken belt))
 - .6 Bypass H-O-A position
 - .7 The digital inputs for the system shall accept 24V or 115VAC (selectable). The bypass shall incorporate internally sourced power supply and not require an external control power source.
 - .8 Customer Interlock Terminal Strip – provide a separate terminal strip for connection of freeze, fire, smoke contacts, and external start command. All external safety interlocks shall remain fully functional whether the system is in Hand, Auto, or Bypass modes (not functional in Fireman's Override 2). The remote start/stop contact shall operate in AFD and bypass modes.
 - .9 Dedicated digital input that will transfer motor from AFD mode to bypass mode upon dry contact closure for fireman's override. Two modes of operation are required.
 - .1 One mode forces the motor to bypass operation and overrides both the AFD and bypass H-O-A switches and forces the motor to operate across the line (test mode). The system will only respond to the digital inputs and motor protections.
 - .2 The second fireman's override mode remains as above, but will also defeat the overload and single-phase protection for bypass and ignore all keypad and digital inputs to the system (run until destruction).
 - .10 The AFD shall include a "run permissive circuit" that will provide a normally open contact whenever a run command is provided (local or remote start command in AFD or bypass mode). The AFD system (AFD or bypass) shall not operate the motor until it receives a dry contact closure from a damper or valve end-switch. When the AFD system safety interlock (fire detector, freezestat, high static pressure switch, etc) opens, the motor shall coast to a stop and the run permissive contact shall open, closing the damper or valve.
 - .11 Class 20 or 30 (selectable) electronic motor overload protection shall be included.
 - .12 There shall be an internal switch to select manual or automatic bypass.
 - .13 There shall be an adjustable current sensing circuit for the bypass to provide loss of load indication (broken belt) when in the bypass mode.

1.7 HARMONIC DISTORTION

IEEE 519-1992 - Harmonic Control in Electrical Power Systems shall be a requirement of this project. Harmonic filters (passive or active, as required), phase multiplication devices, or any other components required to mitigate harmonic voltage THD to 5% and current THD to 8% maximum levels shall be an integral part of the VFD system. Compliance measurement shall be based on actual THD measurement at the VFD circuit breaker terminals during full load VFD operation. Designs which employ shunt tuned

filters must be designed to prevent the importation of outside harmonics which could cause system resonance or filter failure. Calculations supporting the design, including a system harmonic flow analysis, must be provided as part of the submittal process for shunt tuned filters. Any filter designs which cause voltage rise at the VFD terminals must include documentation in compliance with the total system voltage variation of plus or minus 10%. Documentation of Power Quality compliance shall be part of the commissioning required by the VFD supplier. Actual job site measurement testing shall be conducted at full load and documented in the operation and maintenance manuals.

Part 3

3.1 INSTALLATION

- .1 Installation shall be the responsibility of the mechanical and controls contractor. The contractor shall install the drive in accordance with the recommendations of the AFD manufacturer as outlined in the installation manual.
- .2 Power wiring shall be completed by the electrical subcontractor. The contractor shall complete all wiring in accordance with the recommendations of the AFD manufacturer as outlined in the installation manual.
- .3 Control Wiring shall be completed by the controls contractor. The contractor shall complete all wiring in accordance with the recommendations of the AFD manufacturer as outlined in the installation manual.

3.2 START-UP

- .1 Certified factory start-up shall be provided for each drive by a factory authorized service center. A certified start-up form shall be filled out for each drive with a copy provided to The City, and a copy kept on file at the manufacturer.

3.3 PRODUCT SUPPORT

- .1 Factory trained application engineering and service personnel that are thoroughly familiar with the AFD products offered shall be locally available at both the specifying and installation locations. A 24/365 technical support line shall be available on a toll-free line.
- .2 A computer based training CD or 8-hour professionally generated video (VCR format) shall be provided to The City at the time of project closeout. The training shall include installation, programming and operation of the AFD, bypass and serial communication.

3.4 WARRANTY

- .1 Warranty shall be 24 months from the date of certified start-up. The warranty shall include all parts, labor, travel time and expenses. There shall be 365/24 support available via a toll free phone number.

END OF SECTION

Part 1 General

1.1 Systems:

- .1 Sequence of operation:
 - .1 Outside Air Conditions
 - .2 Occupancy Status from Lighting Controls System
 - .3 Existing Loop Pumps
 - .4 Energy Recovery Ventilators
 - .5 Variable Volume Air Handling Units
 - .6 Constant Volume Air Handling Units
 - .7 Make Up Air Units
 - .8 Sump Pit Monitor
 - .9 Food and Nutrition Exhaust Fans
 - .10 CrawlSpace Ventilation System
 - .11 Mechanical/Electrical/Compressor Room Cooling
 - .12 Scheduled Exhaust Fans
 - .13 Variable Air Volume (VAV) Terminal Units
 - .14 Constant Air Volume (CAV) Exhaust – Terminal Units and Flow Sensing Dampers
 - .15 Hydronic Fan Coil Units
 - .16 Hydronic Unit Heater
 - .17 Dust Collector Monitoring

1.2 Related Sections

- .1 Section 25 30 00 - Instruments And Control Elements.
- .2 Section 25 50 02 - Digital Control Equipment.
- .3 Section 26 05 80 - Equipment Wiring: Electrical characteristics and wiring connections.

1.3 System Description

- .1 This section defines the manner in which controls function.
- .2 Requirements for each type of control system operation are specified.
- .3 Equipment, devices, and system components required for control systems are specified in other Sections.

1.4 Submittals For Review

- .1 Section 21 05 00: Procedures for submittals.
- .2 Shop Drawings: Indicate mechanical system controlled and control system components.
 - .1 Label with settings, adjustable range of control and limits. Include written description of control sequence.
 - .2 Include flow diagrams for each control system, graphically depicting control logic.
 - .3 Include draft copies of graphic displays indicating mechanical system components, control system components, and controlled function status and value.

1.5 Submittals At Project Closeout

- .1 Section 21 05 00: Submittals for project closeout.
- .2 Project Record Documents: Record actual locations of components and set points of controls, including changes to sequences made after submission of shop drawings.

Part 2 Products

2.1 Not Used

- .1 Not Used

Part 3 Execution

3.1 Outside Air Conditions

- .1 The controller shall connect to existing building network to monitor the outside air temperature and humidity from existing sensors on the network and calculate the outside air enthalpy on a continual basis. These values shall be made available to the system at all times.

3.2 Occupancy Status From Lighting Controls System

- .1 BACnet interface and network connection terminated in DDC control panel provided by Division 26. Network connection is Cat5e cable for connection to DDC BACnet IP network. Network switch within DDC panel by Division 25.
- .2 Provide programming of DDC controls system to appropriately poll lighting control system to obtain occupancy status (occupied or unoccupied) for every space as applicable for use in control of HVAC systems.

3.3 Existing Loop Pumps

- .1 Chilled Glycol Primary Loop Pumps
 - .2 Existing Chiller Pumps P-3/4 and bypass valve shall be adjusted to accommodate added flow for vocational HVAC equipment.
 - .3 Existing glycol loop circulation pumps, P-5/6 shall be adjusted to accommodate added flow for vocational HVAC equipment.
 - .4 Existing terminal unit heating loop pumps P-7/8 shall be adjusted to accommodate added flow for vocational HVAC equipment.
- .2

3.4 Energy Recovery Ventilator (ERV-3)

- .1 Run Conditions - Scheduled:
 - .1 The unit shall run based upon an operator adjustable schedule.
- .2 Warm-up:
 - .1 When the ERV is called to start and the outdoor air is below 5°C (adj.), the ERV shall begin in 'recirculation mode' for 15 minutes, before reverting back to normal operation.
- .3 Emergency Shutdown:
 - .1 The unit shall shut down and generate an alarm upon receiving an emergency shutdown signal.
- .1 Freeze Protection:

- .1 The unit shall shut down and generate an alarm upon receiving a freezestat status.
- .2 Smoke Detection:
 - .1 The unit shall shut down and generate an alarm upon receiving a smoke detector status.
- .3 Supply Fan:
 - .1 The supply fan shall run anytime the unit is commanded to run, unless shutdown on safeties. To prevent short cycling, the supply fan shall have a user definable (adj.) minimum runtime.
 - .2 Alarms shall be provided as follows:
 - .1 Supply Fan Failure: Commanded on, but the status is off.
 - .2 Supply Fan in Hand: Commanded off, but the status is on.
- .4 Supply Air Duct Static Pressure Control:
 - .1 The controller shall measure duct static pressure and modulate the supply fan VFD speed to maintain a duct static pressure setpoint. The speed shall not drop below 30% (adj.). The static pressure setpoint shall be reset based upon the position of the AHU fresh air dampers, with a goal of reducing the static pressure until at least one AHU fresh air damper is nearly wide open.
 - .2 The duct static pressure setpoint shall be 1.2 in H₂O (adj.).
- .5 Exhaust Fan:
 - .1 The exhaust fan VFD shall speed up and slow down in conjunction with the supply fan VFD and maintain an airflow offset.
 - .2 The exhaust fan shall run anytime the unit is commanded to run, unless shutdown on safeties. To prevent short cycling, the Exhaust fan shall have a user definable (adj.) minimum runtime.
 - .3 The building static pressure in each ERV zone.
 - .1 The exhaust fan shall reset its airflow offset from the supply fan to maintain a building static pressure between 0 Pa and +15 Pa (+0.06" w.c.) (adj.).
 - .4 Alarms shall be provided as follows:
 - .1 Exhaust Fan Failure: Commanded on, but the status is off.
 - .2 Exhaust Fan in Hand: Commanded off, but the status is on.
- .6 Heat Recovery Ventilator Air Filter Differential Pressure Monitor:
 - .1 The controller shall monitor the differential pressure across the filter.
 - .2 Alarms shall be provided as follows:
 - .1 Filter Change Required: Final filter differential pressure exceeds a user definable limit (adj.).
- .7 Supply Air Temperature:
 - .1 The controller shall monitor the supply air temperature.
 - .2 Alarms shall be provided as follows:
 - .3 Low Supply Air Temp: If the supply air temperature is less than 8 °C (46 °F) (adj.).
- .8 Exhaust Air Temperature:
 - .1 The controller shall monitor the exhaust air temperature.
- .9 Exhaust Air Humidity:

- .1 The controller shall monitor the return air humidity and use as required for economizer control.
- .10 When outdoor air conditions are appropriate for free cooling, the DDC shall provide a signal to the ERV to enter free cooling mode. When outdoor conditions are no longer appropriate for free cooling, the ERV shall revert back to heat recovery mode.
 - .1

3.5 Air Handling Unit – Variable Air Volume (AHU-9)

- .1 Run Conditions - Scheduled:
 - .1 The unit shall run based upon an operator adjustable schedule.
 - .1 Occupied Mode: The unit shall maintain
 - .1 A 55°F (adj.) cooling setpoint, reset based on warmest zone and VAV positions to optimize supply air temperature.
 - .2 A 65°F (adj.) heating setpoint, reset based on warmest zone and VAV positions to optimize supply air temperature.
 - .2 Unoccupied Mode (night setback): The unit shall maintain
 - .1 A 60°F (adj.) cooling setpoint, reset based on warmest zone and VAV positions to optimize supply air temperature.
 - .2 A 60°F (adj.) heating setpoint, reset based on warmest zone and VAV positions to optimize supply air temperature.
 - .2 Alarms shall be provided as follows:
 - .1 High Zone Temp: If the zone temperature is greater than the cooling setpoint by a user definable amount (adj.).
 - .2 Low Zone Temp: If the zone temperature is less than the heating setpoint by a user definable amount (adj.).
 - .3 Zone Setpoint Adjust:
 - .1 The occupant shall be able to adjust the zone temperature heating and cooling setpoints at the zone sensor.
 - .4 Zone Optimal Start:
 - .1 The unit shall use an optimal start algorithm for morning start-up. This algorithm shall minimize the unoccupied warm-up or cool-down period while still achieving comfort conditions by the start of scheduled occupied period.
 - .5 Zone Unoccupied Override:
 - .1 A timed local override control shall allow an occupant to override the schedule and place the unit into an occupied mode for an adjustable period of time. At the expiration of this time, control of the unit shall automatically return to the schedule.
- .2 Emergency Shutdown:
 - .1 The unit shall shut down and generate an alarm upon receiving an emergency shutdown signal.
- .3 Freeze Protection:
 - .1 The unit shall shut down and generate an alarm upon receiving a freezestat status.
- .4 High Static Shutdown:

- .1 The unit shall shut down and generate an alarm upon receiving a high static shutdown signal.
- .5 Supply Air Smoke Detection:
 - .1 The unit shall shut down and generate an alarm upon receiving a supply air smoke detector status.
- .6 Supply Fan:
 - .1 The supply fan shall run anytime the unit is commanded to run, unless shutdown on safeties. To prevent short cycling, the supply fan shall have a user definable (adj.) minimum runtime.
 - .2 Alarms shall be provided as follows:
 - .1 Supply Fan Failure: Commanded on, but the status is off.
 - .2 Supply Fan in Hand: Commanded off, but the status is on.
 - .3 Supply Fan Runtime Exceeded: Status runtime exceeds a user definable limit (adj.).
- .7 Supply Air Duct Static Pressure Control:
 - .1 The controller shall measure duct static pressure and modulate the supply fan VFD speed to maintain a duct static pressure setpoint. The speed shall not drop below 30% (adj.). The static pressure setpoint shall be reset based upon the position of the zone dampers, with a goal of reducing the static pressure until at least one zone damper is nearly wide open.
 - .2 The initial duct static pressure setpoint shall be 1.2in H2O (adj.).
 - .3 If no zone damper is nearly wide open, the setpoint shall incrementally reset down to a minimum of 0.5 in H2O (adj.)
 - .4 As one or more dampers nears the wide open position, the setpoint shall incrementally reset up to a maximum of 1.2in H2O (adj.).
- .8 Return Fan:
 - .1 The return fan shall run whenever the supply fan runs.
 - .2 Alarms shall be provided as follows:
 - .1 Return Fan Failure: Commanded on, but the status is off.
 - .2 Return Fan in Hand: Commanded off, but the status is on.
 - .3 Return Fan Runtime Exceeded: Status runtime exceeds a user definable limit (adj.).
- .9 The return fan VFD shall modulate in unison with the supply fan VFD. Return airflow setpoint shall be 100% (adj.) of the supply airflow minus 0 CFM (adj.). The return fan VFD speed shall not drop below 20% (adj.).
- .10 Heating Coil Valve:
 - .1 The controller shall measure the zone temperature and modulate the heating coil valve to maintain its heating setpoint.
 - .2 The heating shall be enabled whenever:
 - .1 Outside air temperature is less than 65°F (adj.).
 - .2 AND the zone temperature is below heating setpoint.
 - .3 AND the supply fan status is on.
 - .4 AND the cooling is not active.
 - .3 The heating coil valve shall open whenever the freezestat (if present) is on.
- .11 Heating Coil Pump:
 - .1 The recirculation pump shall run whenever:

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- .1 The heating coil valve is enabled.
 - .2 OR the freezestat (if present) is on.
 - .2 Alarms shall be provided as follows:
 - .1 Heating Coil Pump Failure: Commanded on, but the status is off.
 - .2 Heating Coil Pump in Hand: Commanded off, but the status is on.
 - .3 Heating Coil Pump Runtime Exceeded: Status runtime exceeds a user definable limit.
 - .12 Cooling Coil Valve:
 - .1 The controller shall measure the zone temperature and modulate the cooling coil valve to maintain its cooling setpoint.
 - .2 The cooling shall be enabled whenever:
 - .1 Outside air temperature is greater than 60°F (adj.).
 - .2 AND the economizer (if present) is disabled or fully open.
 - .3 AND the zone temperature is above cooling setpoint.
 - .4 AND the supply fan status is on.
 - .5 AND the heating is not active.
 - .13 Economizer:
 - .1 Fresh air and Exhaust air Dampers are external to AHU located at roof vents and shall be insulated type to meet specification and schedule requirements.
 - .2 External FA and EA dampers shall operate in conjunction with AHU internal mixed air dampers as economizer when conditions are suitable for free cooling.
 - .3 The controller shall measure the mixed air temperature and modulate the economizer dampers in sequence to maintain a setpoint 2°C (adj.) less than the supply air temperature setpoint. The outside air dampers shall maintain a minimum adjustable position open whenever occupied. Refer to schedule.
 - .4 The economizer shall be enabled whenever:
 - .1 Outside air temperature is less than 18°C (adj.).
 - .2 AND the outside air enthalpy is less than 34kJ/kg (adj.)
 - .3 AND the outside air temperature is less than the return air temperature.
 - .4 AND the outside air enthalpy is less than the return air enthalpy.
 - .5 AND the supply fan status is on.
 - .5 The economizer shall close whenever:
 - .1 Mixed air temperature drops from 4.5°C to 1.5°C (adj.)
 - .2 OR the freezestat (if present) is on.
 - .3 OR on loss of supply fan status.
 - .6 The outside and exhaust air dampers shall close and the return air damper shall open when the unit is off. If Optimal Start Up is available the mixed air damper shall operate as described in the occupied mode except that the outside air damper shall modulate to fully closed.
 - .7 Minimum Outside Air Ventilation - Carbon Dioxide (CO₂) Control:
 - .8 When in the occupied mode, the controller shall measure the return air CO₂ levels and modulate the outside air dampers open on rising CO₂ concentrations, overriding normal damper operation to maintain a CO₂ setpoint of 750 ppm (adj.).
 - .9 Display fresh air flow on system graphics as measured by airflow measuring stations in ductwork.
 - .1 Outdoor airflow from the OA economizer damper and from the AHU fresh air damper shall be monitored whenever the AHU is enabled.

- .10 Motorized damper on relief ductwork back to ERV-3 shall be controlled by DDC to manage duct static and relief airflow. Refer to schematic.
- .14 Final Filter Differential Pressure Monitor:
 - .1 The controller shall monitor the differential pressure across the final filter.
 - .2 Alarms shall be provided as follows:
 - .1 Final Filter Change Required: Final filter differential pressure exceeds a user definable limit (adj.).
- .15 Mixed Air Temperature:
 - .1 The controller shall monitor the mixed air temperature and use as required for economizer control (if present) or preheating control (if present).
 - .2 Alarms shall be provided as follows:
 - .1 High Mixed Air Temp: If the mixed air temperature is greater than 33°C (adj.).
 - .2 Low Mixed Air Temp: If the mixed air temperature is less than 8°C (adj.).
- .16 Return Air Humidity:
 - .1 The controller shall monitor the return air humidity and use as required for economizer control.
 - .2 Alarms shall be provided as follows:
 - .1 High Return Air Humidity: If the return air humidity is greater than 80% (adj.).
 - .2 Low Return Air Humidity: If the return air humidity is less than 25% (adj.).
- .17 Return Air Temperature:
 - .1 The controller shall monitor the return air temperature and use as required for setpoint control or economizer control.
 - .2 Alarms shall be provided as follows:
 - .1 High Return Air Temp: If the return air temperature is greater than 33°C (adj.).
 - .2 Low Return Air Temp: If the return air temperature is less than 8°C (adj.).

3.6 Air Handling Units – Constant Volume (AHU-7, AHU-8, AHU-10)

- .1 Run Conditions – Occupancy Schedule.
 - .1 The unit shall run based upon an operator adjustable schedule.
 - .1 Occupied Mode: The unit shall maintain
 - .1 A 75°F (adj.) cooling setpoint
 - .2 A 70°F (adj.) heating setpoint.
 - .2 Unoccupied Mode (night setback): The unit shall maintain
 - .1 A 85°F (adj.) cooling setpoint.
 - .2 A 65°F (adj.) heating setpoint.
 - .2 Alarms shall be provided as follows:
 - .1 High Zone Temp: If the zone temperature is greater than the cooling setpoint by a user definable amount (adj.).
 - .2 Low Zone Temp: If the zone temperature is less than the heating setpoint by a user definable amount (adj.).
 - .3 Zone Setpoint Adjust:

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- .1 The occupant shall be able to adjust the zone temperature heating and cooling setpoints at the zone sensor.
 - .4 Zone Optimal Start:
 - .1 The unit shall use an optimal start algorithm for morning start-up. This algorithm shall minimize the unoccupied warm-up or cool-down period while still achieving comfort conditions by the start of scheduled occupied period.
 - .5 Zone Unoccupied Override:
 - .1 A timed local override control shall allow an occupant to override the schedule and place the unit into an occupied mode for an adjustable period of time. At the expiration of this time, control of the unit shall automatically return to the schedule.
 - .2 Emergency Shutdown:
 - .1 The unit shall shut down and generate an alarm upon receiving an emergency shutdown signal.
 - .3 Freeze Protection:
 - .1 The unit shall shut down and generate an alarm upon receiving a freezestat status.
 - .4 High Static Shutdown:
 - .1 The unit shall shut down and generate an alarm upon receiving a high static shutdown signal.
 - .5 Supply Air Smoke Detection:
 - .1 The unit shall shut down and generate an alarm upon receiving a supply air smoke detector status.
 - .6 Supply Fan:
 - .1 The supply fan shall run anytime the unit is commanded to run, unless shutdown on safeties. To prevent short cycling, the supply fan shall have a user definable (adj.) minimum runtime.
 - .2 Alarms shall be provided as follows:
 - .1 Supply Fan Failure: Commanded on, but the status is off.
 - .2 Supply Fan in Hand: Commanded off, but the status is on.
 - .3 Supply Fan Runtime Exceeded: Status runtime exceeds a user definable limit (adj.).
 - .7 Return Fan:
 - .1 The return fan shall run whenever the supply fan runs.
 - .2 Alarms shall be provided as follows:
 - .1 Return Fan Failure: Commanded on, but the status is off.
 - .2 Return Fan in Hand: Commanded off, but the status is on.
 - .3 Return Fan Runtime Exceeded: Status runtime exceeds a user definable limit (adj.).
 - .8 Heating Coil Valve:
 - .1 The controller shall measure the zone temperature and modulate the heating coil valve to maintain its heating setpoint.
 - .2 The heating shall be enabled whenever:
 - .1 Outside air temperature is less than 65°F (adj.).
 - .2 AND the zone temperature is below heating setpoint.

- .3 AND the supply fan status is on.
- .4 AND the cooling is not active.
- .3 The heating coil valve shall open whenever the freezestat (if present) is on.
- .9 Heating Coil Pump:
 - .1 The recirculation pump shall run whenever:
 - .1 The heating coil valve is enabled.
 - .2 OR the freezestat (if present) is on.
 - .2 Alarms shall be provided as follows:
 - .1 Heating Coil Pump Failure: Commanded on, but the status is off.
 - .2 Heating Coil Pump in Hand: Commanded off, but the status is on.
 - .3 Heating Coil Pump Runtime Exceeded: Status runtime exceeds a user definable limit.
- .10 Cooling Coil Valve:
 - .1 The controller shall measure the zone temperature and modulate the cooling coil valve to maintain its cooling setpoint.
 - .2 The cooling shall be enabled whenever:
 - .1 Outside air temperature is greater than 60°F (adj.).
 - .2 AND the economizer (if present) is disabled or fully open.
 - .3 AND the zone temperature is above cooling setpoint.
 - .4 AND the supply fan status is on.
 - .5 AND the heating is not active.
- .11 Economizer:
 - .1 Fresh air and Exhaust air Dampers are external to AHU located at roof vents and shall be insulated type to meet specification and schedule requirements.
 - .2 External FA and EA dampers shall operate in conjunction with AHU internal mixed air dampers as economizer when conditions are suitable for free cooling.
 - .3 The controller shall measure the mixed air temperature and modulate the economizer dampers in sequence to maintain a setpoint 2°C (adj.) less than the supply air temperature setpoint. The outside air dampers shall maintain a minimum adjustable position open whenever occupied. Refer to schedule.
 - .4 The economizer shall be enabled whenever:
 - .1 Outside air temperature is less than 18°C (adj.).
 - .2 AND the outside air enthalpy is less than 34kJ/kg (adj.)
 - .3 AND the outside air temperature is less than the return air temperature.
 - .4 AND the outside air enthalpy is less than the return air enthalpy.
 - .5 AND the supply fan status is on.
 - .5 The economizer shall close whenever:
 - .1 Mixed air temperature drops from 4.5°C to 1.5°C (adj.)
 - .2 OR the freezestat (if present) is on.
 - .3 OR on loss of supply fan status.
 - .6 The outside and exhaust air dampers shall close and the return air damper shall open when the unit is off. If Optimal Start Up is available the mixed air damper shall operate as described in the occupied mode except that the outside air damper shall modulate to fully closed.
 - .7 Minimum Outside Air Ventilation - Carbon Dioxide (CO2) Control:

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- .1 When in the occupied mode, the controller shall measure the return air CO₂ levels and modulate the outside air dampers open on rising CO₂ concentrations, overriding normal damper operation to maintain a CO₂ setpoint of 750 ppm (adj.).
 - .8 Display fresh airflow on system graphics as measured by airflow measuring station in ductwork
 - .1 Outdoor airflow from the OA economizer damper and from the AHU fresh air damper shall both be monitored whenever the AHU is enabled.
 - .9 Motorized damper on relief ductwork from AHU-10 back to ERV-3 shall be controlled by DDC to manage duct static and relief airflow. Refer to schematic.

 - .12 Final Filter Differential Pressure Monitor:
 - .1 The controller shall monitor the differential pressure across the final filter.
 - .2 Alarms shall be provided as follows:
 - .1 Final Filter Change Required: Final filter differential pressure exceeds a user definable limit (adj.).
 - .13 Mixed Air Temperature:
 - .1 The controller shall monitor the mixed air temperature and use as required for economizer control (if present) or preheating control (if present).
 - .2 Alarms shall be provided as follows:
 - .1 High Mixed Air Temp: If the mixed air temperature is greater than 33°C (adj.).
 - .2 Low Mixed Air Temp: If the mixed air temperature is less than 8°C (adj.).
 - .14 Return Air Carbon Dioxide (CO₂) Concentration Monitoring:
 - .1 The controller shall measure the return air CO₂ concentration.
 - .2 Alarms shall be provided as follows:
 - .1 High Return Air Carbon Dioxide Concentration: If the return air CO₂ concentration is greater than 1000ppm (adj.) when in the occupied mode.
 - .15 Return Air Humidity:
 - .1 The controller shall monitor the return air humidity and use as required for economizer control.
 - .2 Alarms shall be provided as follows:
 - .1 High Return Air Humidity: If the return air humidity is greater than 80% (adj.).
 - .2 Low Return Air Humidity: If the return air humidity is less than 25% (adj.).
 - .16 Return Air Temperature:
 - .1 The controller shall monitor the return air temperature and use as required for setpoint control or economizer control.
 - .2 Alarms shall be provided as follows:
 - .1 High Return Air Temp: If the return air temperature is greater than 33°C (adj.).
 - .2 Low Return Air Temp: If the return air temperature is less than 8°C (adj.).
 - .17 Run-around Loop (AHU-7 and AHU-8 only, P-33 and P-34)

- .1 The pump shall be enabled whenever:
 - .1 Exhaust air temperature is greater than outside air temperature AND;
 - .2 Outside air temperature is less than 50°F (adj.).
- .2 The pump shall run for freeze protection anytime outside air temperature is less than 38°F (adj.).
- .3 Modulate three-way valve to provide frost control in glycol loop based on exhaust recovery coil leaving air temperature. Refer to schematic.
- .4 To prevent short cycling, the pump shall run for a minimum time and be off for a minimum time (both user adjustable).
- .5 Glycol fill station: low level alarm.
- .6 Run-around Loop Pump Alarms, P-33, P-34
 - .1 Failure: Commanded on, but the status is off.
 - .2 Running in Hand: Commanded off, but the status is on.
 - .3 Runtime Exceeded: Status runtime exceeds a user definable limit.
 - .4 Any alarms generated by the pump drive.

3.7 Make Up Air Systems (MUA-1, MUA-2, MUA-3, MUA-4, MUA-5, MUA-7)

- .1 Interlock schedule:

Make-up Air System	Exhaust Fan
MUA-1	EF-1A and EF-1B, range hood
MUA-2	EF-2A and EF-2B, range hood
MUA-3	EF-3A and EF-3B, range hood
MUA-4	EF-5, EF-6, EF-7, range hoods
MUA-5	EF-8, range hoods
MUA-7	EF-9, welding fume capture

- .2 Run Conditions - Interlocked:
 - .1 Each make-up air unit (MUA) and exhaust fan (EF) group shall run together as shown in the schedule above.
 - .1 Each system will have a clearly labeled system switch located near the user device that will turn the system on. Coordinate final location of system switches with The City’s and Owner’s requirements.
 - .2 When the system switch is turned on, all MUAs and EFs for that system shall turn on.
 - .3 Make-up airflow shall be proven before exhaust fan(s) start.
 - .2 Alarms shall be provided as follows:
 - .1 High Discharge Air Temp: If the discharge temperature is greater than the cooling setpoint by 2.5°C (5°F) (adj.).
 - .2 Low Discharge Air Temp: If the discharge air temperature is less than the setpoint by 2.5°C (5°F) (adj.).
 - .3 MUA Supply Fan Failure: Commanded on, but the status is off.
 - .4 MUA Supply Fan in Hand: Commanded off, but the status is on.
 - .5 MUA Supply Fan Runtime Exceeded: Status runtime exceeds a user definable limit (adj.).
 - .6 Exhaust Fan Failure: Commanded on, but the status is off.
 - .7 Exhaust Fan in Hand: Commanded off, but the status is on.
 - .8 Exhaust Fan Runtime Exceeded: Status runtime exceeds a user definable limit (adj.).
 - .9 All alarms generated by the MUA onboard controller.

- .10
- .3 Discharge Air setpoint:
 - .1 When the thermostat nearest the MUA supply zone is in heating mode, the discharge air set-point will be 24°C (75°F) (adj.).
 - .2 When the thermostat nearest the MUA supply zone is in cooling mode, the discharge air set-point will be 18°C (65°F) (adj.).
 - .3 If neither cooling nor heating mode is applicable, the discharge air temperature shall be 21°C (70°F) (adj.)
- .3 Emergency Shutdown:
 - .1 The unit shall shut down and generate an alarm upon receiving an emergency shutdown signal.
- .4 Freeze Protection:
 - .1 The unit shall shut down and generate an alarm upon receiving a freezestat status.
- .5 Kitchen Demand Control (Make-up/Exhaust System involving MUA-1, MUA-2, MUA-3, MUA-4, MUA-5)
 - .1 The kitchen hood demand controls shall provide a signal to the BMS to indicate the kitchen load. The exhaust fans and make-up air units shall modulate in tandem based on the load from a minimum of 50% to a maximum of 100% of the design airflow. Coordinate with kitchen supplier for more details.

3.8 Domestic Water Recirculation Pump (pP-30, P-31, P32)

- .1 Run Conditions - Scheduled:
 - .1 The unit shall run according to a user definable time schedule in the following modes:
 - .1 Occupied Mode: The unit shall run continuously.
 - .2 Unoccupied Mode (night setback): The unit shall not run.
 - .2 Display equipment status
 - .3 Display alarm if commanded on but not operational
 - .4 Display alarm if commanded off but operational (Hand)

3.9 Sump Pit Monitor (P22 To P-23)

- .1 Packaged Sump Pumps complete with:
 - .1 Control panel with alternator, alarm outputs.
- .2 DDC to monitor:
 - .1 Sump pump controller for faults.
 - .2 High water level as sensed by independent level switch, connect to DDC.
 - .3 Oil detection (where applicable).

3.10 Foods And Nutrition Exhaust Fan (EF-14)

- .1 EF-14 part of alternate price for vocational wing.
- .2 Run condition – System Switch
 - .1 The exhaust fan shall run when the system switch is tuned on.
 - .2 A system switch will be provided. Coordinate final location of switch with The City's requirements.

- .3 Alarms shall be provided as follows:
 - .1 Exhaust Fan Failure: Commanded on, but the status is off.
 - .2 Exhaust Fan in Hand: Commanded off, but the status is on.
 - .3 Exhaust Fan Runtime Exceeded: Status runtime exceeds a user definable limit (adj.).

3.11 Crawlspace Ventilation System (EF-12)

- .1 Run condition – Humidistat
 - .1 The system shall be enabled whenever the outdoor air is above 5°C (41°F) (adj.)
 - .2 The exhaust fan shall run and the intake damper shall open when the humidistat reads a relative humidity above 55% (adj.) and the calculated outdoor dew-point is below the calculated crawlspace dew-point.
- .2 Alarms shall be provided as follows:
 - .1 Exhaust Fan Failure: Commanded on, but the status is off.
 - .2 Exhaust Fan in Hand: Commanded off, but the status is on.
 - .3 Exhaust Fan Runtime Exceeded: Status runtime exceeds a user definable limit (adj.).
 - .4 Damper Failure: Commanded open but damper is closed, or commanded closed and damper is open.

3.12 Mechanical/electrical/compressor Room Cooling (F-2, EF-21)

- .1 Run Condition – Space Temperature
 - .1 On room temperatures above 30°C (86°F)(adj.) open intake and outlet dampers and start exhaust fan.
 - .2 The exhaust fan shall modulate its speeds to maintain the space temperature at the 30°C (86°F)(adj.).
 - .3 When the space temperature falls below 28°C (82°F)(adj.). The fan shall shut down and the dampers shall close.
- .2 Alarms shall be provided as follows:
 - .1 High Room Temp: If the room temperature is greater than 37.5°C (100°F) for a user definable amount of time (adj.).
 - .2 Low Room Temp: If the room temperature is less than 15°C (59°F) for a user definable amount of time (adj.).
 - .3 Exhaust Fan Failure: Commanded on, but the status is off.
 - .4 Exhaust Fan in Hand: Commanded off, but the status is on.
 - .5 Exhaust Fan Runtime Exceeded: Status runtime exceeds a user definable limit (adj.).
 - .6 Damper Failure: Commanded open but damper is closed, or commanded closed and damper is open.

3.13 Scheduled Exhaust Fans (EF-15)

- .1 Run Conditions - Scheduled:
 - .1 The unit shall run according to a user definable time schedule in the following modes:
 - .1 Occupied Mode: The unit shall run continuously.
 - .2 Unoccupied Mode: The unit shall be disabled.
- .2 Alarms shall be provided as follows:

- .1 Exhaust Fan Failure: Commanded on, but the status is off.
- .2 Exhaust Fan in Hand: Commanded off, but the status is on.
- .3 Exhaust Fan Runtime Exceeded: Status runtime exceeds a user definable limit (adj.).

3.14 High-capacity Ceiling Fans (CF-1 To CF-9)

- .1 Run Conditions - Scheduled:
 - .1 The unit shall run according to a user definable time schedule in the following modes:
 - .1 Occupied Mode: The unit shall run continuously.
 - .2 Unoccupied Mode: The unit shall not run unless associated fan coil is required to run to condition space during night setback.
 - .2 Fan speed shall be user adjustable, via DDC by 0-10V signal.

3.15 Variable Air Volume (vav) Terminal Units

- .1 VAV unit with reheat
 - .1 Run Conditions - Scheduled: The unit shall run according to a user definable time schedule in the following modes:
 - .1 Occupied Mode
 - .1 72°F cooling setpoint (adj.)
 - .2 70° F heating setpoint (adj.)
 - .2 Unoccupied Mode (night setback)
 - .1 85°F cooling setpoint (adj.)
 - .2 65°F heating setpoint (adj.)
 - .2 Minimum Ventilation on Carbon Dioxide (CO2) Concentration:
 - .1 When in the occupied mode, the controller shall measure the zone CO2 concentration and modulate the zone damper open on rising CO2 concentrations, overriding normal damper operation to maintain a CO2 setpoint of not more than 750 ppm (adj.).
 - .3 The occupant shall be able to adjust the zone temperature heating and cooling setpoints at the zone sensor.
 - .4 Heating
 - .1 On first stage call for heating the hot water coil valve shall modulate to maintain the discharge air set-point. The discharge air setpoint shall reset up to a maximum of 95°F (adj.) The VAV shall maintain the minimum airflow setpoint, unless overridden on CO2.
 - .2 On second stage call for heating the hot water valve shall maintain the maximum discharge air temperature and the VAV shall modulate to increase airflow up to its maximum.
 - .3 On high space CO2 the VAV shall modulate open to maintain space CO2 setpoint.
 - .5 Cooling
 - .1 On call for cooling the VAV shall modulate open to maintain space setpoint.
 - .2 On high space CO2 the VAV shall modulate open to maintain space CO2 setpoint.
 - .6 Alarms

- .1 Low airflow: If the measured airflow is 70% lower than the set point for 5 minutes (adj.) while the set point is above 0.
 - .2 Low discharge temperature: If the boiler plant is enabled and the discharge air is 15°F (adj.) less than setpoint for 10 minutes (adj.).
 - .3 High Zone Temp: If the zone temperature is greater than the cooling setpoint by a user definable amount (adj.).
 - .4 Low Zone Temp: If the zone temperature is less than the heating setpoint by a user definable amount (adj.)
 - .5 High space CO2: If the space CO2 is 100ppm above the space setpoint for 20 minutes (adj.).
- .2 Fresh air VAV unit
- .1 Run Conditions - interlocked
 - .1 The fresh air VAV unit shall be enabled whenever the associated fan coil is enabled
 - .2 Minimum Ventilation on Carbon Dioxide (CO2) Concentration:
 - .1 When in the occupied mode, the controller shall measure the zone CO2 concentration and modulate the zone damper open on rising CO2 concentrations to maintain a CO2 setpoint of not more than 750 ppm (adj.).
 - .3 Alarms
 - .1 High space CO2: If the space CO2 is 100ppm above the space setpoint for 20 minutes (adj.).

3.16 Constant Volume Exhaust – Terminal Units And Flow Sensing Dampers

- .1 Run Conditions - Continuous:
 - .1 The unit shall run continuously.
- .2 Flow Control:
 - .1 The unit shall maintain a defined airflow setpoint by controlling the airflow through the terminal unit.
 - .2 Controller shall be fail-in-place modulating actuator.
 - .3 Alarms shall be provided as follows:
 - .1 High Airflow: If the airflow is 25% higher than setpoint (adj.).
 - .2 Low Airflow: If the airflow is 25% lower than setpoint (adj.).

3.17 Hydronic Fan Coils

- .1 Run Conditions - Scheduled:
 - 1. The unit shall run according to a user definable time schedule in the following modes:
 - .2 Occupied Mode: The unit shall maintain
 - .1 A 75°F (adj.) cooling setpoint
 - .2 A 70°F (adj.) heating setpoint.
 - .3 Unoccupied Mode (night setback): The unit shall maintain
 - .1 A 85°F (adj.) cooling setpoint.
 - .2 A 55°F (adj.) heating setpoint.
- .2 Alarms shall be provided as follows:
 - .1 High Zone Temp: If the zone temperature is greater than the cooling setpoint by a user definable amount (adj.).

- .2 Low Zone Temp: If the zone temperature is less than the heating setpoint by a user definable amount (adj.).
- .3 Zone Setpoint Adjust:
 - .1 The occupant shall be able to adjust the zone temperature heating and cooling setpoints at the zone sensor within definable range.
- .4 Zone Unoccupied Override:
 - .1 A timed local override control shall allow an occupant to override the schedule and place the unit into an occupied mode for an adjustable period of time. At the expiration of this time, control of the unit shall automatically return to the schedule.
- .5 Fan:
 - .1 The fan shall run anytime the unit is commanded to run unless shutdown on safeties.
- .6 Six-way Pressure Independent Control Valve:
 - .1 The six-valve shall enable heating mode or cooling based on the zone temperature.
 - .2 The valve shall have different maximum flow rates for heating and cooling. Refer to schedules for rates.
 - .3 The controller shall measure the zone temperature and modulate the six-way control valve flow to maintain its temperature setpoint.
 - .4 The cooling shall be enabled whenever:
 - .1 the zone temperature is above cooling setpoint.
 - .2 AND the fan is on.
- .7 Fan Status:
 - .1 The controller shall monitor the fan status.
 - .2 Alarms shall be provided as follows:
 - .1 Fan Failure: Commanded on, but the status is off.
 - .2 Fan in Hand: Commanded off, but the status is on.

3.18 Hydronic Unit Heater

- .1 Run Conditions – Temperature:
 - .1 The unit shall run according to a user definable temperature:
 - .2 The unit shall maintain
 - .1 The unit shall maintain a heating setpoint of 18°C (adj.).
- .2 Zone Setpoint Adjust:
 - .1 The occupant shall be able to adjust the zone temperature heating setpoint at the zone sensor.
- .3 Fan:
 - .1 The fan shall run anytime the zone temperature drops below heating setpoint, unless shutdown on safeties.

3.19 Dust Collector Monitoring

- .1 This system is part of the alternate price for the vocational wing.
- .2 The dust collector shall operate on its own sequence as provided by the dust collector manufacturer. The DDC shall not control the dust collector operation.

- .3 The DDC shall monitor the following points:
 - .1 Status – alarm, run, stop.
 - .2 Abort Gate Status
 - .3 Dust collector run-time hours.
 - .4 Filter status and differential pressure.
 - .5 Filter run-time hours.
 - .6 Compressed air interlock status.
 - .7 Drier status.

END OF SECTION

Part 1 General

1.1 Related Sections

- .1 Division 0 – Bidding & Contract Requirements
- .2 General Requirements
- .3 All Electrical Drawings and Division 25, 26, 27, 28 Series Specification Sections.

1.2 References

- .1 CSA-C22.1-21 - Canadian Electrical Code, Part I (24th Edition), Safety Standard for Electrical Installations.
- .2 CAN3-C235-83 (R2015) - Preferred Voltage Levels for AC Systems, 0 to 50 000 V.
- .3 CSA (Canadian Standards Association).
- .4 ULC (Underwriters' Laboratories of Canada).
- .5 ASTM E-814, - Fire Tests of Penetration Fire Stops.
- .6 ANSI/ UL1479 - Fire Tests of Through Penetration Firestops
- .7 Canada Green Building Council (CaGBC)
 - .1 LEED v4 for Building Design and Construction (BD+C).
 - .2 LEED v4 for Interior Design and Construction (ID+C).
 - .3 California Department of Public Health (CDPH) Standard Method v1.1–2010.
 - .4 South Coast Air Quality Management District (SCAQMD).
 - .5 California Air Resources Board (CARB).

1.3 Regulatory Requirements

- .1 Conform to CSA-C22.1-21.
- .2 Comply with all CSA Electrical Bulletins in force at time of tender submission.
- .3 Comply with all provincial by-laws, ordinances, codes, rulings, and other requirements.
- .4 Comply with requirements of the electrical supply authority and the local inspection authority.
- .5 Products: Listed and classified by CSA, or ULC and as suitable for the purpose specified and indicated. Where there is no alternative to supplying equipment which is not CSA certified, obtain special approval from the appropriate Inspection Departments.
- .6 Provide 3rd party certification where specified to verify compliance with LEED v4 requirements.

1.4 Definitions

- .1 The following are definitions of terms and expressions used in the specification:
 - .1 Contract Administrator: Electrical Engineering Contract Administrator: Epp Siepman Engineering Inc.

- .2 Inspection Authority: agent of any authority having jurisdiction over construction standards associated with any part of electrical work on site.
- .3 Supply Authority: electrical power utility company responsible for delivery of electrical power to project.
- .4 Electrical Code: Canadian Electrical Code or Local Code in effect at project location.
- .5 Indicated: as shown on Contract drawings or noted in Contract Documents.
- .6 Install: To remove from site storage, move or transport to intended location, install in position, connect to utilities, repair site caused damage, and make ready for use.
- .7 Supply: To acquire or purchase, ship or transport to the site, unload, remove packaging to permit inspection for damage, re-package, replace damaged items, and safely store on-site.
- .8 Provide: Wherever the term "provide" is used in relationship to equipment, conduit and other materials specified for the work, it means "supply, install, connect and leave in working order all materials and necessary wiring, supports, access panels, etc., as necessary for equipment indicated." Wherever the terms "provide" is used in connection with services such as testing, load balancing, start-up, preparation of drawings for any part of the work, it means procure, prepare, supervise, take responsibility for, and pay for these services.
- .9 Typical: A representative characteristic that is standard for all installations whether individually noted or not throughout the documents. "Typical" applies to each individual or combined installation except where specifically noted or otherwise indicated that the application is non-typical.
- .10 Exposed: Any work not concealed in wall, shaft, or ceiling cavities or spaces. Work behind doors, in closets or cupboards or under counters is considered exposed.
- .11 New: Produced from new materials.
- .12 Renewed: Produced or rejuvenated from an existing material to like-new condition to serve a new or existing service.
- .13 Defective: A condition determined exclusively by the Contract Administrator.

1.5 Permits & Fees

- .1 Submit all quantities of drawings and specifications necessary for examination and approval to Electrical Permit Department and Electrical Supply Authority prior to commencement of work.
- .2 Obtain and pay for all permits necessary for the electrical installation.

1.6 Inspection

- .1 Furnish a Certificate of Acceptance from the Inspection Authorities on completion of work. Copies of Certificate shall be included in Maintenance Manuals.
- .2 Certificate of Inspection and Approval shall be submitted before final payment may be considered to be due.

- .3 During the course of the project construction, the Contract Administrator will carry out periodic site reviews and prepare a deficiency list for remedial action by the Electrical Subcontractor. When requested, the electrical Subcontractor shall respond in writing to the Contract Administrator, stating corrective action and completion date for each item listed as deficient. This response shall be in the hands of the Contract Administrator within three working days of receipt of the Site Review Report.

1.7 Product Changes & Substitutions

- .1 Change in Product/Products: Submit request for substitution or alternative in accordance with this Section, the Instructions to Bidders, and Division 01 Product Exchange Procedures Division 01 Substitutions Sections. In case of a discrepancy between this section and Division 00 and Divisions 01, the more stringent requirements shall apply.
- .2 The Instructions to Bidders specify time restrictions for submitting requests for Substitutions during the bidding period to requirements specified in this section.
- .3 Document each request with complete data substantiating compliance of proposed Substitution with Contract Documents.
- .4 Any substituted item submitted for consideration must not exceed the available space limitations, and all additional costs for mechanical, electrical, structural and architectural revisions required to incorporate the substituted material shall be the responsibility of the Electrical Division. Review maximum dimensions and weights when provided in the specification and schedules, and where not specified review the drawings for space limitations.
- .5 A request constitutes a representation that the Bidder:
 - .1 Has investigated proposed Product and determined that it meets or exceeds the quality level of the specified Product.
 - .2 Will provide the same warranty for the Substitution as for the specified Product.
 - .3 Will coordinate installation and make changes to other Work which may be required for the Work to be complete with no additional cost to The City.
 - .4 Waives claims for additional costs or time extension which may subsequently become apparent.
 - .5 Will reimburse The City and Contract Administrator for review or redesign services associated with re-approval by authorities.
- .6 Substitutions will not be considered when they are indicated or implied on shop drawing or product data submittals, without separate written request, or when acceptance will require revision to the Contract Documents.

1.8 Submittals For Review

- .1 Refer to Division 01.
- .2 Progress Payment Application Template
 - .1 Prior to the first application for payment, submit for review a draft progress application template.
 - .2 Progress Application shall contain separate line items for the following systems:
 - .1 Site Services

- .2 Distribution Equipment including Panels, Distribution Panels, Transformers, etc.
- .3 Emergency Generator and Standby Power Systems
- .4 Lighting
- .5 Lighting Controls
- .6 Branch Wiring, Conduit, Raceway, Boxes
- .7 Exit & Emergency Lighting
- .8 Electric Heat
- .9 Sound Masking
- .10 Voice/Data
- .11 Paging
- .12 Audio/Visual Systems
- .13 Intercom
- .14 Fire Alarm
- .15 CCTV
- .16 Intrusion
- .17 Access Control
- .3 Progress for each system shall break out labor and materials separately.
- .3 Shop Drawings Administrative Requirements
 - .1 Shop drawings shall be submitted electronically in PDF format documents to shopdrawings@eppsiepmann.com.
 - .2 Shop drawing documents shall be grouped by specification section. Clearly list the specification section on the front page or cover sheet of the submittal. Shop drawings related to multiple sections may not be grouped together into a single document. Documents that are groups incorrectly will be returned without being examined and shall be considered rejected.
 - .1 Each drawing shall include the name of project as found on the drawings or specifications, the equipment supplier and the specification section that the equipment is specified under.
 - .3 Submit to Contract Administrator submittals listed for review. Submit with reasonable promptness and in orderly sequence so as to not cause delay in Work. Failure to submit in ample time is not considered sufficient reason for an extension of Contract Time and no claim for extension by reason of such default will be allowed.
 - .4 Work affected by submittal shall not proceed until review is complete.
 - .5 Present Shop Drawings, product data, samples and mock-ups in SI Metric and/or Imperial inch-pound units, to match the units used in the schedules.
- .4 Shop Drawings and Product Data
 - .1 Submit shop drawings and product data for review by the Contract Administrator. All drawings shall be in English and metric dimensions or in imperial where indicated. Manufacture of equipment shall not commence until shop drawings have been reviewed.
 - .2 Material submitted for review shall be marked up to bear the Electrical Subcontractor's and where applicable the Utility's reviewed stamp.

- .3 Shop drawings shall be reviewed by the Electrical Subcontractor, general Contractor, and where applicable the Utility prior to submittal to Contract Administrator, confirming that they meet all the design requirements. This review represents that necessary requirements have been determined and verified, or will be, and that each submittal has been checked and co-ordinated with requirements of Work and Contract Documents.
 - .4 Submittals not stamped, signed, dated, identified as to specific project, and attesting to their being reviewed will be returned without being examined and shall be considered rejected.
 - .5 Indicate details of construction, dimensions, capacities, weights and electrical performance characteristics of equipment or material.
 - .6 Where applicable, include wiring, single line and schematic diagrams.
 - .7 Include wiring drawings or diagrams showing inter-connection with work of other sections.
- .5 Provide scaled drawings showing layout of all electrical equipment and coordination of same with mechanical equipment in all electrical, electrical/mechanical and voice data rooms.
 - .6 Submit samples in accordance with General Conditions. Samples shall be forwarded to the Contract Administrator's office and returned. 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 Electrical Subcontractor in the tender documents. This sample will be used for comparison with the actual production run of successful manufacturer.
 - .7 Submit shop drawings of service entrance equipment to utilities.

1.9 Closeout Submittals

- .1 Refer to Division 01.
- .2 Prepare instructions and data using personnel experienced in maintenance and operation of described products.
- .3 Four (4) weeks prior to Substantial Performance of the Work, submit to the Contract Administrator, one (1) draft copy of operating and maintenance manuals in Canadian English.
- .4 Copy will be returned with Contract Administrator's comments.
- .5 Revise content of documents as required prior to final submittal.
- .6 Two (2) weeks prior to Substantial Performance of the Work, submit to the Contract Administrator, three (3) final copies of operating and maintenance manuals in Canadian English.
- .7 Summary audit documents associated with requirements for LEED classification documentation.
- .8 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, 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 all warranty information.
- .5 Submit Maintenance Manuals to the Contract Administrator for review. Manuals that are incomplete shall be returned to the Electrical Subcontractor for completion. Completed manuals shall be submitted, to the satisfaction of the Contract Administrator, before final payment may be considered to be due.
- .6 Format
 - .1 Refer also to Section 01 78 00 for formats for manuals. Where there is a discrepancy with this section, follow the requirements of 01 78 00.
 - .2 Organize data in the form of an instructional manual.
 - .3 Binders: vinyl, hard covered, 3 'D' ring, loose leaf 8.5 x 11 inch (219 x 279 mm) with spine and face pockets.
 - .4 When multiple binders are used, correlate data into related consistent groupings. Identify contents of each binder on spine.
 - .5 Cover: Identify each binder with type or printed title 'Project Record Documents'; list title of project and identify subject matter of contents.
 - .6 Arrange content by systems under Section numbers and sequence of Table of Contents.
 - .7 Provide tabbed fly leaf for each separate product and system, with typed description of product and major component parts of equipment.
 - .8 Text: Manufacturer's printed data, or typewritten data.
 - .9 Drawings: provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.
- .7 Contents
 - .1 Refer also to Section 01 78 00 for formats for contents. Where there is a discrepancy with this section, follow the requirements of 01 78 00.
 - .2 Table of Contents: Provide:
 - .1 Title of project.
 - .2 Date of submission.
 - .3 Names, addresses, and telephone numbers of Contract Administrator and Electrical Subcontractor with name of responsible parties.
 - .4 Schedule of products and systems, indexed to content of volume.
 - .3 For each product or system, list names, addresses and telephone numbers of related Subcontractors and suppliers, including local source of supplies and replacement parts.

- .4 Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation; delete inapplicable information. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions specified in Section 01 45 00.
 - .5 Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control, wiring, and schematic diagrams and performance curves.
 - .6 Include Systems Certifications where applicable.
 - .7 Include manufacturer specific warranties where applicable.
 - .8 Include a list of maintenance materials provided in each related section.
 - .9 Certificate of Acceptance: Relevant certificates issued by authorities having jurisdiction, including code compliance certificate, life safety systems performance certificate.
 - .10 Training: Record of The Division's representative training as specified.
- .9 Maintenance Materials:
- .1 Provide maintenance materials as specified. Include a list of the maintenance materials in each related section of the operation and maintenance data.
 - .2 Turn materials over to The Division in an orderly fashion upon completion of installation.
- .10 Record Documentation:
- .1 Prior to Substantial Performance of the Work, electronically transfer the marked-up information from the as-built documents, as follows:
 - .1 Drawings: Transfer the marked-up information to AutoCAD and produce an electronic record set in Adobe Acrobat (PDF) format, as well as the AutoCAD file.
 - .2 Specifications: Adobe Acrobat (PDF).
 - .2 Mark revised documents as "RECORD DOCUMENTS". Include all revisions.
 - .3 Submit completed record documents to Contract Administrator by electronic transfer.
 - .4 Project record documents shall comprise a complete and accurate record of the actual electrical installation. Record drawings that are inaccurate or incomplete shall be returned to the Electrical Subcontractor for correction and completion.
 - .5 Record drawings shall contain a stamp bearing the words "Record Drawing" or "As-Built Drawing", the Electrical Subcontractor's company name, date, and the Electrical Subcontractor's signature.
 - .6 The Contract Administrators will recommend a suitable deficiency holdback until accurate and complete record drawings have been submitted in acceptable form.
 - .7 Indicate on record drawings, location of all buried services. This information is to be certified correct by Contract Administrator before backfilling commences.
 - .8 Record actual size and location of all cables including depth of cables where buried.
 - .9 Electrical Subcontractor shall take all schedules/details from specification and put onto additional drawing sheets for Record Drawings.

1.10 Examination

- .1 Prior to submitting a tender, examine the site and local conditions which will affect the work. Refer to the Architectural, Mechanical and Structural drawings, schedules and specifications for construction details to be certain that the electrical work can be satisfactorily carried out as specified. Claims for extra payments resulting from conditions which could reasonably be foreseen during an examination of the documents and/or site, will not be recognized.
- .2 Ensure that all equipment designated as “Existing to Remain” or “Existing to be Relocated” is suitable for its intended re-use, including panelboards and circuits. Report any discrepancies to the Contract Administrator before tender close.
- .3 Refer to General Conditions for instructions regarding a prearranged site visit during the tender period.
- .4 Notify Contract Administrator of any discrepancies, omissions, etc., prior to the awarding of the Contract, otherwise the Electrical Subcontractor shall perform the work as directed at no additional cost to The City.

1.11 SHORT CIRCUIT/COORDINATION/ARC FLASH STUDY

- .1 Provide a Short Circuit Study based on the IEEE calculation methods found in IEEE 551. The study shall include a summarized table which lists all equipment included in the short circuit study and their respective short circuit interrupt ratings. The study shall list equipment which marginally passes or fails the short circuit test calculations. The study shall also provide recommendations for mitigating equipment which marginally pass or fail their associated short circuit ratings.
- .2 Provide a Protection and Coordination Study based on IEEE 242 and IEEE 1015. The study shall include all circuit breakers, relays, fuses, transformers, and other protective equipment which are fed from all energy sources in the associated distribution. The study shall include time-current curves as necessary to determine all circuit breaker settings. The study shall include an analysis of all time-current curves, an analysis of the coordinated circuit breaker settings, and recommendations for mitigating any potential protection and coordination issues. The study shall include all phase and ground fault curves with recommended settings for full selective coordination on all life safety devices including but not limited to generators, fire pumps, elevators and lifts. The study shall include a table of all circuit breaker settings for every circuit breaker considered in the study. The study shall be coordinated with the Arc Flash study to mitigate serious potential arc flash incident energies when applicable.
- .3 Provide an Arc Flash study based on IEEE 1584 and CSA Z462. The arc flash study shall include all areas in the distribution where an arc-flash hazard is present which includes, but is not limited to, equipment analyzed in the short circuit study. The arc flash study shall be coordinated with the protection and coordination study. The Arc Flash Study shall include, for all considered equipment, worst case arc flash results including the local incident energies, working distances, and arc flash boundaries.
- .4 Provide Arc Flash labels based on the results of the Arc Flash Study. Labels shall conform to the requirements set out in CSA Z462.

- .5 Submit a preliminary copy of the studies complete with short circuit information and preliminary breaker coordination to the Contract Administrator with distribution shop drawings. Feeder lengths for the preliminary study shall be based on worst case estimates based on the intended installation by the Electrical Subcontractor.
- .6 Submit a final copy of the Short Circuit/Coordination/Arc Flash Study to the Contract Administrator upon completed installation of all feeders and distribution. Final copy of Short Circuit/Coordination/Arc Flash Study shall be signed and sealed by a Professional Engineer registered in the province of Manitoba. Feeder lengths shall be based as-installed on site measurements. Arc Flash Study shall be based on real fault data, provided by the utility. All data sources and their respective origins shall be listed and included in the report or appendices.
- .7 Include the final copy of the Short Circuit/Coordination/Arc Flash Study in each Maintenance Manual.
- .8 Provide a model of the study in its native digital file format and submit with the final report. Standard of acceptance: SKM, Etap, and Easy Power analysis model files.
- .9 Ensure circuit protective devices such as over current trips, relays, fuses, are installed and adjusted to values and settings as recommended in the Studies.
- .10 Ensure arc flash labels are affixed to the appropriate equipment and placed on the equipment as per the guidelines set out in CSA Z462.
- .11 Arc flash labels shall be placed on the exterior of the electrical equipment; free of moving doors, hinges, and moving parts; and be visible on approach to the electrical equipment. Panelboards in public spaces may have their arc flash labels installed inside of a hinged door provided the equipment is constructed such that with the door open there are no exposed current-carrying parts.
- .12 The Short Circuit study shall include all infrastructure from the secondary side of the utility distribution transformer including all existing and new infrastructure.

1.12 Efficiency Manitoba

- .1 Electrical Subcontractor shall make application on behalf of the owner for the Efficiency Manitoba Incentive for all available rebates under the Commercial Lighting Program.
- .2 Application shall be made, and acceptance provided by Efficiency Manitoba prior to commencement of demolition.
- .3 Electrical Subcontractor shall gather all information as required to complete the application.
- .4 Electrical Subcontractor shall provide updates to the owner regarding status of the application and expected rebates.

Part 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 Request for approval of material, as equal, shall conform to the specification.
- .4 Equivalent materials and equipment
 - .1 Bidders shall submit a tender based on the specified materials and equipment only.
 - .2 Bidders may submit a tender based on equivalent materials and equipment only if such items have been approved as equals by the Contract Administrator.
 - .3 Bidders may submit, with their tender, an alternate price based on alternate materials and equipment only if such items have been approved as alternates by the Contract Administrator.
 - .4 Submissions for equals or alternates shall be received by the Contract Administrator, ten (10) working days prior to tender closing. Submissions shall include sufficient manufacturer's data to clearly show equivalency, as well as an itemized list of equal or alternate items, the items for which they were submitted and a space for the Contract Administrator to indicate "approved equal", "approved alternate", or "not approved". Submittal list will be returned or may be picked up at the Contract Administrator's office. Where submissions are not returned by the Contract Administrator before tender closing or are not received by the Contract Administrator ten (10) working days before close of tender, they are considered not approved.
 - .5 All submissions shall include the following phrase "We have reviewed all Contract documents, Contract drawings and specifications relating to the equipment presented herein" and shall bear the name and signature of the manufacturer or their agent.
- .5 Wet applied material including but not limited to interior adhesives, coatings, sealants, paint shall be classified as Low-emitting materials under LEED v4 BD+C, to meet the threshold of at least 90%, by volume, for emission and 100% for Volatile Organic Compound (VOC). Certification to be provided to confirm compliance with General Emissions Evaluation and VOC content requirements for wet applied products.
 - .1 General emissions evaluation. Building products must be tested and determined compliant in accordance with California Department of Public Health (CDPH) Standard Method v1.1-2010, using the applicable exposure scenario. The default scenario is the private office scenario. The manufacturer's or third-party certification must state the exposure scenario used to determine compliance. Claims of compliance for wet-applied products must state the amount applied in mass per surface area. Manufacturers' claims of compliance with the above requirements must also state the range of total VOCs after 14 days (336 hours), measured as specified in the CDPH Standard Method v1.1:
 - .1 0.5 mg/m3 or less;
 - .2 between 0.5 and 5.0 mg/m3; or
 - .3 5.0 mg/m3 or more.

- .2 Additional VOC content requirements for wet-applied products. In addition to meeting the general requirements for VOC emissions (above), on-site wet-applied products must not contain excessive levels of VOCs, for the health of the installers and other trades workers who are exposed to these products. To demonstrate compliance, a product or layer must meet the following requirements, as applicable. Disclosure of VOC content must be made by the manufacturer. Any testing must follow the test method specified in the applicable regulation.
- .3 All paints and coatings wet-applied on site must meet the applicable VOC limits of the California Air Resources Board (CARB) 2007, Suggested Control Measure (SCM) for Architectural Coatings, or the South Coast Air Quality Management District (SCAQMD) Rule 1113, effective June 3, 2011.
- .4 All adhesives and sealants wet-applied on site must meet the applicable chemical content requirements of SCAQMD Rule 1168, July 1, 2005, Adhesive and Sealant Applications, as analyzed by the methods specified in Rule 1168. The provisions of SCAQMD Rule 1168 do not apply to adhesives and sealants subject to consumer product VOC regulations.

2.2 Voltage Ratings

- .1 Operating voltages: to CAN3-C235-83(R2015).
- .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 shall operate in extreme operating conditions established in above standard without damage to equipment.

2.3 Finishes

- .1 Finish outdoor electrical equipment such as parking lot panels, to match light standards.
- .2 Paint indoor switchgear light grey to EEMAC-2Y-1.
- .3 Paint indoor distribution enclosure trims light grey to EEMAC-2Y-1. Distribution tub shall be galvanized.
- .4 Paint outdoor electrical equipment enclosures with two (2) coats of U.V. resistant Urethane Enamel to minimum 1.5 mil dry coat thickness. Colour shall be "equipment green" to EEMAC 2Y-1.
- .5 Clean and touch up surfaces of shop-painted equipment, scratched or marred during shipment or installation, to match original paint.
- .6 Clean, prime and paint exposed wiring, conduit, junction and pull boxes, hangers, racking, and fasteners to prevent rusting and to match surrounding finishes where applicable.

2.4 Labels And Warning Signs

- .1 Manufacturer's nameplates and CSA labels shall be visible and legible after equipment is installed.

- .2 Provide warning signs on equipment, as required, to meet the requirements of the Inspection Authorities, including indication of multiple power sources.
- .3 Provide quantity as required of buried cable signs reading "Buried Cable" and "Buried High Voltage Cable". Signs shall be installed at building structure/equipment, at locations as directed on site and as per Canadian Electrical Code.

2.5 Protection

- .1 Guards
 - .1 Provide guards for all electrical equipment and devices in gymnasium and other areas subject to damage.
- .2 Sprinkler Proof Equipment
 - .1 All surface mounted electrical equipment located in sprinklered areas shall be sprinkler proof and shall be provided with suitable hoods and shields.
 - .2 Entrance of conduits into the top of surface mount electrical panels/cabinets/distributions and motor control centers shall utilize O-rings and watertight connectors.
 - .3 All recessed mounted branch circuit panels and distribution panels shall be provided with a Type 2 enclosure.
- .3 Construction
 - .1 Protect exposed live equipment during construction for personnel safety.
 - .2 Shield and mark live part "LIVE () VOLTS", with appropriate voltage.
 - .3 Arrange for installation of temporary doors for rooms containing electrical distribution equipment. Keep these doors locked except when under direct supervision.

2.6 Spare Parts And Maintenance Materials

- .1 Assemble spare parts as specified.
- .2 Include the following:
 - .1 Part number.
 - .2 Identification of equipment or system for which parts are applicable.
 - .3 Installation instructions as applicable.
- .3 Provide a written list complete with The City's signature assuring that spare parts have been received by The City.

2.7 Access Doors

- .1 Access doors shall be minimum #12 gauge prime coat painted bonderized steel. Each shall 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 ULC. listed and labeled and of a rating to maintain the fire separation integrity.
- .2 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.

- .3 Supply access doors in inaccessible construction shall give access to all concealed junction boxes, pullboxes, conductor joints and other similar electrical work which may need maintenance or repair.
- .4 Before commencing installation of electrical work, submit to the Architect for approval, a list of required access doors showing the exact sizes and locations of such access doors. Locate access doors in walls and partitions to the Architect's approval, and arrange electrical work to suit. Access doors shall be, wherever possible, of a standard size for all applications. Confirm exact dimensions with the Architect, prior to ordering.
- .5 Access doors will be installed by the Division responsible for the particular type of construction in which access doors are required. Supply the access doors to the Division installing same at the proper time to avoid construction delays.

Part 3 Execution

3.1 Coordination With Other Trades

- .1 Refer to Mechanical, Structural, Architectural and Interior Design drawings and specifications for additional electrical work in connection with other Divisions. Where such work is included in other sections of the specifications, provide equipment, conduit, wiring, etc. (in accordance with the approved manufacturer's shop drawings), as required, for operation of the specified equipment.
- .2 Schedule execution of electrical work with associated work specified in other Divisions.
- .3 Coordinate electrical work with work of other trades to avoid conflicts with pipes, air ducts or other equipment. Provide additional supports, wiring, etc., to relocate electrical equipment, as required, where structural members, air ducts, piping or other equipment interferes with the electrical installation.
- .4 Prior to installation provide scaled drawings of all mechanical/electrical rooms and communication rooms showing layout of all equipment (mechanical and electrical) for Contract Administrator review.

3.2 Quality Assurance

- .1 Do complete installations in accordance with CSA-C22.1-21.
- .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 installations shall comply with all requirements of the electrical supply authority and the inspection authority.
- .4 Electrical installation shall be in accordance with the applicable versions of the Canadian 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.

3.3 Workmanship

- .1 Install equipment, conduit and cables in a workmanlike manner to present a neat appearance to the satisfaction of the Contract Administrator. 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/junction boxes and apparatus requiring maintenance, adjustment or eventual replacement, with adequate clearances and accessibility for same.
- .3 Provide for all requirements shown on shop drawings or manufacturer's installation instructions.
- .4 Work deemed by the Contract Administrator to be unsatisfactory shall be replaced at no additional cost.

3.4 Delivery Storage And Handling

- .1 Deliver all materials to site in an orderly fashion.
- .2 Store all materials in a clean and dry place, secure from vandalism or theft. All materials shall be left in shipping containers until required for use.
- .3 Provide additional protection such as tarps, padding, wood skids, etc., as required to ensure protection of equipment and as directed by the Architect.

3.5 Excavation And Backfilling

- .1 Excavate and backfill as required for underground electrical services as indicated. Provide protective materials around and over services and be present at all times during excavation and backfilling to supervise work. Backfilling shall restore the excavated area to the original condition and shall include sodding where required.
- .2 Work shall be in accordance with the current CSA Bulletin.
- .3 Include all costs for excavation and backfilling, for any underground electrical installation, unless otherwise indicated.
- .4 Work shall be arranged in such a manner that will not interfere with regular pedestrian or vehicular traffic patterns.
- .5 Provide trenching, cable installations and backfill promptly. Open trenches shall be barricaded in an appropriate manner.
- .6 Cables required to cross under roadways, paved areas, sidewalks, etc. shall be installed in PVC conduits pushed under such areas.
- .7 Six (6") of sand shall be provided surrounding installed cables and 2" x 4" treated plank installed 6" above the cables. Install cable marker tape in all trenches, minimum 12" above cables. The remainder of the trench shall be backfilled with granular base course. All backfill material shall be thoroughly tamped and compacted to at least 90% of maximum density at optimum moisture. The ground shall be left free from ruts and rough spots. In any asphalt areas, backfill shall be granular material only.

- .8 All sodded areas disturbed or damaged during trenching and backfilling shall be repaired with manured soil mix and resodded. Make all repairs to damaged asphalt and/or concrete surfaces to match existing.
- .9 Care shall be taken when excavating near existing services. Existing trees and shrubbery in work area shall be protected from damage.
- .10 Install buried cable signs as per CEC and Manitoba Electrical addendums.

3.6 Conduit Sleeves And Holes

- .1 Install conduit, and sleeves, prior to pouring of concrete. Sleeves through concrete shall be sized for free passage of conduit.
- .2 Holes through exterior walls and roof shall be flashed and made weatherproof.
- .3 Make necessary arrangements for cutting of chases, drilling of holes and other structural work required to install electrical conduits, cables, pullboxes and outlet boxes.
- .4 Install cables, conduits, and fittings to be embedded or plastered over, neatly and close to building structure so furring can be kept to minimum.
- .5 Provide a minimum of two (2) separate conduit sleeves embedded in each concrete lighting fixture base. At least one (1) unused conduit shall be for possible future extension of wiring.
- .6 All conduits and cables shall be entered into the building above grade unless otherwise noted.
- .7 All coring in buildings with electrical in the slab shall be scanned at Electrical Subcontractor's expense to prevent damage.

3.7 Cutting And Patching

- .1 Pay the costs of all cutting and patching required for the installation of electrical work. Payment for cutting and patching shall be made through the General Contractor.
- .2 Cutting and patching required for the installation of electrical work shall be done by the particular trade whose work is involved. No cutting or patching shall be carried out by the tradesman employed on the electrical work.
- .3 Obtain the approval of the Architect before arranging for any cutting. Patching shall restore the affected area to the original condition; materials and methods used for patching shall be in accordance with the requirements of the corresponding Divisions of the specification.

3.8 Device Installation

- .1 Device Location
 - .1 Locate devices as indicated.
 - .2 Do not install devices back-to-back in wall.
 - .3 Drawings are schematic only and do not indicate all architectural or structural elements.
 - .4 Change location of devices at no extra cost or credit, providing distance does not exceed 10'-0" (3 m) and information is provided before installation.

- .5 Locate light switches on latch side of doors.
 - .6 Vertically align devices of different systems when shown in close proximity to each other and occurring at different mounting heights.
 - .7 Coordinate mounting heights and location of all equipment with Architectural, Mechanical and Structural Drawings prior to installation of rough-in boxes.
- .2 Mounting Heights
- .1 Mounting height of equipment is from finished floor to centre line of equipment unless specified or indicated otherwise.
 - .2 If mounting height of equipment is not indicated, verify with Architect before proceeding with installation.
 - .3 Install electrical equipment at the following heights unless indicated or directed otherwise:

Device / Equipment	Mounting Height	
Devices above counters	150mm	6"****
Receptacles:		
- General (Accessible Height)	450mm	18"
- Mechanical/Shop Areas	1000mm	40"
- Clock	2150mm	84"
- Above top of continuous baseboard heater	200mm	8"
- Exterior	1000mm	40"
Switches, Dimmers, push buttons, Luxo bracket		
- General	1150	45"
Clocks	2150mm	84"
Exit Signs	25mm*****	1"*****
Emergency Lighting Battery Banks/Remote Headers	2350mm* or 150mm**	92"* or 6"*
Automatic Door Operator Pushbuttons	900mm	36"
Occupancy Sensors – Switch based with manual override controls.	1150mm	45"
Occupancy Sensors – General	Per manufacturers recommendations	
Fire Alarm Visual, Audible, & Combination Devices	2350mm* or 150mm**	92"* or 6"*
Fire Alarm Manual Pullstations	1200mm	47"
Thermostats		
- General	1150mm	45"
Intercom Stations	1150mm	45"
Proximity/Card Readers	900mm	36"
Communication Outlets (Accessible Height)	450mm	18"
Hand Dryers	1200mm	47"
Branch Circuit Panelboards, Control Panels, Annunciators. Install panels taller than 1800mm (72") with bottom no more than 100mm (4")	2000mm*	78"*

above floor.		
Enclosed circuit breakers	1600mm***	60"***

- *Measured to top of device/equipment
- **Measured from Ceiling to top edge of device where mounting height would be lower than required specification.
- ***Measured to operating handle of device.
- ****Coordinate counter backsplash heights with architectural drawings prior to rough-in. Maintain minimum 1" clearance above backsplash height to bottom of finished wall plate.
- *****Measured above door trim to underside of device.

- .1 Coordinate all mounting heights with Architectural elevations.
- .2 Where installed in block or brick, mounting heights shall be as above or at bottom of nearest course.
- .4 Panelboards and other equipment which are to be surface mounted shall be installed on minimum 19mm (3/4") good one side, fir plywood mounting backboards. Treat backboards with wood preservative prior to installation and paint with primer and two (2) coats gray enamel before any equipment is mounted. Provide plywood mounted boards unless specified otherwise in other sections.
- .5 Panelboards mounted on exterior concrete/block walls shall have minimum 3/4" air gap behind enclosure (to minimize condensation).
- .6 All transformers, motor control centers and floor-mounted distribution panels shall be mounted on 100mm (4") concrete housekeeping pads. The Electrical Subcontractors shall be responsible for provision of these pads.

3.9 Fireproofing

- .1 Where cables or conduits pass through block or concrete walls and floors and any fire-rated assembly, seal openings with firestopping systems that have been tested for specific fire-resistance-rated construction conditions conforming to the construction assembly type, penetrating item type, annular space requirements, and fire-rating involved in each instance.
- .2 Provide products that upon curing, do not re-emulsify, dissolve, leach, breakdown or otherwise deteriorate over time from exposure to atmospheric moisture, sweating pipes, ponding water or other forms of moisture characteristic during and after construction.
- .3 Openings within walls and floors designed to accommodate cabling systems subjected to frequent cable changes shall be provided with re-enterable products.
- .4 Fire proofing of electrical cables, conduits, trays, etc, passing through fire barriers shall conform to local codes and inspection authorities.
- .5 Fire stop materials shall be asbestos free and have been tested in accordance with ASTM E-814, and ULC 1479.
- .6 Fire stop and smoke seals shall be done in accordance with Section 07 84 00.
- .7 Approved manufacturers:

- .1 Nelson Firestop Products
- .2 Specified Technologies
- .3 Hilti Firestop

3.10 Load Balance

- .1 Measure phase current to panelboards with normal loads operating at time of measurement. Adjust branch circuit connections as required to obtain best balance of current between phases and record changes.
- .2 Measure phase voltages at loads and adjust transformer taps to within 2% of rated voltage of equipment.
- .3 Submit, at completion of work, a report listing phase and neutral currents on panelboards, transformers and motor control centres, operating under normal load. State hour and date on which each load was measured, and voltage at time of test.
- .4 Include load balance test results in maintenance manuals.

3.11 Testing

- .1 Conduct and pay for tests including, but not limited to, the following systems:
 - .1 Power generation and distribution system.
 - .2 Circuits originating from branch distribution panels.
 - .3 Lighting and its control.
 - .4 Motors, heaters and associated control equipment including sequenced operation of systems where applicable.
 - .5 Heating cables and mats.
 - .6 Systems:
 - .1 Fire Alarm
 - .2 Public Address
 - .3 Communication cabling systems.
 - .4 Intrusion Detection
 - .5 Access Control
 - .6 CCTV
 - .7 Grounding systems.
- .2 Insulation Resistance Testing
 - .1 Megger circuits, feeders and equipment up to 350V with a 500V instrument.
 - .2 Megger 350-600V circuits, feeders and equipment with a 1000V instrument.
 - .3 Check resistance to ground before energizing.
- .3 Furnish Manufacturer's Certificate or letter confirming that entire installation, as it pertains to each system, has been installed to manufacturer's instructions. Submit letter in accordance with this section.
- .4 Carry out tests in presence of Contract Administrator where directed.
- .5 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project.
- .6 Submit test results in Maintenance Manuals.

3.12 Care, Operation And Start-up

- .1 Instruct The City's operating personnel in the operation, care and maintenance of equipment. Arrangement of such instructional sessions shall 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.

3.13 Cleaning

- .1 Final cleaning shall be done in accordance with the specification.
- .2 Final cleaning shall include, but not be limited to, all lighting reflectors, lenses, and other lighting surfaces that have been exposed to dust and dirt throughout the course of construction.

END OF SECTION

Part 1

General

1.1

Section Includes

- .1 Building wire and cable.
- .2 Armoured cable.
- .3 Metal clad cable.
- .4 Variable frequency (speed) drive cable.
- .5 Wiring connectors and connections.

1.2

Related Sections

- .1 Section 26 05 53 - Electrical Identification.

1.3

References

- .1 CSA-C22.1-18 - Canadian Electrical Code, Part I (24th Edition), Safety Standard for Electrical Installations.
- .2 C22.2 No. 0.3-09 (R2014) - Test Methods for Electrical Wires and Cables.
- .3 CSA C22.2 No. 51-14 - Armoured Cables.
- .4 CSA C22.2 No. 52-15 - Underground Secondary and Service Entrance Cables.
- .5 CAN/CSA-C22.2 No. 65-18 - Wire Connectors.
- .6 CSA C22.2 No. 75-17 - Thermoplastic-Insulated Wires and Cables.
- .7 CSA C22.2 No. 123-16 - Metal Sheathed Cables.
- .8 CAN C22.2 No.131-17 - Type TECK 90 Cable.
- .9 CSA C22.2 No. 208-14 - Fire Alarm and Signal Cable.
- .10 NECA (National Electrical Contractor's Association) - National Electrical Installation Standards (NEIS).
- .11 NETA (InterNational Electrical Testing Association) - ANSI/NETA ATS-2017 - Standard for Acceptance Testing Specifications for Electrical Power Equipment and Systems.
- .12 CSA (Canadian Standards Association).
- .13 ULC (Underwriters' Laboratories of Canada).

1.4

Administrative Requirements

- .1 Refer to 26 05 00 Common Work Results for Electrical.
- .2 Coordination:
 - .1 Coordinate with other work having a direct bearing on work of this section.
 - .2 Where wire and cable destination is indicated and routing is not shown, determine exact routing and lengths required.

1.5 Submittals For Review

- .1 Refer to 26 05 00 Common Work Results for Electrical.
- .2 Product Data: Provide for Fire Rated Cable.

1.6 Submittals For Information

- .1 Refer to 26 05 00 Common Work Results for Electrical.
- .2 Design Data: Indicate voltage drop and ampacity calculations for aluminum conductors substituted for copper conductors.
- .3 Installation Data: Indicate application conditions and limitations of use stipulated by product testing agency specified under Regulatory Requirements.

1.7 Closeout Submittals

- .1 Refer to 26 05 00 Common Work Results for Electrical.
- .2 Record Documentation:
 - .1 Record actual locations of components and circuits.
 - .2 Record routing of all equipment and panelboard feeders.

1.8 Quality Assurance

- .1 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum five (5) years documented experience.

1.9 Regulatory Requirements

- .1 Conform to CSA-C22.1.
- .2 Provide products listed and classified by CSA or ULC and as suitable for the purpose specified and indicated.

1.10 Project Conditions

- .1 Conductor sizes are based on copper unless indicated as aluminum or "AL".
- .2 If aluminum conductor is substituted for copper conductor, size to match circuit requirements for conductor ampacity and voltage drop.

Part 2 Products

2.1 Building Wire And Cable

- .1 Description: Single conductor insulated wire.
- .2 Conductor: Copper unless otherwise noted.
- .3 Insulation Voltage Rating: 600 volts.
- .4 Insulation: Thermoplastic material rated 90 degrees C.

2.2 Armoured Cable

- .1 Description: Type ACWU90 and AC90.

- .2 Conductor: Copper unless otherwise noted.
- .3 Insulation Voltage Rating: 600 volts.
- .4 Insulation Temperature Rating: 90 degrees C.
- .5 Insulation Material: Thermoplastic.

2.3 Metal Clad Cable

- .1 Description: Type TECK90.
- .2 Conductor: Copper unless otherwise noted.
- .3 Insulation Voltage Rating: 600 volts.
- .4 Insulation Temperature Rating: 90 degrees C.
- .5 Conductor Insulation Material: Cross-Linked Polyethylene (XPPE), type RW90.
- .6 Armour Material: Aluminum.
- .7 Armour Design: Interlocked metal tape.
- .8 Outer jacket: PVC.
- .9 Rating: Hazardous Location, CSA FT4

2.4 Variable Frequency (speed) Drive Cable:

- .1 Provide variable frequency drive cables meeting the requirements of CSA C22.2 No. 123 and CSA C22.2 No. 174 from all VFD's to each designated motor load, comprised as follows:
 - .1 Sectored ground design consisting of 3 bare bonding conductors.
 - .2 1000 volt rated cross linked polyethylene insulated phase conductors.
 - .3 FT4 rated PVC outer jacket.
 - .4 Sized to suit project requirements.

2.5 Connectors

- .1 Pressure type connectors, fixture type splicing connectors, cable clamps and lugs, as required.

Part 3 Execution

3.1 Examination

- .1 Refer to 26 05 00 Common Work Results for Electrical.
- .2 Verify that field measurements are as indicated.
- .3 Verify that interior of building has been protected from weather.
- .4 Verify that mechanical work likely to damage wire and cable has been completed.
- .5 Verify that raceway installation is complete and supported.

3.2 Preparation

- .1 Completely and thoroughly swab raceway before installing wire.

3.3 Wiring Methods

- .1 Concealed Dry Interior Locations: Use only building wire in raceway.
- .2 Exposed Dry Interior Locations: Use only building wire in raceway.
- .3 Above Accessible Ceilings: Use only building wire in raceway.
- .4 Wet or Damp Interior Locations: Use only armoured cable with jacket, metal clad cable, and building wire in raceway.
- .5 Exterior Locations: Use only metal clad cable.
- .6 Underground Installations: Use only metal clad cable.
- .7 Use wiring methods indicated.

3.4 Installation

- .1 Route wire and cable as required to meet project conditions.
- .2 Install cable to the CSA-C22.1.
- .3 Use solid conductor for feeders and branch circuits 10 AWG and smaller.
- .4 Use stranded conductors for control circuits.
- .5 Use conductor not smaller than 12 AWG for power and lighting circuits.
- .6 Use conductor not smaller than 16 AWG for control circuits.

Maximum Conductor Length for 120V Branch Circuits

Breaker Size[A]	Conductor	
	Size [AWG]	Max Length [m]
15A	#12	20
	#10	35
	#8	55
	#6	90
20A	#12	15
	#10	25
	#8	40
	#6	65
	#4	110
30A	#10	15
	#8	25
	#6	45
	#4	70

- .7 Pull all conductors into raceway at same time.

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- .8 Use suitable wire pulling lubricant for building wire 4 AWG and larger.
 - .9 Protect exposed cable from damage.
 - .10 All cable routed below grade shall enter/exit the building below grade unless noted otherwise.
 - .11 Support cables above accessible ceiling, using spring metal clips to support cables from structure. Do not rest cable on ceiling panels.
 - .12 Single conductor cables shall be installed one cable diameter apart on suspended cable tray or channel supports and shall be clamped with aluminum cable clamps. Cables shall be terminated using non-magnetic connectors and shall be watertight for top entry. Cable armour shall be grounded via an aluminum plate at the supply end and isolated via an insulating plate, at the load end of the cable. A #3/0 AWG insulated (unless otherwise noted) copper ground wire shall be installed with each set of feeder cables. Cable bending radius shall be at least twelve times the overall cable diameter and bend shall not damage or distort the outer sheath.
 - .13 Armoured cable shall be used for connections from conduit systems to recessed luminaires in accessible ceilings. Cable shall be of sufficient length to allow the lighting fixture to be relocated to any location within an 1800mm (6') radius. Cable shall be clamped before entering the lighting fixture and shall be clipped before entering the conduit system junction box. (Minimum requirements).
 - .14 Armoured cable may be used for connections from conduit systems to wiring devices in steel stud partitions and for interconnection of wiring devices within steel stud partitions. Cables shall be clipped before entering junction or outlet boxes.
 - .15 Fire Rated Cable shall be installed in complete unbroken lengths parallel with building lines and terminated as per manufacturer's instructions. Care shall be taken at all times to prevent the entry of moisture into the ends of the cable.
 - .16 Fire Rated Cable shall be surface-mounted to building surfaces with stainless steel banding or straps.
 - .17 Provide VFD cable between the VFD and associated motor for all for all VFD driven motors. Coordinate VFD locations with mechanical. VFD cable lengths shall be kept as small as practically possible to reduce electromagnetic interference. Maintain as much separation as possible between noise-susceptible cables and VFD cables: a minimum of 1 ft. for shielded instrumentation cables and 3 ft. for unshielded instrumentation cables. If the VFD cables and noise-susceptible cables must lie close to each other, parallel runs shall not exceed 3 m (10 ft.). If VFD cable must cross other cable type, cables shall cross perpendicularly, at a single point.
 - .18 Use suitable cable fittings and connectors.
 - .19 Neatly train and lace wiring inside boxes, equipment, and panelboards.
 - .20 Clean conductor surfaces before installing lugs and connectors.
 - .21 Make splices, taps, and terminations to carry full ampacity of conductors with no perceptible temperature rise.

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- .22 Terminate aluminum conductors with tin-plated aluminum- bodied compression connectors only. Fill with anti- oxidant compound before installing conductor.
 - .23 Use suitable reducing connectors or mechanical connector adaptors for connecting aluminum conductors to copper conductors.
 - .24 Use split bolt connectors for copper conductor splices and taps, 6 AWG and larger. Tape uninsulated conductors and connector with electrical tape to 150 percent of insulation rating of conductor.
 - .25 Use solderless pressure connectors with insulating covers for copper conductor splices and taps, 8 AWG and smaller.
 - .26 Use insulated spring wire connectors with plastic caps for copper conductor splices and taps, 10 AWG and smaller.
 - .27 Identify wire and cable to Section 26 05 53. Identify each conductor with its circuit number or other designation indicated.

END OF SECTION

Part 1

General

1.1 Section Includes

- .1 Grounding electrodes and conductors.
- .2 Equipment grounding conductors.
- .3 Bonding.

1.2 References

- .1 CSA-C22.1-18 - Canadian Electrical Code, Part I (24th Edition), Safety Standard for Electrical Installations.
- .2 IEEE 81-2012 IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Grounding System.

1.3 System Description

- .1 Metal and underground water pipe.
- .2 Metal frame of the building.
- .3 Metal and underground gas piping system.
- .4 Rod electrode.

1.4 Performance Requirements

- .1 Maximum Grounding System Resistance: 5 ohms.

1.5 Submittals For Review

- .1 Refer to 26 05 00 Common Work Results for Electrical.
- .2 Product Data: Provide for grounding electrodes and connections.

1.6 Submittals For Information

- .1 Refer to 26 05 00 Common Work Results for Electrical.
- .2 Test Reports: Indicate overall resistance to ground.

1.7 Closeout Submittals

- .1 Refer to 26 05 00 Common Work Results for Electrical.
- .2 Record Documentation: Record actual locations of components and grounding electrodes.
- .3 Certificate of Compliance: Indicate approval of installation by authority having jurisdiction.

1.8 Quality Assurance

- .1 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three (3) years experience.

1.9 Regulatory Requirements

- .1 Products: Listed and classified by ULC and/or CSA as suitable for the purpose specified and indicated.

Part 2 Products

2.1 Rod Electrodes

- .1 Material: Copper-clad steel.
- .2 Diameter: 15.8 mm(5/8 inch) minimum.
- .3 Length and Quantity: As required to meet performance requirements.

2.2 Mechanical Connectors

- .1 Material: Bronze.

2.3 Wire

- .1 Material: Stranded copper.
- .2 Grounding Electrode Conductor: Size to meet CSA-C22.1 requirements.

Part 3 Execution

3.1 Examination

- .1 Refer to 26 05 00 Common Work Results for Electrical.
- .2 Verify that final backfill and compaction has been completed before driving rod electrodes.

3.2 Installation

- .1 Install rod electrodes as indicated. Install additional rod electrodes as required to achieve specified resistance to ground.
- .2 Provide bonding to meet Regulatory Requirements.
- .3 Exposed conductors shall be protected from mechanical injury.
- .4 Mechanical connections shall be used for bonding connections to equipment. Soldered joints shall not be permitted.
- .5 Buried connections of grounding and bonding conductors shall be made using exothermic welding process.
- .6 Provide bonding wire connected to both ends of flexible conduit. Neatly attach to exterior of flexible conduit.
- .7 Provide separate ground conductors for all exterior pole mounted luminaires.
- .8 Interface with site grounding system.
- .9 Bonding connections shall be made using a star configuration. Loop connections shall be avoided.

- .10 Single conductor cables with metallic armour shall be bonded at the supply end only. Provide non-metallic entry plates for load end terminations. Provide a separate bonding conductor.
- .11 Provide separate bonding conductor in all non-metallic raceways.
- .12 Bond together metal siding not attached to grounded structure; bond to ground.
- .13 Equipment Grounding Conductor: Provide separate, insulated conductor within each feeder and branch circuit raceway. Terminate each end on suitable lug, bus, or bushing.
- .14 Provide additional separate bonding conductor within branch circuit raceways where indicated on the drawings. Terminate each end on suitable lug, bus, or bushing.

3.3 System Grounding

- .1 Install system and circuit grounding connection to neutral points of 600V and 208V systems.
- .2 Grounding conductors shall be routed in or adjacent to primary conduits or cables.
- .3 Provide grounding connection to utility pad mounted transformer in accordance with the requirements of the supply authority.

3.4 Equipment Bonding

- .1 Install bonding connections to typical equipment included in, but not necessarily limited to:
 - .1 Service equipment
 - .2 Distribution Panels
 - .3 Transformers
 - .4 Motor Frames
 - .5 Starters
 - .6 Control Panels
 - .7 Building Steel Work
 - .8 Elevators
 - .9 Outdoor lighting

3.5 Communication And Security Systems

- .1 Install communications grounding system for bonding of all telephone, data, fire alarm, paging, security as follows:
 - .1 Provide minimum #6 AWG ground (or larger as indicated on drawings) from all voice/data, server, and IT communications rooms to main building ground.
 - .2 Provide grounding for utility telephone and data demarcation locations in accordance with utility requirements.
 - .3 Sound, fire alarm, and other communication and security systems as indicated.

3.6 Field Quality Control

- .1 Perform ground continuity and resistance tests using fall-of-potential measurement system method per IEEE 81-2012 standards. A report shall be submitted to the Contract Administrator from the testing agency.

- .2 Perform tests before energizing electrical system.
- .3 Disconnect ground fault indicator, if provided, during tests.
- .4 A ground electrode with an unsatisfactory resistance test result shall be altered as necessary until the required resistance reading is achieved.

END OF SECTION

Part 1 General

1.1 Section Includes

- .1 Conduit and equipment supports.
- .2 Anchors and fasteners.

1.2 References

- .1 CSA-C22.1-18 - Canadian Electrical Code, Part I (24th Edition), Safety Standard for Electrical Installations.
- .2 CECA - Canadian Electrical Contractor's Association.
- .3 CSA (Canadian Standards Association).
- .4 ULC (Underwriters' Laboratories of Canada).

1.3 Submittals For Review

- .1 Refer to 26 05 00 Common Work Results for Electrical.
- .2 Product Data: Provide manufacturer's catalogue data for fastening systems.

1.4 Regulatory Requirements

- .1 Provide products listed and classified by CSA and as suitable for purpose specified and shown.

Part 2 Products

2.1 Product Requirements

- .1 Materials and Finishes: Provide adequate corrosion resistance.
- .2 Provide materials, sizes, and types of anchors, fasteners and supports to carry the loads of equipment and conduit. Consider weight of wire in conduit when selecting products.
- .3 Anchors and Fasteners:
 - .1 Concrete Structural Elements: Use expansion anchors.
 - .2 Steel Structural Elements: Use beam clamps and spring steel clips.
 - .3 Concrete Surfaces: Use expansion anchors.
 - .4 Hollow Masonry, Plaster, and Gypsum Board Partitions: Use toggle bolts and hollow wall fasteners.
 - .5 Solid Masonry Walls: Use expansion anchors.
 - .6 Sheet Metal: Use sheet metal screws.
 - .7 Wood Elements: Use wood screws.

2.2 Steel Channel

- .1 U-shape, galvanized steel, size 1.6" x 1.6" (40 x 40 mm), 0.1" (2.5 mm) thick, surface-mounted, suspended or set in poured concrete walls and ceilings as required.

2.3 Installation

- .1 Install products to manufacturer's written instructions.

-
- .2 Provide anchors, fasteners, and supports to CSA-C22.1.
 - .3 Do not fasten supports to pipes, ducts, mechanical equipment, and conduit.
 - .4 Do not use powder-actuated anchors.
 - .5 Obtain permission from Contract Administrator before using powder-actuated anchors.
 - .6 Do not drill or cut structural members.
 - .7 Obtain permission from Contract Administrator before drilling or cutting structural members.
 - .8 Do not use plastic cable ties.
 - .9 Fabricate supports from structural steel or steel channel. Rigidly weld members or use hexagon head bolts to present neat appearance with adequate strength and rigidity. Use spring lock washers under all nuts.
 - .10 Install surface-mounted cabinets and panelboards with minimum of four anchors.
 - .11 In wet and damp locations use steel channel supports to stand cabinets and panelboards 25 mm (1 inch) off wall.
 - .12 Use sheet metal channel to bridge studs above and below cabinets and panelboards recessed in hollow partitions.

END OF SECTION

Part 1 General

1.1 Section Includes

- .1 Metal conduit.
- .2 PVC coated metal conduit.
- .3 Flexible metal conduit.
- .4 Liquid tight flexible metal conduit.
- .5 Electrical metallic tubing.
- .6 Non-metallic conduit.
- .7 Electrical non-metallic tubing.

1.2 Related Sections

- .1 Section 07 84 00 - Firestopping.
- .2 Section 26 05 34 - Boxes.
- .3 Section 26 05 26 - Grounding And Bonding.
- .4 Section 26 05 29 - Electrical Supporting Devices.
- .5 Section 26 05 53 - Electrical Identification.

1.3 References

- .1 CSA-C22.1-18 - Canadian Electrical Code, Part I (24th Edition), Safety Standard for Electrical Installations.
- .2 CSA C22.2 No. 18.1-13 (R2018) - Metallic Outlet Boxes.
- .3 CSA C22.2 No. 45.1-07 (R2017) - Electrical Rigid Metal Conduit - Steel.
- .4 CSA C22.2 No. 56-17 - Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit.
- .5 CSA-C22.2 No. 83.1-07 (R2017) - Electrical Metallic Tubing - Steel.
- .6 CSA C22.2 No. 211.1-06 (R2016) - Rigid Types EB1 and DB2/ES2 PVC Conduit.
- .7 CSA C22.2 No. 211.2-06 (R2016) - Rigid PVC (Unplasticized) Conduit.
- .8 CSA C22.2 No. 2420-09 (R2014) - Belowground Reinforced Thermosetting Resin Conduit (RTRC) and Fittings.
- .9 CAN/CSA-C22.2 No. 227.1-06 (R2016) - Electrical Nonmetallic Tubing.
- .10 CSA C22.2 No. 227.2.1-14 - Liquid-Tight Flexible Nonmetallic Conduit.
- .11 CSA (Canadian Standards Association).
- .12 UL (Underwriters' Laboratories of Canada).

1.4 Administrative Requirements

- .1 Refer to 26 05 00 Common Work Results for Electrical.

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

1.5 CLOSEOUT SUBMITTALS

- .1 Refer to 26 05 00 Common Work Results for Electrical.
- .2 Record Documentation:
 - .1 Accurately record actual routing of conduits equal to or larger than 35mm (1-1/4").
 - .2 Accurately record actual routing of backbone conduit runs.
 - .3 Accurately record actual routing of all conduit in slab.

1.6 Regulatory Requirements

- .1 Design conduit size to CSA-C22.1.
- .2 Provide products listed and classified by CSA or ULC as suitable for purpose specified and shown.

1.7 Delivery, Storage, And Protection

- .1 Refer to 26 05 00 Common Work Results for Electrical.
- .2 Accept conduit on site. Inspect for damage.
- .3 Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.
- .4 Protect PVC conduit from sunlight.

Part 2 Products

2.1 Conduit Requirements

- .1 Minimum Size: 21 mm (3/4 inch) unless otherwise specified.
- .2 Underground Installations:
 - .1 More than 1525 mm(5 ft) from Foundation Wall: Use thick wall non-metallic conduit.
 - .2 Within 1525 mm(5 ft) from Foundation Wall: Use rigid steel conduit.
 - .3 In or Under Slab on Grade: Use thick wall non-metallic conduit.
 - .4 Minimum Size: 27 mm(1 inch).
 - .5 Provide a separate ground wire in all below-grade conduits.
 - .6 Provide an exterior trace wire for all conduits containing non-current carrying cabling.
 - .7 Use waterproof fittings.
- .3 Outdoor Locations, Above Grade: Use rigid steel conduit.
- .4 In Slab:
 - .1 Use electrical non-metallic tubing.
 - .2 Maximum Size Conduit in Slab: 27mm (1 inch) and 16mm (1/2 inch) for conduits crossing each other.
- .5 Wet and Damp Locations: Use non-metallic conduit.

- .6 Dry Locations:
 - .1 Concealed: Use electrical metallic tubing.
 - .2 Exposed: Use electrical metallic tubing.

2.2 Metal Conduit

- .1 Rigid Steel Conduit: C22.2 No. 45.1.
- .2 Fittings and Conduit Bodies: All steel fittings.

2.3 Flexible Metal Conduit

- .1 Description: Interlocked steel construction.
- .2 Fittings: CSA C22.2 No. 56.
- .3 Provide a separate ground wire in all flexible metal conduit.

2.4 Liquid Tight Flexible Metal Conduit

- .1 Description: Interlocked steel construction with PVC jacket.
- .2 Fittings: CSA C22.2 No. 56.
- .3 Provide a separate ground wire in all liquid tight flexible metal conduit.

2.5 Electrical Metallic Tubing (emt)

- .1 Description: CSA C22.2 NO. 83.1; galvanized tubing.
- .2 Fittings and Conduit Bodies: CSA C22.2 No. 83.1; steel, set screw type.
- .3 Refer to Section 26 05 53 for colour requirements.

2.6 Non-metallic Conduit

- .1 Description:
 - .1 CSA C22.2 No. 211.2; PVC.
 - .2 CSA C22.2 No. 327-18; HDPE
- .2 Fittings and Conduit Bodies:
 - .1 CSA C22.2 No. 211.2.
 - .2 CSA C22.2 No. 327-18
- .3 Provide a separate ground wire in all non-metallic conduit

2.7 Electrical Non-metallic Tubing

- .1 Description: CSA 227.1.
- .2 Fittings and Conduit Bodies: CSA 227.1.
- .3 Provide a separate ground wire in all electrical non-metallic tubing.

2.8 Fittings

- .1 Fittings shall be manufactured for use with conduit specified.
- .2 Insulated throat liners on connectors.

- .3 Steel raintight connector fittings complete with O-rings, for use on weatherproof or sprinklerproof enclosures. Steel raintight couplings shall be used for surface conduit installation exposed to moisture or sprinkler heads. Steel raintight connectors shall be used for all top entries to panels, contactors and motor control centres.
- .4 Expansion fittings
 - .1 Outdoor locations - Weatherproof expansion fittings with internal bonding assembly, suitable for 100 mm (4") or 200 mm (8") linear expansion.
 - .2 Wet and Damp Locations - Watertight expansion fittings with integral bonding jumper suitable for linear expansion, and 21 mm (3/4") deflection in all directions, as required.
 - .3 Panel Entry - Weatherproof expansion fittings for linear expansion as required.
 - .4 PVC Conduit - O-ring type expansion fittings.
 - .5 Flexible watertight conduit between junction boxes with integral bonding jumper suitable for linear and lateral movement greater than 19 mm (3/4").

Part 3 Execution

3.1 Examination

- .1 Refer to 26 05 00 Common Work Results for Electrical.
- .2 Verify that field measurements are as shown on Drawings.
- .3 Verify routing and termination locations of conduit prior to rough-in.
- .4 Conduit routing is shown on Drawings in approximate locations unless dimensioned. Route as required to complete wiring system.
- .5 Drawings do not contain all conduits. Provide all conduit as required for a complete system.
- .6 All conduit sizes indicated on drawings are minimum sizes unless otherwise noted. Where larger conduit sizes are required to meet Canadian Electrical Code requirements, Electrical Subcontractor shall provide larger size at no additional cost. Increase conduit size at no extra costs where required to accommodate length of run and voltage drop requirements in accordance with Canadian Electrical Code requirements.

3.2 Installation

- .1 Install conduit to CSA C22.1.
- .2 Install non-metallic conduit to manufacturer's written instructions.
- .3 Arrange supports to prevent misalignment during wiring installation.
- .4 Support conduit using coated steel or malleable iron straps, lay-in adjustable hangers, clevis hangers, and split hangers.
- .5 Group related conduits; support using conduit rack.
- .6 Construct rack using steel channel. Provide space on each for 25% additional conduits.
- .7 Fasten conduit supports to building structure and surfaces to Section 26 05 29.
- .8 Do not support conduit with wire or perforated pipe straps. Remove wire used for temporary supports.

-
- .9 Do not attach conduit to ceiling support wires.
 - .10 Arrange conduit to maintain headroom and present neat appearance.
 - .11 Provide flexible metal conduit for all connections to motors, recessed lighting, suspended lighting, transformers, and equipment subject to movement or vibration.
 - .12 Provide conduit systems for all home run and main branch wiring in ceiling spaces. AC-90 shall be used only for connections from conduit systems to wiring devices in steel stud partitions and lighting fixtures for a maximum of 1830 mm (6 feet) horizontally from the conduit system junction box.
 - .13 Conduit Routing:
 - .1 All conduit shall be concealed except in mechanical and electrical rooms or as otherwise noted.
 - .2 Where surface conduit is installed:
 - .1 Locate more than 2000 mm (78 inches) from infrared or gas-fired heaters.
 - .2 Group conduits on suspended or surface rack support.
 - .3 Route conduit parallel and perpendicular to walls.
 - .4 Route conduit installed above accessible ceilings parallel and perpendicular to walls.
 - .5 Route conduit through roof openings for piping and ductwork or through suitable roof jack with pitch pocket.
 - .6 Route conduit in and under slab from point-to-point.
 - .7 Do not route conduits through structural members unless otherwise indicated.
 - .8 Do not route conduit through terrazzo or concrete toppings unless otherwise indicated.
 - .9 Do not route conduit horizontally in masonry walls unless otherwise indicated.
 - .10 Do not cross conduits in slab.
 - .14 Conduits in Poured Concrete:
 - .1 Submit marked up drawings of proposed conduit routing complete with conduit sizes to Structural and Electrical Contract Administrators for approval prior to installation.
 - .2 Coordinate installation of conduit to suit reinforcing steel.
 - .3 Locate in centre third of slab.
 - .4 Provide minimum separation of 150 mm (6") between parallel conduit runs.
 - .5 Do not install conduit in drop panels, beams, or columns unless approved by the Structural Contract Administrator.
 - .6 Where conduits are grouped, or do not follow perpendicular to parallel to building lines, provide photos in electronic format (minimum resolution 1920x1080) of conduit installation prior to concrete pour.
 - .7 Record drawings shall indicate location of all conduit embedded in concrete, or run below slab complete with dimensions to building lines.
 - .8 For slab-on-grade, conduit larger than 27 mm (1") shall be routed below slab and encased in minimum 75 mm (3") of concrete.
 - .15 All conduit below grade shall be sloped to provide drainage away from the building.
 - .16 Maintain adequate clearance between conduit and piping.

- .17 Maintain 300 mm (12 inch) clearance between conduit and surfaces with temperatures exceeding 40 degrees C (104 degrees F).
- .18 Cut conduit square using saw or pipe cutter; de-burr cut ends.
- .19 Bring conduit to shoulder of fittings; fasten securely.
- .20 Where threaded connections are used, threads shall be of sufficient length to ensure a tight connection.
- .21 Where conduit becomes blocked, remove and replaced blocked sections.
- .22 Join non-metallic conduit using cement as recommended by manufacturer.
 - .1 Wipe non-metallic conduit dry and clean before joining.
 - .2 Apply full even coat of cement to entire area inserted in fitting.
 - .3 Allow joint to cure for 20 minutes, minimum.
- .23 Use conduit hubs to fasten conduit to sheet metal boxes in damp and wet locations and to cast boxes.
- .24 Install no more than equivalent of two 90-degree bends between boxes.
 - .1 Use conduit bodies to make sharp changes in direction, as around beams.
 - .2 Use hydraulic one-shot bender to fabricate and factory elbows for bends in metal conduit larger than 53 mm (2 inch) size.
 - .3 All metallic conduit shall be bent cold. Replace sections where conduit is kinked or flattened by more than 10% of its original diameter.
- .25 Avoid moisture traps; provide junction box with drain fitting at low points in conduit system.
- .26 Ensure conduit systems are dry prior to installation of wiring.
- .27 Provide suitable fittings to accommodate expansion and deflection where conduit crosses seismic and control expansion joints, and where conduit transitions from below to above grade.
- .28 Provide polypropylene pull string in each empty conduit except sleeves and nipples.
- .29 Use suitable caps to protect installed conduit against entrance of dirt and moisture.
- .30 Ground and bond conduit to Section 26 05 26.
- .31 Identify conduit to Section 26 05 53.

END OF SECTION

Part 1

General

1.1

Section Includes

- .1 Wall and ceiling outlet boxes.
- .2 Floor boxes.
- .3 Pull and junction boxes.

1.2

Related Sections

- .1 Section 07 84 00 - Firestopping.
- .2 Section 08 31 00 - Access Doors And Frames.
- .3 Section 26 27 26 - Wiring Devices.
- .4 Section 26 27 16 - Cabinets And Enclosures.

1.3

References

- .1 CSA-C22.1-18 - Canadian Electrical Code, Part I (24th Edition), Safety Standard for Electrical Installations.
- .2 CSA C22.2 No. 18.1-13 (R2018) - Metallic Outlet Boxes.
- .3 CSA C22.2 No. 40-17 - Junction and Pull Boxes.
- .4 CSA C22.2 No. 85-14 - Rigid PVC Boxes and Fittings.
- .5 CSA (Canadian Standards Association).
- .6 ULC (Underwriters' Laboratories of Canada).

1.4

Administrative Requirements

- .1 Refer to 26 05 00 Common Work Results for Electrical.
- .2 Coordination:
 - .1 Coordinate with other work having a direct bearing on work of this section.
 - .2 Coordinate installation of outlet box for equipment connected under Section 26 05 80.

1.5

Closeout Submittals

- .1 Refer to 26 05 00 Common Work Results for Electrical.
- .2 Record Documentation: Record actual locations and mounting heights of outlet, pull, and junction boxes on project record documents.

1.6

Regulatory Requirements

- .1 Products: Listed and classified by CSA or ULC, and as suitable for the purpose specified and indicated.

Part 2

Products

2.1 Outlet Boxes

- .1 Sheet Metal Outlet Boxes: CSA-C22.2 No. 18, galvanized steel.
 - .1 Luminaire and Equipment Supporting Boxes: Rated for weight of equipment supported; include 13 mm (1/2 inch) male fixture studs where required.
 - .2 Concrete Ceiling Boxes: Concrete type.
- .2 Non-metallic Outlet Boxes: CSA-C22.2 No. 18.
- .3 Cast Boxes: CSA-C22.2 No. 18, Type FS or FD as indicated or as required, cast ferric alloy. Provide gasketed cover by box manufacturer. Provide threaded hubs.
- .4 In-wall Boxes: 18 gauge white powder coated steel complete with trim ring, will accept standard single gang outlet boxes, wiring devices and cover plates, complete with screw-on steel cover with cable exit.
- .5 Wall Plates for Finished Areas: As specified in Section 26 27 26.

2.2 Floor Boxes

- .1 Floor Boxes: CSA-C22.2 No. 18, fully adjustable, four compartments with feed through tunnel compartment, [shallow 62 mm (2-7/16 inches)] [standard 87 mm (3-7/16 inches)] deep, suitable for concrete or wood floor applications.
- .2 Manufacturers:
 - .1 Legrand Wiremold: RFB4 series.
 - .2 Thomas & Betts Steel City: 665 series.
- .3 Substitutions: Refer to 26 05 00 Common Work Results for Electrical.
- .4 Material: [Cast iron], [steel] and.
- .5 Shape: Rectangular.
- .6 Service Fittings: As specified in Section 26 27 26.
- .7 Shape: [Rectangular] [Round] [Octagonal] and.
- .8 Service Fittings: As specified in Section 26 27 26.

2.3 Pull And Junction Boxes

- .1 Sheet Metal Boxes: CSA-C22.2 No. 18, galvanized steel.
- .2 Hinged Enclosures: As specified in Section 26 27 16.
- .3 Surface Mounted Cast Metal Box: CSA-C22.2 No. 18, Type 4 or Type 6 as required or as indicated; flat-flanged, surface mounted junction box:
 - .1 Material: Galvanized cast iron.
 - .2 Cover: Provide with ground flange, neoprene gasket, and stainless steel cover screws.
- .4 In-Ground Cast Metal Box: CSA-C22.2 No. 18, Type 6, flanged, recessed cover box for flush mounting:
 - .1 Material: Galvanized cast iron.
 - .2 Cover: Non-skid cover with neoprene gasket and stainless steel cover screws.
 - .3 Cover Legend: "ELECTRIC".

- .5 Fibreglass Hand Holes: Die moulded glass fibre hand holes:
 - .1 Cable Entrance: Pre-cut 150 x 150 mm (6 x 6 inch) or as indicated, cable entrance at centre bottom of each side.
 - .2 Cover: Glass fibre weatherproof cover with non-skid finish.

Part 3

Execution

3.1 Examination

- .1 Refer to 26 05 00 Common Work Results for Electrical.
- .2 Verify locations of floor boxes and outlets throughout prior to rough-in.

3.2 Installation

- .1 Install boxes to CSA-C22.1.
- .2 Install in locations as shown on drawings, and as required for splices, taps, wire pulling, equipment connections and compliance with regulatory requirements.
- .3 Set wall mounted boxes at elevations to accommodate mounting heights specified in section for outlet device and as indicated. Coordinate locations with architectural drawings.
- .4 Electrical boxes are shown on drawings in approximate locations unless dimensioned. Adjust box location up to 3 m (10 ft) if required to accommodate intended purpose.
- .5 Orient boxes to accommodate wiring devices oriented as specified in Section 26 27 26.
- .6 Maintain headroom and present neat mechanical appearance.
- .7 Install pull boxes and junction boxes above accessible ceilings and in unfinished areas only.
- .8 Inaccessible Ceiling Areas: Install outlet and junction boxes no more than 150 mm (6 inches) from ceiling access panel or from removable recessed luminaire.
- .9 Install boxes to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 84 00.
- .10 Coordinate mounting heights and locations of outlets mounted above counters, benches, and backsplashes.
- .11 Locate outlet boxes to allow luminaires positioned as shown on reflected ceiling plan.
- .12 Align adjacent wall mounted outlet boxes for switches, thermostats, and similar devices.
- .13 Use flush mounting outlet box in finished areas.
- .14 Locate flush mounting box in masonry wall to require cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat opening.
- .15 Do not install flush mounting box back-to-back in walls; provide minimum 150 mm (6 inches) separation. Provide minimum 600 mm (24 inches) separation in acoustic rated walls.
- .16 Secure flush mounting box to interior wall and partition studs. Accurately position to allow for surface finish thickness.

- .17 Use stamped steel bridges to fasten flush mounting outlet box between studs.
- .18 Install flush mounting box without damaging wall insulation or reducing its effectiveness.
- .19 Use in-wall boxes for wall mounted television and smart board power and communications applications.
- .20 Do not install in-wall box back-to-back in walls; provide minimum 150 mm (6 inches) separation. Provide minimum 600 mm (24 inches) separation in acoustic rated walls.
- .21 Secure in-wall box to interior wall and partition studs. Accurately position to allow for surface finish thickness.
- .22 Use stamped steel bridges to fasten in-wall outlet box between studs.
- .23 Install in-wall mounting box without damaging wall insulation or reducing its effectiveness.
- .24 Use adjustable steel channel fasteners for hung ceiling outlet box.
- .25 Do not fasten boxes to ceiling support wires.
- .26 Support boxes independently of conduit.
- .27 Use gang box where more than one device is mounted together.
- .28 Use gang box with plaster ring for single device outlets.
- .29 Use cast outlet box in exterior locations where exposed to the weather and wet locations.
- .30 Set floor boxes level.
- .31 Large Pull Boxes: Where pull boxes have a long dimension of 305 mm (12 inches) or more, use hinged enclosure in interior dry locations, surface-mounted cast metal box in other locations.

3.3 Adjusting

- .1 Adjust floor box flush with finish flooring material.
- .2 Adjust flush-mounting outlets to make front flush with finished wall material.
- .3 Install knockout closures in unused box openings.

3.4 Cleaning

- .1 Refer to 26 05 00 Common Work Results for Electrical.
- .2 Clean interior of boxes to remove dust, debris, and other material.
- .3 Clean exposed surfaces and restore finish.

END OF SECTION

Part 1 General

1.1 Section Includes

- .1 Nameplates and labels.
- .2 Wire markers.
- .3 Conduit markers.
- .4 Underground warning tape.

1.2 Related Sections

- .1 Section 09 90 00 - Painting.

1.3 References

- .1 CSA (Canadian Standards Association).
- .2 ULC (Underwriters' Laboratories of Canada).

1.4 Submittals For Review

- .1 Refer to 26 05 00 Common Work Results for Electrical.
- .2 Product Data: Provide catalogue data for nameplates, labels, and markers.
- .3 Installation Data: Provide list of all equipment requiring nameplates complete with associated nameplate configuration for review.

1.5 Regulatory Requirements

- .1 Provide products listed and classified by CSA or ULC and as suitable for purpose specified and shown.

1.6 Language

- .1 All identification shall be in English.

Part 2 Products

2.1 Nameplates And Labels

- .1 Nameplates:
 - .1 Exterior –Stainless steel, etched and color filled with stamped product specific labelling.
 - .2 Interior - Engraved three-layer laminated plastic, white letters on blue background for normal power and systems, white letters on red background for life safety power and systems, and white letters on orange background for standby power and systems.
 - .3 Locations:
 - .1 Electrical distribution, motor control centres, disconnect switches, panelboards and control equipment enclosures.
 - .1 Nameplate shall include:
 - .1 Distribution Name

- .2 Distribution Voltage, Phase, Wires, Amperage
- .3 Room Location
- .4 Fed From:
 - .1 Panel Name
 - .2 Supplying Breaker Size/Poles
 - .3 Room Location
- .2 Electrical distribution and motor control centres..
 - .1 Nameplates at individual breakers shall include:
 - .1 Load Name
 - .2 Room Location of Load
 - .3 Breaker Size/Poles
- .3 Electrical distribution and panelboards where breakers are applied in series ratings shall also include:
 - .1 "BREAKERS ARE INSTALLED IN A SERIES RATED COMBINATION AND SHALL ONLY BE REPLACED WITH COMPONENTS OF THE SAME TYPE AND RATING."
- .4 Circuit breakers and fused switches which directly feed a single conductor cable shall include the maximum continuous load allowed:
 - .1 "MAXIMUM CONTINUOUS LOAD: X AMPS"
- .5 Adjustable circuit breakers shall include the maximum continuous load allowed:
 - .1 "MAXIMUM CONTINUOUS LOAD: X AMPS"
- .6 Mechanical equipment disconnect switches:
 - .1 Nameplate shall include:
 - .1 Mechanical Equipment Mark
 - .2 Panel Name & Circuit number
- .7 Communication/Systems Racks & Cabinets
 - .1 Nameplate shall include:
 - .1 System Name
 - .2 Room Number
 - .3 Rack/Cabinet Number (if applicable)
 - .4 Fed From:
 - .1 Room Number.
 - .2 Rack/Cabinet Number (if applicable)
 - .3 Patch Panel and/or Rack Position (if applicable)
- .8 Fire Alarm System Equipment
 - .1 Nameplate shall include:
 - .1 Room Number
 - .2 Equipment Name
 - .3 Fed From:
 - .1 Room Number.

-
- .2 Panel Name and Circuit Number
- .9 Fire Alarm Equipment Branch Circuit Breakers
 - .1 Nameplate shall indicate "FIRE ALARM PANEL" or approved wording.
 - .10 Pole mounted luminaires.
 - .1 Nameplate shall include:
 - .1 Manufacturer & Model # of Pole
 - .2 Manufacturer & Model # of Luminaire
 - .3 Voltage
 - .4 Driver Model #
 - .5 Lamp Wattage & Model #
 - .6 Fed From Panel & Circuit Number
 - .11 Emergency Lighting Units.
 - .1 Nameplate shall include:
 - .1 Unit #
 - .2 Manufacturer & Model # of unit equipment
 - .3 AC circuit supplying unit
 - .4 AC lighting circuits monitored (voltage relay)
 - .5 Date installed
 - .12 Parking receptacles.
 - .1 Nameplate shall include:
 - .1 Circuit number
 - .4 Letter Size:
 - .1 Use 6 mm(1/4 inch) letters for identifying equipment mark designations and system types.
 - .2 Use 3 mm(1/8 inch) letters for identifying supporting information.
 - .3 Use 6 mm(1/4 inch) letters for identifying grouped equipment and loads.
 - .5 Nameplates on exterior equipment shall be UV & weather resistant.
 - .6 Wording on nameplates shall be approved prior to manufacture. Submit schedule of nameplates and wording.
- .2 Labels: Plastic self-adhesive non-smear labels with 5 mm(3/16 inch) black letters on white background.
- .1 Locations:
 - .1 Wiring devices, including lighting control devices and receptacles.
 - .1 Label shall include:
 - .1 Indicate associated panel and circuit number.
 - .2 E.g. "A-32" (A is for Panel-A, and 32 is the circuit number)
 - .3 Lighting controls to include brief description of lighting being controlled.
 - .4 E.g. "Pendants"

- .2 Voice/Data Outlets
 - .1 Label shall include:
 - .1 Indicate associated rack or cabinet name
 - .2 Indicate associated patch panel and drop number
 - .3 E.g. "IDC-A-13" (IDC is for rack name, patch panel A, drop number 13)
 - .3 Voice/Data Patch Panels
 - .1 Label shall include:
 - .1 Indicate associated rack or cabinet name
 - .2 Indicate patch panel name.
 - .3 E.g. "IDC-A" (IDC is for rack name, patch panel A)

2.2 Wire Markers

- .1 Wire Markers: Permanent tape type wire markers not susceptible to thermal or mechanical influence.
- .2 Locations:
 - .1 Each conductor at panelboard gutters, pull boxes, outlet and junction boxes and each load connection.
 - .1 Legend:
 - .1 Power and Lighting Circuits: Branch circuit or feeder number indicated on drawings.
 - .2 Control Circuits: Control wire number indicated on Shop Drawings.
 - .2 Voice/Data drops including both ends of cable.
 - .1 Label shall include:
 - .1 Indicate associated rack or cabinet name
 - .2 Indicate associated patch panel and drop number
 - .3 E.g. "IDC-A-13" (IDC is for rack name, patch panel A, drop number 13)

2.3 Conduit Markers

- .1 Manufacturers:
 - .1 Brady; Product: BMP71 Indoor/Outdoor Vinyl Labels.
 - .2 Substitutions: Refer to Section 26 05 00.
- .2 Description: Vinyl label.
- .3 Location: Provide markers for each conduit longer than 4.7 m(10 ft).
- .4 Spacing: 6 m(20 ft) on centre.
- .5 Colour:
 - .1 Normal Power System: Blue
 - .2 Life-Safety Power System: Red
 - .3 Fire Alarm System: Red.
 - .4 Communication System: Yellow

- .5 Security Systems: Black
- .6 Controls System: White

- .6 Legend:
 - .1 600 Volt System: 600V.
 - .2 120/208 Volt System: 120/208V.
 - .3 Fire Alarm System: FIRE ALARM.
 - .4 Communication System:
 - .1 VOICE
 - .2 DATA
 - .3 VOICE/DATA
 - .5 Public Address System: PA
 - .6 CCTV System: CCTV
 - .7 Access Control System: ACCESS CONTROL
 - .8 Intrusion System: INTRUSION
 - .9 Controls System: CONTROLS

2.4 Underground Warning Tape

- .1 Manufacturers: Brady
 - .1 Product: Detectable Identoline.

Part 3 Execution

3.1 Preparation

- .1 Degrease and clean surfaces to receive nameplates and labels.

3.2 Application

- .1 Install nameplate and label parallel to equipment lines.
- .2 Secure nameplate to equipment front using rivets or screws.
- .3 Secure nameplate to inside surface of door on panelboard that is recessed in finished locations.
- .4 Conduit shall be integrally colour coded through a colouring process applied by the conduit manufacturer.
- .5 Identify conduit using field painting to Section [09 90 00].
- .6 Paint coloured band on each conduit longer than 2 m(6 ft).
- .7 Paint bands 6 m(20 ft) on centre.
- .8 Colour:
 - .1 600 Volt System: Orange
 - .2 208 Volt System: Blue
 - .3 Fire Alarm System: Red.
 - .4 Communication System: Yellow
 - .5 Security Systems: Black
 - .6 Controls System: White

-
- .9 Identify underground conduits using underground warning tape. Install one tape per trench at 75 mm(3 inches) below finished grade.
 - .10 Provide identification on all junction box covers indicating associated system, panel and circuit numbering using permanent marker.

END OF SECTION

Part 1

General

1.1 Section Includes

- .1 Electrical connections to equipment specified under other sections.

1.2 Related Sections

- .1 Section 26 05 00 - Common Work Results for Electrical.
- .2 Section 08 33 23 - Overhead Coiling Doors.
- .3 Section 22 47 00 - Plumbing Equipment.
- .4 Section 26 05 33 - Conduit.
- .5 Section 26 05 19 - Building Wire And Cable.
- .6 Section 26 05 34 - Boxes.

1.3 References

- .1 CSA-C22.1-18 - Canadian Electrical Code, Part I (24th Edition), Safety Standard for Electrical Installations.
- .2 CSA C22.2 No. 127-18 - Equipment and Lead Wires.
- .3 ANSI/NEMA WD 6-2016 Wiring Devices—Dimensional Specifications.
- .4 NEMA WD 1-1999 (R2015) - General Colour Requirements for Wiring Devices.
- .5 CSA (Canadian Standards Association).
- .6 ULC (Underwriters' Laboratories of Canada).

1.4 Administrative Requirements

- .1 Refer to 26 05 00 Common Work Results for Electrical.
- .2 Coordination:
 - .1 Coordinate with other work having a direct bearing on work of this section.
 - .2 Obtain and review shop drawings, product data, and manufacturer's instructions for equipment provided under other sections.
 - .3 Determine connection locations and requirements.
- .3 Sequencing:
 - .1 Sequence rough-in of electrical connections to coordinate with installation schedule for equipment.
 - .2 Sequence electrical connections to coordinate with start-up schedule for equipment.

1.5 Submittals For Review

- .1 Refer to 26 05 00 Common Work Results for Electrical.
- .2 Product Data: Provide wiring device manufacturer's catalogue information showing dimensions, configurations, and construction.

1.6 Submittals For Information

- .1 Refer to 26 05 00 Common Work Results for Electrical.
- .2 Installation Data: Indicate application conditions and limitations of use stipulated by Product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of Product.

1.7 Regulatory Requirements

- .1 Products: Listed and classified by CSA or ULC, and as suitable for the purpose specified and indicated.

Part 2 Products

2.1 Mechanical Connections

- .1 Include motor starters, disconnects, conduit, wire, fittings, interlocks, outlet boxes, junction boxes, and all associated equipment required to provide power wiring for mechanical equipment, unless otherwise indicated.
- .2 Include pushbutton stations, motor protective switches, interlocks, conduit, wire, devices, and fittings required to provide control wiring for mechanical equipment, except for temperature/humidity control systems.
- .3 Unless otherwise noted, motors and control devices shall be supplied by Division 21, 22, and 23. Motor horsepower ratings shall be as shown in the Division 21, 22, and 23 specifications.
- .4 Provide the Mechanical Subcontractor with a copy of the Motor Schedule and ensure conformance with voltage shown.
- .5 All equipment, mounted on the exterior of the building, shall be weatherproof.

2.2 Automatic Door Operators

- .1 Power: Wire and connect motorized door operators as indicated.
- .2 Controls: Wire and connect all associated controls including but not limited to entry pushbuttons, vertical kick bars, motion sensors, electric strikes, electric locks, key switches etc. Confirm controls requirements with automatic door shop drawings and General Contractor.
- .3 Interface with Other Systems: Interface with access control system and intrusion alarm system as indicated. Coordinate sequencing of door operators with other systems to the Division's requirements.
- .4 Execution: Coordinate complete installation with automatic door shop drawings and General Contractor.

2.3 Overhead Door Operators

- .1 Power: Provide a disconnect switch at overhead door motor electrical connection.

- .2 Controls: Wire and connect overhead door up/down controls complete with all safety controls including but not limited to remote control panel, open/close drive loops and infrared safety beams. Confirm controls requirements with overhead door shop drawings and General Contractor.
- .3 Interface with Other Systems: Interface with access control system and intrusion alarm system as indicated. Coordinate sequencing of door operators with other systems to the Division's requirements.
- .4 Execution: Coordinate complete installation with overhead door shop drawings and General Contractor.

Part 3

Execution

3.1

Examination

- .1 Refer to 26 05 00 Common Work Results for Electrical.
- .2 Verify that equipment is ready for electrical connection, wiring, and energization.

3.2

Electrical Connections

- .1 Make electrical connections to equipment manufacturer's written instructions.
- .2 Make conduit connections to equipment using flexible conduit. Use liquid-tight flexible conduit with watertight connectors in damp or wet locations.
- .3 Make wiring connections using wire and cable with insulation suitable for temperatures encountered in heat producing equipment.
- .4 Provide receptacle outlet where connection with attachment plug is indicated or as required. Provide cord and cap where field-supplied attachment plug is indicated or as required.
- .5 Provide suitable strain-relief clamps and fittings for cord connections at outlet boxes and equipment connection boxes.
- .6 Install disconnect switches, controllers, control stations, and control devices as indicated or as required by the manufacturer of the associated equipment.
- .7 Modify equipment control wiring with terminal block jumpers as indicated or as required.
- .8 Provide interconnecting conduit and wiring between devices and equipment where indicated or as required.
- .9 Coolers and Freezers: Cut and seal conduit openings in freezer and cooler walls, floor, and ceilings.
- .10 Illuminated Signage: Provide a disconnect switch for illuminated signage.
- .11 Mechanical Equipment:
 - .1 Power Wiring
 - .1 Install power feeders, starters, disconnects, and associated equipment and make connections to all mechanical equipment.
 - .2 Install branch circuit wiring for mechanical system control panels, time clocks, and control transformers.

- .3 Install main power feeders to starter/control panels furnished by Division 21, 22, and 23. Install branch wiring from starter/control panels to controlled equipment such as motors, electric coils, etc.
- .4 Flexible connections to motors shall not exceed 6 feet (1.83 m), unless approved by Contract Administrator.
- .2 Controls
 - .1 Install all electrical controls as indicated on the drawing schedules.
 - .2 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.
 - .3 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.
 - .4 Wire and connect electrical interlocks for starters supplied by Division 21, 22, and 23.
 - .5 Wire and connect hi-limit cutouts for remotely mounted electric heating coils provided by Division 21, 22, and 23.
- .3 Disconnects
 - .1 Disconnects shall be mounted independently from the equipment that it's serving.

END OF SECTION

Part 1

General

1.1 Section Includes

- .1 Two-winding transformers.

1.2 Related Sections

- .1 Section 26 05 26 - Grounding And Bonding.
- .2 Section 26 05 33 - Conduit: Flexible conduit connections.

1.3 References

- .1 CSA-C22.1-18 - Canadian Electrical Code, Part I (24th Edition), Safety Standard for Electrical Installations.
- .2 CSA-C9-17 - Dry-Type Transformers.
- .3 CSA C22.2 NO. 47-13 (R2018) - Air-Cooled Transformers (Dry Type).
- .4 NEMA ST20-1992 (R1997) - Dry Type Transformers for General Applications. (Rescinded Standard - included for information only)
- .5 CSA (Canadian Standards Association).
- .6 ULC (Underwriters' Laboratories of Canada).

1.4 Submittals For Review

- .1 Refer to 26 05 00 Common Work Results for Electrical.
- .2 Product Data: Provide outline and support point dimensions of enclosures and accessories, unit weight, voltage, power, and impedance ratings and characteristics, tap configurations, insulation system type, and rated temperature rise.

1.5 Submittals For Information

- .1 Refer to 26 05 00 Common Work Results for Electrical.
- .2 Test Reports: Indicate loss data, efficiency at 25%, 50%, 75% and 100% rated load, and sound power level per octave band from 63Hz – 8kHz.

1.6 Closeout Submittals

- .1 Refer to 26 05 00 Common Work Results for Electrical.
- .2 Record Documentation: Record actual locations of transformers in project record documents.

1.7 Quality Assurance

- .1 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum five (5) years documented experience.

1.8 Regulatory Requirements

- .1 Products: Listed and classified by CSA and as suitable for the purpose specified and indicated.

1.9 Delivery, Storage, And Protection

- .1 Refer to 26 05 00 Common Work Results for Electrical.
- .2 Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.
- .3 Handle to manufacturer's written instructions. Lift only with lugs provided for the purpose. Handle carefully to avoid damage to transformer internal components, enclosure, and finish.

Part 2 Products

2.1 Two-winding Transformers

- .1 Manufacturers:
 - .1 Delta
 - .2 Hammond
 - .3 Bmag
 - .4 Substitutions: Refer to Section 26 05 00.
- .2 Description: NEMA ST20, factory-assembled, air cooled dry type transformers ratings as indicated.
- .3 Primary Voltage: 600 volts, 3 phase.
- .4 Secondary Voltage: 208Y/120 volts, 3 phase.
- .5 Insulation system and average winding temperature rise for rated kVA as follows:
 - .1 1-15 kVA: Class 185 with 115 degrees C (200 degrees F) rise.
 - .2 16-500 kVA: Class 220 with 150 degrees C (277 degrees F) rise.
- .6 Case temperature: Do not exceed 35 degrees C (60 degrees F) rise above ambient at warmest point at full load.
- .7 Winding Taps:
 - .1 Transformers Less than 15 kVA: Two 5% below rated voltage, full capacity taps on primary winding.
 - .2 Transformers 15 kVA and Larger: NEMA ST20.
- .8 Sound Levels: Maximum sound levels:
 - .1 1-25 kVA: 45 dB.
 - .2 26-150 kVA: 50 dB.
 - .3 151-300 kVA: 55 dB.
 - .4 301-500 kVA: 60 dB.
- .9 Basic Impulse Level: 10 kV for transformers less than 300 kVA, 30 kV for transformers 300 kVA and larger.

- .10 Ground core and coil assembly to enclosure by means of a visible flexible copper grounding strap.
- .11 Mounting:
 - .1 1-15 kVA: Suitable for wall mounting.
 - .2 16-75 kVA: Suitable for floor and wall mounting.
 - .3 Larger than 75 kVA: Suitable for floor mounting.
- .12 Coil Conductors: Continuous windings with terminations brazed or welded.
- .13 Enclosure: NEMA ST20, Type 3R ventilated. Provide lifting eyes or brackets.
- .14 Isolate core and coil from enclosure using vibration-absorbing mounts.
- .15 Nameplate: Include transformer connection data.

2.2 Source Quality Control

- .1 Refer to 26 05 00 Common Work Results for Electrical.
- .2 Production test each unit according to NEMA ST20.

Part 3 Execution

3.1 Installation

- .1 Install transformers to manufacturer's instructions.
- .2 Set transformer plumb and level.
- .3 Use flexible conduit, under the provisions of Section 26 05 33, 600 mm (24 inches) minimum length, for connections to transformer case. Make conduit connections to side panel of enclosure.
- .4 Mount wall-mounted transformers using integral flanges or accessory brackets provided by the manufacturer.
- .5 Mount floor-mounted transformers on vibration isolating pads suitable for isolating the transformer noise from the building structure.
- .6 Mount floor-mounted transformers on 100 mm (4") housekeeping pad.
- .7 Provide grounding and bonding to Section 26 05 26.
- .8 Provide minimum 150 mm (6") of clearance from walls and 100 mm (4") of clearance from adjacent equipment for ventilation.
- .9 Maintain shipping supports after transformer is installed and remove just before putting transformer into service.
- .10 Loosen isolation pad retaining bolts until no compression is visible.

3.2 Adjusting

- .1 Measure primary and secondary voltages and make appropriate tap adjustments.

END OF SECTION

Part 1

General

1.1

Section Includes

- .1 Fusible switch assemblies.
- .2 Non-fusible switch assemblies.

1.2

References

- .1 CSA-C22.1-18 - Canadian Electrical Code, Part I (24th Edition), Safety Standard for Electrical Installations.
- .2 CSA-C22.2 No. 4-04 (2009) - Enclosed and Dead-Front Switches.
- .3 CSA-C22.2 No. 248.1-11 - Low-voltage fuses - Part 1: General requirements.
- .4 NETA ATS 2007 - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.
- .5 CSA (Canadian Standards Association).
- .6 ULC (Underwriters' Laboratories of Canada).

1.3

Submittals For Review

- .1 Refer to 26 05 00 Common Work Results for Electrical.
- .2 Product Data: Provide switch ratings and enclosure dimensions.

1.4

Closeout Submittals

- .1 Refer to 26 05 00 Common Work Results for Electrical.
- .2 Record Documentation: Record actual locations of enclosed switches in project record documents.

1.5

Quality Assurance

- .1 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum five (5) years documented experience.

1.6

Regulatory Requirements

- .1 Products: Listed and classified by CSA and ULC, and as suitable for the purpose specified and indicated.

Part 2

Products

2.1

Fusible Switch Assemblies

- .1 Fusible Switches: CSA-C22.2 No. 4, Type as indicated with externally operable handle interlocked to prevent opening front cover with switch in ON position, enclosed load interrupter knife switch. Handle lockable in OFF position.
- .2 Fuse clips: Designed to accommodate fuses as indicated.

2.2 Non-fusible Switch Assemblies

- .1 Non-Fusible Switches: CSA-C22.2 No. 4, Type as indicated with externally operable handle interlocked to prevent opening front cover with switch in ON position, enclosed load interrupter knife switch. Handle lockable in OFF position.

2.3 Enclosures

- .1 Enclosures: CSA-C22.2 No. 4.
 - .1 Interior Dry Locations: Type 1.
 - .2 Exterior Locations: Type 3R.
 - .3 Exterior Locations: Type 4 Heavy Duty

Part 3 Execution

3.1 Installation

- .1 Install to CSA-C22.1.
- .2 Install fuses in fusible disconnect switches.
- .3 Apply adhesive tag on inside door of each fused switch indicating CSA fuse class and size installed.

3.2 Field Quality Control

- .1 Refer to 26 05 00 Common Work Results for Electrical.
- .2 Perform inspections and tests listed in NETA ATS, Section 7.5.

END OF SECTION

Part 1

General

1.1

Section Includes

- .1 Distribution panelboards.
- .2 Branch circuit panelboards.

1.2

Related Sections

- .1 Section 26 05 26 - Grounding and Bonding.
- .2 Section 26 05 53 - Electrical Identification.

1.3

References

- .1 CSA-C22.1-18 - Canadian Electrical Code, Part I (24th Edition), Safety Standard for Electrical Installations.
- .2 CSA-C22.2 No. 29-15 - Panelboards and Enclosed Panelboards.
- .3 CSA C22.2 No. 94.1-15 Enclosures for Electrical Equipment, Non-Environmental Considerations
- .4 CSA C22.2 No. 94.2-15 Enclosures for Electrical Equipment, Environmental Considerations
- .5 NEMA ICS 2-2000 (R2005) - Industrial Control and Systems: Controllers, Contactors, and Overload Relays Rated 600 Volts.
- .6 NEMA KS 1-2001 (R2006) - Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum).
- .7 NETA ATS 2007 - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.
- .8 CSA (Canadian Standards Association).
- .9 ULC (Underwriters' Laboratories of Canada).
- .10 ANSI/UL 1449, Standard for Safety for Surge Protective Devices
- .11 ANSI/IEEE C62.41.1, Guide on the Surge Environment in Low Voltage AC Power Circuits
- .12 ANSI/IEEE C62.41.2, Recommended Practice on Characterization of Surges in Low Voltage AC Power Circuits
- .13 ANSI/IEEE C62.45, Recommended Practice on Surge Testing for Equipment Connected to Low Voltage AC Power Circuits
- .14 IEEE C62.62, Test Specifications for Surge Protective Devices for Low Voltage AC Power Circuits
- .15 IEEE C62.72, Guide for the Application of Surge-Protective Devices for Low-Voltage AC Power Circuits

1.4

Submittals For Review

- .1 Refer to 26 05 00 Common Work Results for Electrical.

- .2 Shop Drawings: Indicate outline and support point dimensions, voltage, main bus ampacity, integrated short circuit ampere rating, circuit breaker and fusible switch arrangement and sizes.

1.5 Submittals For Information

- .1 Refer to 26 05 00 Common Work Results for Electrical.
- .2 Installation Data: Indicate application conditions and limitations of use stipulated by product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.6 Closeout Submittals

- .1 Refer to 26 05 00 Common Work Results for Electrical.
- .2 Maintenance Data: Include spare parts listing; source and current prices of replacement parts and supplies; and recommended maintenance procedures and intervals.
- .3 Record Documentation: Record actual locations of panelboards and record actual circuiting arrangements in project record documents.

1.7 Maintenance Material Submittals

- .1 Refer to 26 05 00 Common Work Results for Electrical.
- .2 Extra Stock Materials: Provide two (2) of each panelboard key.

1.8 Quality Assurance

- .1 Products of This Section: Manufactured to ISO 14000 and ISO 9000 and certification requirements.
- .2 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum five (5) years documented experience.

1.9 Regulatory Requirements

- .1 Products: Listed and classified by CSA and as suitable for the purpose specified and indicated.

Part 2 Products

2.1 Distribution Panelboards

- .1 Manufacturers:
 - .1 Eaton
 - .2 Schneider
 - .3 Siemens
 - .4 Substitutions: Refer to Section 26 05 00.
- .2 Description: CSA-C22.2 No.29, circuit breaker type.
- .3 Panelboard Bus: Aluminum and ratings as indicated. Provide copper ground bus in each panelboard.

- .4 Minimum integrated short circuit rating: 22,000 amperes rms symmetrical for 250 volt panelboards; 50,000 amperes rms symmetrical for 600 volt panelboards or as indicated.
- .5 Moulded Case Circuit Breakers: CSA-C22.2 No. 5, circuit breakers with integral thermal and instantaneous magnetic trip in each pole. Provide circuit breakers ULC listed as Type HACR for air conditioning equipment branch circuits.
- .6 Circuit Breaker Accessories: Trip units and auxiliary switches as indicated.
- .7 Enclosure: CSA C22.2 No. 94.1:
 - .1 Surface mounted: Type 1 with sprinkler-hood.
 - .2 Recessed mounted: Type 1.
 - .3 Exterior use: Type 4 or as indicated.
- .8 Cabinet Front: Surface type, continuous hinged trim complete with hinged door (door-in-door) with flush lock, metal directory frame and finished in manufacturer's standard gray enamel.

2.2 Branch Circuit Panelboards

- .1 Manufacturers:
 - .1 Eaton
 - .2 Schneider
 - .3 Siemens
 - .4 Substitutions: Refer to Section 26 05 00.
- .2 Description: CSA-C22.2 No.29, circuit breaker type, lighting and appliance branch circuit panelboard.
- .3 Panelboard Bus: Aluminum and ratings as indicated. Provide copper ground bus in each panelboard.
- .4 Minimum Integrated Short Circuit Rating: 10,000 amperes rms symmetrical for 250 volt panelboards; 18,000 amperes rms symmetrical for 600 volt panelboards or as indicated.
- .5 Moulded Case Circuit Breakers: CSA-C22.2 No. 5, bolt-on and type thermal magnetic trip circuit breakers, with common trip handle for all poles, listed as Type SWD for lighting circuits, Type HACR for air conditioning equipment circuits, Class A ground fault interrupter circuit breakers where scheduled. Do not use tandem circuit breakers unless indicated.
- .6 Enclosure: CSA C22.2 No. 94.1:
 - .1 Surface mounted: Type 1 with sprinkler-hood.
 - .2 Recessed mounted: Type 1.
 - .3 Exterior use: Type 4 or as indicated.
- .7 Cabinet Box: 153 mm(6 inches) deep, 508 mm(20 inches) wide.
- .8 Cabinet Front: Surface type, continuous hinged trim complete with hinged door (door-in-door) with flush lock, metal directory frame and finished in manufacturer's standard gray enamel.

2.3 Surge Protective Devices (spds):

- .1 SPDs shall be close-coupled to panelboard equipment for the protection of AC electrical circuits and equipment from the effects of lightning induced currents, substation switching transients, and internally generated transients resulting from inductive and/or capacitive load switching and other electronic equipment.
- .2 The surge suppression system shall be comprised of Types 1, 2, & 3 SPDs that are listed and labeled for their intended installation. System design shall be in accordance with the latest edition of the IEEE C62 standards.
- .3 Characteristics:
 - .1 Nominal Discharge Current Rating (In)
 - .1 Type 1 & 2 devices - 20 kA
 - .2 Type 3 devices - 3 kA
 - .2 Short Circuit-Current Rating (SCCR) shall be no less than 200 kA.
 - .3 Maximum Continuous Operating Voltage (MCOV):
 - .1 No less than 15% of normal system operating voltage.
 - .2 No more than 25% of normal system operating voltage.
 - .4 Minimum Voltage Protection Rating (VPR)
 - .1 120/208V - 700 Volts L-N, 1200 Volts L-L
 - .2 347/600V - 1200 Volts L-N, 2000 Volts L-L
 - .5 Noise Filtering
 - .6 Surge Rating (Imax) shall be no less than:
 - .1 MD:1: 200kA
 - .2 Branch Circuit Panels (CP2A and CP3): 100kA
- .4 Provide SPDs as indicated on the electrical single line diagram.

Part 3 Execution

3.1 Installation

- .1 Install panelboards to CSA-C22.1 and to manufacturer's written instructions.
- .2 Install panelboards plumb. Install recessed panelboards flush with wall finishes.
- .3 Height: Refer to section 26 05 00.
- .4 Provide filler plates for unused spaces in panelboards.
- .5 Provide typed circuit directory for each branch circuit panelboard. Revise directory to reflect circuiting changes required to balance phase loads.
- .6 Provide engraved plastic nameplates under the provisions of Section 26 05 53.
- .7 Provide spare conduits out of each recessed panelboard to an accessible location below floor and above ceiling where applicable. Minimum spare conduits: three (3) empty 35mm (1-1/4") up and two (2) 35mm (1-1/4") down. Identify each as spare.
- .8 Ground and bond panelboard enclosure according to Section 26 05 26.

3.2 Field Quality Control

- .1 Refer to 26 05 00 Common Work Results for Electrical.

-
- .2 Perform inspections and tests listed in NETA ATS Section 7.4 for switches, Section 7.5 for circuit breakers.

3.3 Adjusting

- .1 Measure steady state load currents at each panelboard feeder; rearrange circuits in the panelboard to balance the phase loads to within 20% of each other.
- .2 Maintain proper phasing for multi-wire branch circuits.

END OF SECTION

Part 1

General

1.1 Section Includes

- .1 Hinged cover enclosures.
- .2 Cabinets.
- .3 Terminal blocks.
- .4 Accessories.

1.2 Related Sections

- .1 Section 26 05 29 - Electrical Supporting Devices.

1.3 References

- .1 CSA-C22.1-18 - Canadian Electrical Code, Part I (24th Edition), Safety Standard for Electrical Installations.
- .2 CAN/CSA-C22.2 No. 94-M91 (R2006) - Special Purpose Enclosures.
- .3 CSA-C22.2 No. 158-10 - Terminal Blocks.
- .4 CSA (Canadian Standards Association).
- .5 ULC (Underwriters' Laboratories of Canada).

1.4 Submittals For Review

- .1 Refer to 26 05 00 Common Work Results for Electrical.
- .2 Product Data: Provide manufacturer's standard data for enclosures and cabinets.

1.5 Submittals For Information

- .1 Refer to 26 05 00 Common Work Results for Electrical.
- .2 Installation Data: Indicate application conditions and limitations of use stipulated by product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.6 Maintenance Material Submittals

- .1 Refer to 26 05 00 Common Work Results for Electrical.
- .2 Extra Stock Materials: Provide two (2) of each key.

1.7 Regulatory Requirements

- .1 Conform to requirements of CSA-C22.1.
- .2 Products: Listed and classified by CSA and as suitable for the purpose specified and indicated.

Part 2

Products

2.1 Hinged Cover Enclosures

- .1 Construction: CAN/CSA-C22.2 No. 94.
 - .1 Surface Mounted Indoor: Type 1 16 gauge steel enclosure complete with sprinkler drip hood.
 - .2 Recessed Mounted Indoor: Type 2 16 gauge steel enclosure.
 - .3 Exterior Use: Type 4 14 gauge steel enclosure or as indicated.
- .2 Covers: Surface or Flush cabinet front with continuous hinge,
 - .1 Indoor: Held closed by flush latch operable by key.
 - .2 Outdoor: Held closed by hasp and staple for padlock.
- .3 Provide interior metal panel for mounting terminal blocks and electrical components; finish with white enamel.
- .4 Enclosure Finish: Manufacturer's standard grey enamel.

2.2 Cabinets

- .1 Boxes: Galvanized steel.
- .2 Box Size: 600 mm(24 inches) wide x 600 mm(24 inches) high x 150 mm(6 inches) deep.
- .3 Backboard: Provide [19 mm(3/4 inch)] thick plywood backboard for mounting terminal blocks. Paint matte white.
- .4 Fronts: Steel, surface type with screw cover front and door with concealed hinge, and flush lock. Finish with gray baked enamel.
- .5 Provide metal barriers to form separate compartments wiring of different systems and voltages.
- .6 Provide accessory feet for free-standing equipment.

2.3 Terminal Blocks

- .1 Manufacturers:
- .2 Terminal Blocks: CSA-C22.2 No. 158.
- .3 Power Terminals: Unit construction type with closed back and tubular pressure screw connectors, rated 600 volts.
- .4 Signal and Control Terminals: Modular construction type, suitable for channel mounting, with tubular pressure screw connectors, rated 300 volts.
- .5 Provide ground bus terminal block, with each connector bonded to enclosure.

Part 3 Execution

3.1 Installation

- .1 Install components to CSA-C22.1 and to manufacturer's written instructions.
- .2 Install enclosures and boxes plumb. Anchor securely to wall and structural supports at each corner to Section 26 05 29.
- .3 Install cabinet fronts plumb.

3.2 Cleaning

- .1 Refer to 26 05 00 Common Work Results for Electrical.
- .2 Clean electrical parts to remove conductive and harmful materials.
- .3 Remove dirt and debris from enclosure.
- .4 Clean finishes and touch up damage.

END OF SECTION

Part 1

General

1.1 Section Includes

- .1 Wall switches.
- .2 Wall dimmers.
- .3 Receptacles.
- .4 Device plates and decorative box covers.
- .5 Floor box service fittings.
- .6 Poke-through service fittings.
- .7 Access floor box.

1.2 Related Sections

- .1 Section 26 05 34 - Boxes.

1.3 References

- .1 CSA-C22.1-18 - Canadian Electrical Code, Part I (24th Edition), Safety Standard for Electrical Installations.
- .2 CSA C22.2 No. 42-10 (R2015) - General Use Receptacles, Attachment Plugs, and Similar Wiring Devices
- .3 CSA C22.2 No. 42.1-13 (R2017) - Cover Plates for Flush-Mounted Wiring Devices.
- .4 CSA C22.2 No. 55-15 - Special use switches.
- .5 CAN/CSA C22.2 No. 111-18 - General-Use Snap Switches.
- .6 CSA C22.2 No. 184-15 - Solid-State Lighting Controls.
- .7 CSA (Canadian Standards Association).
- .8 ULC (Underwriters' Laboratories of Canada).

1.4 Submittals For Review

- .1 Refer to 26 05 00 Common Work Results for Electrical.
- .2 Product Data: Provide manufacturer's catalogue information showing dimensions, colours, and configurations.

1.5 Submittals For Information

- .1 Refer to 26 05 00 Common Work Results for Electrical.
- .2 Installation Data: Submit manufacturer's installation instructions.

1.6 Maintenance Material Submittals

- .1 Refer to 26 05 00 Common Work Results for Electrical.
- .2 Extra Stock Materials:

- .1 Provide two (2) of each style, size, and finish wall plate.
- .2 Provide [two (2)], [split nozzles] [protective rings] and.
- .3 Provide [two (2)] carpet rings.

1.7 Quality Assurance

- .1 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum five (5) years documented experience.

1.8 Regulatory Requirements

- .1 Provide products listed and classified by CSA and as suitable for the purpose specified and indicated.

Part 2 Products

2.1 Wall Switches

- .1 Manufacturers:
 - .1 Leviton
 - .2 Hubbell
 - .3 Cooper
 - .4 Legrand
 - .5 Substitutions: Refer to Section 26 05 00.
- .2 General-use snap switch:
 - .1 Grade: Commercial Specification Grade CSA-C22.2 No. 111
 - .2 Style: Standard toggle
 - .3 Device Body: White nylon toggle.
 - .4 Ratings: Match branch circuit and load characteristics. Amperage rating shall be marked on body of switch.
- .3 Body and Handle: White with nylon toggle.
- .4 Indicator Light: Separate pilot strap red colour with load on.
- .5 Locator Pilot Light: Separate pilot strap red colour.

2.2 Wall Dimmers & Occupancy Sensors

- .1 Refer to Lighting Control Schedule.

2.3 Ceiling Occupancy Sensors & Photocell

- .1 Refer to Lighting Control Schedule.

2.4 Astronomic Wall Switch Timer

- .1 Application: As indicated on the plans and schedules.
- .2 Manufacturers:
 - .1 NSI Industries model SS721Z.
 - .2 Substitutions: Refer to Section 26 05 00
- .3 Description: Seven (7) day astronomic in-wall time switch complete with manual on/off override.

- .4 Scheduling: Ten (10) on and off pairs of set points available for individual programs on each day of the week. Minimum setting of one (1) minute per schedule.
- .5 Operation Modes: Random, Manual, and Vacation modes.
- .6 Power Backup: Supercapacitor complete with two (2) days backup.
- .7 Device Body: Smooth white.
- .8 Ratings:
 - .1 Resistive Loads: 16 amps
 - .2 LED Drivers: 10 amps
 - .3 Motor Load: 1/2HP
- .9 Operating Temperature: 0 degrees C. to 40 degrees C.

2.5 Receptacles

- .1 Manufacturers:
 - .1 Leviton
 - .2 Hubbell
 - .3 Cooper
 - .4 Legrand
- .2 General-duty duplex convenience receptacle:
 - .1 Grade: Industrial Specification Grade, Nema WD-6 Compliant, CSA-C22.2 No.42.
 - .2 Style: Standard.
 - .3 Device Body: Smooth white nylon face and base.
 - .4 CSA Configuration: Type as specified and indicated.
 - .5 Tamper resistant as indicated or as per Electrical Code.
- .3 Configuration: Type as specified and indicated.
 - .1 General Use Receptacles Tamperproof: Classrooms and other general areas.
 - .1 15A - CAT#5262.
 - .2 20A - CAT#5362.
 - .2 High Abuse Receptacles: Labs, shop areas and gymnasiums, corridors.
 - .1 15A - CAT#5262
 - .2 20A – CAT#5362
 - .3 GFCI Receptacles
 - .1 15A - CAT#7599
 - .2 20A – CAT#7899
 - .4 Exterior GFCI
 - .1 20A - CAT#X7891-PL
- .4 GFCI Receptacle: Duplex receptacle with integral ground fault circuit interrupter to meet regulatory requirements complete with steady-on “Green-Power-On” and steady-on “Red-Power-Tripped Off” LED indicator lights.
- .5 Exterior Use Receptacle: Extra Heavy Duty Industrial grade duplex receptacle with integral ground fault circuit interrupter to meet regulatory requirements complete with steady-on “Green-Power-On” and steady-on “Red-Power-Tripped Off” LED indicator lights complete with UV and corrosion resistant device body complete with CSA 5-20R configuration only.

- .6 Range Receptacle: CSA configuration 14-50R commercial specification grade complete with stainless steel faceplate.
 - .1 Flush Mounted: Leviton CAT#1279-W-50
 - .2 Surface Mounted: Leviton CAT#55050
- .7 Dryer Receptacle: CSA configuration 14-30R commercial specification grade complete with stainless steel faceplate.
 - .1 Flush Mounted: Leviton CAT#1278-W-30A
 - .2 Surface Mounted: Leviton CAT#55054
- .8 Suitable for No. 10 AWG for back and side wiring.
- .9 Break-off links for use as split receptacles.
- .10 Double wipe contacts and riveted grounding contacts.
- .11 Receptacles shall be of one manufacturer throughout the project.

2.6 Wall Plates

- .1 Standard Stainless Steel Cover Plate: 430 type stainless steel cover plate complete with protective plastic film. Combination or multi-gang covers as required or indicated. Jumbo or standard size as indicated or specified.
- .2 Metallic While-in-Use covers: Nema 3R rated, die-cast aluminum construction with powder coated "chip resistant" paint corrosion protection and plug/cord management, suitable for horizontal mounting on device box only, and padlock provision.
- .3 Weatherproof Cover Plate: Gasketed cast metal with gasketed double hinged device covers suitable for horizontal mounting on device box only. Provide single hinged device cover for GFI type receptacle only.

Part 3 Execution

3.1 Examination

- .1 Refer to 26 05 00 Common Work Results for Electrical.
- .2 Verify that outlet boxes are installed at proper height.
- .3 Verify that wall openings are neatly cut and will be completely covered by wall plates.
- .4 Verify that floor boxes are adjusted properly.
- .5 Verify that branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.

3.2 Preparation

- .1 Provide extension rings to bring outlet boxes flush with finished surface.
- .2 Clean debris from outlet boxes.

3.3 Installation

- .1 Install to CSA-C22.1 and to manufacturer's written instructions.
- .2 Install devices plumb and level.

- .3 Install switches with OFF position down.
- .4 Provide neutral conductor in box for all line voltage lighting control devices.
- .5 Install wall dimmers to achieve full rating specified and indicated after de-rating for ganging as instructed by manufacturer.
- .6 Do not share neutral conductor on load side of dimmers.
- .7 Install receptacles with grounding pole on bottom.
- .8 Install tamper resistant receptacles in all classrooms, child care areas, hotel/motel guest rooms and suites, corridors, and offices.
- .9 Install tamper resistant receptacles in all rooms for child care facilities, preschools, schools and dwelling units.
- .10 Use exterior use receptacles for exterior applications unless noted otherwise.
- .11 Connect wiring device grounding terminal to branch circuit equipment grounding conductor and outlet box.
- .12 Install locator pilot light for lighting controls located in crawlspace.
- .13 Install decorative plates on switch, receptacle, and blank outlets in finished areas.
- .14 Connect wiring devices by wrapping conductor around screw terminal.
- .15 Use jumbo size plates for outlets installed in masonry walls.
- .16 Stainless steel protective coverings shall be maintained until project completion and turn-over to the Division.
- .17 Install galvanized steel plates on outlet boxes and junction boxes in unfinished areas, above accessible ceilings, and on surface mounted outlets.
- .18 Install metallic While-In-Use covers on exterior receptacles.
- .19 Use weatherproof covers for parking receptacles, and dust-tight applications only, or as indicated.
- .20 Install protective rings on active flush cover service fittings.

3.4 Interface With Other Products

- .1 Coordinate locations of outlet boxes provided under Section 26 05 34 to obtain mounting heights specified and as indicated on drawings.

3.5 Field Quality Control

- .1 Refer to 26 05 00 Common Work Results for Electrical.
- .2 Inspect each wiring device for defects.
- .3 Operate each wall switch with circuit energized and verify proper operation.
- .4 Verify that each receptacle device is energized.
- .5 Test each receptacle device for proper polarity.
- .6 Test each GFCI receptacle device for proper operation.

3.6 Adjusting

- .1 Adjust devices and wall plates to be flush and level.

3.7 Cleaning

- .1 Refer to 26 05 00 Common Work Results for Electrical.
- .2 Clean exposed surfaces to remove splatters and restore finish.

END OF SECTION

Part 1

General

1.1 Section Includes

- .1 Manual motor controllers.
- .2 Magnetic motor controllers.
- .3 Combination magnetic motor controllers.

1.2 Related Sections

- .1 Section 26 05 29 - Electrical Supporting Devices.
- .2 Section 26 05 53 - Electrical Identification: Engraved nameplates.

1.3 References

- .1 CSA-C22.1-18 - Canadian Electrical Code, Part I (24th Edition), Safety Standard for Electrical Installations.
- .2 CSA-C22.2 No. 14 10 - Industrial Control Equipment.
- .3 CSA-C22.2 No. 248.1-11 - Low-voltage fuses - Part 1: General requirements.
- .4 CSA-C22.2 No. 5-09 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures.
- .5 CAN/CSA-C22.2 No. 94-M91 (R2006) - Special Purpose Enclosures.
- .6 CSA-C22.2 No. 4-04 (2009) - Enclosed and Dead-Front Switches.
- .7 CSA (Canadian Standards Association).
- .8 ULC (Underwriters' Laboratories of Canada).

1.4 Submittals For Review

- .1 Refer to 26 05 00 Common Work Results for Electrical.
- .2 Product Data: Provide catalogue sheets showing voltage, controller size, ratings and size of switching and over-current protective devices, short circuit ratings, dimensions, and enclosure details.

1.5 Submittals For Information

- .1 Refer to 26 05 00 Common Work Results for Electrical.
- .2 Test Reports: Indicate field test and inspection procedures and test results.
- .3 Installation Data: Indicate application conditions and limitations of use stipulated by product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.

1.6 Maintenance Material Submittals

- .1 Refer to 26 05 00 Common Work Results for Electrical.

-
- .2 Extra Stock Materials: Provide three (3) of each size and type fuse installed.

1.7 Quality Assurance

- .1 Perform Work to CSA-C22.1.
- .2 Maintain one (1) copy of each document on site.
- .3 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum ten (10) years documented experience.

1.8 Regulatory Requirements

- .1 Provide products listed and classified by CSA as suitable for purpose specified and indicated.

Part 2 Products

2.1 Manual Controllers

- .1 Manual Motor Controller: CSA-C22.2 No. 14, AC general-purpose Class A, manually operated, full-voltage controller with overload element, red pilot light and auxiliary contact and push button operator.
- .2 Fractional Horsepower Manual Controller: CSA-C22.2 No. 14, AC general-purpose Class A, manually operated, full-voltage controller for fractional horsepower induction motors, with thermal overload unit, red and green pilot light, and toggle operator.
- .3 Motor Starting Switch: CSA-C22.2 No. 14, AC general-purpose Class A, manually operated, full-voltage controller for fractional horsepower induction motors, without thermal overload unit, with red pilot light and toggle operator.
- .4 Enclosure: CAN/CSA-C22.2 No. 94; Type 1B.

2.2 Automatic Controllers

- .1 Magnetic Motor Controller: CSA-C22.2 No. 14, AC general-purpose Class A, magnetic controller for induction motors rated in horsepower.
- .2 Reversing Controllers: Include electrical interlock and integral time delay transition between FORWARD and REVERSE rotation.
- .3 Two Speed Controllers: Include integral time delay transition between FAST and SLOW speeds.
- .4 Coil operating voltage: 600 and 120 volts, 60 Hertz.
- .5 Overload Relay: CSA-C22.2 No. 14; bimetal.
- .6 Enclosure: NEMA ICS 6, Type 1.

2.3 Product Options And Features

- .1 Auxiliary Contacts: CSA-C22.2 No. 14, two (2) each field convertible contacts in addition to seal-in contact.
- .2 Cover Mounted Pilot Devices: CSA-C22.2 No. 14, heavy duty type.

- .3 Pilot Device Contacts: CSA-C22.2 No. 14, Form Z, rated A150.
- .4 Pushbuttons: Recessed type.
- .5 Indicating Lights: LED type.
- .6 Selector Switches: Rotary type.
- .7 Relays: CSA-C22.2 No. 14.
- .8 Control Power Transformers: 120 volt secondary, sized for 20% spare capacity, in each motor starter. Provide fused secondary, and bond unfused leg of secondary to enclosure.

2.4 Disconnects

- .1 Combination Controllers: Combine motor controllers with switch (fusible or non-fusible), motor circuit protector, and disconnect in common enclosure.
- .2 Motor Circuit Protector: CAN/CSA-C22.2 No. 5, circuit breakers with integral instantaneous magnetic trip in each pole.
- .3 Fusible Switch Assemblies: CAN/CSA-C22.2 No. 4, enclosed knife switch with externally operable handle. Fuse clips: Designed to accommodate Class J and R fuses.

2.5 Fuses

- .1 Interrupting Rating: 200,000 rms amperes.

Part 3 Execution

3.1 Installation

- .1 Install enclosed controllers where indicated, to manufacturer's written instructions.
- .2 Install enclosed controllers plumb. Provide supports to Section 26 05 29.
- .3 Height: 1.6 m (5 ft) to operating handle.
- .4 Install fuses in fusible switches.
- .5 Select and install overload heater elements in motor controllers to match installed motor characteristics.
- .6 Provide engraved plastic nameplates under the provisions of Section 26 05 53.
- .7 Provide neatly typed label inside each motor controller door identifying motor served, nameplate horsepower, full load amperes, code letter, service factor, and voltage/phase rating.

END OF SECTION

Part 1 General

1.1 Section Includes

- .1 Luminaires.
- .2 Emergency lighting inverter.
- .3 Exit signs.
- .4 LED luminaires and drivers.
- .5 Luminaire accessories.

1.2 References

- .1 ANSI/NEMA C78.379-2006 - American National Standard for Electric Lamps - Classification of the Beam Patterns of Reflector Lamps.
- .2 CSA-C22.1-18 - Canadian Electrical Code, Part I (24th Edition), Safety Standard for Electrical Installations.
- .3 CSA-C22.2 No. 9.0-96 (R2006) - General Requirements for Luminaires.
- .4 CSA-C22.2 No. 250.0-08 - Luminaires.
- .5 CSA-C22.2 No. 141-15 - Emergency lighting equipment.
- .6 CAN/CSA-E920-98 (R2007) - Ballasts for Tubular Fluorescent Lamps - General and Safety Requirements.
- .7 CAN/CSA-E928-98 (R2007) - Auxiliaries for Lamps - A.C. Supplied Electronic Ballasts for Tubular Fluorescent Lamps - General and Safety Requirements.
- .8 CAN/CSA-E61347-2-3-03 (R2008) - Lamp Controlgear - Part 2-3: Particular Requirements for A.C. Supplied Electronic Ballasts for Fluorescent Lamps.
- .9 NEMA WD 6-2002 (R2008) - Wiring Devices - Dimensional Requirements.
- .10 CSA (Canadian Standards Association).
- .11 ULC (Underwriters' Laboratories of Canada).

1.3 Submittals For Review

- .1 Refer to 26 05 00 Common Work Results for Electrical.
- .2 Shop Drawings: Indicate dimensions and components for each luminaire that is not a standard product of the manufacturer.
- .3 Product Data: Provide dimensions, ratings, and performance data.

1.4 Submittals For Information

- .1 Refer to 26 05 00 Common Work Results for Electrical.

- .2 Installation Data: Submit data indicating application conditions and limitations of use stipulated by product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.5 Closeout Submittals

- .1 Refer to 26 05 00 Common Work Results for Electrical.
- .2 Operation and Maintenance Data: Submit manufacturer's operation and maintenance instructions for each product.

1.6 Maintenance Material Submittals

- .1 Refer to 26 05 00 Common Work Results for Electrical.
- .2 Extra Stock Materials:
 - .1 Provide two (2) of each plastic lens type.
 - .2 Provide ten (10) replacement lamps for each lamp type.
 - .3 Provide two (2) of each ballast type.

1.7 Quality Assurance

- .1 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum five (5) years documented experience.
- .2 Conform to requirements of CSA C22.1, and to Efficiency Manitoba..
- .3 Products: Listed and classified by CSA, and as suitable for the purpose specified and indicated.

Part 2 Products

2.1 Luminaires

- .1 Manufacturers:
 - .1 Refer to Luminaire Schedule on drawings.
 - .2 Substitutions: Refer to Section 26 05 00 Common Work Results for Electrical.
 - .1 All requests for substitutions shall be complete with photometric layouts indicating proposed luminaire performance in a 1' by 1' grid.

2.2 Emergency Lighting Inverter

- .1 Description: Stand-alone pure sine wave output inverter unit equipment designed to operated designated incandescent, fluorescent and LED fixtures on emergency power and their full nominal lumen rating.
- .2 Battery: 12 volt, valve regulated lead acid type, with minimum 1/2 hour capacity at full load.
- .3 Inverter:
 - .1 120VAC +/- 3%
 - .2 60Hz +/- 1%

- .3 Transfer Time <1s.
- .4 Load Power Factor: 0.9 leading to 0.9 lagging.
- .5 AC lockout
- .6 Short circuit and brownout protection..

- .4 Housing: Factory white powder coat paint finish steel cabinet.
- .5 Indicators: Lamps to indicate AC ON and RECHARGING.
- .6 TEST Switch: Transfers unit from external power supply to integral battery supply.
- .7 Auto-test self-diagnostic
- .8 Electrical Connection: Hard wired
- .9 Input Voltage: 120V.
- .10 Manufacturers:
 - .1 Refer to Emergency Battery Bank Schedule on drawings.
 - .2 Substitutions: Refer to Section 26 05 00

2.3 Exit Signs

- .1 Housing: Steel
- .2 Face: Green Pictogram face with white chevrons.
- .3 Directional Arrows: Universal type for field adjustment
- .4 Mounting: Universal, for field selection and as indicated
- .5 Lamps: LED
- .6 Input Voltage: Universal 120-347VAC, 6-24VDC.
- .7 Manufacturers:
 - .1 Refer to Emergency Lighting Schedule on drawings.
 - .2 Substitutions: Refer to Section 26 05 00

2.4 Led Luminaires And Drivers

- .1 All Luminaires
 - .1 Comply with IES LM-79-08 Approved Method for measuring lumen maintenance of LED light sources.
 - .2 Comply with IES LM-80-08 Approved Method for electrical and photometric measurement of SSL product.
 - .3 LED's shall be Restriction of Hazardous Substances Directive (RoHS) compliant.
 - .4 LED arrays shall be sealed, high performance, long life type; minimum 70% rated output at 50,000 hours.
 - .5 LED luminaires shall deliver a minimum of 60 lumens per watt.
 - .1 LED's shall be "Bin No. 1" quality.
 - .6 Drivers shall be solid state and accept 120 through 277 VAC at 60 Hz input.
 - .7 The LED light source shall be fully dimmable with use of compatible dimmers switch designated for low voltage loads.
 - .8 LED color temperatures: CRI 85, 2700K as noted +/- 145K.
 - .9 LED color temperatures: CRI 85, 4000K as noted +/- 275K.

-
- .10 LED color temperatures: CRI 85, 5000K as noted +/-283K.
 - .11 Luminaires shall have internal thermal protection.
 - .12 Luminaires shall not draw power in the off state. Luminaires with integral occupancy, motion, photo-controls, or individually addressable luminaires with external control and intelligence are exempt from this requirement. The power draw for such luminaires shall not exceed 0.5 watts when in the off state.
 - .13 Color spatial uniformity shall be within .004 of CIE 1976 diagram.
 - .14 Color maintenance over rated life shall be within .007 of CIE 1976.
 - .15 Indoor luminaires shall have a minimum CRI of 85.
 - .16 Luminaire manufacturers shall adhere to device manufacturer guidelines, certification programs, and test procedures for thermal management
 - .17 LED package(s)/module(s)/array(s) used in qualified luminaires shall deliver a minimum 70% of initial lumens, when installed in-situ, for a minimum of 50,000 hours.
 - .18 Luminaires shall be fully accessible from below ceiling plane for changing drivers, power supplies and arrays.
- .2 Power Supplies and Drivers
- .1 Efficiency Manitoba approved.
 - .2 Power Factor: 0.90 or higher
 - .3 Maximum driver case temperature not to exceed driver manufacturer recommended in-situ operation.
 - .4 Output operating frequency: 60Hz.
 - .5 Interference: EMI and RFI compliant with FCC 47 CFR Part 15.
 - .6 Total Harmonic Distortion Rating: 20% Maximum.
 - .7 Meet electrical and thermal conditions as described in LM-80 Section 5.0.
 - .8 Primary Current: Confirm primary current with Drawings.
 - .9 Secondary Current: Confirm secondary current specified by individual luminaire manufacturers.
 - .10 Compatibility: Certified by manufacturer for use with individually specified luminaire and individually specified control components.
 - .11 Solid-state control components to be integral or external per each specified luminaire. Remote control gear to be enclosed in Class 1, Class 2, or NEMA 3R enclosures as required.
- .3 Controller and Control System
- .1 System electronics driver / controller to use coordinated communication protocols: DMX512, 0-10V, DALI, or proprietary as required.
 - .2 The Electrical Subcontractor shall ensure that external control equipment is compatible with LED control requirements
 - .3 Provide connector types and wiring as appropriate for un-interrupted communication between devices, considering distance maximums, field obstructions, and accessibility. Ensure that connection points are optically isolated for system noise reduction.
 - .4 Compatibility: Certified by manufacturer for use with individually specified luminaire and individually specified power supplies and/or drivers

- .5 Luminaires used for emergency lighting connected to emergency lighting inverter to be controlled by relay type control that senses loss of normal power and controls the fixture to operate at 100%, locking out all other control until normal power is restored.

2.5 Accessories

- .1 Description: Standard down light reflector shall be semi-specular unless noted otherwise.
- .2 Joiner Fittings: As specified for linear lighting systems, or as required for end to end continuous row mounting as indicated on drawings. Fittings to match style and finish of luminaire specified.
- .3 End Caps: As specified for linear lighting systems, or as required for end of row or stand-alone luminaire installations as indicated on drawings. End caps to match style and finish of luminaire specified.
- .4 Power Cord: As required for suspended lighting systems where wiring is exposed between fixture canopy and fixture lamp assembly. Power cord shall match finish of lighting fixture. Provide 0-10V combination cable as required for dimming purposes. Length of cable shall be suitable for minimum suspension length of 4'-0" from ceiling finish. Confirm final lengths with installation requirements.
- .5 Wireguard: As specified for luminaire, or as indicated on the drawings.
 - .1 Gauge: Minimum 8 gauge unless noted otherwise.
 - .2 Color: Custom color to be confirmed by architect at time of shop drawing review.

2.6 Source Quality Control

- .1 Refer to 26 05 00 Common Work Results for Electrical.

Part 3 Execution

3.1 Installation

- .1 Support luminaires larger than 600 x 1200 mm(24 x 48 inch) size independent of ceiling framing.
- .2 Locate recessed ceiling luminaires as indicated on reflected ceiling plan.
- .3 Install surface mounted luminaires, emergency lighting, and exit signs plumb and adjust to align with building lines and with each other. Secure to prevent movement.
- .4 Exposed Grid Ceilings: Fasten surface mounted luminaires to ceiling grid members using bolts, screws, or suitable clips.
- .5 Install recessed luminaires to permit removal from below.
- .6 Install recessed luminaires using accessories and firestopping materials to meet regulatory requirements for fire rating.
- .7 Install clips to secure recessed grid-supported luminaires in place.

- .8 Install wall mounted luminaires, emergency lighting units, and exit signs at height as indicated.
- .9 Install end to end, or continuous rows of luminaires with appropriate joiner fittings to match the luminaire manufacturer and finish.
- .10 Install linear lighting with appropriate end caps where practicable.
- .11 Lighting installed in corridors shall be oriented to maximize light distribution along the corridor rather than across it.
- .12 Install accessories provided with each luminaire.
- .13 Make wiring connections to branch circuit using building wire with insulation suitable for temperature conditions within luminaire.
- .14 Bond products and metal accessories to branch circuit equipment grounding conductor.
- .15 Install specified lamps in each luminaire, emergency lighting unit and exit sign.

3.2 Field Quality Control

- .1 Operate each luminaire after installation and connection. Inspect for proper connection and operation.

3.3 Adjusting

- .1 Aim and adjust luminaires as directed.
- .2 Position exit sign directional arrows as indicated.

3.4 Cleaning

- .1 Refer to 26 05 00 Common Work Results for Electrical.
- .2 Clean electrical parts to remove conductive and deleterious materials.
- .3 Remove dirt and debris from enclosures.
- .4 Clean photometric control surfaces as recommended by manufacturer.
- .5 Clean finishes and touch up damage.

3.5 Closeout Activities

- .1 Demonstration: Demonstrate luminaire operation for minimum of one (1) hours.

3.6 Protection Of Finished Work

- .1 Refer to 26 05 00 Common Work Results for Electrical.
- .2 Re-lamp luminaires with failed lamps at Substantial Completion.

END OF SECTION

Part 1

General

1.1 Section Includes

- .1 Luminaires and accessories.
- .2 Lamps.
- .3 Poles.

1.2 Related Sections

- .1 Section 03 30 00 - Cast-in-place Concrete: Foundations for poles.

1.3 References

- .1 C22.2 NO. 250.0-18 - Luminaires.
- .2 C22.2 No. 9.0-96 (R2016) - General Requirements for Luminaires.
- .3 CAN/CSA-A14-07 (R2017) - Concrete Poles.
- .4 C22.2 No. 206-17 - Lighting Poles.
- .5 CAN/CSA-C239-02 (R2016) - Performance Standard for Dusk-to-Dawn Luminaires.
- .6 CAN/CSA-E60598-2-3-98 (R2017) - Luminaires - Part 2: Particular Requirements - Section 3: Luminaires for Road and Street Lighting.
- .7 CAN/CSA-E61347-2-3-03 (R2013) - Lamp Controlgear - Part 2-3: Particular Requirements for A.C. Supplied Electronic Ballasts for Fluorescent Lamps.
- .8 CAN/CSA-E922-98 (R2007) - Ballasts for Discharge Lamps (Excluding Tubular Fluorescent Lamps) - General Safety Requirements.
- .9 IES RP-33-14 - Lighting for Exterior Environments
- .10 IES RP8-14 - Roadway Lighting.
- .11 IES RP20-14 - Lighting for Parking Facilities.
- .12 CSA (Canadian Standards Association).
- .13 ULC (Underwriters' Laboratories of Canada).

1.4 Administrative Requirements

- .1 Refer to 26 05 00 Common Work Results for Electrical.
- .2 Coordination:
 - .1 Coordinate with other work having a direct bearing on work of this section.
 - .2 Provide bolt templates and pole mounting accessories to installer of pole foundations.

1.5 Submittals For Review

- .1 Refer to 26 05 00 Common Work Results for Electrical.
- .2 Product Data: Provide dimensions, ratings, and performance data.

-
- .3 Shop Drawings: Indicate dimensions and components for each luminaire which is not a standard Product of the manufacturer.

1.6 Submittals For Information

- .1 Refer to 26 05 00 Common Work Results for Electrical.
- .2 Installation Data: Indicate application conditions and limitations of use stipulated by Product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of Product.

1.7 Closeout Submittals

- .1 Refer to 26 05 00 Common Work Results for Electrical.
- .2 Maintenance Data: Submit maintenance data for each luminaire.

1.8 Maintenance Material Submittals

- .1 Refer to 26 05 00 Common Work Results for Electrical.

1.9 Quality Assurance

- .1 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum five (5) years documented experience.

1.10 Regulatory Requirements

- .1 Products: Listed and classified by CSA and as suitable for the purpose specified and indicated.

1.11 Delivery, Storage, And Protection

- .1 Refer to 26 05 00 Common Work Results for Electrical.
- .2 Store and handle lighting poles to CAN/CSA-A14 and CSA-C22.2 No. 206.

Part 2 Products

2.1 Luminaires And Accessories

- .1 Manufacturers:
 - .1 Refer to Luminaire Schedule on drawings.
 - .2 Substitutions: None.

2.2 Poles

- .1 Manufacturers:
 - .1 Valmont.
 - .2 Substitutions: None, match existing.
- .2 Material and Finish: Black finish.
- .3 Section Shape and Dimensions: 5-inch square.
- .4 Height: As indicated.

- .5 Base: Fatigue resistant.
- .6 Accessories: Anchor bolts and cast reinforced handhole.
- .7 Loading Capacity Ratings:
 - .1 As required.
- .8 Warranty: Lifetime warranty for defects in material, workmanship and to be free from corrosion.

Part 3 Execution

3.1 Installation

- .1 Provide concrete bases for lighting poles at locations indicated, to Section 03 30 00.
- .2 Install poles plumb. Provide shims and double nuts to adjust plumb. Grout around each base.
- .3 Install lamps in each luminaire.
- .4 Bond metal poles, metal accessories and luminaires to branch circuit equipment grounding conductor.

3.2 Field Quality Control

- .1 Refer to 26 05 00 Common Work Results for Electrical.
- .2 Operate each luminaire after installation and connection. Inspect for improper connections and operation.

3.3 Adjusting

- .1 Aim and adjust luminaires to provide illumination levels and distribution as directed and indicated on Drawings.

3.4 Cleaning

- .1 Refer to 26 05 00 Common Work Results for Electrical.
- .2 Clean electrical parts to remove conductive and deleterious materials.
- .3 Remove dirt and debris from enclosure.
- .4 Clean photocell control surfaces as recommended by manufacturer.
- .5 Clean finishes and touch up damage.

3.5 Protection Of Finished Work

- .1 Refer to 26 05 00 Common Work Results for Electrical.
- .2 Re-lamp luminaires where lamps have failed at Substantial Completion.

END OF SECTION

Part 1 General

1.1 Section Includes

- .1 Electric unit heaters.
- .2 Electric cabinet heaters.
- .3 Electric baseboard heaters.
- .4 Thermostats and accessories.

1.2 References

- .1 NEMA DC 3-2008 - Residential Controls - Electric Wall-Mounted Room Thermostats.

1.3 Submittals For Review

- .1 Section 01 33 00: Submission procedures.
- .2 Product Data: Provide unit size, finish, and performance data.

1.4 Submittals For Information

- .1 Section 01 33 00: Submission procedures.
- .2 Installation Data: Manufacturer's special installation requirements.

1.5 Closeout Submittals

- .1 Section 01 78 00: Submission procedures.
- .2 Operation and Maintenance Data:
 - .1 Include instructions for safe operating procedures.
 - .2 Include instructions for replacement parts and troubleshooting diagnostics.
 - .3 Include recommended cleaning methods, cleaning materials, and waxes for interior parts and exterior finishes.

Part 2 Products

2.1 Manufacturers

- .1 Manufacturers:
 - .1 Ouellet
 - .2 Chromalox
 - .3 Stelpro
 - .4 Q-Mark

2.2 Electric Horizontal Discharge Unit Heaters

- .1 Description: Electric unit heater for suspended mounting, with fan forced air distribution over electric resistance heating coils and horizontal discharge.
- .2 Input Voltage: Refer to Schedule.
- .3 Output Rating: Refer to Schedule.

-
- .4 Heating Element: Enclosed copper tube, aluminum finned element of coiled nickel-chrome resistance wire centred in tubes and embedded in refractory material.
 - .5 Input Fuses: Provide integral fuses for units rated more than 48 amperes full load.
 - .6 Provide line voltage disconnect switch for each input circuit.
 - .7 Fabrication: Fabricate cabinet of heavy welded steel.
 - .8 Provide hinged and latched panel for electrical connection and control compartment.
 - .9 Provide internal shroud around heating elements to assure uniform air flow and delivery temperature across heater face.
 - .10 Provide suitable fan blade protection using wire guard.
 - .11 Cabinet Finish: Use corrosion-resisting primer and finish with baked enamel, colour beige.
 - .12 Contactor: Provide contactor control for unit.
 - .13 Thermostat: Provide remote low voltage thermostat to control contactor.
 - .14 Provide low voltage control transformer.
 - .15 Operating Stages: One (1).
 - .16 Provide terminal blocks for power and control wiring connections.
 - .17 Louvre: Provide discharge louvre with individually adjustable blades.

2.3 Electric Downflow Discharge Unit Heaters

- .1 Description: Electric unit heater for suspended mounting, with fan forced air distribution over electric resistance heating coils and vertical discharge.
- .2 Input Voltage: Refer to Schedule.
- .3 Output Rating: Refer to Schedule.
- .4 Heating Element: Enclosed copper tube, aluminum finned element of coiled nickel-chrome resistance wire centred in tubes and embedded in refractory material.
- .5 Input Fuses: Provide integral fuses for units rated more than fort-eight (48) amperes full load.
- .6 Provide line voltage disconnect switch for each input circuit.
- .7 Fabrication: Fabricate cabinet of heavy welded steel.
- .8 Provide hinged and latched panel for electrical connection and control compartment.
- .9 Cabinet Finish: Use corrosion-resisting primer and finish with baked enamel.
- .10 Contactor: Provide contactor control for unit.
- .11 Thermostat: Refer to Schedule.
- .12 Provide low voltage control transformer.
- .13 Operating Stages: One (1).

- .14 Provide terminal blocks for power and control wiring connections.
- .15 Diffuser: Louvre type, adjustable from 0 degrees to 45 degrees (0 to 50 grads).

2.4 Electric Baseboard Units

Description: Pedestal mounted electric convector heater with resistance heating element.

- .1 Input Voltage: Refer to Schedule.
- .2 Output Rating: Refer to Schedule.
- .3 Heating Element: Enclosed copper tube, aluminum finned element of coiled nickel-chrome wire embedded in refractory material.
- .4 Element Hangers: Ball bearing cradle type.
- .5 Provide line voltage disconnect switch integral with thermostat to directly control heater element.
- .6 Fabrication: Fabricate cabinet of heavy welded steel.
- .7 Grille: Fabricate from stamped steel sheet.
- .8 Provide captive-screw held panel for electrical connection and control compartment.
- .9 Cabinet Finish: Use corrosion-resisting primer and finish with baked enamel.
- .10 Grille Finish: Use corrosion-resisting primer and finish with baked enamel, colour white.
- .11 Provide terminal blocks for power and control wiring connections.

2.5 Accessories

- .1 Room Thermostat: Heating only low voltage thermostat with control point reset.
- .2 Mounting Accessories: Impact resistant clear enclosure with lockable cover.

Part 3 Execution

3.1 Examination

- .1 Verify existing conditions before starting work.
- .2 Verify that field measurements are as instructed by manufacturer and shown on Drawings.
- .3 Verify that field conditions are acceptable and are ready to receive work.
- .4 Verify that required utilities are available, in proper location, and ready for use.
- .5 Beginning of installation means installer accepts existing conditions.

3.2 Installation

- .1 Install to manufacturer's written instructions.
- .2 Locate each unit in position indicated.
- .3 Install unit with sufficient clearance from adjacent construction, piping, ductwork, and other obstructions to allow access for service and maintenance.

- .4 Support unit heaters from structure using construction details shown on Drawings.

3.3 Field Quality Control

- .1 Section 01 45 00: Field adjusting and testing.
- .2 Verify operation of each electric heating unit by measuring input voltage and current simultaneously for period of ten minutes of continuous operation.

3.4 Closeout Activities

- .1 Demonstration: Demonstrate location of circuit breakers and switches serving electric heating branch circuits, and location and setting procedures for thermostats and other heating controls.

END OF SECTION

Part 1 General

1.1 Related Requirements

- .1 Section 26 05 26 – Grounding and Bonding.

1.2 References

- .1 American National Standards Institute
 - .1 ANSI J-STD-607-A-2002, Joint Standard - Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications.
- .2 Telecommunications Industries Association (TIA)/Electronic Industries Alliance (EIA)
 - .1 TIA/EIA-606-2002, Administration Standard for the Commercial Telecommunications Infrastructure.

1.3 System Description

- .1 Telecommunications grounding and bonding system consist of grounding busbars, bonding backbones, and other bonding conductors.
- .2 Provides ground reference for telecommunications systems within building and bonding to it of telecommunications rooms.
- .3 Metallic pathways, cable shields, conductors, and hardware within telecommunications spaces are bonded to telecommunications grounding and bonding system.

Part 2 Products

2.1 Telecommunications Main Grounding Busbar (TMGB)

- .1 Existing.

2.2 Telecommunications Grounding Busbar (TGB)

- .1 Existing.

2.3 Telecommunications Bonding Backbone (TBB)

- .1 Existing.

2.4 Telecommunications Bonding Conductor (TBC)

- .1 #6 AWG copper conductor, green marked to: ANSI J-STD-607-A.

2.5 Warning Labels

- .1 Non-metallic warning labels in English to: ANSI J-STD-607-A.
- .2 Identify labels with wording "If this connector is loose or must be removed, please call the building telecommunications manager".

Part 3 Execution

3.1 TELECOMMUNICATIONS MAIN GROUNDING BUSBAR (TMGB)

- .1 Modify and expand the existing TMGB as required to accommodate the addition and renovation.

3.2 Telecommunications Grounding Busbar (TGB)

- .1 Modify and expand the existing TGB as required to accommodate the addition and renovation.

3.3 Bonding Conductors General

- .1 When placed in ferrous metallic conduit or EMT longer than 1 m, bond to each end of conduit or EMT using grounding bushing and #6 AWG copper conductor.

3.4 Telecommunications Bonding Conductor (TBC)

- .1 Use approved 2 hole compression lugs for connection to TMGB or TGB.

3.5 Bonding To TGB

- .1 Bond metallic raceways in telecommunications room to TGB using #6 AWG copper conductor.
- .2 For cables within telecommunications room having shield or metallic member, bond shield or metallic member to TGB using #6 AWG copper conductor.
- .3 Bond equipment racks and cabinets located in telecommunications room to TGB using #6 AWG copper conductor.

3.6 Labelling

- .1 Apply warning labels to telecommunications bonding and grounding conductors.
- .2 Apply additional administrative labels to: TIA/EIA-606.

END OF SECTION

Part 1 General

1.1 Action And Informational Submittals

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for communication raceway systems and include product characteristics, performance criteria, physical size, finish and limitations.

1.2 Delivery, Storage And Handling

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

Part 2 Products

2.1 System Description

- .1 Empty telecommunications raceways system consists of outlet boxes, cover plates, terminal and distribution cabinets, conduits, cable trays, pull boxes, sleeves and caps, fish wires, service poles, service fittings, concrete encased ducts.
- .2 Overhead cable tray distribution system.

2.2 Material

- .1 Conduits: EMT type, in accordance with Section 26 05 33 - Conduits.
- .2 Junction boxes: in accordance with Section 26 05 34 - Boxes.
- .3 Cabinets and enclosures: in accordance with Section 26 27 16 – Cabinets and Enclosures.
- .4 Fish wire: polypropylene type.

Part 3 Execution

3.1 Examination

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for communication raceway systems installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate in presence of The City.
 - .2 Inform The City 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 The City.

3.2 Installation

- .1 Install empty raceway system, including underfloor or overhead distribution system, fish wire, terminal cabinets, outlet boxes, floor boxes, pull boxes, cover plates, conduit, sleeves and caps, cable tray, service poles, miscellaneous and positioning material to constitute complete system.
- .2 Maintain the following clearances from all electrical equipment as follows:
 - .1 Transformers above 5kVA – 1000mm
 - .2 347/600V power – 1000mm
 - .3 120V power – 50mm
 - .4 208/240V power – 300mm
 - .5 Motors – 1000mm
 - .6 120V fluorescent lighting – 300mm
 - .7 347V fluorescent lighting – 1000mm

3.3 Cleaning

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

3.4 Protection

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by pathways for communications systems installation.

END OF SECTION

Part 1

General

1.1 Related Requirements

- .1 Section 26 05 00 Common Work Results for Electrical.

1.2 References

- .1 Canadian Standards Association (CSA International)
 - .1 CSA-C22.2 No. 214-02, Communications Cables (Bi-National standard with UL 444).
 - .2 CSA-C22.2 No. 232-M1988(R2004), Optical Fiber Cables.
- .2 Telecommunications Industry Association (TIA)/Electronic Industries Alliance (EIA)
 - .1 TIA/EIA-568-C.1-(2001), Commercial Building Telecommunications Cabling Standard, Part 1: General Requirements.
 - .2 TIA/EIA-568-C.2-(2001), Commercial Building Telecommunications Cabling Standard, Part 2: Balanced Twisted-Pair Cabling Components.
 - .3 TIA/EIA-568-C.3-(2000), Optical Fiber Cabling Components Standard.
 - .4 TIA/EIA-606-A-(2002), Administration Standard for the Commercial Telecommunications Infrastructure.
 - .5 TIA TSB-140-2004, Telecommunications Systems Bulletin - Additional Guidelines for Field-Testing Length, Loss and Polarity of Optical Fiber Cabling Systems.
 - .6 TIA-598-C-(2005), Optical Fiber Cable Color Coding.

1.3 Definitions

- .1 Refer to TIA/EIA-598-C, Annex A for definitions of terms: optical-fiber interconnect, distribution, and breakout cables.

1.4 System Description

- .1 Structured telecommunications wiring system consist of unshielded-twisted-pair and optical fiber cables, terminations, connectors, cross-connection hardware and related equipment installed inside building for occupant's telecommunications systems, including voice (telephone), data, and image.
- .2 Installed in physical star configuration with separate horizontal and backbone sub-systems.

1.5 Action And Informational Submittals

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 As-built Records and Drawings:
 - .1 Provide Microsoft Access database reflecting cable installation and cross-connections.
 - .2 Provide electronic drawings in AutoCAD 2012 format depicting all construction.
 - .3 Provide two (2) bound complete hard-copy sets of as-built records to The City
 - .1 Provide and place one hard copy of as-built records for each telecommunications room in plan holder in each telecommunications room.

1.6 Quality Assurance

- .1 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

Part 2 Products

2.1 CATEGORY 6A CABLE

- .1 Four-pair, 100 ohm balanced unshielded-twisted-pair (UTP) cable, flame test classification FT6 or CMP to: CSA-C22.2 No. 214, Category 6A (Cat 6A) to: TIA/EIA-568-B.2.
- .2 Meets or exceeds requirements of ANSI/TIA-568-C.2 Category 6A and ISO 11801 2nd Edition Class E channel standards
- .3 Meets or exceeds requirements of ANSI/TIA-568-C.2 and IEC 61156-5 Category 6A component standards
- .4 Meets or exceeds requirements of IEEE 802.af and IEEE 802.3at for PoE applications
- .5 Cable diameter: 0.236" (5.9mm) nominal
- .6 Configuration:
 - .1 Unshielded
 - .2 Twisted pairs – 4
 - .3 Conductors – 23 AWG
- .7 Descending length cable markings enable easy identification of remaining cable.
- .8 Minimum bend radius shall be no less than four times the outer diameter of the cable.
- .9 Cables are to be labelled within 4-inches of each termination.
- .10 Cable and connectivity to be of one manufacturer.
- .11 Acceptable Manufactures:
 - .1 Belden RevConnect (10GXW)
 - .2 Leviton (Atlas-X1 Millenium)

2.2 CATEGORY 6 CABLE

- .1 Four-pair, 100 ohm balanced unshielded-twisted-pair (UTP) cable, flame test classification FT6 or CMP to: CSA-C22.2 No. 214, Category 6 (Cat 6) to: TIA/EIA-568-B.2.
- .2 Meets or exceeds requirements of ANSI/TIA-568-C.2 Category 6 and ISO 11801 2nd Edition Class E channel standards
- .3 Meets or exceeds requirements of ANSI/TIA-568-C.2 and IEC 61156-5 Category 6 component standards
- .4 Meets or exceeds requirements of IEEE 802.af and IEEE 802.3at for PoE applications
- .5 Cable diameter: 0.236" (5.9mm) nominal
- .6 Configuration:
 - .1 Unshielded
 - .2 Twisted pairs – 4

.3 Conductors – 23 AWG

- .7 Descending length cable markings enable easy identification of remaining cable.
- .8 Minimum bend radius shall be no less than four times the outer diameter of the cable.
- .9 Cables are to be labelled within 4-inches of each termination.
- .10 Cable and connectivity to be of one manufacturer.
- .11 Acceptable Manufactures:
 - .1 Belden RevConnect (2400)
 - .2 Leviton (Atlas-X1)

2.3 Work Area Utp 4-pair Modular Jack

- .1 Eight-position modular jack ("RJ-45"), type T568A Category 6 to: TIA/EIA-568- C.2:
 - .1 In self-contained surface-mount box, 4 jacks per box.
 - .2 Mounted in compatible single gang faceplate, flush entry, 4 jack positions per faceplate.

2.4 Termination And Cross-connection Hardware For Utp

- .1 Patch panel, 2 rack units high, 48 ports:
 - .1 Each port equipped with factory installed "RJ-45" jacks, type T568A Category 6 to: TIA/EIA-568-C.2.
 - .2 Horizontal cable-management unit for every 48 ports.

2.5 Utp Equipment Patch Cords

- .1 For every terminated workstation cable installed, provide (1) snag-less cable with factory-installed male plug at one end to mate with "RJ-45" jack with factory-installed male plug at other end to mate with "RJ-45" jack Category 6, 4 pairs to: TIA/EIA-568-C.2.
- .2 Must be of the same or exceed the performance as the Category 6 horizontal cabling.
- .3 Lengths to be 1 meter to reduce cable management burden.
- .4 Colour-coded as follows:
 - .1 Data – Blue
 - .2 Wireless – Green
 - .3 Video – Red
 - .4 Phone – Yellow
 - .5 Door Entry – Purple
 - .6 Paging - Black

2.6 Utp Work Area Cords

- .1 For every terminated cable, provide (1) 3 metre long blue snag-less cable with factory-installed male plug at one end to mate with "RJ-45" jack with factory-installed male plug at other end to mate with "RJ-45" jack Category 6, 4 pairs, to: TIA/EIA-568-C.2. Unless specified otherwise.
- .2 Must be of the same or exceed the performance as the Category 6 horizontal cabling.

2.7 Wireless Access Points

- .1 Wireless Access Points shall be POE and shall be Division supplied and Electrical Subcontractor Installed. Electrical Subcontractor to allow for 20' of cable slack in the ceiling so Wireless Access Point can be easily relocated as needed for optimum location, coordinate final location with the Division.
- .2 Provide (2) Category 6A cables for each Wireless Access Point.

2.8 Data Cabinets

- .1 Floor mountable equipment cabinet to be 44/45U high and the frame to be constructed of rugged 12 GA steel welded and rigid, 30" deep and 22" wide.
- .2 Front and rear lockable perforated doors.
- .3 Standard with 19" EIA 10-32 tapped mounting holes with permanently marked U spacing identification.
- .4 Cabinet is standard with one copper 10-32 x 0.5 L ground stud.
- .5 All racks to be black in colour and tapped front and back with 10-32 holes.
- .6 Built-in vertical wire management 6" x 6" in dimensions.
- .7 Acceptable Manufacturer: Dell 4220

2.9 Data Racks

- .1 Floor mountable 2-Post equipment rack to be 44/45U high and the frame to be constructed of rugged 12 GA steel welded and rigid.
- .2 Standard with 19" EIA 10-32 tapped mounting holes with permanently marked U spacing identification.
- .3 Rack is standard with one copper 10-32 x 0.5 L ground stud.
- .4 .All racks to be black in colour and tapped front and back with 10-32 holes.

2.10 Horizontal Wire Managers

- .1 One (1) 2 rack unit horizontal cable management shall be provided for every 48 port patch panel.
- .2 Shall feature a front access design with a hinged cover.
- .3 Shall be minimum of 2 Rack Unit, steel construction and with black powder coat finish.
- .4 Shall have a hinged door with a positive (nonmagnetic) locking system.

2.11 Optical-fiber Cable

- .1 Distribution with conductive members, multi-mode 50/125, laser-optimized OM3, 4700 MHz km capacity, 12 strands to: CSA-C22.2 No. 232 TIA/EIA-568- B.3, flame test classification FT4 or OFNR, each end terminated with duplex LC connectors.

2.12 Optical-fiber Patch Panel

- .1 Mounted in rack or cabinet, 1 rack units, with lockable cover, capable of terminating 48 pairs of fiber, equipped with duplex LC compatible adapters.

2.13 Optical-fiber Patch Cords

- .1 Interconnect cable, 2 strands, 1 metre long, each end equipped with duplex LC connectors. Multi-Mode 50/125, laser-optimized OM3, 4700 MHz km capacity to: TIA/EIA-568-B.3.

Part 3 Execution

3.1 Installation Of Termination And Cross-connect Hardware

- .1 Install termination and cross-connect hardware on wall as indicated and according to manufacturers' instructions. Identify and label as indicated to: TIA/EIA-606-A.

3.2 Installation Of Horizontal Distribution Cables

- .1 Install horizontal cables as indicated in conduits, cable trays, and "J" hooks from telecommunication rooms to individual work-area jacks. Identify and label as indicated to: TIA/EIA-606-A.
- .2 Support horizontal cables at intervals not exceeding 1 metres.
 - .1 Where raceways are used to distribute cables to each zone, provide supplementary "J" hooks to support cables at intervals not exceeding 1 metres.
- .3 Terminate horizontal cables in telecommunications room and at individual work-area jacks.
 - .1 Identify and label as indicated to: TIA/EIA-606-A.
- .4 Coil spare cables and store in ceiling space in zone.
- .5 Harness slack cable in cabinets, racks, and wall-mounted termination and cross-connection hardware.

3.3 Installation Of Backbone Cables

- .1 Install backbone cables from the new data rack to the data rack as indicated and according to manufacturers' instructions.
 - .1 Identify and label as indicated to: TIA/EIA-606-A.

3.4 Installation Of Equipment Cables

- .1 Install equipment cables from equipment patch panel as indicated.
 - .1 Identify and label as indicated to: TIA/EIA-606-A.

3.5 Implement Cross-connections

- .1 Implement cross-connections using jumper wires, and patch cords as specified.

3.6 Field Quality Control

- .1 Test horizontal UTP cables as specified below and correct deficiencies provide record of results as hard copy, electronic record via email.

- .1 Perform tests for Permanent Link on installed cables, including spares:
 - .1 Category 6 using certified level III tester to: TIA/EIA-568-C.2.
 - .2 Perform the following tests: wire map, length, insertion loss, NEXT loss, ELFEXT, PSELFEXT, ACR, PSACR, propagation delay, delay skew, return loss.
- .2 Perform tests for Channel on 20% of cross-connected data horizontal cabling installed from each telecommunications room, including shortest and longest drops from each telecommunications room: should more than 5% of tested cables fail, test remaining cross-connected data cables.
 - .1 Category 6 using certified level III tester to: TIA/EIA-568-C.2.
 - .2 Perform the following tests: wire map, length, insertion loss, NEXT loss, ELFEXT, PSELFEXT, ACR, PSACR, propagation delay, delay skew, return loss.
- .1 Test Optical-fiber strands for attenuation to: TIA/EIA-568-B.1 and correct deficiencies: provide record of results as hard copy, and electronic record via email.
 - .1 Test backbone links in both directions. Backbone links:
 - .1 Test multi-mode fiber at both applicable wavelengths (850 nm and 1300 nm).
 - .2 Maximum attenuation: Cable attenuation + Connector loss + Splice loss.
 - .1 Multi-mode-fiber attenuation coefficients:
 - .1 3.0 db/km @ 850 nm; and
 - .2 1.5 db km @ 1300 nm
 - .2 Maximum connector insertion loss: 0.75 db per pair and maximum splice insertion loss: 0.3 db.
 - .2 Perform additional Tier 2 tests using optical time domain reflectometer (OTDR) on backbone fiber pairs.
 - .1 Correct deficiencies.
 - .2 Provide record of results as described in SUBMITTALS.
- .3 Provide record of results as electronic record on CD to: TIA/TSB-140.
- .4 Provide record of results as electronic record via email to: TIA/TSB-140.
- .5 All test equipment must have been calibrated/re-calibrated once a year or within the period recommended by the manufacturer.

3.7 Electrical Subcontractor Certification

- .1 The cabling system shall be installed by the Electrical Subcontractor contractor or Communications Subcontractor certified by the cable manufacturer.

3.8 Warranty

- .1 The Electrical Subcontractor shall support the installed system for a period of two years from the date of acceptance by The City.
- .2 The Electrical Subcontractor shall be responsible for obtaining all documentation necessary to achieve manufacturer's warranty

- .3 The manufacturer shall provide a minimum 20 year warranty for the complete cabling system.
- .4 The manufacturer's warranty shall be provided directly to The City and shall be independent of the Electrical Subcontractor.

END OF SECTION

Part 1

General

1.1 Section Includes

- .1 Alarm control panel.
- .2 Initiating Devices.
- .3 Signaling devices.

1.2 Related Sections

- .1 Section 08 71 00 - Door Hardware - General.
- .2 Section 26 05 19 - Building Wire and Cable.

1.3 References

- .1 CAN/ULC-S303-M91(R1999) - Local Burglar Alarm Units and Systems.
- .2 CAN/ULC-S304-06 - Signal Receiving Centre and Premise Burglar Alarm Control Units.
- .3 ULC-306-03 - Intrusion Detection Units.
- .4 ULC-S318-96 - Power Supplies for Burglar Alarm Systems.
- .5 NFPA 730 - Guide for Premises Security, 2011 Edition.
- .6 NFPA 731 - Installation of Electronic Premises Security Systems, 2011 Edition.

1.4 System Description

- .1 Existing DMP integrated access control and intrusion detection system expanded and modified as required by Fontaine Electric.

1.5 Submittals For Review

- .1 Section 01 33 00: Submission procedures.
- .2 Product Data: Provide electrical characteristics and connection requirements.
- .3 Shop Drawings: Indicate system wiring diagram showing each device and wiring connection required.

1.6 Submittals For Information

- .1 Section 01 33 00: Submission procedures.
- .2 Test Reports: Indicate satisfactory completion of required tests and inspections.
- .3 Installation Data: Manufacturer's special installation requirements.
 - .1 Indicate application conditions and limitations of use stipulated by Product testing agency.
 - .2 Include instructions for storage, handling, protection, examination, preparation, installation, and starting of Product.

1.7 Closeout Submittals

- .1 Section 01 78 00: Submission procedures.

- .2 Maintenance Contracts: Provide service and maintenance of intrusion detection system for one (1) year from Date of Substantial Completion.
- .3 Operation Data: Operating instructions.
- .4 Maintenance Data: Maintenance and repair procedures.
- .5 Record Documentation: Record actual locations of initiating devices, signaling appliances, and end-of-line devices.

1.8 Quality Assurance

- .1 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum ten (10) years experience and with service facilities within 160 km(100 miles) of Project.

1.9 Regulatory Requirements

- .1 Products Requiring Electrical Connection: Listed and classified by ULC as suitable for the purpose specified and indicated.

Part 2 Products

2.1 Manufacturers

- .1 All new product shall be fully compatible with the existing DMP system.
- .2 Substitutions: None.

2.2 Alarm & Access Control Panel

- .1 Control Panel: Existing DMP XR550 series control panel.

2.3 Zone Expanders

- .1 Manufacturer: DMP; Product 714-16

2.4 Initiating Devices

- .1 Motion Sensor:
 - .1 Manufacturer: Bosch; Product ISC-CDL1-W15
- .2 Water Alarm:
 - .1 Manufacturer: Winland; Product WB-200

2.5 Zone Keypad Controller

- .1 Manufacturer: DMP; Product 7060AW

2.6 Reader

- .1 Manufacturer: HID; Product 5395

2.7 Reader Interface Module

- .1 Manufacturer: DMP; Product 734

Part 3 Execution

3.1 Installation

- .1 Install to manufacturer's written instructions.
- .2 Use 16 AWG minimum size conductors for detection and signal circuit conductors. Install wiring in conduit.
- .3 Make conduit and wiring connections to door hardware devices provided under Section 08 71 00.

3.2 Manufacturer's Field Services

- .1 Section 01 78 00: Prepare and start components.
- .2 Include services of technician to supervise installation, adjustments, final connections, system testing, and the Division training.

3.3 Demonstration

- .1 Section 01 79 00: Systems demonstrations.
- .2 Demonstrate normal and abnormal modes of operation, and required responses to each.
- .3 Training: Provide two(2)hours of training to the Division personnel. Provide sign-off sheet from the Division personnel to confirm acceptance of training.

END OF SECTION

Part 1 General

1.1 Section Includes

- .1 Fire alarm initiating and signaling devices.
- .2 Auxiliary fire alarm equipment and wiring.

1.2 Related Sections

- .1 Section 08 71 00 - Door Hardware - General: Door closers, electric locks, electric releases.
- .2 Section 08 36 13 - Sectional Doors.
- .3 Section 21 13 00 - Sprinklers.
- .4 Section 23 33 00 - Duct Work Accessories: Smoke dampers.
- .5 Section 26 05 00 - Common Work Results for Electrical
- .6 Section 26 05 19 - Building Wire and Cable.

1.3 References

- .1 The latest version of the following including all amendments:
 - .1 CAN/ULC S524 - Standard for the Installation of Fire Alarm Systems.
 - .2 CAN/ULC S525 - Audible Signal Devices for Fire Alarm Systems, Including Accessories.
 - .3 CAN/ULC S526 - Visible Signal Devices for Fire Alarm Systems.
 - .4 CAN/ULC S527 - Control Units for Fire Alarm Systems
 - .5 CAN/ULC S528 - Manual Pull Stations for Fire Alarm Systems.
 - .6 CAN/ULC S529 - Smoke Detectors for Fire Alarm Systems.
 - .7 CAN/ULC S530 - Heat Actuated Fire Detectors for Fire Alarm Systems.
 - .8 CAN/ULC S536 - Inspection and Testing of Fire Alarm Systems.
 - .9 CAN/ULC-S537 - Standard for Verification of Fire Alarm Systems.
 - .10 CAN/ULC S541 - Speakers for Fire Alarm Systems, Including Accessories.
 - .11 ULC ORD-C386-1990 - Flame Detectors.

1.4 System Description

- .1 Fire Alarm System: Existing, fully supervised, manual and automatic, single stage addressable fire alarm system with networked fire alarm control panels.
- .2 The existing fire alarm system shall be expanded and modified as required to carry out fire alarm and protection functions consisting of receiving alarm signals, initiating alarm and trouble sequences, continuous supervision of fire alarm components and wiring, actuation of annunciators and auxiliary functions and signals to remote monitoring agency.
- .3 The existing fire alarm system shall be expanded, and will include, but not be limited to the following:
 - .1 Power supplies and booster facilities
 - .2 Manual alarm stations

- .3 Automatic alarm initiating devices
- .4 Audible and visual signal devices
- .5 End-of-line devices
- .6 Ancillary devices
- .7 Input and output modules
- .8 Isolator modules

1.5 Submittals For Review

- .1 Section 01 33 00: Submission procedures.
- .2 Product Data: Provide electrical characteristics and connection requirements.
- .3 Shop Drawings:
 - .1 Provide system wiring diagram showing each device and wiring connection required.
 - .1 Wiring diagram shall be specific to the project and shall meet manufacturers recommendations and required building codes and standards.

1.6 Submittals For Information

- .1 Section 01 33 00: Submission procedures.
- .2 Test Reports: Indicate satisfactory completion of required tests and inspections.
- .3 Installation Data: Manufacturer's special installation requirements.
 - .1 Indicate application conditions and limitations of use stipulated by Product testing agency.
 - .2 Include instructions for storage, handling, protection, examination, preparation, installation, and starting of products.

1.7 Closeout Submittals

- .1 Section 01 78 00: Submission procedures.
- .2 Maintenance Contracts: Provide service and maintenance of fire alarm system for one (1) year from Date of Substantial Completion.
- .3 Operation Data: Operating instructions.
- .4 Maintenance Data: Maintenance and repair procedures.
- .5 Record Documentation: Record actual locations of initiating devices, signaling appliances, and end-of-line devices. Include zone number and device number for each device installed. Include circuit number for signalling appliances.

1.8 Maintenance Material Submittals

- .1
- .2 Extra Stock Materials: None.

1.9 Quality Assurance

- .1 Expand and modify fire alarm system to CAN/ULC S524.

1.10 Regulatory Requirements

- .1 Products Requiring Electrical Connection: Listed and classified by ULC and as suitable for the purpose specified and indicated.

Part 2 Products

2.1 Manufacturers

- .1 All new product shall be fully compatible with the existing Mircom fire alarm system.
- .2 Substitutions: None.

2.2 Fire Alarm And Smoke Detection Control Panel

- .1 Control Panel: Existing Mircom FX-2003-12NDS networked fire alarm control panel.

2.3 Manual Initiating Devices

- .1 Single Stage Manual Station: Non-coded type, double action manual station with key-operated reset lock constructed of red-colored polycarbonate. The station shall be designed that after emergency operation they cannot be restored to normal without key.
 - .1 Addressable manual station shall be complete with loop polling LED (Green).
 - .2 Non-Addressable stations shall be used in crawlspaces only, or as indicated. Connect to addressable zone module as indicated.
 - .3 Provide manufacturer's standard backbox for surface applications. Backbox finish to match station finish.

2.4 Automatic Initiating Devices

- .1 Heat Detector: Combination rate-of-rise and fixed temperature, rated 57 degrees C (135 degrees F) and temperature rate of rise of 8.3 degrees C (15 degrees F).
 - .1 Addressable heat detector shall be complete with inter-changeable plug-in base and loop polling LED (Green).
 - .2 Non-Addressable moisture-proof heat detector shall be equal to Mircom CR-135-MP. Non-Addressable, moisture-proof heat detectors shall be used in crawlspaces only, or as indicated. Connect to addressable zone module as indicated.
- .2 Ceiling Mounted Smoke Detector: Addressable photoelectric type with adjustable sensitivity with inter-changeable plug-in base and loop polling LED (Green). LED shall provide (Red) visual indication of detector actuation. Provide auxiliary relay contact as indicated. Provide sounder bases as indicated.
- .3 Ceiling Mounted Combination Smoke Detector and Fixed Temperature Heat Detector: Addressable photoelectric type smoke detector with adjustable sensitivity with inter-changeable plug-in base and loop polling LED (Green). LED shall provide (Red) visual indication of detector actuation. Fixed temperature shall be rated 57 degrees C (135 degrees F). Provide auxiliary relay contact as indicated. Provide sounder bases as indicated.

- .4 Duct Mounted Photoelectric Smoke Detector: Addressable photoelectric type with key-operated NORMAL-RESET-TEST switch, duct sampling tubes extending width of duct, and visual indication of detector actuation, in duct-mounted housing. Provide auxiliary relay contact as indicated. Housing shall be complete with tamper signal and shall be suitable to mount on square or rectangular duct. Provide addressable relay.
- .5 Multi-Criteria Fire/CO Detector: Addressable combination detector combines smoke, CO, light/flame, and heat sensing technology in one device with adjustable sensitivity settings, and loop polling LED (Green). LED shall provide (Red) visual indication of detector actuation. Unit shall be complete with separate CO detection signal, and built-in CO cell end-of-life warning and fault. Provide dual sounder bases as indicated with separate audible signals for fire or CO alarm.

2.5 Input Modules

- .1 Fully addressable modules to facilitate the monitoring of the following:
 - .1 Sprinkler flow and tamper inputs
 - .2 Dry contact devices

2.6 Output Modules

- .1 Fully addressable output modules with provision to accept a 24 VDC input from the control panel or local power supply (transponder) to facilitate the following:
 - .1 Audible signals
 - .2 Visual signals
- .2 Output modules shall provide dry normally open contact with output up to 2A at 24V.

2.7 Signal Line Isolators

- .1 Provide signal isolators on addressable loops to suit CAN/ULC S524 and CAN/ULC S537.

2.8 Signaling Appliances

- .1 Alarm Horns and Strobes: The signalling device shall be 2-wire, and shall operate at 24VDC. Horn sound rating shall be rated at a sound level of at least 95dB at 3m (10ft). Horn tones and volume shall be field adjustable by way of integral switch. Strobe candela (cd) rating shall be field adjustable by way of integral switch. Standard strobe cd shall be field adjustable from 15 – 115cd. High cd strobes shall be field adjustable from 135 – 185cd. Provide ceiling or wall mounted, standard or high cd, indoor or outdoor units as indicated. All devices shall be red in color.
- .2 Interior remote annunciators: Existing Mircom RA-1000 series remote multiplex annunciator.

2.9 Auxiliary Devices

- .1 Door Release: Magnetic door holder with integral diodes to reduce buzzing. Coil voltage 24 VDC.
- .2 Door Release: Door closer as specified in Section 08 71 00.

2.10 Remote Signal Power Supplies/signal Circuit Boosters

- .1 Solid state microprocessor based power supply complete with integral transient protection, connected to the local addressable initiating circuit.
- .2 Signal circuits shall be supervised using integral addressable output modules.
- .3 Power supply shall be 120 VAC input. Interface power supply with battery charger and batteries to provide uninterruptible transfer of power to standby source during primary power failure or loss. Batteries shall be sized to suit ULC requirements.

2.11 End-of-line Devices

- .1 End-of-line devices shall control supervisory current where required, and sized to ensure correct supervisory current for each circuit. Open, short or ground fault in any circuit will alter supervisory current in that circuit, initiating an alarm or trouble condition.

2.12 Fire Alarm Wire And Cable

- .1 Fire Alarm Power Branch Circuits: Building wire as specified in Section 26 05 19.
- .2 Initiating Device and Indicating Appliance Circuits:
 - .1 Description: Type FAS solid conductor, complete with red tinted interlocking armour as required
 - .2 Conductor: Copper unless otherwise noted.
 - .3 Insulation Voltage Rating: 300 volts.
 - .4 Insulation: Coded PVC insulation and with overall red PVC jacket in accordance with the Canadian Electrical Code, rated 105 degrees C. Use shielded cable as per manufacturer's recommendations only.
- .3 To initiating circuits: 18 AWG minimum, and in accordance with manufacturer's requirements.
- .4 To audible signal circuits: 14 AWG minimum, and in accordance with manufacturer's requirements.
- .5 To visual signal circuits: 12 AWG minimum, and in accordance with manufacturer's requirements.
- .6 Wiring shall be as per manufacturer's recommendations. All wiring shall be in conduit unless noted otherwise.

2.13 Accessories

- .1 Manual Station Vandal Guard: Clear vandal resistant, UV Stabilized polycarbonate shield and frame complete with integral 95db piezo horn and battery. Flush mounted or surface as indicated. Outdoor rated as required. Vandal guard shall be equal to STI Stopper II series.
- .2 Wire Guard: ULC listed 9 gauge steel wire complete with corrosion resistant polyester coating and tamper resistant hardware where indicated. Wire guard to be suitably sized to accommodate device and/or equipment being protected.

Part 3 Execution

3.1 Installation

- .1 Install products to manufacturer's written instructions and CAN/ULC S524, local and national codes, as indicated, and as recommended by the manufacturer.
- .2 All initiating and signalling devices, control panels and remote annunciators shall be flush mounted unless indicated otherwise.
- .3 Install devices at heights indicated in Section 26 05 00.
- .4 Where Manual Stations are located in public areas, install Manual Station Vandal Guard.
- .5 Locate detectors minimum 0.45m (18") from air discharge or return grille as measured from the edge of the detector, and not closer than 300 mm (12") to lighting fixtures.
- .6 Locate ceiling mounted detectors minimum 100mm (4") from edge of ceiling where it meets the wall as measured from the edge of the detector.
- .7 Detectors shall be located such that a clear space of 450mm is maintained between the detector and any obstructions except where ceiling mounted obstructions protrude less than 100 mm (4") from the ceiling.
- .8 In areas without finished ceilings, mount detectors at underside of deck above unless otherwise indicated.
- .9 Mount end-of-line devices in separate box adjacent to last device in circuit.
- .10 Mount outlet box for electric door holder to withstand 36 kg (80 lbs) pulling force.
- .11 Make conduit and wiring connections to duct smoke detectors, sprinkler valve tamper and flow switches, fire suppression system control panels, door release devices, smoke control fans and equipment.
- .12 Circuiting for fire alarm devices shall be as follows:
 - .1 Provide Class "A" addressable initiating/alarm circuits throughout unless indicated otherwise.
 - .2 Provide Class "B" audible/visual signal circuits for signal circuits throughout unless indicated otherwise.
 - .3 Circuits shall have a minimum 15% spare capacity for future system expansion.
 - .4 All SLC, signal and power riser wiring shall be supervised, including internal wiring between modules.
- .13 Where wiring is required to be surface mounted within finished areas, wiring shall be installed in a single piece metal raceway unless noted otherwise. Color of raceway shall be white unless noted otherwise.
- .14 Where devices are surface mounted in finished areas, provide a surface mounted metal raceway device box. Color of box shall match the device.
- .15 Where initiating devices are located within an attic space, and crawlspace, non-addressable type devices shall be used, connected to an addressable zone module located outside the attic space and/or crawlspace in an accessible location. Associated EOL's and Modules shall be clearly labelled.

- .16 Where attic spaces and crawlspaces are compartmentalized, each compartment shall be wired in such a manner that each compartment is on a separate fire alarm zone. Provide additional zone modules as required.
- .17 Branch circuit breakers supplying fire alarm equipment shall be lockable in the "ON" position. A red lamacoid nameplate shall be affixed on the electrical panel adjacent the associated circuit breaker indicating "FIRE ALARM PANEL" or other approved wording.
- .18 Programming of room names and numbers shall match the Division's name and numbering scheme.

3.2 Wiring Methods

- .1 Concealed Dry Interior Locations: Use only FAS wire in raceway.
- .2 Exposed Dry Interior Locations: Use only FAS wire in raceway.
- .3 Above Accessible Ceilings: Use only FAS wire in raceway.
- .4 Wet or Damp Interior Locations: Use only FAS wire in raceway.
- .5 Exterior Locations: Use only FAS wire in raceway.
- .6 Underground Installations: Use only FAS wire in raceway.

3.3 Interconnections

- .1 Interconnect with all systems and devices as identified on the drawings.

3.4 Field Quality Control

- .1 Section 01 45 00: Field inspection and testing.
- .2 Test to CAN/ULC S536 and CAN/ULC-S537 and local inspection authority requirements.
- .3 Include services to re-test system one (1) month prior to completion of warranty.

3.5 Manufacturer's Field Services

- .1 Section 01 78 00: Prepare and start components.
- .2 Include services of certified technician to supervise installation, adjustments, final connections, and system testing.

3.6 Closeout Activities

- .1 Demonstration: Demonstrate normal and abnormal modes of operation, and required responses to each.

END OF SECTION

Part 1 General

1.1 DESCRIPTION

- .1 This Specification shall cover the protection of existing and re-located trees within the limits of the construction site and within 3m of the site construction extents where tree canopies overhang the school site and could be damaged. Special care is required to protect the foliage, branches, trunk and roots of these trees from damage that could result from construction operations.
- .2 The Contractor shall furnish all labour, materials, equipment and services necessary to complete the Work as specified herein.
- .3 The Contractor shall be responsible for preventing the following types of damage.
 - .1 Compaction under the root zone of the tree (usually the extent of the tree canopy above) caused by vehicular traffic and material storage.
 - .2 Trunk damage and branch damage caused by equipment operations, material storage, or nailing and bolting.
 - .3 Trunk and branch damage caused by ropes or guy wires.
 - .4 Root poisoning from spilled solvents, gasoline, paint, and other noxious materials.
 - .5 Branch damage due to improper pruning or trimming.
 - .6 Damage from alteration of soil PH balance caused by depositing lime, concrete, plaster, or other waste materials near the root zone.

1.2 QUALIFICATITONS

- .1 All tree pruning, fertilizing and amendments to ensure continued tree health during construction to be completed by a licensed Arborist or Canadian Horticultural Technician (CCHT) as approved by Contract Administrator.
- .2 Confirm qualifications by submitting the arborists name and a copy of their certification to the Contract Administrator at project start up.

1.3 LEED REQUIREMENTS

- .1 Comply with all LEED requirements as described in the LEED Requirements Section.
- .2 Ensure erosion and sedimentation control measures are in place and in full working order.
- .3 Source topsoil and planting medium amendments from local manufacturers within 50km of the site by truck.

1.4 WASTE MANAGEMENT AND DISPOSAL

- .1 Do not dispose of unused soil amendments into sewer systems, into lakes, streams, onto ground or in locations where it will pose health or environmental hazard.
- .2 Separate waste materials for disposal or recycling per local municipal requirements.
- .3 Do not bury waste or take biodegradable planting medium products to the refuse dump. Return unused planting medium to supplier for recycling.

1.5 DAMAGE ASSESSMENT

- .1 Trees Below 100 mm Caliper and 3m height.

- .1 Deciduous trees below 200 mm caliper and coniferous trees below 4m height destroyed or badly damaged by construction operations, shall be removed and replaced with trees of the same size, species, and variety at not additional cost to the City. Replacement trees are to be reviewed and approved by the Contract Administrator prior to installation.
- .2 Trees Over 100 mm Caliper and 3m height.
 - .1 Deciduous trees over 200 mm caliper and coniferous trees over 4m height badly damaged or destroyed by construction operations, shall be not only be replaced by a ball and burlap deciduous tree with a minimum 50mm caliper or a 2.4m height coniferous tree but shall also be assessed a \$5,000 fine per tree to be credited back to the City as a replacement cost for the loss of a mature tree canopy.

Part 2 Products

2.1 MATERIALS

- .1 Burlap fabric.
- .2 Dimension lumber for strapping: 19 x 140 x 2400 mm.
- .3 Steel wire, 9 to 12 gauge.
- .4 High density polyethylene 4 ft. ht. snow fence or approved alternate complete with matched posts.

Part 3 Execution

3.1 GENERAL

- .1 All tree protection is to be in place prior to start of site works and stay in place until construction completion.
- .2 All trees within the project area or immediately adjacent to the project boundary (trunks within 4m and overhanging tree canopies) are to be protected from damage, except trees designated for removal.
- .3 Obtain approval from Contract Administrator of all proposed protection materials, methods and locations prior to construction commencement.
- .4 Ensure that all construction activity, including but not limited to, the storage of materials and equipment, disposal of debris and the parking, maintenance and re-fuelling of all vehicles shall not be carried out within the drip line of all trees not designated for removal or inside of any barrier erected for the protection of vegetation.
- .5 Where damage to a tree does occur, the Contractor shall notify the Contract Administrator and arrange for a certified arborist to prune and dress the wound(s). More substantial damage to trees not designated for removal will invoke the conditions under Item 1.3 Damage Assessment.

3.2 TREE PROTECTION

- .1 Flag trees requiring protection with orange surveyors tape. Obtain approval of Contract Administrator prior to commencing tree protection strapping.

- .2 Apply timber strapping to trees in close proximity to moving equipment and construction work and to any trees greater than 300mm Ø designated for protection on the drawings.
 - .1 Wrap trunk with a layer or burlap.
 - .2 Install 1x6 or approved alternate dimensioned lumber, placed vertically, spaced 25 to 50 mm apart around the circumference of the mature tree trunks. Strap smaller trees with appropriately sized lumber.
 - .3 Secure with steel wire.
- .3 Stake out diameter of overhead canopy and create a secondary tree protection fenced buffer with a minimum 2m radius from the tree trunk. Multiple trees can be fenced into one secondary fence if they are close enough together. Obtain Contract Administrator's approval of layout and erect snow fence plumb straight true and securely anchored. If secondary fence is damaged during construction replace or mend immediately. Fence can be removed for localized works being completed by hand under the tree canopy.
- .4 Do not operate or park heavy machinery or store materials within 3 meters of the fenced off area.

3.3 PRE-PRUNING

- .1 Identify any problematic tree canopies that may impede access or construction circulation on site with the Contract Administrator at project start up. Certified Arborist or CHT to prune problematic limbs prior to heavy equipment accessing the construction site.

3.4 MAINTENANCE DURING CONSTRUCTION

- .1 From the time of acceptance of protection measures by the Contract Administrator to end of the construction and maintenance period, care for the protected trees as follows.
 - .1 Keep strapping and fences in good order.
 - .2 Monitor and direct heavy traffic and laydown away from treed areas.
 - .3 Water to maintain soil moisture conditions for optimum growth and health of plant material without causing erosion.
 - .4 Apply fertilizer in early spring at manufacturer's suggested rate.
 - .5 Make certified Arborist or CHT available to remove dead, broken or hazardous branches from trees as directed by the Contract Administrator on site.
 - .6 Replace trees and pay damage fines as determined on site by the Contractor as substantial completion walk through and one year warranty review (as it sometimes takes trees some time to die after stress).

END OF SECTION

Part 1 General

1.1 GENERAL

- .1 This specification shall cover the stripping and removal of in-situ organic topsoil and associated vegetative cover as indicated on the drawings.

1.2 RELATED SECTIONS

- .1 Section 31 22 00 – Site Grading
- .2 Section 32 01 05 – Environmental Protection
- .3 Section 32 91 19 – Topsoil & Finish Grading

1.3 LEED REQUIREMENTS

- .1 Comply with all LEED requirements as described in Section 01 47 15 – LEED Sustainable Requirements.

Part 2 Products

2.1 EQUIPMENT

- .1 Use flat blade stripping equipment capable of cleanly removing topsoil and associated vegetative material off site and separating it from parent subsoil materials. Obtain approval of equipment to be used prior to commencing stripping operations.

Part 3 Execution

3.1 TEMPORARY EROSION AND SEDIMENTATION CONTROL

- .1 Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to sediment and erosion control plan, specific to site, that complies with requirements of authorities having jurisdiction, whichever is more stringent.
- .2 Inspect, repair, and maintain erosion and sedimentation control measures during stripping and construction activities until permanent vegetation has been established.
- .3 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

3.2 STRIPPING OF TOPSOIL

- .1 Ensure that stripping procedures are conducted in accordance with applicable Provincial, and Municipal requirements.
- .2 Remove topsoil before construction procedures commence to avoid compaction of existing topsoil.
- .3 Handle topsoil only when it is dry and warm.
- .4 Do not strip topsoil when wind speeds exceed 25 km/hr.
- .5 Remove topsoil and stripped vegetation by motorized equipment from targeted areas by non-chemical means and haul away to local facility for processing and re-use.

- .6 Remove brush from targeted area by non-chemical means and dispose of through mulching.
- .7 Strip topsoil horizon only; avoid mixing topsoil with subsoil.
- .8 Recycle stripped topsoil to local soil manufacturing facility within 50km of the construction site if possible. Document recycling for LEED purposes.

3.3 CLEAN-UP

- .1 Clean up roadways, access routes and construction site exit points daily during topsoil stripping and stockpiling operations.
- .2 Remove accumulated environmental dirt, surplus materials, rubbish, tools and equipment barriers from the site at the end of stripping operations.

3.4 ACCEPTANCE

- .1 Obtain approval of stripped site from Contract Administrator, prior to proceeding with site grading operations.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Layout and rough grading of site features per drawing documents including: sub grade preparation for all hard surfaces, shrub bed and swale excavation and shaping, general site fill, athletic fields, berm and landform shaping.

1.2 RELATED SECTIONS

- .1 Section 31 23 10 – Excavation Trenching and Backfilling
- .2 Section 31 11 23 – Aggregate Base
- .3 Section 32 91 19 – Topsoil & Finish Grading

1.3 LEED REQUIREMENTS

- .1 Comply with all LEED requirements as described in Section 01 47 15 – LEED Sustainable Requirements.
- .2 Ensure erosion and sedimentation control measures are in place and in full working order complete with necessary documentation prior to commencing rough grading operations.
- .3 Re-use fill excavated on site during drainage swale and building construction to build up the site around the building and build up landforms as indicated on the drawings.
- .4 If additional fill is required, arrange for fill from a site that is no further than 100km away by truck.

1.4 REERENCES

- .1 American Society for Testing and Materials (ASTM): ASTM D698 [91(1998)], Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (600 kN m/m).

1.5 EXISTING CONDITIONS

- .1 Examine subsurface investigation report in Section 00 31 00, and project area survey.
- .2 Locate underground and surface utility lines and buried objects.
- .3 Report discrepancies to Contract Administrator if they impact proposed work.
- .4 Any damage to utilities during construction are the responsibility of the Contractor and shall be repaired at no additional cost to the City.

1.6 PROTECTION

- .1 Protect existing fencing, trees, landscaping, natural features, bench marks, buildings, pavement, surface or underground utility lines which are to remain as noted on the drawings or directed by Contract Administrator. If damaged, restore to original or better condition unless directed otherwise.
- .2 Maintain access roads to prevent accumulation of construction related debris on roads.
- .3 Separate waste materials for disposal or recycling in accordance with Section 01 74 21 – Construction / Demolition Waste Management.

Part 2 Products

2.1 MATERIALS

- .1 Common fill: selected material from excavation, grading or other sources as recommended by Section 00 31 00 – Geotechnical Report and approved by the Geotechnical Engineer and Contract Administrator. Fill to be unfrozen and free from rocks larger than 75mm, concrete, sod, refuse or other deleterious materials.
- .2 Subgrade fill for hard surfaces: stone aggregate per the latest edition of the City of Winnipeg Standard Construction Specification CW 3110 and as recommended by Section 00 31 00 – Geotechnical Report and approved by the Geotechnical Engineer and Contract Administrator.

Part 3 Execution

3.1 COORDINATE RELATED WORKS & LAYOUT

- .1 Coordinate work to prevent damage to existing infrastructure designated to remain.
- .2 Coordinate work to prevent damage to all new or existing utilities coming into and through the site.
- .3 Engage professional surveyor to layout all major site features as indicated on the drawings. Immediately report any discrepancies encountered during layout, to the Contract Administrator.

3.2 GRADING

- .1 Rough grade to levels, profiles, and contours allowing for surface treatment as indicated.
- .2 Proof roll and inspect exposed surface with Contract Administrator, identifying any problem areas that will require remediation through geotechnical engineering.
- .3 Sub-excavate and repair any silt pockets or soft spots encountered on site, as directed by Geotechnical or Civil Engineer.
- .4 Remove any areas found to be contaminated with fossil fuels or chemicals. Report areas to the Contract Administrator.
- .5 Uniformly slope surfaces between grades indicated, unless otherwise noted. Shape slopes with rounded transitions at the top of and bottom of embankments. Blend new work to existing with smooth transitions.
- .6 Prior to placing common fill over existing ground, scarify surface to depth of 150 mm. Maintain fill and existing surface at approximately the same moisture content to facilitate bonding.
- .7 Refer to pavement design section drawings, for Geotextile applications.
- .8 Place fill in maximum 6" (150mm) lifts. Compact to required density prior to placing additional lifts.
- .9 Compact filled and disturbed areas to corrected maximum dry density to ASTM D698, as follows:
 - .1 95% under landscaped areas.
 - .2 98% under and to a distance of 1.0m beyond edge of paved or hard landscaped areas.
- .10 Do not disturb soil within branch spread of trees or shrubs designated to remain.

3.3 TESTING

- .1 Test in accordance with Section 01 21 00 – Allowances.

- .2 Testing of materials and compaction compliance will be carried out by testing laboratory appointed by the Contractor. Testing laboratory to be certified in accordance with CSA A283.
- .3 Submit testing procedure and frequency of tests to Contract Administrator for approval. Have each major area of construction tested.
- .4 Areas that fail minimum compaction requirements shall be re-compacted and tested by the Contractor at no additional cost to the City. Produce final compaction test results for deficient areas, prior to proceeding with hard and soft site development operations.
- .5 Testing costs to be paid for from cash allowances.

3.4 SHORTAGE AND SURPLUS MATERIAL

- .1 Supply all necessary fill to meet grading and backfilling requirements.
- .2 Remove surplus material and material unsuitable for fill, grading or landscaping off site, to local facility, as approved by the Contract Administrator.

3.5 TEMPORARY GRADING

- .1 Temporarily grade areas to drain away from building construction site. Grade so that water will drain away from buildings, walls and paved areas to silt control catchment areas, catch basins, landscape drains and other disposal areas approved by the Contract Administrator.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 31 62 14 – Precast Concrete Piles.

1.2 MEASUREMENT PROCEDURES

- .1 Provide Lump sum price for the foundation work in accordance with the structural drawings.

1.3 SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data: submit manufacturer's printed product literature, specifications and datasheet.
- .3 Sub-surface investigation report: when site conditions differ from those indicated, submit written notification to Contract Administrator and await further instructions.
- .4 Submit schedule of planned sequence of driving to for review, not less than 2 weeks prior to commencement of pile driving.
- .5 Equipment:
 - .1 Upon request submit prior to pile installation for review by Contract Administrator, list and details of equipment for use in installation of piles.
 - .2 Impact hammers: submit manufacturer's written data as specified.
 - .3 Non-impact methods; submit characteristics to evaluate performance.
- .6 Quality assurance submittals:
 - .1 Test reports: submit 2 copies of certified test reports for piles from approved independent testing laboratories, indicating compliance with specifications for specified performance characteristics and physical properties.
 - .2 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and manufacturer's instructions.
- .2 Protect piles from damage due to excessive bending stresses, impact, abrasion or other causes during delivery, storage and handling.
- .3 Replace damaged piles to satisfaction of Contract Administrator.

1.5 EXISTING CONDITIONS

- .1 Sub-surface investigation report has been included as part of this specification. Contractor is to review the report and become familiar with the subsurface conditions.
- .2 Notify Contract Administrator in writing if subsurface conditions at site differ from those indicated and await further instructions from Contract Administrator . Do not proceed with

pile locations / sizes / extensions, etc. where not on drawings without written approval from the Contract Administrator.

1.6 SCHEDULING

- .1 Provide schedule of planned sequence of driving to Contract Administrator for review, not less than two weeks prior to commencement of pile driving.

Part 2 Products

2.1 MATERIALS

- .1 Material requirements for piles are specified in Section 31 62 14 – Precast Concrete Piles.
- .2 Supply or fabricate full length piles as indicated and provide equipment to handle full length piles without cutting and splicing.
- .3 Splice piles only with written approval of Contract Administrator.
 - .1 When permitted, provide details for Contract Administrator review.
 - .2 Design details of splice to bear dated signature stamp of professional engineer registered or licensed in Province of Manitoba, Canada.

2.2 EQUIPMENT

- .1 Impact hammers: provide manufacturer's name, type, rated energy per blow at normal working rate, mass of striking parts of hammer, mass of driving cap and type and elastic properties of hammer and pile cushions.
- .2 Non-impact methods of installation such as augering, jacking, vibratory hammers or other means: provide full details of characteristics necessary to evaluate performance.
- .3 Hammer:
 - .1 Drop hammers will not be permitted.
 - .2 Hammers to be capable of developing a blow at operating speed with an energy of not less than 40,000 joules per blow. Hammer is to be capable of being adjusted to deliver reduced impact. When required bearing capacity is not obtained by use of hammers complying with minimum requirements, use larger hammer only as approved by Contract Administrator. For diesel hammers, provide independent calibrated pressure gauges on hammer side of all valves. Provide calibration certificate dated within 6 months of calibration.
- .4 Leads:
 - .1 Construct pile driver leads to provide free movement of hammer. Hold leads in position at top and bottom, with guys, stiff braces, or other means to ensure support to pile while being driven. Inclined heads to be used for battered piles.
 - .2 Length: provide length of leads so that use of a follower is unnecessary.
 - .3 Swing leads:
 - .1 Not permitted.
- .5 Followers:

- .1 Obtain written approval from Contract Administrator prior to using followers. When permitted, provide followers of such size, shape, length and mass to permit driving pile in desired location to required depth and resistance. Provide followers with socket or hood carefully fitted to top of pile to minimize loss of energy and prevent damage to pile.
- .2 Drive applicable load test piles using similar follower.

Part 3 Execution

3.1 PREPARATION

- .1 Protection:
 - .1 Protect adjacent structures, services and work of other sections from hazards due to pile driving operations.
 - .2 Arrange sequencing of pile driving operations and methods to avoid damages to adjacent existing structures.
 - .3 When damages occur, remedy damaged items to restore to original or better condition at own expense.
- .2 Ensure that ground conditions at pile locations are adequate to support pile driving operation and load testing operation.
 - .1 Make provision for access and support of piling equipment during performance of Work.
- .3 Pre-bore piles to 4 metres depth, or as required by geotechnical engineer.
- .4 Drive piles within embankments only when embankment has been placed and compacted to at least bottom elevation of pile cap.
- .5 Do not drive piles until excavation has been completed.
- .6 In areas requiring fill, either place and compact fill after piles are installed or drive piles after fill has been placed and compacted to at least bottom elevation of pile cap.

3.2 DESIGN LOAD CAPACITY

- .1 Design load capacity of pile at working load is as indicated on drawings.
- .2 Installation of each pile will be subject to review of Contract Administrator. Contract Administrator will be sole judge of acceptability of each pile with respect to final driving resistance, depth of penetration or other criteria used to determine bearing capacity. Pile driving rig shall not be removed from site prior to Contract Administrator's review of final driving of all piles.
- .3 Drive each pile to final set as directed by Contract Administrator, and in accordance with Geotechnical Report.
- .4 Determine required final driving resistance using formula approved by Contract Administrator.
- .5 Drive each pile to practical refusal.

3.3 APPLICATION / DRIVING

- .1 Drive precast piles only when concrete has attained strength of 35 MPa.
- .2 Use driving caps and cushions to protect piles.
 - .1 Reinforce pile heads if necessary. Piles with damaged heads will be rejected by Contract Administrator.
- .3 Hold piles securely and accurately in position while driving.
- .4 Deliver hammer blows along axis of pile. Ensure pile is not overstressed.
- .5 Do not drive piles within 8 m of masonry or concrete which has been in place less than 7 days.
- .6 Ensure no contact between pile and structure takes place when driving batter piles adjacent to existing structures.
- .7 Do not drive batter piles until vertical piles within radius of 8m have been fully driven.
- .8 Restrike already driven piles lifted during driving of adjacent piles to confirm set.
- .9 Remove loose and displaced material from around piles after completion of driving, and leave clean, solid surfaces to receive foundation concrete.
- .10 Cut off piles neatly and squarely at elevations to tolerance of plus or minus 25 mm.
 - .1 Provide sufficient length above cut-off elevation so that part damaged during driving is cut off.
 - .2 Do not cut tendons or other reinforcement, which will be used to tie pile caps to pile.
- .11 Remove cut-off lengths from site on completion of work.

3.4 DRIVING TOLERANCES

- .1 Pile heads to be within 50 mm of locations as indicated.
- .2 Piles not to be more than 2% of length out of vertical alignment.

3.5 OBSTRUCTIONS

- .1 Where obstruction is encountered that causes sudden unexpected change in penetration resistance or deviation from specified tolerances, remove obstruction.

3.6 DAMAGED OR DEFECTIVE PILES

- .1 Leave rejected pile in place, place adjacent pile and modify pile cap as directed in writing by Contract Administrator.
- .2 No extra compensation will be made for additional piles and other costs due to installation of damaged or defective piles.

3.7 PROTECTION

- .1 Protect adjacent structures, services and work of other sections from hazards due to pile driving operations.

- .2 Arrange sequencing of pile driving operations and methods such that no damage occurs to adjacent existing structures. If damaged, remedy damaged items to restore to original or better condition at own expense.

3.8 FIELD QUALITY CONTROL

- .1 Independent review of piling operations shall be done by an independent inspection and testing agency under a cash allowance.
- .2 Maintain accurate records of driving for each pile, including:
 - .1 Type and make of hammer, stroke or related energy.
 - .2 Other driving equipment including water jet, driving cap, cushion.
 - .3 Pile size and length, location of pile in pile group, location or designation of pile group.
 - .4 Sequence of driving piles in group.
 - .5 Number of blows per metre for entire length of pile and number of blows per 25mm for final sets, over the last 75 mm.
 - .6 Final tip and cut-off elevations.
 - .7 Other pertinent information such as interruption of continuous driving, pile damage.
 - .8 Record elevation taken on adjacent piles before and after driving of each pile.
- .2 Provide Contract Administrator with three copies of records.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 31 61 13 – Pile Foundations, General Requirements.

1.2 MEASUREMENT PROCEDURES

- .1 Provide Lump sum price for the foundation work in accordance with the structural drawings.

1.3 REFERENCES

- .1 American Society for Testing and Materials International (ASTM)
 - .1 ASTM A1064/A1064M-22, Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.
 - .2 ASTM A416/A416M-24, Standard Specification for Steel Strand, Uncoated Seven-Wire for Prestressed Concrete.
 - .3 ASTM A421/A421M-21, Standard Specification for Uncoated Stress-Relieved Steel Wire for Prestressed Concrete.
- .2 Canadian Standards Association (CSA International)
 - .1 CSA-A23.1-19/A23.2-19, Concrete Materials and Methods of Concrete Construction/Methods of Test for Concrete.
 - .2 CAN/CSA-A3000-23, Cementitious Materials Compendium (consists of A3001, A3002, A3003, A3004 and A3005).
 - .3 CAN/CSA-G30.18-2021 Carbon Steel Bars for Reinforcing.
 - .4 CAN/CSA-A23.4/A251, Qualification Code for Architectural and Structural Precast Concrete Products.
- .3 Precast/Prestressed Concrete Institute (PCI)
 - .1 PCI MNL-116-21, Quality Control for Plants and Production of Structural Precast Concrete Products, 4th Edition.

1.4 SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product data: submit manufacturer's printed product literature, specifications and datasheet.
- .3 Quality assurance submittals:
 - .1 Test reports: submit certified test reports for piles from approved independent testing laboratories, indicating compliance with specifications for specified performance characteristics and physical properties.

1.5 DESIGN REQUIREMENTS

- .1 Design loads as indicated on Structural Drawings.
- .2 Do not splice piles without Contract Administrator's permission. When permitted, provide details for Contract Administrator review. Design details of splice to bear signature and stamp of professional engineer registered or licensed in Province of Manitoba.

1.6 TEST REPORTS

- .1 Upon request, submit certified copies of quality control tests related to this project as specified in CSA A251.

1.7 QUALITY ASSURANCE

- .1 Manufacturer of precast concrete components: certified by CSA as meeting requirements of CSA A251.
- .2 A Contractor experienced in the related type or work and having at their disposal all necessary equipment shall perform all work.
- .3 Allowable tolerances:
 - .1 Lateral tolerances: all units shall be located so as to have a maximum lateral deviation at the top of the unit of 50 mm.
 - .2 Vertical tolerance: all piles shall be driven without varying more than 2% from the vertical.
 - .3 Pile cutoffs at elevations indicated +/- 25 mm.
 - .4 Piles not meeting these requirements will be rejected.
- .4 Drive all units to develop loads indicated on drawings to the criteria in the Geotechnical Report.
- .5 Comply with all local and provincial safety codes and regulations.

1.8 SITE CONDITIONS

- .1 Visit the site to ascertain any special conditions that may affect the work.
- .2 A subsurface Geotechnical investigation report of the site has been prepared and has been included as part of this specification.
- .3 Review the Geotechnical Report to identify subsurface conditions that may be encountered.

1.9 DELIVERY, STORAGE, AND HANDLING

- .1 Deliver, store and handle in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .3 Ensure handling and installation stresses are within safe limits.
- .4 Avoid damage to piles during handling, placing pile in leads, and during pile driving operations.
- .5 Support piles laterally during driving, but allow rotation in leads.
- .6 Where pile or projecting reinforcement orientation is essential take precautionary measures to maintain orientation during driving.
- .7 Support battered piles to prevent excessive bending stresses in pile.
- .8 Square top of pile to longitudinal axis of pile.
 - .1 Maintain axial alignment of pile hammer with that of pile.
- .9 Provide identification for points of lifting by painted stripes or lift hooks set in.

- .10 Provide identification for points of support for storage. Store all units at site in such a way as to avoid undue stresses before driving.
- .11 During delivery and storage support long piles continuously along their lengths.
- .12 All foundation units delivered to site that do not conform to terms of this specification may be rejected by Contract Administrator.

1.10 PROTECTION

- .1 Protect public and construction personnel, adjacent structures and work of other sections from hazards attributable to pile driving operations.
- .2 Protect pile surfaces from damage and spalling.

Part 2 Products

2.1 MATERIALS

- .1 All piles standard hexagonal, precast, prestressed, to sizes indicated on drawings by an approved supplier.
- .2 Cement: Type HS, HSb or HSe (sulphate resistant).
- .3 Concrete strength: minimum 35 MPa at the time of driving. Concrete strength at transfer of prestress: as required by manufacturer.
- .4 Prestressing steel: to ASTM A416, uncoated seven-wire stress-relieved strand, grade 270.
 - .1 Prestressing steel: free of grease, oil, wax, paint, soil, dirt, and loose rust.
 - .2 Do not use prestressing strands or wire having kinks, bends, or other defects.
- .5 Welded wire mesh: to ASTM A-185.
- .6 Spiral reinforcement: to ASTM A82, cold drawn steel wire.
- .7 Cementitious materials: in accordance with Section 03 30 00 - Cast-in-Place Concrete.
- .8 Reinforcing steel: to CAN/CSA-G30.18 and in accordance with Section 03 20 00 - Concrete Reinforcing 400 MPa yield.

2.2 FABRICATION

- .1 Fabricate precast concrete piles to lengths, cross sectional areas, reinforcement as required to meet capacities indicated.
- .2 Fabricate piles to following finish tolerances:
 - .1 Length: ± 3 mm per metre of length.
 - .2 Cross section: solid section -6 to +12 mm.
 - .3 Deviation from straight line: not more than 3 mm per metre of length, nor 12 mm in full length.
 - .4 Pile head: +/- 10 mm per metre from true right angle plane. Surface irregularities +/- 3 mm.
 - .5 Location of reinforcing steel: Main reinforcing cover: -3mm to +6 mm. Spacing of spiral +/- 12 mm.

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 Provide approved type of protection cap with cushion block to top of pile when driving. Cushion block material softwood such as green hemlock. Plywood not acceptable.
- .2 Do not typically splice piles. If splicing of piles should be required, only pre-manufactured cast-in splice shoes approved by the Contract Administrator will be considered.
- .3 On completion of driving, cut off pile at required elevation. Make circumferential cut with concrete saw to prevent spalling of pile below cut-off elevation. Make pile cut off absolutely horizontal.
- .4 Drive piles at locations indicated and to depth sufficient to develop required loading.
- .5 Minimum prebored depth for piles from excavation 4.0 metres, or as indicated in geotechnical report.
- .6 Prebored holes to have 50 mm larger diameter than piles to be placed unless indicated otherwise on the drawings.
- .7 Remove boulders encountered in prebored holes using a core barrel or other approved method.
- .8 Remove, relocate, redrive and provide additional piles where directed when boulders or other obstructions prevent driving piles to an adequate bearing strata or within allowable tolerances in locations indicated on the drawings. Perform such work at no additional cost to the Contract.
- .9 Perform pile driving with a diesel hammer capable of delivering a rated energy of at least 40,000 joules.
- .10 Refusal criteria for driving piles shall be established by inspection at time of driving, and in accordance with the criteria in the Geotechnical Report.
- .11 Replace piles that are excessively damaged through driving or which are believed to be broken with new piles at a suitable location at no additional cost to Contract.
- .12 Piles shall be of sufficient length to allow 450 mm of strand to extend into the structure above.
- .13 If a pile or piles should be driven below required elevation to accommodate exposed strand requirements, cut off such piles 450 mm below the top of pile (except at single pile caps) and install an extension to details as supplied by the Contract Administrator at no extra cost to the Contract.
- .14 Drive all piles to required final set in competent hard glacial till deposit.
- .15 Drive piles continuously, without intermission until driven to required final set, at depth adequate to support the loads indicated on the drawings.

- .16 Observe and check pile upheaval. Redrive pile to refusal and final set any piles showing uplift after driving adjacent piles.

3.3 CLEAN-UP

- .1 After installation of foundation units, remove all excess concrete and other debris and leave site in clean condition.

END OF SECTION

Part 1 General

1.1 LEED REQUIREMENTS

- .1 Comply with all LEED requirements as described in Section 01 47 15 – LEED Sustainable Requirements.

1.2 FIRES

- .1 Fires and burning of trash on site is not permitted.

1.3 DISPOSAL OF WASTES

- .1 Do not bury rubbish and waste materials on site.
- .2 Do not dispose of waste or volatile materials, such as mineral spirits, oil or paint thinner into waterways, storm or sanitary sewers.

1.4 DRAINAGE

- .1 Provide temporary drainage and pumping as necessary to keep excavations and site free from water.
- .2 Do not pump water containing suspended materials into waterways, sewer or drainage systems.
- .3 Control disposal or runoff of water containing suspended materials or other harmful substances in accordance with local authority requirements.

1.5 SITE DEMOLITION AND PLANT PROTECTION

- .1 Protect existing and re-located trees and plants on site and adjacent properties.
- .2 Strap trees and erect 1.22 m snowfence around trees.
- .3 Avoid unnecessary traffic, dumping and storage of materials over root zones.
- .4 Minimize stripping of topsoil and vegetation.

1.6 POLLUTION CONTROL

- .1 Maintain temporary erosion and pollution control features installed under this contract.
- .2 Control emissions from equipment and plant to local authorities' emission requirements.
- .3 Prevent sandblasting and other extraneous materials from contaminating air beyond application area, by providing temporary enclosures.
- .4 Cover or wet down dry materials and rubbish to prevent blowing dust and debris. Provide dust control for temporary roads.

Part 2 Products

- .1 Not used.

Part 3 Execution

- .1 Not used

END OF SECTION

Part 1 General

1.1 REERENCES

- .1 Refer to the most recent edition of the City of Winnipeg Works and Operations Division Standard Construction Specifications.

Part 2 Products

2.1 MATERIALS

- .1 Granular subbase to conform to requirements of CW 3110-R5.

Part 3 Execution

3.1 INSPECTION OF EXISTING SUBGRADE

- .1 Place granular subbase after subgrade is inspected and approved by Contract Administrator.

3.2 PLACING

- .1 Place and compact subbase to conform to requirements of CW 3110-R5.

3.3 FINISH TOLERANCES

- .1 Finish compacted surface to within plus or minus 13 mm (1/2") of established grade and cross section, but not uniformly high or low. Add 25 mm (1") to design grades in fill areas to allow for expected settlement as directed by Contract Administrator.
- .2 Correct surface irregularities by loosening and adding or removing material until surface is within specified tolerance.

3.4 MAINTENANCE

- .1 Maintain finished subbase in condition conforming to this Section until succeeding base is constructed, or until granular subbase is accepted by Contract Administrator.

END OF SECTION

Part 1 General

1.1 GENERAL

- .1 This specification shall cover the stripping and removal of in-situ organic topsoil and associated vegetative cover as indicated on the drawings.

1.2 RELATED SECTIONS

- .1 Section 00 31 00 – Geotechnical Report
- .2 Section 31 22 13 – Site Grading
- .3 Section 32 12 16 – Asphalt Paving
- .4 Section 32 16 15 – Concrete Walks, Curbs, and Gutters

1.3 LEED REQUIREMENTS

- .1 Comply with all LEED requirements as described in Section 01 47 15 LEED Sustainable Requirements

1.4 REFERENCES

- .1 American Society for Testing and Materials (ASTM)
 - .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/ft³) (600kN m/m³).
 - .5 ASTM D1557-00, Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000ft lbf/ft³) (2,700kN m/m³).
 - .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 Manitoba Infrastructure & Transportation Construction Specifications, current edition.

1.5 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 aggregate required prior to beginning operation.

1.6 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials for disposal or recycling in accordance with Section 01 74 21 - Construction / Demolition Waste Management
- .2 Divert unused granular material from landfill to local facility as approved by Contract Administrator.

Part 2 Products

2.1 GRANULAR C – SUBBASE MATERIAL:

- .1 Aggregate in accordance with Section 00 31 00 - Geotechnical Report, and *City of Winnipeg Standard Construction Specification CW 3100*.

2.2 GRANULAR B – BASE MATERIAL:

- .1 Aggregate in accordance with Section 00 31 00 - Geotechnical Report, and *City of Winnipeg Standard Construction Specification CW 3100*.

2.3 GRANULAR A – BASE MATERIAL

- .1 Aggregate in accordance with Section 00 31 00 - Geotechnical Report, and *City of Winnipeg Standard Construction Specification CW 3100*.

Part 3 Execution

3.1 RELATED WORK

- .1 Re-establish or adjust all layout and grading markers set during surveyed layout operations completed in section 31 22 13 - Site Grading as necessary to continue the installation of hard surfaces on site.
- .2 Report any discrepancies to the Contract Administrator immediately.
- .3 Obtain approval of rough grading, any unforeseen subsurface remediation and layout adjustments prior to proceeding with aggregate base course installations.
- .4 Ensure all drainage features, underground services, site lighting service lines, light standard bases, parking signage bases, catch basins and utility systems have been installed, tested and approved prior to installing aggregate base courses.

3.2 PLACING

- .1 Place granular base immediately after sub-grade is inspected and approved by the Contract Administrator.
- .2 Construct granular base to depths and grades indicated on the drawings for all of the various hard surface finishes on site.
- .3 Do not place frozen or excessively wet material. Do not place materials when daytime temperatures are below -5° C.
- .4 Place material only on clean, unfrozen surface, free from snow and ice.
- .5 Begin spreading base material on crown line or on high side of one-way slope.

- .6 Place granular base materials using methods that do not lead to segregation or degradation as per *City of Winnipeg Standard Construction Specifications*.
- .7 For spreading and shaping material, use spreader boxes having adjustable templates or screens, which will place material in uniform layers of required thickness.
- .8 Place material to full width in uniform layers, not exceeding 150mm compacted thickness.
- .9 Shape each layer to smooth contours and compact to specified density before succeeding layer is placed.
- .10 Remove and replace any portion of each lift in which material becomes segregated during spreading and commence installation from a firm, compacted surface.

3.3 COMPACTION

- .1 Compact to corrected maximum dry density of not less than 98% to ASTM D698 as directed by Section 00 31 00 - Geotechnical Report.
- .2 Shape and roll each lift 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 vibrating plate compactors or mechanical tampers approved by the Contract Administrator.
- .5 Correct surface irregularities by loosening and adding or removing material until surface is within specified tolerance.

3.4 SITE TOLERANCES

- .1 Finished base surface to be within 10mm of elevation as indicated, but not uniformly high or low.

3.5 TESTING

- .1 Test in accordance with Section 01 21 00 – Allowances.
- .2 Inspection and testing of aggregate base courses will be carried out by a Testing Laboratory appointed by the Contractor. Testing laboratory to be certified in accordance with CSA A283.
- .3 Have each major area of construction tested.
 - .1 Turn Around yard at center point, minimum 3m from existing catch basin
 - .2 Garbage enclosure pad
 - .3 Alternate Price Area
 - .4 Dust collector
- .4 The Contract Administrator reserves the right to request additional compaction tests at locations to be determined on site to ensure compaction is verified in unforeseen problem locations.
- .5 Areas that fail minimum compaction requirements shall be re-compacted and tested by the Contractor at no additional cost to the City.

3.6 SURPLUS MATERIAL

- .1 Recycle surplus material and material back to quarry or processing site.

3.7 CLEANING

- .1 Perform cleaning after aggregate base courses to remove construction and accumulated environmental dirt. Remove surplus materials, excess materials, rubbish, tools and equipment.

3.8 ACCEPTANCE

- .1 Obtain final approval of aggregate base course installation via field observation with Contract Administrator prior to proceeding with any hard surface finishes.
- .2 Produce final compaction test results for deficient areas prior to proceeding with hard surface finishes.

3.9 PROTECTION

- .1 Maintain finished base in condition conforming to this section until finishes are installed.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 03 10 00 – Concrete Forming and Accessories
- .2 Section 03 20 00 – Concrete Reinforcing
- .3 Section 03 30 00 – Cast in Place Concrete
- .4 Section 31 23 33 – Excavating, Trenching and Backfilling

1.2 REFERENCES

- .1 American Society for Testing and Materials (ASTM), latest edition
 - .1 ASTM D698, Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400ft lbf/ft³) (600kN m/m³)
- .2 Canadian General Standards Board (CGSB), latest edition
 - .1 CAN/CGSB 1.2, Boiled Linseed Oil
 - .2 CAN/CGSB 3.3, Kerosene
- .3 Canadian Standards Association (CSA), latest edition
 - .1 CAN/CSA A23.1/A23.2, Concrete Materials and Methods of Concrete Construction/Methods of Test for Concrete
- .4 City of Winnipeg Standard Construction Specifications, latest edition.

1.3 MEASUREMENT PROCEDURES

- .1 Concrete walks: will be measured in square metres.
- .2 Concrete curbs and gutters: will be measured in linear metres.
- .3 Borrow material: will be measured in cubic metres compacted in place.
- .4 Place materials defined as hazardous or toxic waste in designated containers.
- .5 Ensure emptied containers are sealed and stored safely.

Part 2 Products

2.1 MATERIALS

- .1 Concrete mixes and materials: to Section 03 30 00 Cast in Place Concrete.
- .2 Reinforcing steel: to Section 03 20 00 - Concrete Reinforcing.
- .3 Joint filler, Curing Compound: to Section 03 30 00 Cast in Place Concrete.
- .4 Granular base: to Section 31 23 33 Excavating, Trenching and Backfilling.
- .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 33 Excavating, Trenching and Backfilling.
- .7 Boiled linseed oil: to CAN/CGSB 1.2 latest.
- .8 Kerosene: to CAN/CGSB 3.3 latest.

Part 3 Execution

3.1 GRADE PREPARATION

- .1 Do grade preparation work in accordance with Section 31 23 33 – 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 150mm layers and compact to at least 95% of maximum density to ASTM D698 or latest.

3.2 GRANULAR BASE

- .1 Obtain approval of subgrade before placing granular base.
- .2 Place granular base material to lines, widths, and depths as indicated.
- .3 Compact granular base to at least 95% of maximum density to ASTM D698.

3.3 CONCRETE

- .1 Obtain approval of granular base and reinforcing steel prior to placing concrete.
- .2 Do concrete work in accordance with Section 03 30 00 Cast in Place Concrete.
- .3 Immediately after floating, give sidewalk surface uniform broom finish to produce regular corrugations not exceeding 2 mm deep, by drawing broom in direction normal to centre line.
- .4 Provide edging as indicated with 10 mm radius edging tool.
- .5 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. Hand finish surfaces when directed by Contract Administrator.
- .6 Unless noted otherwise, Work of this Section shall be to City of Winnipeg standards.

3.4 TOLERANCES

- .1 Finish surfaces to within 3mm 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 1500 m or as per drawings. Install expansion joints as indicated at intervals of 6 m.
- .2 When sidewalk is adjacent to curb, make joints of curb, gutters and sidewalk coincide.

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 Section 03 30 00 Cast in Place Concrete.
- .3 Seal isolation joints with sealant approved by Contract Administrator.

3.7 CURING

- .1 Cure concrete by adding moisture continuously in accordance with CAN/CSA A23.1 or latest to exposed finished surfaces for at least one (1) day after placing or sealing moisture in by curing compound approved by Contract Administrator.
- .2 Where burlap is used for moist curing, place two prewetted layers on concrete surface and keep continuously wet during curing period.
- .3 Apply curing compound evenly to form continuous film, in accordance with manufacturer's requirements.

3.8 BACKFILL

- .1 Allow concrete to cure for seven (7) days prior to backfilling.
- .2 Backfill to designated elevations with material approved by Contract Administrator. Compact and shape to required contours as indicated or as directed by Contract Administrator.

3.9 LINSEED OIL TREATMENT

- .1 After concrete has cured for specified curing time and when surface of concrete is clean and dry, apply two coats of linseed oil mixture uniformly to surfaces of curbs, walks and gutters.
- .2 Linseed oil mixture to consist of 50% boiled linseed oil and 50% mineral spirits by volume.
- .3 Apply treatment when air temperature is above 10°C.
- .4 Apply first coat at 135 mL/m².
- .5 Apply second coat at 90 mL/m² when first coat has dried.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 32 16 15 – Concrete Walks, Curbs and Gutters
- .2 Section 09 90 00 – Painting

1.2 REFERENCE STANDARDS

- .1 Install chain link fence in accordance with CAN/CGSB-138.3-96 unless otherwise specified.

1.3 SUBMITTALS

- .1 Submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Use construction drawings as reference only in preparing submittals. Field verify as-built conditions and dimensions. Report any discrepancies to Contract Administrator if as-built conditions are significantly different from drawings.
- .3 Submit shop drawings for all fencing, gates and related items.
- .4 Drawings to clearly indicate size, assembly, welds, hardware, materials, core thicknesses, finishes, connections, joints, method of anchorage, number and size of anchors, supports, reinforcement, installation details and accessories for all aspects of work.
- .5 Shop drawings shall identify and quantify all hardware and miscellaneous items to be used.
- .6 Shop drawings to indicate related, adjacent materials, and connections.
- .7 Have shop drawings approved prior to providing samples for review and approval.
- .8 Provide templates, patterns, fixing diagrams as required for installation.

Part 2 Products

2.1 MATERIALS

- .1 Concrete Mixes and Materials: To Section 03 30 00 - Cast-in-Place Concrete.
 - .1 Nominal coarse aggregate size: 20 mm.
 - .2 Minimum Compressive strength: 20 MPa at 28 days.
- .2 Chain Link Fence Fabric: to CAN/CGSB-138.1.
 - .1 9 gauge, 50 mm mesh, knuckled top and bottom.
 - .2 Fence Height: 1.82 m (6'), pipe length 3.35m (11')
- .3 Posts, Braces and Rails: To CAN/CGSB-138.2, galvanized steel pipe. Dimensions as indicated: gate posts schedule 40 pipe; end and corner posts .125 wall; line posts .100 wall. Gate, end and corner posts: 89mm diameter. Line posts: 60mm diameter. Rails: Minimum 43mm diameter.
- .4 Bottom Tension Wire: To CAN/CGSB-138.1, Table 2, single strand, galvanized steel wire, 5 mm ϕ .
- .5 Tie Wire Fasteners: To CAN/CGSB-138.1, Table 2 (steel wire), single strand, vinyl coated or galvanized conforming to requirements of fence fabric.
- .6 Tension Bar: To ASTM A653/A653M, 5 x 20 mm minimum galvanized steel.

- .7 Gates: Single or double sided latching gate latches as indicated. Lockable. Self-closing as indicated, to CAN/CGSB-138.4.
- .8 Gate Frames: To ASTM A 53, galvanized steel pipe, standard weight 45 mm outside \varnothing pipe for outside frame, 35 mm outside \varnothing pipe for interior bracing.
- .9 Fabricate gates as indicated with electrically welded joints, and painted with zinc pigmented paint after welding.
- .10 Furnish gates with galvanized, malleable iron hinges, latch and latch catch with provision for padlock, which can be attached and operated from either side of the installed gate.
- .11 Fittings and Hardware: To CAN/CGSB-138.2, cast aluminum alloy, galvanized steel or malleable or ductile cast iron. Post caps to provide waterproof fit, to fasten securely over posts and to carry top rail.
- .12 Organic Zinc Rich Coating: To CAN/CGSB-1.181.

2.2 FINISHES

- .1 Galvanizing:
 - .1 For Chain Link Fabric: To CAN/CGSB-138.1 Grade 2.
 - .2 For Pipe: 550 g/ m² minimum to ASTM A 90.
 - .3 For Other Fittings: To CAN/CSA-G164.

Part 3 Execution

3.1 GRADING

- .1 Remove debris and correct ground undulations along fence line to obtain smooth uniform gradient between posts. Provide clearance between bottom of fence and ground surface neither less than 25 mm nor more than 50 mm.

3.2 ERECTION OF FENCE

- .1 Erect fence along lines indicated and in accordance with CAN2-138.3. Chain link fabric on the outside face of the posts.
- .2 For corner, end and gate posts, excavate post-holes to 1200 mm depth x 300 mm \varnothing and bulb bottom of holes as well as for intermediate posts at every 60.0 m along fence line and imbed in concrete. Typical line posts may be push installed to 1500 mm depth minimum, subject to approval of field conditions by Contract Administrator.
- .3 On rock, drill out post holes minimum 300 mm depth x diameter of post, plus 25 mm. fill with non-shrink cement grout.
- .4 Space line posts 3.0 m (10'-0") apart, measured parallel to ground surface.
- .5 Space straining posts at equal intervals not exceeding 150 m (450') if distance is greater than 150 m (450') between end or corner posts on straight continuous lengths of fence over reasonably smooth grade.
- .6 Install additional straining posts at sharp changes in grade and where directed.
- .7 Install corner post where change in alignment exceeds 30 degrees.
- .8 Install end posts at end of fence and at buildings. Install gate-posts on both sides of gate openings.

- .9 Where concrete is used, place concrete in post-holes then embed posts into concrete minimum 825 mm depth. Slope top of concrete 50 mm away from posts. Brace to hold posts in plumb position and true to alignment and elevation until concrete has set.
- .10 Do not install fence fabric until concrete has cured a minimum of five (5) days.
- .11 Install brace between end and gate-posts and nearest line post, placed in centre of panel and parallel to ground surface. Install braces on both sides of corner and straining posts in similar manner.
- .12 Install horizontal brace to all panels of fences 2.44 (8' 0") m and higher.
- .13 Install top rail between posts and fasten securely to terminal posts and secure waterproof caps and overhang tops.
- .14 Install bottom tension wire, stretch tightly and fasten securely to end, corner, gate and straining posts with turnbuckles and tension bar bands.
- .15 Lay out fence fabric. Stretch tightly to tension recommended by manufacturer and fasten to end, corner, gate and straining posts with tension bar secured to post with tension bar bands spaced at 300 mm intervals. Knuckled selvedge at top and bottom.
- .16 Secure fabric to top rails, line posts and bottom tension wire with tie wires at 450 mm (18") intervals. Give tie wires minimum two twists.
- .17 Ensure all manufacturers / suppliers tags are removed from installed materials.

3.3 INSTALLATION OF GATES

- .1 Install gates in locations as indicated and where directed by Contract Administrator.
- .2 Level ground between gate-posts and set gate bottom approximately 40 mm above ground surface.

3.4 TOUCH UP

- .1 Repair damaged galvanized surfaces. Clean damaged surfaces with wire brush removing loose and cracked coatings. Apply two (2) coats of approved organic zinc-rich paint to damaged areas in accordance with Section 09 90 00 - Painting. Pre-treat damaged surfaces according to manufacturer's instructions for zinc-rich paint.

3.5 CLEANING

- .1 Clean and trim areas disturbed by operations. Dispose of surplus excavated material as directed.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 01 33 00 – Submittal Procedures
- .2 Section 01 74 19 – Construction Waste Management and Disposal
- .3 Section 01 78 00 – Closeout Submittals
- .4 Section 32 16 15 – Concrete Walks, Curbs and Gutters

1.2 SUBMITTALS

- .1 Submit product data in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
- .3 Indicate dimensions, sizes, assembly, anchorage and installation details for each furnishing specified.
- .4 Provide maintenance data for care and cleaning of site furnishings for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.
- .5 Provide replacement part information to the City with maintenance data.

1.3 QUANTITIES

- .1 Note quantities for site furnishing are not listed below. Refer to Unit Price Form at front end of bid documents for quantities required.

Part 2 Products

2.1 TRENCH GRATE COVERS

- .1 Pre-fabricated trench grate covers complete with frame. As manufactured by Urban Accessories, distributed by Parkworks by MAKR, contact (800) 667-4264 or info@parkworks.ca
- .2 Model: Cascade. Material: 100% Recycled Grey Iron. Finish: Raw Natural Finish installed as per Manufacturer's instructions.
- .3 Size: 12" (305mm) wide. Refer to Drawings for lengths and locations.

2.2 SPLASH PAD

- .1 Pre-cast concrete splash pad, as supplied by Barkman Concrete, Winnipeg, MB. Contact 1 (204) 667-3310, website www.barkmanconcrete.com, or approved equivalent:
- .2 762 mm length by 305 mm width by 80 mm depth, in locations shown on Drawings,

2.3 EXTERIOR TABLES & CHAIRS

- .1 Lexicon 1500 Series table by Maglin Site Furniture.
 - .1 Model No.: LXT1500-18595
 - .1 Length: 71 5/8" (1819mm), 30" (762mm) height.
 - .2 Finish: Powdercoated Steel.

- .3 Colour: Silver.
- .2 Table Model number: MTB-1500-00010.
 - .1 Table Leg: Powdercoated,
 - .2 Colour: Yellow RAL 1018.
- .3 Table End Cap Model number: MTB-1500-00067.
- .4 Table 2ft Side Extension Model number: MTB-1500-00034.
- .5 Bench Seat Model number: MBE-1500-00032.
- .6 Bench End Cap Model number: MBE-1500-00013.
- .7 Bench Leg Style 1 – Armless,
 - .1 Powdercoated, Colour: Yellow RAL 1018.
- .8 Table and seat surface material: Thermally Treated Ash.
 - .1 Surface Mounted.
- .9 As supplied by Maglin Site Furniture. Contact Jackie Nielsen, Western Canada Sales Representative. Phone (800) 716-5506 ext. 6020, email: jackie.nielsen@maglin.com.

Part 3 Execution

3.1 INSTALLATION

- .1 Do not install site furnishings until all hard landscape components have been installed and accepted.
- .2 Assemble furnishings in accordance with manufacturer's instructions. Obtain Contract Administrator's approval of assembled furnishings prior to mounting.
- .3 Stake or mark out (non-permanent markings) site furnishings locations on site for Contract Administrator approval prior to surface mounting or installation.
- .4 Install all furnishings true, plumb, anchored and firmly supported. Ensure set screw for ground sleeve is set above finish grade and accessible.
- .5 Touch up damaged finishes to the approval of Contract Administrator.
- .6 Turn over spare parts and touch up paint to the City.

END OF SECTION

Part 1 General

1.1 RELATED WORK

- .1 Section 31 22 13 - Site Grading
- .2 Section 05 50 00 - Metal Fabrications
- .3 Section 09 90 00 - Painting and Coating

1.2 QUALITY ASSURANCE

- .1 Identify lumber by official grade mark continuing symbol of grading agency, mill number or name, grade of lumber, species or species grouping or combination designation, rules under which grade and conditions of seasoning at time of manufacture.

1.3 SAMPLES

- .1 Provide a 138mm wide x 300mm long sample of proposed wood products and finishes for approval prior to ordering material. Approved samples will act as the standard of finish for all site carpentry.

1.4 SHOP DRAWINGS

- .1 Provide shop drawings of miscellaneous metal fittings and components in accordance with Section 01 33 00 – Submittal Procedures.

1.5 LEED REQUIREMENTS

- .1 Comply with all LEED requirements as described in Section 01 47 15 – LEED Sustainable Requirements.

1.6 ENVIRONMENTAL PROTECTION

- .1 Collect and remove from site all waste pieces and sawdust from wood materials. Dispose of in accordance with Section 01 35 43 - Environmental Procedures.

Part 2 Products

2.1 MATERIALS

- .1 Kebony Clear Radiata Dimensional Lumber, size: 38 x 184 (Item #: 2557) for arbour. FSC certified American Radiata Pine modified with bio-based liquid. Minimum moisture content: 4-8%. All lumber to be free of defects, warping or checking. As supplied by North on Sixty, phone (416) 538-3325, email: hello@northonsixty.com, website: www.northonsixty/kebony
- .2 Rust-proof or acid-proof mounting fasteners must be used. Stainless steel, aluminum, enameled or foiled fixtures must be used to avoid discolouration of the wood. Galvanized fasteners are not acceptable.
- .3 Hardware: Bolts, nuts, washers, lag screws, to be stainless steel or acid proof where noted, sizes to suit application. Galvanize hardware is not acceptable.
- .4 Use plastic or neoprene washers between disparate materials such as concrete, wood and metal to prevent corrosion.

Part 3 Execution

3.1 PREPARATION

- .1 Obtain Contract Administrator's approval of rough grades and layout prior to construction.

3.2 HANDLING AND USE

- .1 Handle and use Kebony Wood material in a manner which will avoid damage or field fabrication, causing alteration in original treatment and finish.
- .2 Treatment in field of cuts or end treatment is not required for Kebony.

3.3 WORKMANSHIP

- .1 Construct all work to details, using adequate fastening methods to ensure solid, durable finished work suitable for the purpose intended.
- .2 Install Kebony per manufacturers written specifications and installation guide found at: www.kebony.com .
- .3 Pre-drill all fasteners. Do all fastening neatly, evenly and thoroughly.
- .4 Install all members true to line, levels and elevations. Set plumb and space uniformly.
- .5 Use timbers of the longest possible length to minimize joints.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 01 33 00 – Submittal Procedures
- .2 Section 01 45 00 – Quality Control
- .3 Section 32 91 19 – Topsoil and Finish Grading

1.2 SUBMITTALS

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

1.3 QUALITY ASSURANCE

- .1 Certificates: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.
- .2 Conduct a pre-installation meeting to verify project requirements, installation instructions and warranty requirements.

1.4 SCHEDULING

- .1 Schedule sod laying to coincide with preparation of soil surface.
- .2 Schedule sod installation when frost is not present in ground.

1.5 LEED REQUIREMENTS

- .1 Comply with all LEED requirements as described in Section 01 47 15 – LEED Sustainable Requirements.

1.6 WASTE MANAGEMENT AND DISPOSAL

- .1 Do not dispose of unused fertilizer into sewer systems, into lakes, streams, onto ground or in locations where it will pose health or environmental hazard.

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 mixture of cultivars of Kentucky Bluegrass, containing not less than three (3) named dwarf varieties grown from certified seed.
 - .2 Turf Grass Nursery Sod quality:
 - .1 Not more than two (2) broadleaf weeds or 10 other weeds per 40 square metres.
 - .2 Density of sod sufficient so that no soil is visible from height of 1500 mm when mown to height of 50 mm.
 - .3 Mowing height limit: 35 to 65 mm. Remove clippings.

- .4 Soil portion of sod: 9 to 15 mm in thickness.
- .5 Sod grown on mineral soil base. Peat sod will NOT be accepted.
- .2 Sod establishment support:
 - .1 Wooden pegs: 17 x 8 x 200 mm or approved alternate.
- .3 Water:
 - .1 Free of impurities that would inhibit growth.
- .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 quality at source.
- .2 When proposed source of sod is approved, use no other source without written authorization from the Contract Administrator.

Part 3 Execution

3.1 PREPARATION

- .1 Verify that grades are correct and prepared complete with fertilizer, in accordance with Section 32 91 19 - Topsoil and Finish Grading. If discrepancies occur, notify Contract Administrator and do not commence sodding work until instructed by Contract Administrator.
- .2 Do not perform work under adverse field conditions such as frozen soil, excessive heat, excessively wet soil or soil covered with snow, ice, or standing water.
- .3 Fine grade surface free of humps and hollows to smooth, even grade, to contours and elevations indicated, to tolerance of plus or minus 8 mm, for Turf Grass Nursery Sod, surface to drain naturally.
- .4 Remove and dispose of weeds; debris; stones 50 mm in diameter and larger; soil contaminated by oil, gasoline and other deleterious materials; off site.

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. Lay a full row of sod not less than 300mm in width along the perimeter of sodded areas and parallel to walkways.
- .3 Lightly roll sod as directed by the Contract Administrator in two directions to provide close contact between sod and soil. The use of heavy rollers to correct irregularities in grade is not permitted. Re-roll as directed by Contract Administrator if necessary.

3.3 SOD PLACEMENT ON SLOPES AND PEGGING

- .1 Place and peg sod on slopes steeper than 3 horizontal to 1 vertical, within 1 m of all catch basins, landscape drains and within 1 m of drainage channels and ditches to following the pattern:
 - .1 100 mm below top edge at 200 mm on centre for first sod sections along contours of slopes.
 - .2 Not less than 3-6 pegs per square meter.
 - .3 Not less than 6-9 pegs per square meter in drainage structures. Adjust pattern as directed by Contract Administrator.
 - .4 Drive pegs to 20 mm above soil surface of sod sections.

3.4 MAINTENANCE DURING ESTABLISHMENT PERIOD

- .1 Perform the following operations from time of installation until acceptance.
- .2 Water sodded areas in sufficient quantities and at frequency required to maintain optimum soil moisture condition to depth of 75 to 100 mm.
- .3 Cut grass to 60 mm when or prior to it reaching height of 75 mm. Remove clippings which will smother sodded or adjacent seeded areas as directed by Contract Administrator.
- .4 Maintain sodded areas 95% weed free.
- .5 Fertilize areas in accordance with fertilizing program during establishment period. Spread half of required amount of fertilizer in one direction and remainder at right angles and water in well.

3.5 ACCEPTANCE

- .1 Turf Grass Nursery Sod areas will be accepted by Contract Administrator provided that:
 - .1 Sodded areas are properly established.
 - .2 Sod is free of bare and dead spots and without weeds.
 - .3 No soil is visible from height of 1500 mm when grass has been cut to a height of 50 mm.
 - .4 Sodded areas have been cut minimum two (2) times prior to acceptance.
- .2 Areas sodded in fall will be accepted in the following spring one (1) month after the start of the growing season provided acceptance conditions are fulfilled.

3.6 WARRANTY

- .1 Provide a one (1) year warranty against deterioration, bare spots or damage from faulty materials or workmanship from date of acceptance.

3.7 CLEANING

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

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 32 92 23 – Sodding
- .2 Section 32 93 10 – Tree, Shrub and Groundcover Planting

1.2 PROTECTION OF EXISTING FACILITIES

- .1 Protect elements surrounding the work of this section from damage or disfiguration. Protect landscaping and other features remaining as final work. Protect existing structures, fences, roads, sidewalks, paving and curbs.

1.3 SCHEDULING OF WORK

- .1 Schedule placing of topsoil to permit immediate planting operations.

1.4 SAMPLES

- .1 Provide three (3), 1 litre samples of topsoil proposed for use on this project for testing in accordance with Section 01 33 00 Submittal Procedures, a minimum of four (4) weeks prior to construction. Do not move topsoil to site prior to confirmation of test results. Samples must be representative of topsoil to be used on site.

1.5 DELIVERY AND STORAGE

- .1 Deliver and store fertilizer in waterproof bags accompanied in writing by weight, analysis and name of manufacturer.

1.6 LEED REQUIREMENTS

- .1 Comply with all LEED requirements as described in Section 01 47 15 – LEED Sustainable Requirements.

1.7 WASTE MANAGEMENT AND DISPOSAL

- .1 Do not dispose of unused soil amendments into sewer systems, into lakes, streams, onto ground or in locations where it will pose health or environmental hazard.

Part 2 Products

2.1 TOPSOIL

- .1 Topsoil for sodded/seeded areas, tree wells and planting beds: mixture of particulates, micro organisms and organic matter which provides suitable medium for supporting intended plant growth.
 - .1 Dark brown to black, loam textured, imported topsoil, free of living plants and branches.
 - .2 Ph value: 6.0 to 7.5.
 - .3 Contain no toxic elements or growth inhibiting materials.
 - .4 Conductivity: maximum 2.5dS/m
 - .5 Free of Couchgrass or Canadian Thistle rhizomes

- .6 Finished surface free from:
 - .1 Debris and stones over 50 mm diameter.
 - .2 Coarse vegetative material, 10 mm diameter and 100 mm length, occupying more than 2% of soil volume.
- .2 Consistence: friable when moist.
- .3 Contractor is responsible for supplying materials necessary to amend topsoil to specified characteristics.

2.2 SOIL AMENDMENTS

- .1 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.
- .2 Sand: washed sand, medium to coarse textured.
- .3 Organic matter: compost Category A, unprocessed organic matter, such as rotted manure, hay, straw, bark residue or sawdust, meeting the organic matter, stability and contaminant requirements.
- .4 Limestone:
 - .1 Ground agricultural limestone.
 - .2 Gradation requirements: percentage passing by weight, 90% passing 1.0 mm sieve, 50% passing 0.125 mm sieve.
- .5 Fertilizer: complete commercial synthetic slow release fertilizer with maximum 35% water soluble nitrogen. Rate and ratio as recommended by soil test results.

2.3 SOIL MIXES

- .1 All Purpose, Four Way Light Mix for sodded, seeded areas, tree pits and planting beds, or approved equal. Well mixed and screened combination of: 40% Black Topsoil, 35% Peat Moss, 15% Sand and 10% Compost by volume.
- .2 Prepare sub-grade surface as per finish grading.

2.4 SOURCE QUALITY CONTROL

- .1 Advise Contract Administrator of sources of topsoil mix and amendments to be utilized in preparing manufactured topsoil with sufficient lead-time for testing.
- .2 Contractor is responsible for amendments to supply topsoil mix as specified.
- .3 Soil testing to be completed by recognized testing facility for pH, N, P and K, electro-conductivity and organic matter.
- .4 Testing of topsoil will be carried out by testing laboratory designated or approved by the Contract Administrator.
 - .1 Soil sampling, testing and analysis to be in accordance with Provincial standards.

- .5 If soils are deemed deficient from testing, ensure that testing lab provides soil amendment and or fertilizer recommendations.

Part 3 Execution

3.1 PREPARATION OF EXISTING GRADE

- .1 Verify that grades are correct. If discrepancies occur, notify Contract Administrator and do not commence work until instructed by Contract Administrator.
- .2 Grade soil, eliminating uneven areas and low spots, ensuring positive drainage.
- .3 Remove debris, roots, branches, stones in excess of 50 mm diameter and other deleterious materials. Remove soil contaminated with calcium chloride, toxic materials and petroleum products. Remove debris which protrudes more than 75 mm above surface. Dispose of removed material off site.
- .4 Cultivate entire area which is to receive topsoil to minimum depth of 100 mm. Cross cultivate those areas where equipment used for hauling and spreading has compacted soil.

3.2 PLACING AND SPREADING OF TOPSOIL / PLANTING SOIL

- .1 Place topsoil after Contract Administrator has accepted sub-grade.
- .2 Spread topsoil in uniform layers not exceeding 150 mm over approved, dry unfrozen subgrade, where sodding / seeding and planting is indicated.
- .3 For sodded areas keep topsoil 15 mm below finished grade.
- .4 Spread topsoil/planting soil as indicated on the drawings for shrub beds and tree pits, allowing for the following minimum depths after settlement:
 - .1 100mm for sodded and seeded areas.
 - .2 300mm for shrub beds.
- .5 Manually spread topsoil/planting soil around trees, shrubs and obstacles.

3.3 SOIL AMENDMENTS

- .1 For planting beds, sod and seeding, apply and thoroughly mix soil amendments into full specified depth of topsoil/planting soil at the applicable rates determined from soil testing.

3.4 APPLICATION OF FERTILIZER

- .1 Spread fertilizer over entire area of topsoil/planting soil at rate and ratio determined by soil testing.
- .2 Mix fertilizer thoroughly into upper 50 mm of topsoil mix.

3.5 FINAL GRADING

- .1 Grade to eliminate rough spots and low areas and ensure positive drainage. Prepare loose friable bed by means of cultivation and subsequent raking.
- .2 Consolidate topsoil mix to required bulk density using equipment approved by Contract Administrator. Leave surfaces smooth, uniform and firm against deep footprinting.

3.6 ACCEPTANCE

- .1 The Contract Administrator will review and test topsoil/planting soil in place and determine acceptance of material, depth of topsoil and finish grading.

3.7 SURPLUS MATERIAL

- .1 Dispose of materials not required off site as directed by Contract Administrator.

3.8 CLEANING

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

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 01 33 00 – Submittal Procedures
- .2 Section 01 45 00 – Quality Control
- .3 Section 32 91 19 – Topsoil 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-2001.
- .3 Department of Justice Canada (Jus)
 - .1 Canadian Environmental Protection Act (CEPA), 1999, c. 33.
 - .2 Transportation of Dangerous Goods Act (TDGA), 1992, c.34.
- .4 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS)..

1.3 SUBMITTALS

- .1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Submit product data for:
 - .1 Fertilizer.
- .3 Submit samples for:
 - .1 Stone Mulch.

1.4 LEED REQUIREMENTS

- .1 Comply with all LEED requirements as described in Section 01 47 15 – LEED Sustainable Requirements.

1.5 RELOCATION AND PRE-PLANTING CARE

- .1 Coordinate relocation of plants and excavation of holes to ensure minimum time lapse between digging and planting.
- .2 Cover plant foliage with tarpaulin and protect bare roots by means of dampened straw, peat moss, saw dust or other acceptable material to prevent loss of moisture during storage if applicable.
- .3 Remove broken and damaged roots with sharp pruning shears.

1.6 STORAGE AND PROTECTION

- .1 Protect plant material from frost, excessive heat, wind and sun during relocation.
- .2 Immediately store and protect plant material which will not be installed within four (4) hours after removal in storage location approved by Consultant.

- .3 Protect stored plant material from frost, wind and sun and as follows:
 - .1 For bare root plant material, preserve moisture around roots by heeling-in or burying roots in topsoil and watering to full depth of root zone.
 - .2 For pots and containers, maintain moisture level in containers.

1.7 SCHEDULING

- .1 Obtain approval from Consultant of schedule fourteen (14) days in advance of plant relocation.
- .2 Schedule to include:
 - .1 Plant removal date.
 - .2 Plant relocation area, and maintenance schedule.
 - .3 Planting/re-planting date.

Part 2 Products

2.1 PLANT MATERIAL

- .1 Quality and source: comply with Guide Specifications for Nursery Stock, latest edition of Canadian Nursery Trades Association (CNTA) referring to size and development of plant and root ball. Measure plant material and root ball. Measure plants when branches are in their natural position. Height and spread dimensions refer to main body of plant and not from branch tip to branch tip. Measure caliper for trees minimum 300 mm (12") above grade for trees 100 mm (4") caliper and larger and 150 mm (6") above grade for trees up to 100 mm (4") caliper.
- .2 Type of root preparation, sizing, grading and quality: comply to Canadian Standards for Nursery Stock.
 - .1 Source of plant material: grown in Zone 3a in accordance with Plant Hardiness Zones in Canada.
- .3 Plant Material: free of disease, insects, defects or injuries and structurally sound with strong fibrous root system.
- .4 Plant species, cultivars and sizes as indicated on the drawings. Substitutions to plant material as indicated on planting plan are not permitted unless written approval has been obtained as to type, variety and size from the Consultant. Plant substitutions must be of similar species and of equal size as those originally specified.
- .5 Relocated material: dig plant material with spade, lift root ball from hole, transport to planting location and place into spade dug prepared planting hole with scarified bottom and sides.
- .6 Refer to drawings for species and quantities of plant material to be relocated.
- .7 Refer to Plant Specification List on the Drawings for species, quantities, size and quality of plant materials.

2.2 PLANTING MIX

- .1 Topsoil/Planting Mix: as specified in Section 32 91 19 - Topsoil and Finish Grading.

2.3 WATER

- .1 Potable and free of impurities or minerals that may be detrimental to plant growth.

2.4 WOOD MULCH

- .1 Natural wood mulch for use in planting beds: Natural brown in colour, varying in size from 25 - 75mm +/- in length, 12 - 25mm thick from deciduous trees. Bark shall be clean, free of debris, needles, twigs, leaves, soil and friable material. Natural wood mulch to be supplied by Reimer Soils or approved equal. Pine Bark mulch or Bark Nuggets will not be accepted.
- .2 Provide samples of bark mulch for approval by the Consultant 14 days prior to shipping to site and installation.

2.5 STONE MULCH

- .1 Stone mulch: Crushed black granite, 17 - 38mm ϕ , clean stone to depth as indicated on drawings.
- .2 Provide samples of stone mulch for approval by the Consultant 14 days prior to installation.

Part 3 Execution

3.1 RELATED WORK

- .1 Obtain approval of clearing and grubbing, earthwork and related work, and site grading prior to commencing work in this section.

3.2 PRE-PLANTING PREPARATION

- .1 Ensure plant material is acceptable to the Consultant prior to relocation.
- .2 Remove damaged roots and branches from plant material.

3.3 EXCAVATION AND PREPARATION OF PLANTING BEDS

- .1 Preparation of planting beds is specified in Section 32 91 19 - Topsoil Placement and Grading. Layout plants in pots on beds for Consultant approval prior to installation.
- .2 For individual planting holes:
 - .1 Stake out or on top of prepared beds for the locations of all plants. Obtain field approval of planting layouts from Landscape Architect prior to excavating and planting holes.
 - .2 Excavate planting holes to depths and widths as indicated.
 - .3 Remove rocks, roots, debris and toxic material from excavated material that will be used as planting soil. Dispose of excess material.
 - .4 Scarify sides of all planting holes.
 - .5 Remove water that enters excavations prior to planting. Notify Consultant if water source is groundwater.

3.4 PLANTING

- .1 Provide plant relocation schedule. Relocate plants only under conditions that are conducive to good health and safe physical conditions of plants. Extending planting operations over a long period will not be accepted.
- .2 Plant vertically in locations as indicated. Orient plant material to give best appearance in relation to most viewed sides of the plant.
- .3 For groundcovers, backfill soil evenly to finish grade and tamp to eliminate air pockets.

- .4 Water plant material thoroughly.
- .5 After soil settlement has occurred, fill with soil to finish grade.
- .6 Dispose of surplus material off site.

3.5 MULCHING

- .1 Stone Mulch:
 - .1 Obtain approval of stone mulch areas before mulching material is applied.
 - .2 Place and secure geotextile around perimeter and with minimum 400mm overlap between seems.
 - .3 Spread stone mulch to depths as indicated on Drawings immediately after placing geotextile.
 - .4 Do not displace or damage the geotextile during placement. Remove and replace any damaged areas if they occur.
 - .5 Rake stone mulch to a smooth, even finish.

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-20, Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
 - .3 ASTM C136/C136M-19, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
 - .4 ASTM D698-12(2021), Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³)).
 - .5 ASTM D1248-16, Standard Specification for Polyethylene Plastics Extrusion Materials For Wire and Cable.
 - .6 ASTM E11-22, Standard Specification for Woven Wire Test Sieve Cloth and Test Sieves.

1.2 QUALITY ASSURANCE

- .1 Mock-ups.
 - .1 Prepare mock-up of foundation drainage piping installation in accordance with Section 01 45 00.
 - .2 Mock-up to include drainage piping and filter aggregate as specified complete-with rigid insulation cover board as detailed.
 - .3 Prepare mock-up on site as part of final installation. Mock-up will be reviewed for pipe bedding preparation, materials specified, and quality of installation.
 - .4 Once approved, mock-ups will set standard of acceptance for remaining installations.

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.
- .5 Waste Management and Disposal in accordance with Section 01 74 19

Part 2 Products

2.1 MANUFACTURERS

- .1 Basis of Design Products.
 - .1 Solid and Perforated Pipe.
 - .1 Big 'O' with Sock Filter.
 - .2 Prinsco Goldline GLP.
 - .3 ADS Corrugated Drainage Pipe complete-with sock, fittings, clean-outs, locking end caps.

- .2 Requests for substitutions will be considered subject to specified requirements and in accordance with *B7 Substitutes of the Bidding Procedures*.
- .3 Supply all products from single manufacturer.

2.2 MATERIALS

- .1 Solid and Perforated Pipe: to ASTM D1248, 150 mm diameter, corrugated high density polyethylene tubing for subdrainage applications complete-with fittings and clean-outs with solid end caps. Provide geotextile sock filter for perforated pipe sections.
- .2 Filter Aggregate.
 - .1 Drainage material to consist of no less than 19 mm clean natural riverwash stone 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 in accordance with ASTM C136/C136M.
 - .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/C131M, Grading A.

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.

3.2 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 pipe bed true to grade and to provide continuous and uniform bearing surface for pipe. Shape transverse depressions, as required, to suit joints.
 - .4 Compact each layer full width of bed to 95% maximum density to ASTM D698.
- .2 Pipe Laying.
 - .1 Grade bedding to establish pipe slope.
 - .2 Ensure pipe interior and coupling surfaces are clean before laying. Connect pipes using manufacturer's recommended fittings.
 - .3 Lay perforated pipe minimum to slope of 1:100. Do not use concrete, masonry, stones, wood, or any type of shim to establish pipe slope.
 - .4 Install solid end plugs at ends of collector piping to protect pipe ends from damage and ingress of foreign material.
 - .5 Connect pipe to sump pit by appropriate adapters manufactured for this purpose.

- .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 95% maximum density to ASTM D698.
 - .5 Compact each layer from mid-height of pipe to underside of backfill to 90% maximum density to ASTM D698.
- .4 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.
- .5 Locking End Caps at Exposed Clean-Outs Pipe.
 - .1 Install solid end caps at exposed clean-outs.
 - .2 Mechanically fasten galvanized hinged hasp lock to pipe and end cap for security. Padlock by Owner.

END OF SECTION

PEMBINA TRAILS COLLEGIATE

VOCATIONAL WING ADDITION

50 FRONTIER TRAIL, WINNIPEG, MANITOBA

Architectural Project Manual Details

CONTENTS:

REFERENCE NUMBER	DESCRIPTION	DETAIL SHEET(S)	No. of DWG(S)
AP0	CONTENTS	AP0.01	1
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	DRAWING SYMBOLS AND CONVENTIONS	AP0.03	1
	REFERENCE SYMBOLS	AP0.04	1

DETAILS:

AP2	CRAWLSPACE DETAILS	AP2.01 - AP2.07	7
	CONSTRUCTION DETAILS	AP2.20 - AP2.23	4
	ROOF DETAILS	AP2.50 - AP2.61	12
AP3	CEILING DETAILS	AP3.01 - AP3.05	5
AP5	WALL SECTION DETAILS	AP5.01 - AP5.08	8
AP6	STAIR DETAILS	AP6.01 - AP6.02	2
AP7	TYPICAL MOUNTING AND ACCESSORIES	AP7.01 - AP7.06	6
AP8	MILLWORK DETAILS AND INTERIOR DETAILS	AP8.01 - AP8.25	25
TOTAL DRAWINGS:			73

 THE CITY OF WINNIPEG ASSETS & PROJECT MANAGEMENT DEPARTMENT MUNICIPAL ACCOMMODATIONS DIVISION 3-65 GARRY STREET, R3C 4K4	PROJECT PEMBINA TRAILS COLLEGIATE VOCATIONAL WING 50 FRONTIER TRAIL, WINNIPEG, MANITOBA, R3Y 2H1			SHEET TITLE ARCHITECTURAL PROJECT MANUAL DETAILS CONTENTS		
	DRAWN BY: HW	CHECKED BY: HW	DESIGNED BY: HW	APPROVED BY: JT	DATE: 2024.04.01 eFILE: 1929V_PTCV_ARCH_2023.rvt	SCALE: 1:1 PROJECT No: 2020-127

MASTER ABBREVIATIONS LIST FOR DRAWINGS:

(REFER TO DOOR SCHEDULE AND ROOM FINISH SCHEDULE FOR DOOR AND ROOM FINISH ABBREVIATIONS)

&	AND	FE (-S) (-F)	FIRE EXTINGUISHER (SEMI-RECESSED)	OSC	OVERFLOW SCUPPER THROUGH CURB
@	AT		(FULLY RECESSED)	OSD	OVERFLOW SCUPPER & DOWNSPOUT
⊕	CENTERLINE		FORCE FLOW UNIT	OX	SINGLE OXYGEN OUTLET
99	EMERGENCY CALL BUTTON	FF	FIRE HOSE CABINET		
ACS	ACOUSTICAL CEILING TILE SYSTEM	FHC	FINISH OR FINISHEED		
ADJ.	ADJUSTABLE	FIN.	FLOOR		
ADO	AUTOMATIC DOOR OPERATOR	FLR.	FIRE-RATED		
A.F.F./AFF	ABOVE FINISH FLOOR	FR	FULL SIZE		
ALUM.	ALUMINUM	F.S.			
ANOD.	ANODIZED	Ga.	GAUGE	P	PAINT
APPROX.	APPROXIMATE	GALV.	GALVANIZED	PARG.	CEMENT PARGING
ASPH.	ASPHALT	G.B.	GYPSON BOARD	PCT	PRIVACY CURTAIN TRACK
AWP	ACOUSTIC WALL PANEL	GBEP	GYPSON BOARD - EPOXY PAINT FINISH	PH.	PHENOLIC
			GLOVE DISPENSER (NIC)	PL.	PLASTIC
BD.	BOARD		GLAZING	PL OR PL. LAM.	PLASTIC LAMINATE
BGL	BUMPER GUARD, LOWER		GROMMET	PLP	PLASTIC LAMINATE PANELS
BGU	BUMPER GUARD, UPPER		GLAZING SURFACE FILM	PLBG.	PLUMBING
BLDG.	BUILDING			PREFAB.	PREFABRICATED
BM.	BEAM	H.B.	HOSE BIB	PREFIN.	PREFINISHED
BR.	BRONZE	H.M.	HOLLOW METAL	P.T.	PRESSURE TREATED
B.S./BS	BOTH SIDES	HORIZ.	HORIZONTAL	PTD. OR PTD	PAINTED
BSMT.	BASEMENT	HR	HANDRAIL	PVC	POLYVINYL CHLORIDE
		H.S.S.	HOLLOW STEEL SECTION	PW	PLYWOOD
CA	SINGLE COMPRESSED AIR OUTLET	H.	HEIGHT	QTY.	QUANTITY
C.B.	CATCH BASIN	HWT.	HOT WATER TANK		
CC	CUBICLE CURTAIN			R.D.	ROOF DRAIN
CG (1200)	CORNER GUARD (# = HEIGHT)	I.D.	INSIDE DIAMETER	RDD	ROOF DRAIN DISCHARGE
CJ	CONTROL JOINT	INSUL.	INSULATION	REINF.	REINFORCED OR REINFORCING
CL.	CLEAR	INT.	INTERIOR	REQ'D.	REQUIRED
CLG.	CEILING	IVT	IV TRACK	REV.	REVISION
C/M	CEILING MOUNTED			R.O.	ROUGH OPENING
CMU	CONCRETE MASONRY UNIT	JAN.	JANITOR	RWL	RAIN WATER LEADER
CO2	SINGLE CARBON DIOXIDE OUTLET			SBD	SCUPPER BOX & DOWNSPOUT
C.O.	CLEAN OUT	KB	KEYBOARD TRAY	SC	SHARPS CONTAINER (NIC)
COL.	COLUMN	LAV.	LAVATORY	SIM. OR SIM	SIMILAR
CONC.	CONCRETE	LGL	LOUVERED GLAZING	SL.	SLOPE
CONST.	CONSTRUCTION	LP	LIGHTING PANEL	SP	SPANDREL PANEL
CONT.	CONTINUOUS	LWCS	LINEAR WOOD CEILING SYSTEM	SPD	SUMP PUMP PIT DISCHARGE
CPT	CARPET			SQ.	SQUARE
CPU	CPU HOLDER	M	METRE	S.S. OR SS	STAINLESS STEEL
CR	CHAIR RAIL	MA	SINGLE MEDICAL AIR OUTLET	SSM	SOLID SURFACING MATERIAL
CS	CULTURED STONE	MAX.	MAXIMUM	ST.	STAIR
C/W	COMPLETE WITH	MB	MARKERBOARD	STL.	STEEL
		MDF	MEDIUM DENSITY FIBERBOARD	STRUCT.	STRUCTURAL
DA	DATA OUTLET			SUSP.	SUSPENDED
DAMP.	DAMP PROOFING MEMBRANE	MECH.	MECHANICAL	T & G	TONGUE AND GROOVE
DF	DRINKING FOUNTAIN	MEZZ.	MEZZANINE	TB	TACK BOARD
DIA.	DIAMETER	M.H.	MANHOLE	TS	TACK SURFACE
DN.	DOWN	MIN.	MINIMUM	T.O.	TOP OF
DRE	DUPLEX RECEPTACLE - EMERGENCY POWER	MISC.	MISCELLANEOUS	TYP.	TYPICAL
DRN	DUPLEX RECEPTACLE - NORMAL POWER	mm	MILLIMETER		
DS	DOWNSPOUT	M.O.	MASONRY OPENING	U/C	UNDER COUNTER
DW	DISPLAY WALL	MOD. BIT.	MODIFIED BITUMINOUS	UM	UNFRAMED MIRROR
DWG.	DRAWING	MTD	MOUNTED	U.N.O.	UNLESS NOTED OTHERWISE
		MV	MASONRY VENEER	U/S	UNDERSIDE
E OR ELECT.	ELECTRICAL	N	SINGLE NITROGEN OUTLET	V	SINGLE VACUUM OUTLET
EIFS	EXTERIOR INSULATION AND FINISH SYSTEM	NC	NURSE CALL	V.B.	VAPOUR BARRIER
		NO. OR #	NUMBER	VERT.	VERTICAL
ELEV.	ELEVATION	N.I.C. OR NIC	NOT IN CONTRACT	VEST.	VESTIBULE
ELP	ELECTRICAL PANEL	N.T.S.	NOT TO SCALE	VL	VALANCE LIGHT
EQ.	EQUAL			W/.	WITH
ES OR ESP	EXPOSED STRUCTURE - PAINTED	O/C	ON COUNTER	WD.	WOOD
ESU	EXPOSED STRUCTURE - UNFINISHED	O.C.	ON CENTRE	W/M	WALL MOUNTED
		O.D.	OUTSIDE DIAMETER	WGCS	WOOD GRILLE CEILING SYSTEM
EXIST.	EXISTING	DFF	DIVISION FURNISHED PRODUCT (IN CONTRACT INSTALLATION)	WR.	WASHROOM
EXT.	EXTERIOR			WV	WOOD VENEER
FACP	FIRE ALARM CONTROL PANEL	O.H.	OVERHEAD	X	EXISTING
F.D.	FLOOR DRAIN	O.S.	OVERFLOW SCUPPER	XJ	EXPANSION JOINT
FDC	FIRE DEPARTMENT CONNECTION	OSB	ORIENTED STRAND BOARD	XR	EXISTING TO BE RELOCATED


 THE CITY OF WINNIPEG
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 3-65 GARRY STREET, R3C 4K4

PROJECT
**PEMBINA TRAILS COLLEGIATE
 VOCATIONAL WING**
 50 FRONTIER TRAIL, WINNIPEG, MANITOBA, R3Y 2H1

SHEET TITLE
**MASTER ABBREVIATIONS LIST
 FOR DRAWINGS**

DRAWN BY:
HW

CHECKED BY:

DESIGNED BY:

APPROVED BY:

DATE:
2024.04.01

eFILE:
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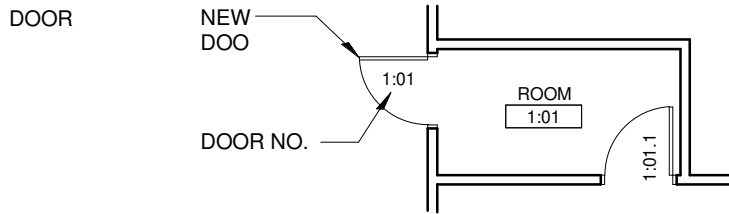
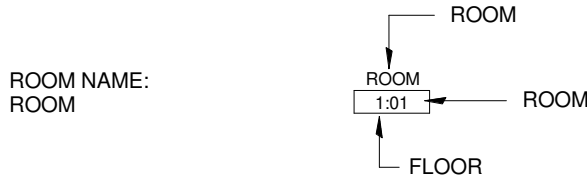
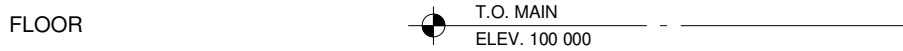
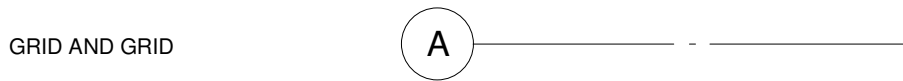
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PROJECT No: 2020-127

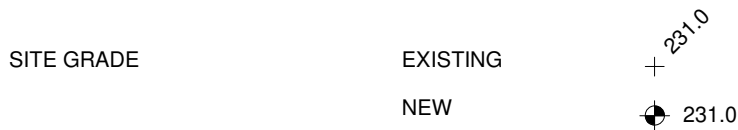
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AP0.02

DRAWING SYMBOLS AND CONVENTIONS:

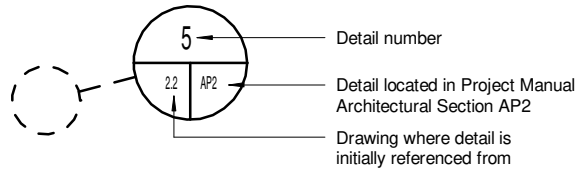
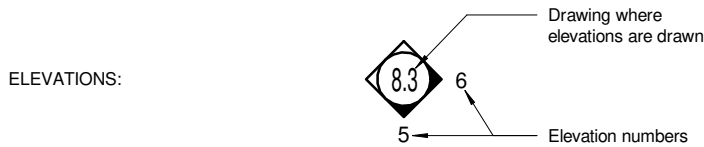
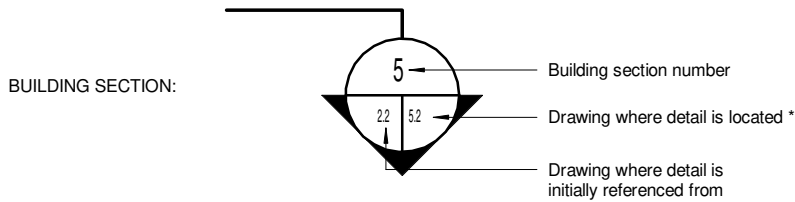
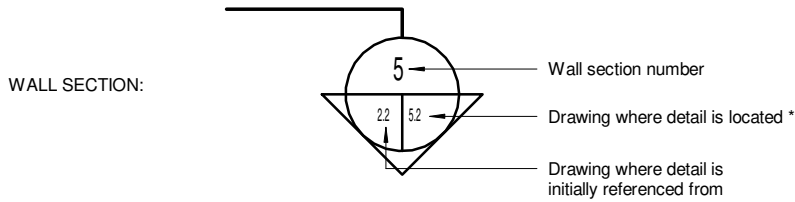
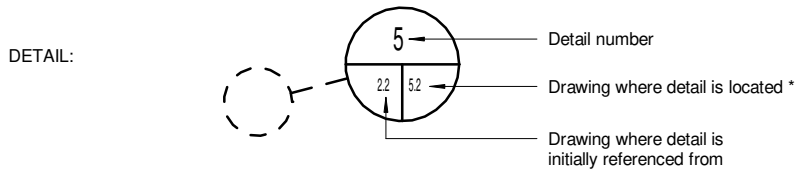


Note:
Typically the door number matches the number of the room that the door enters into regardless of the direction of swing. When a room contains more than one door the number sequence is as per the following example: 1:01, 1:01.1, 1:01.2



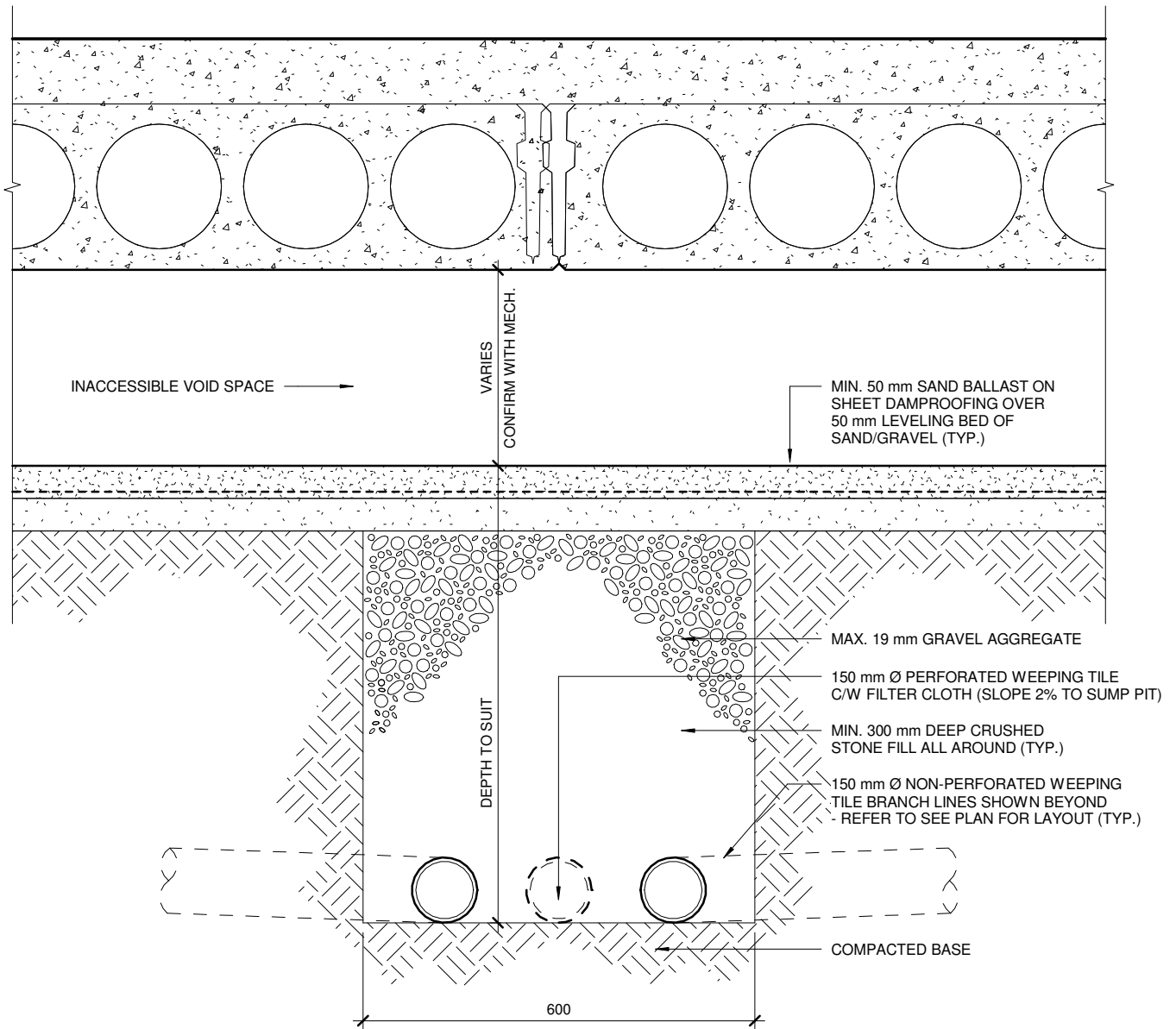
	THE CITY OF WINNIPEG ASSETS & PROJECT MANAGEMENT DEPARTMENT MUNICIPAL ACCOMMODATIONS DIVISION 3-65 GARRY STREET, R3C 4K4			PROJECT PEMBINA TRAILS COLLEGIATE VOCATIONAL WING 50 FRONTIER TRAIL, WINNIPEG, MANITOBA, R3Y 2H1		SHEET TITLE DRAWING SYMBOLS AND CONVENTIONS	
	DRAWN BY:	CHECKED BY:	DESIGNED BY:	APPROVED BY:	DATE:	SCALE:	SHEET No:
HW				2024.04.01		AP0.03	
				eFILE: 1929V_PTCV_ARCH_2023.rvt	PROJECT No: 2020-127		

DRAWING REFERENCE SYMBOLS:



* is When REFERENCE SYMBOL includes the letters 'AP' or referenced as AP2.5; it indicates the detail is located in the PROJECT MANUAL

THE CITY OF WINNIPEG ASSETS & PROJECT MANAGEMENT DEPARTMENT MUNICIPAL ACCOMMODATIONS DIVISION 3-65 GARRY STREET, R3C 4K4		PROJECT PEMBINA TRAILS COLLEGIATE VOCATIONAL WING 50 FRONTIER TRAIL, WINNIPEG, MANITOBA, R3Y 2H1			SHEET TITLE DRAWING REFERENCE SYMBOLS	
DRAWN BY:	CHECKED BY:	DESIGNED BY:	APPROVED BY:	DATE: 2024.04.01	SCALE: 1:1	SHEET No:
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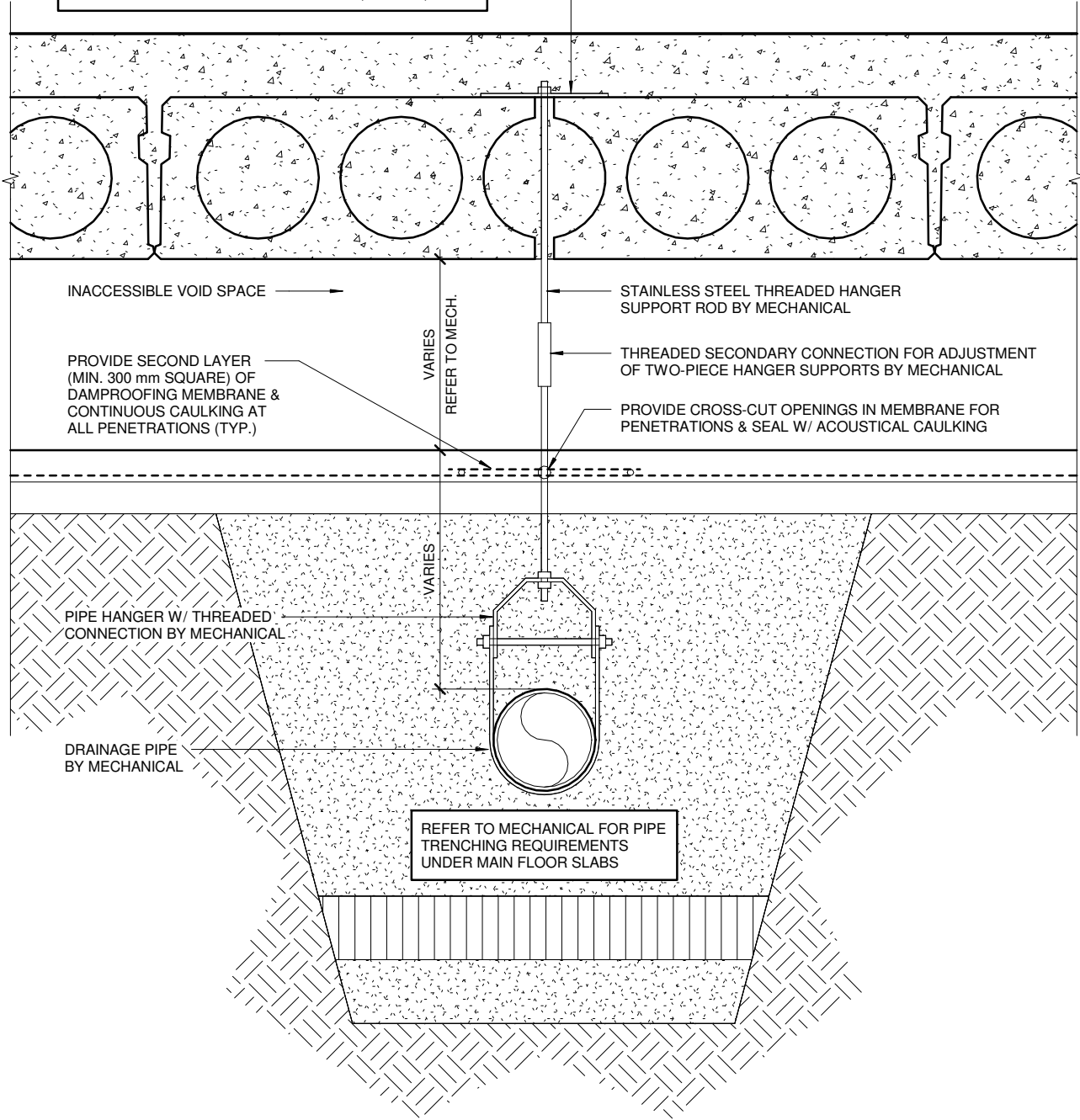


1. EXCAVATE BASE OF TRENCH TO SUIT SLOPE OF WEeping TILE TO SUMP PIT.
2. SET WEeping TILE ON BASE OF EXCAVATION.

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DRAWN BY:	CHECKED BY:	DESIGNED BY:	APPROVED BY:	DATE:	SCALE:	SHEET No:
HW	HW	HW	JT	2024.04.01	1:10	AP2.01
				eFILE: 1929V_PTCV_ARCH_2023.rvt	PROJECT No: 2020-127	

NOTE:
SEAL DAMPROOFING MEMBRANE TO ALL PENETRATIONS WITH ACOUSTICAL CAULKING. SUPPORT WITH TUCK TAPE &/OR METAL BANDING (TYPICAL)

SECURE PIPE HANGER SUPPORT ROD TO TOP OF CONCRETE HOLLOWCORE SLAB W/ 75 x 75 x 6.35 STEEL PLATE & LOCK WASHER/NUT - VERIFY LOAD



VARIES REFER TO MECH.

VARIES REFER TO MECH.

INACCESSIBLE VOID SPACE

PROVIDE SECOND LAYER (MIN. 300 mm SQUARE) OF DAMPROOFING MEMBRANE & CONTINUOUS CAULKING AT ALL PENETRATIONS (TYP.)

STAINLESS STEEL THREADED HANGER SUPPORT ROD BY MECHANICAL

THREADED SECONDARY CONNECTION FOR ADJUSTMENT OF TWO-PIECE HANGER SUPPORTS BY MECHANICAL

PROVIDE CROSS-CUT OPENINGS IN MEMBRANE FOR PENETRATIONS & SEAL W/ ACOUSTICAL CAULKING

PIPE HANGER W/ THREADED CONNECTION BY MECHANICAL

DRAINAGE PIPE BY MECHANICAL

REFER TO MECHANICAL FOR PIPE TRENCHING REQUIREMENTS UNDER MAIN FLOOR SLABS

1. EXCAVATE BASE OF TRENCH TO SUIT SLOPE OF WEEPING TILE TO SUMP PIT.
2. SET WEEPING TILE ON BASE OF EXCAVATION.

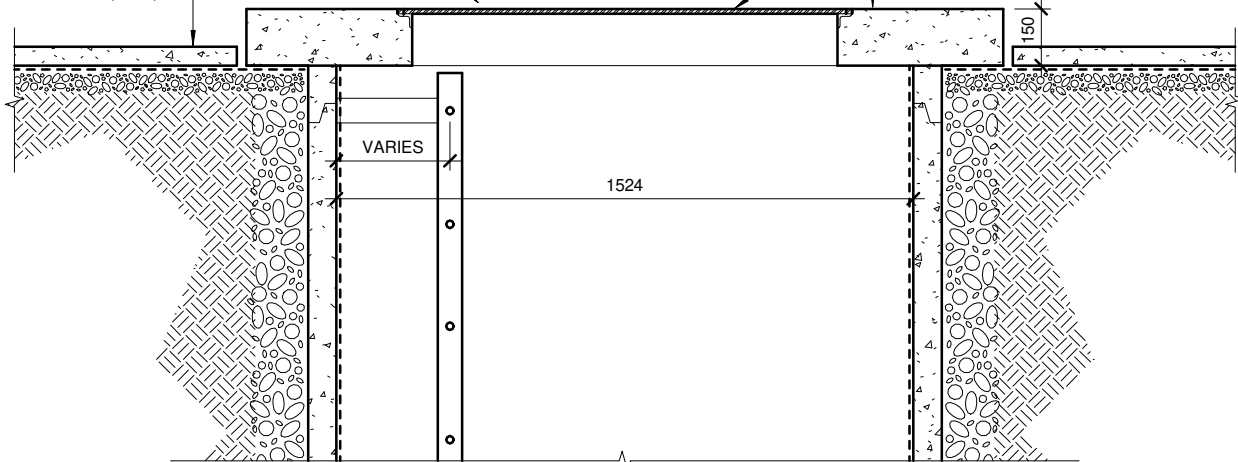
 THE CITY OF WINNIPEG ASSETS & PROJECT MANAGEMENT DEPARTMENT MUNICIPAL ACCOMMODATIONS DIVISION 3-65 GARRY STREET, R3C 4K4		PROJECT PEMBINA TRAILS COLLEGIATE VOCATIONAL WING 50 FRONTIER TRAIL, WINNIPEG, MANITOBA, R3Y 2H1			SHEET TITLE INACCESSIBLE VOID SPACE PIPE SUPPORT		
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				eFILE: 1929V_PTCV_ARCH_2023.rvt	PROJECT No: 2020-127		

SUMP PIT FRAME AND COVER - REFER TO PROJECT MANUAL SHEET DETAIL AP2.04

1200 mm SQ. CHECKER PLATE COVER

CONCRETE PRECAST PAVERS TO SUIT (TYP.)

2000 mm SQ. CONCRETE SLAB



65 x 10 mm GALV. STEEL STRINGERS

DRAINAGE PIPE SLOPED 2% MIN. - SEAL PENETRATIONS WITH GROUT (TYP.)

1524 mm INSIDE DIA. CONCRETE RINGS. VERIFY MIN. SIZE WITH MECHANICAL EQUIPMENT

65 x 10 mm GALV. STEEL SUPPORT BRACKETS SECURED TO PRECAST CONCRETE

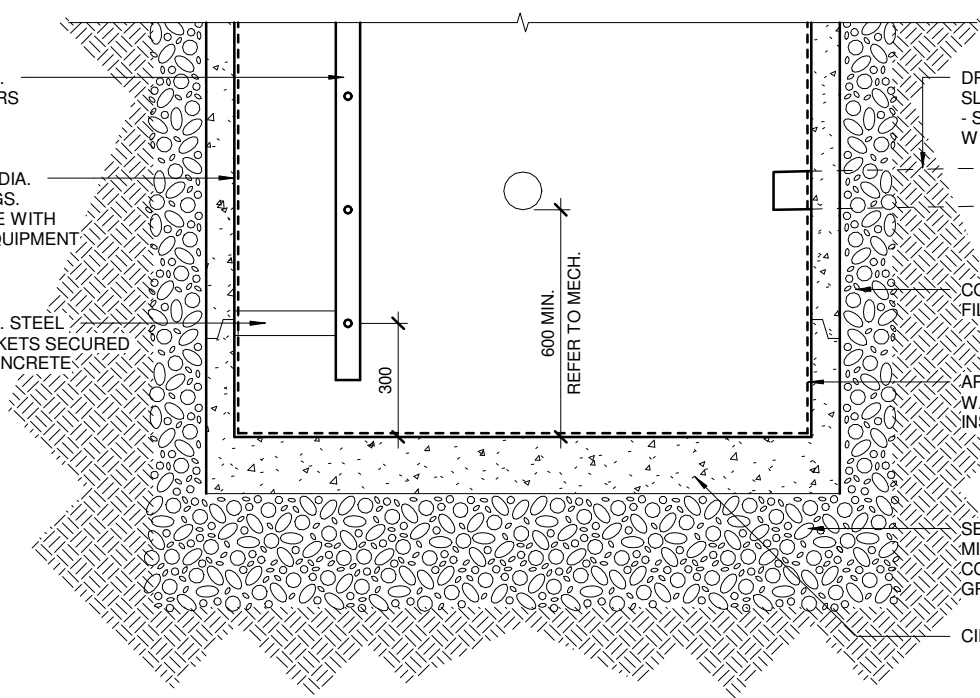
600 MIN. REFER TO MECH.

COMPACTED GRANULAR FILL AROUND SUMP PIT

APPLY CRYSTALLINE WATER PROOFING TO INSIDE OF PIT (TYP.)

SET PRECAST PIT ON MIN. 300 mm COMPACTED GRANULAR FILL

CIP BOTTOM (OPTIONAL)



NOTE:

1. PRECAST CONCRETE SUMP PIT CATCH BASIN MIN. INSIDE DIA. 1524 mm C/W HEAVY DUTY GALVANIZED STEEL LID AND CONTINUOUS GASKET
2. OVERALL SUMP PIT DEPTH TO BE SET BY THE CONTRACTOR WHILE MAINTAINING 2% MIN. WEEPING TILE SLOPE AND 600 mm FROM THE CENTER OF THE LOWEST WEEPING TILE INLET TO BOTTOM OF PIT
3. MINIMUM PIT SIZE SHOWN / ONE PIECE ACCEPTABLE
4. GALVANIZED LADDER RUNGS OPTIONAL BY PRECAST SUPPLIER.



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PROJECT
PEMBINA TRAILS COLLEGIATE
VOCATIONAL WING
50 FRONTIER TRAIL, WINNIPEG, MANITOBA, R3Y 2H1

SHEET TITLE
PRECAST CONCRETE SUMP PIT SECTION

DRAWN BY:
HW

CHECKED BY:
HW

DESIGNED BY:
HW

APPROVED BY:
JT

DATE:
2024.04.01
eFILE:
1929V_PTCV_ARCH_2023.rvt

SCALE:
1 : 20

PROJECT No: 2020-127

SHEET No:
AP2.03

PROVIDE GASKET TO SEAL ALL JOINTS & PENETRATIONS (TYP.)

HINGED COVER

FIXED COVER

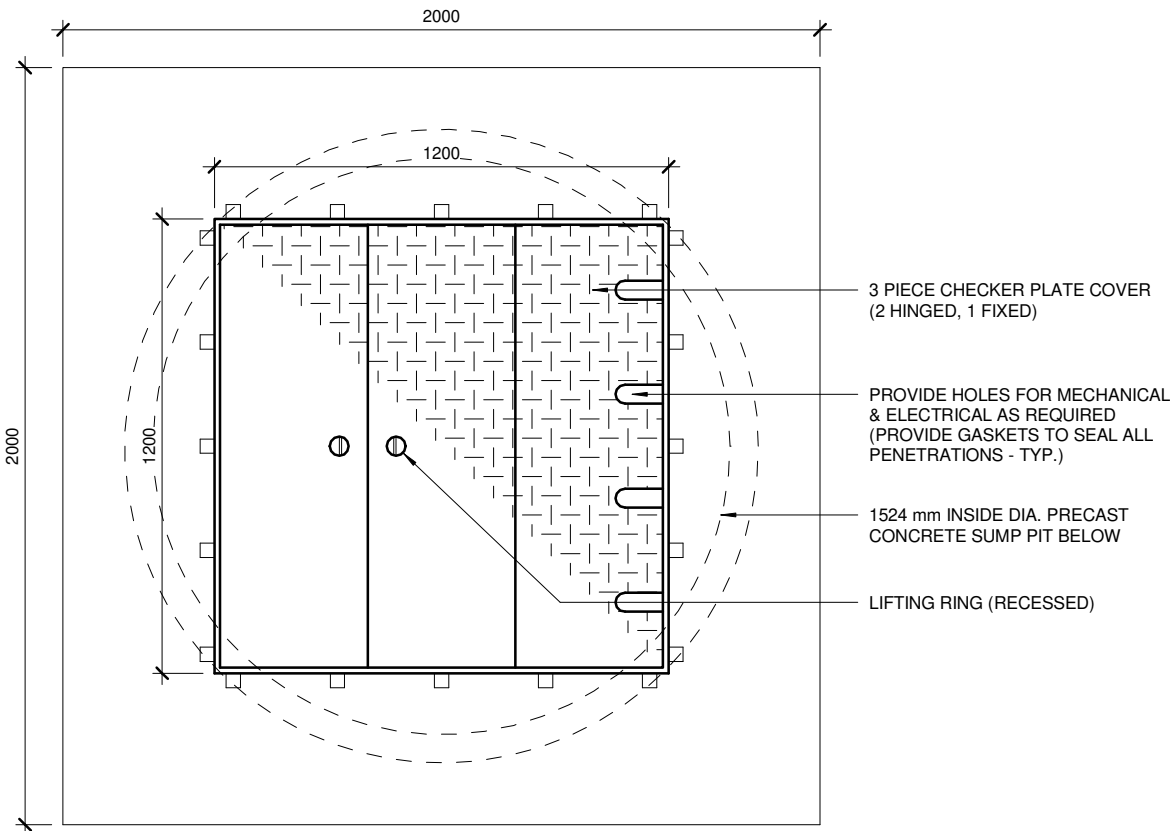
38 x 4 mm ANCHOR
610 mm O.C. MIN.

38 x 38 x 6 mm
ANGLE FRAME

WELD PLATE AT BUTT JOINT

TYPICAL FRAME DETAIL

SCALE 1 : 5



NOTE:

PRECAST CONCRETE SUMP PIT MIN. INSIDE DIA. 1524 mm
C/W HEAVY DUTY GALVANIZED STEEL LID AND CONTINUOUS GASKET



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PROJECT
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VOCATIONAL WING
50 FRONTIER TRAIL, WINNIPEG, MANITOBA, R3Y 2H1

SHEET TITLE
PRECAST CONCRETE SUMP PIT
FRAME & COVER

DRAWN BY:
HW

CHECKED BY:
HW

DESIGNED BY:
HW

APPROVED BY:
JT

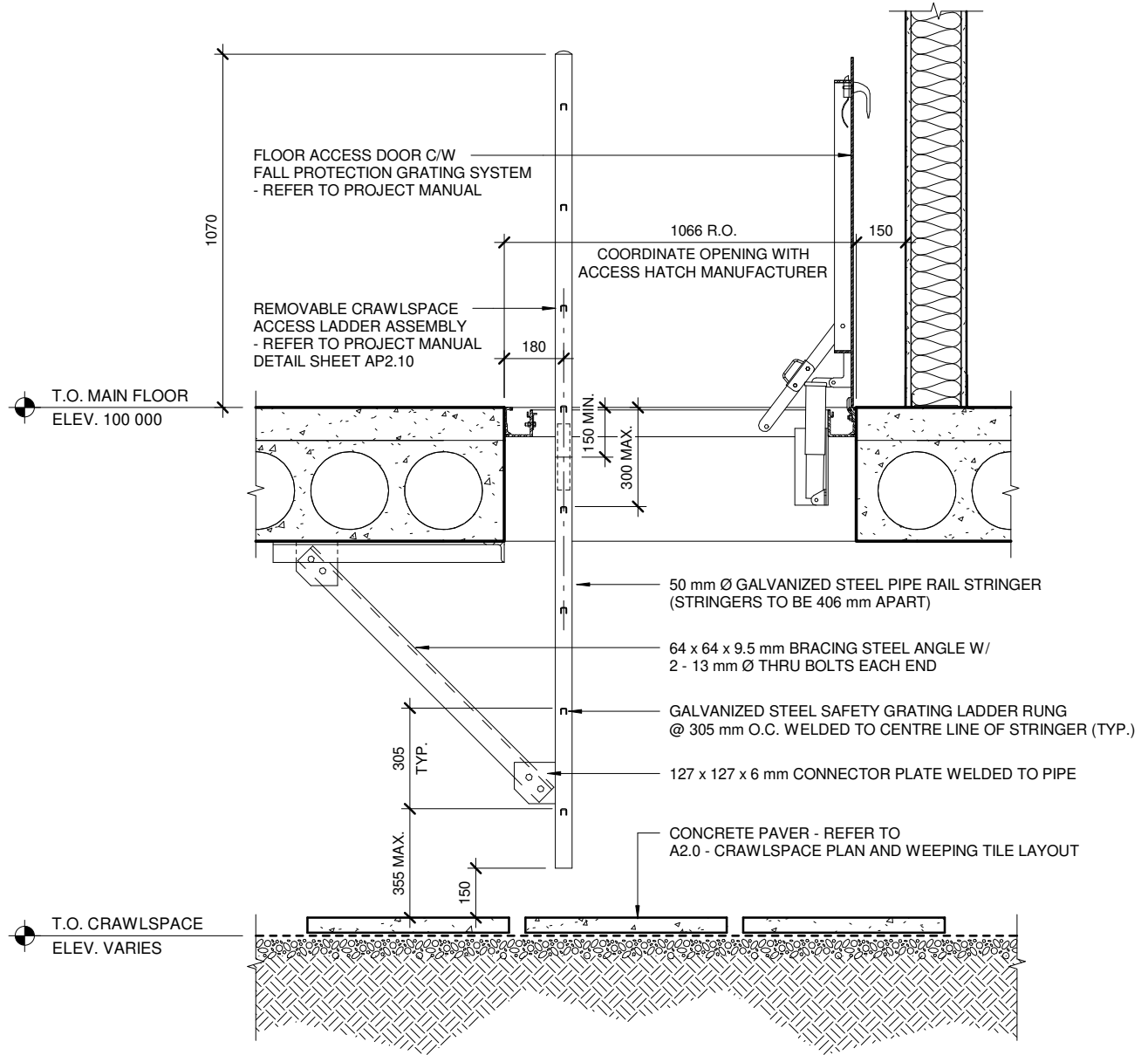
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SCALE:
As indicated

PROJECT No: 2020-127

SHEET No:

AP2.04



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PROJECT
PEMBINA TRAILS COLLEGIATE
VOCATIONAL WING
50 FRONTIER TRAIL, WINNIPEG, MANITOBA, R3Y 2H1

SHEET TITLE
CRAWLSPACE ACCESS HATCH

DRAWN BY:
HW

CHECKED BY:
HW

DESIGNED BY:
HW

APPROVED BY:
JT

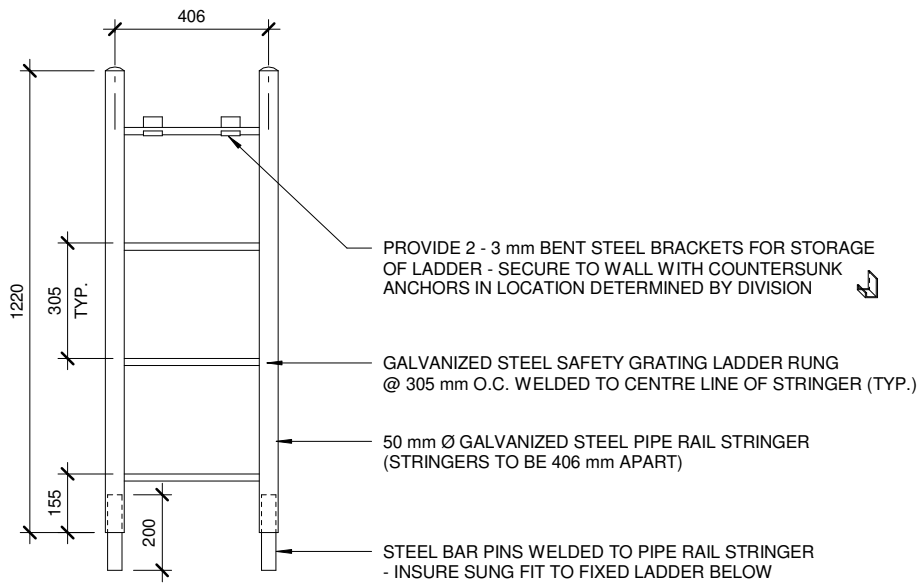
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PROJECT No: 2020-127

SHEET No:

AP2.05



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PROJECT
 PEMBINA TRAILS COLLEGIATE
 VOCATIONAL WING
 50 FRONTIER TRAIL, WINNIPEG, MANITOBA, R3Y 2H1

SHEET TITLE
 CRAWLSPACE ACCESS HATCH -
 REMOVABLE LADDER

DRAWN BY:

HW

CHECKED BY:

HW

DESIGNED BY:

HW

APPROVED BY:

JT

DATE:

2024.04.01

eFILE:

1929V_PTCV_ARCH_2023.rvt

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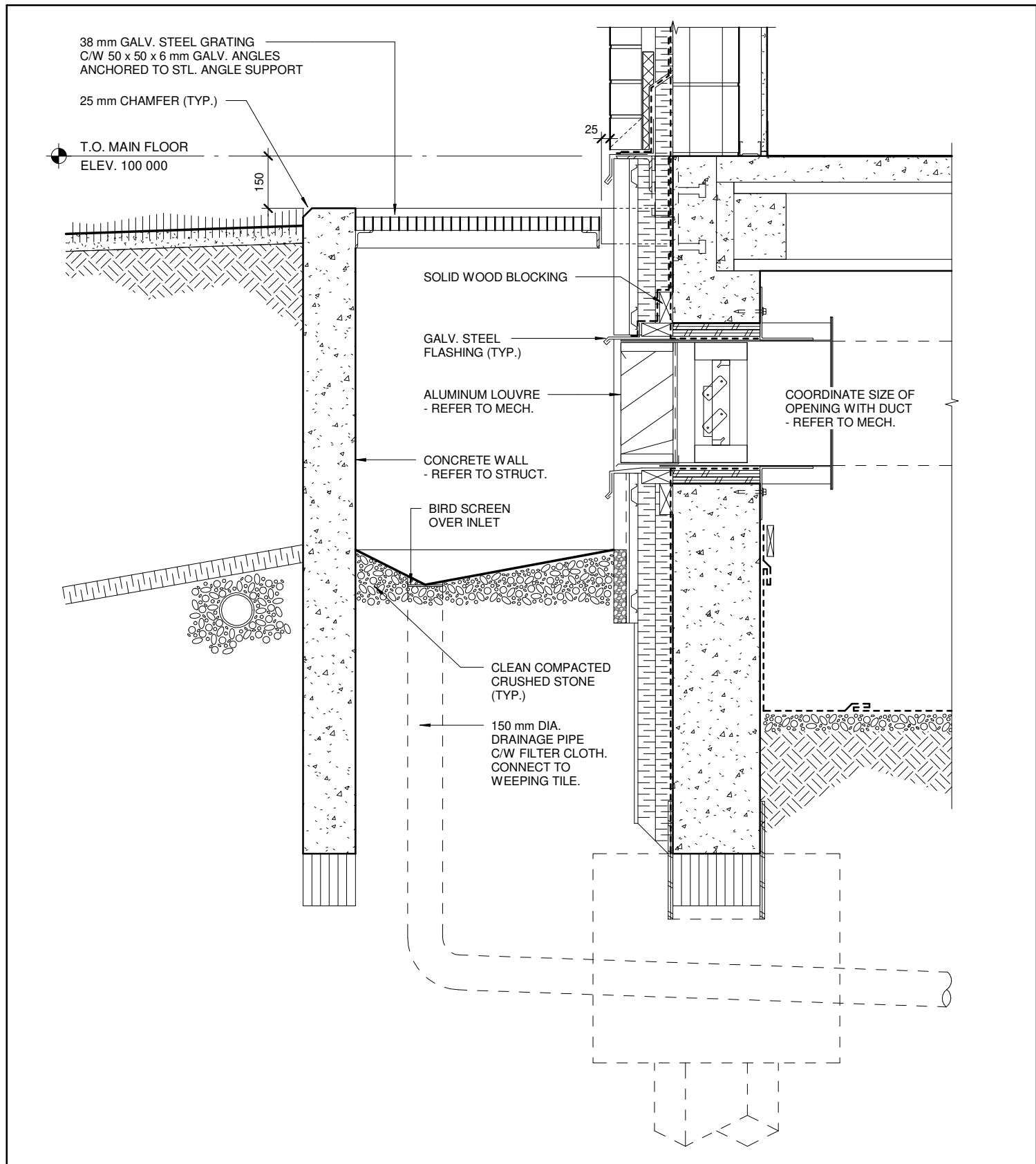
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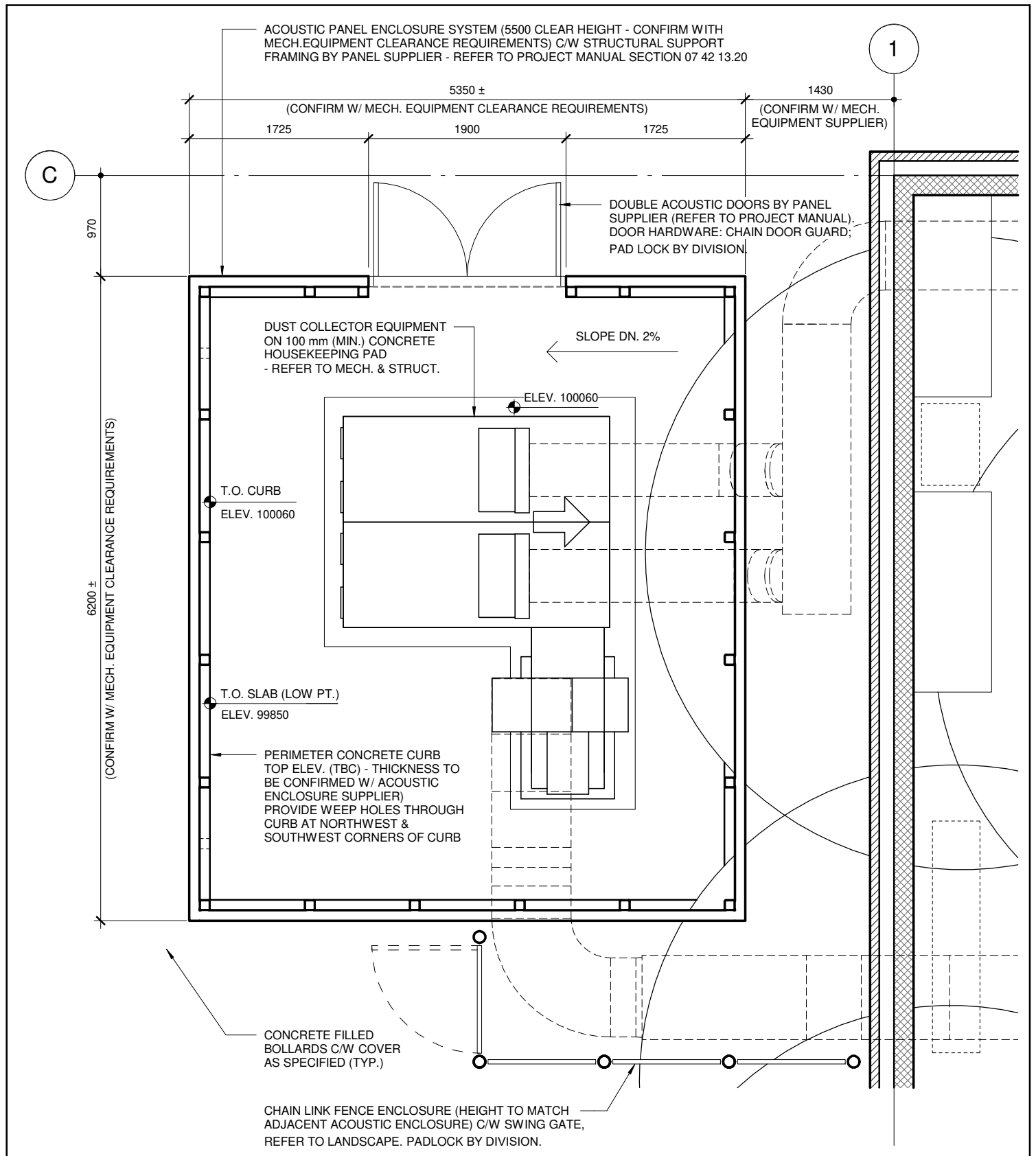
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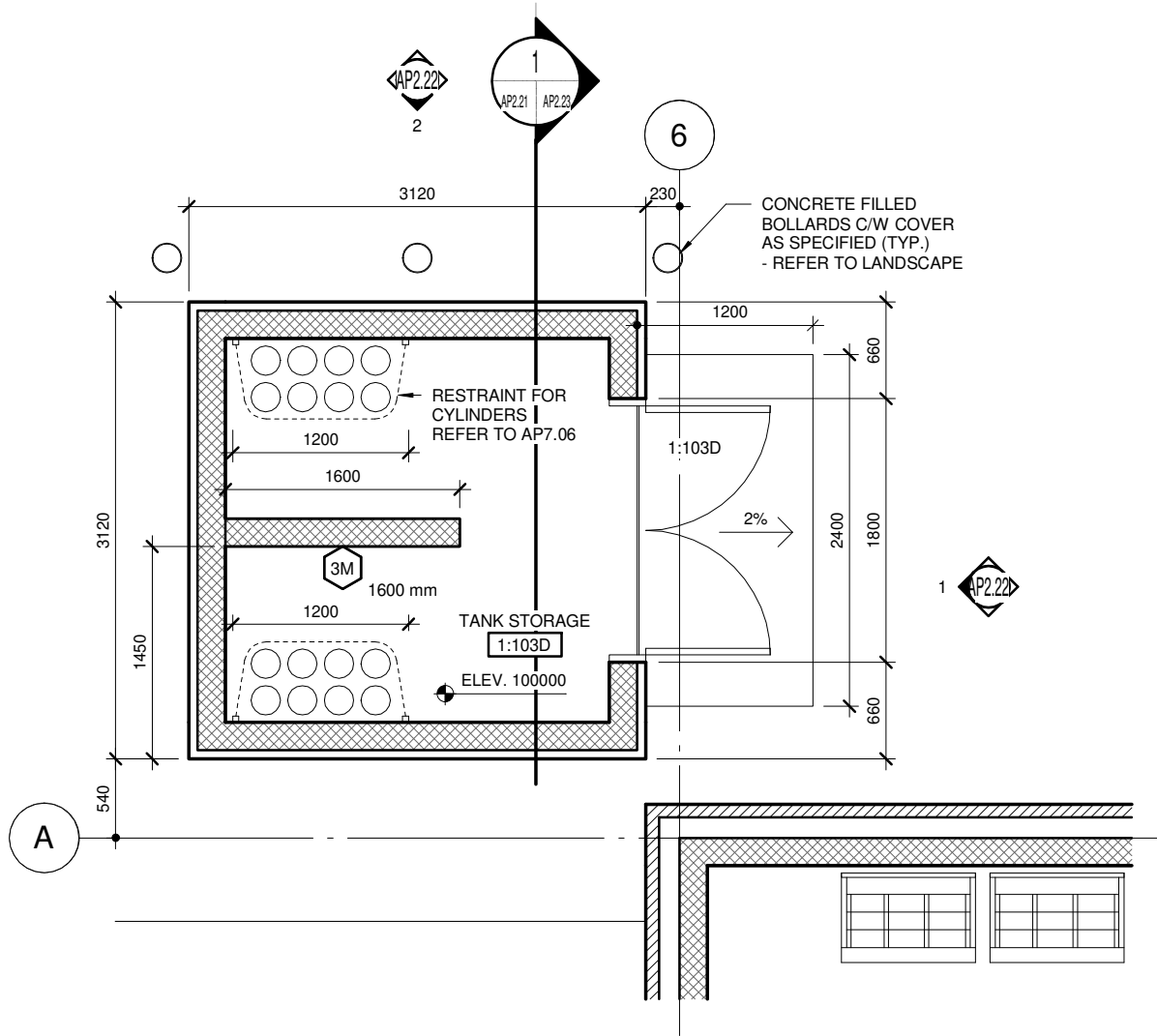
AP2.06



 <p>THE CITY OF WINNIPEG ASSETS & PROJECT MANAGEMENT DEPARTMENT MUNICIPAL ACCOMMODATIONS DIVISION 3-65 GARRY STREET, R3C 4K4</p>		<p>PROJECT PEMBINA TRAILS COLLEGIATE VOCATIONAL WING 50 FRONTIER TRAIL, WINNIPEG, MANITOBA, R3Y 2H1</p>			<p>SHEET TITLE SECTION THROUGH CONCRETE AREAWAY</p>	
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				eFILE: 1929V_PTCV_ARCH_2023.rvt	PROJECT No: 2020-127	

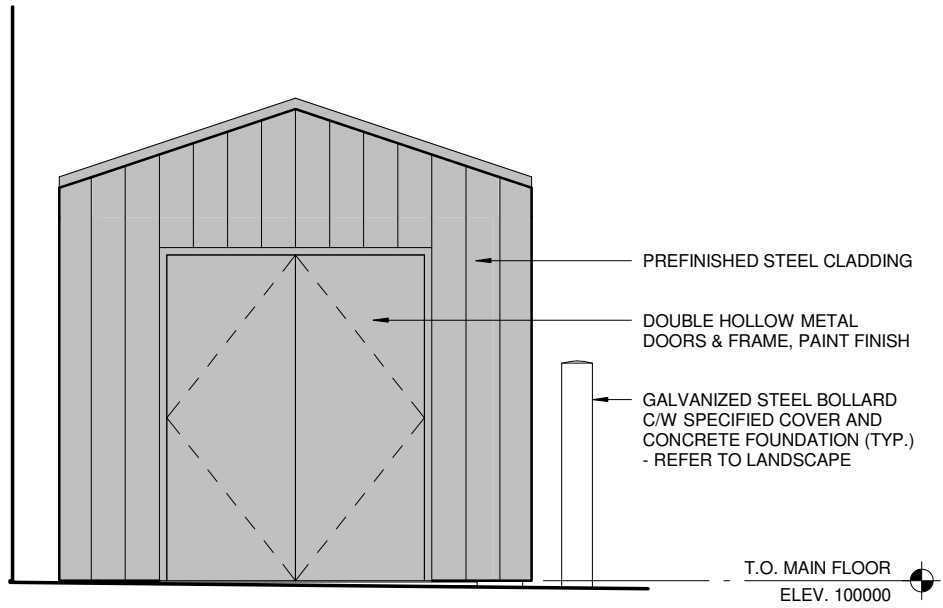


 <p>THE CITY OF WINNIPEG ASSETS & PROJECT MANAGEMENT DEPARTMENT MUNICIPAL ACCOMMODATIONS DIVISION 3-65 GARRY STREET, R3C 4K4</p>		<p>PROJECT PEMBINA TRAILS COLLEGIATE VOCATIONAL WING 50 FRONTIER TRAIL, WINNIPEG, MANITOBA, R3Y 2H1</p>			<p>SHEET TITLE DUST COLLECTOR - ACOUSTIC ENCLOSURE ENLARGED PLAN</p>	
DRAWN BY:	CHECKED BY:	DESIGNED BY:	APPROVED BY:	DATE:	SCALE:	SHEET No:
HW	HW	HW	JT	2024.04.01	1 : 50	AP2.20
				eFILE: 1929V_PTCV_ARCH_2023.rvt	PROJECT No: 2020-127	



 THE CITY OF WINNIPEG ASSETS & PROJECT MANAGEMENT DEPARTMENT MUNICIPAL ACCOMMODATIONS DIVISION 3-65 GARRY STREET, R3C 4K4		PROJECT PEMBINA TRAILS COLLEGIATE VOCATIONAL WING 50 FRONTIER TRAIL, WINNIPEG, MANITOBA, R3Y 2H1			SHEET TITLE TANK STORAGE SHED ENLARGED PLAN		
DRAWN BY:	CHECKED BY:	DESIGNED BY:	APPROVED BY:	DATE:	SCALE:	SHEET No:	
HW	HW	HW	JT	2024.04.01	1:50	AP2.21	
				eFILE: 1929V_PTCV_ARCH_2023.rvt	PROJECT No: 2020-127		

A



EAST ELEVATION

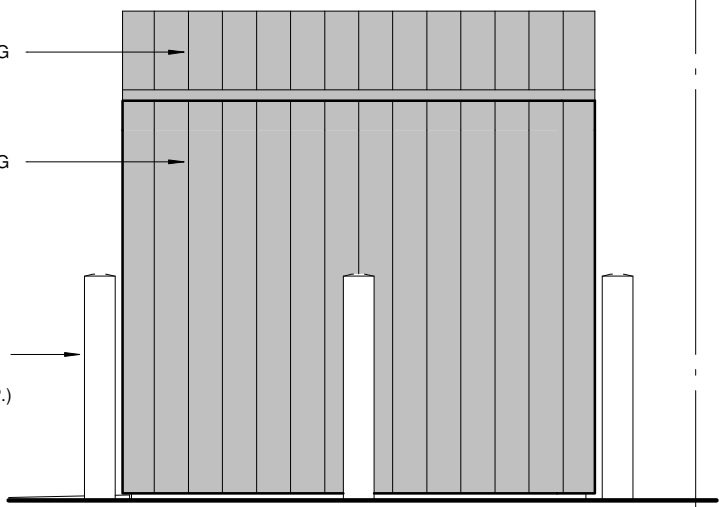
SCALE 1 : 50

5

PREFINISHED STEEL CLADDING


PREFINISHED STEEL CLADDING

GALVANIZED STEEL BOLLARD
C/W SPECIFIED COVER AND
CONCRETE FOUNDATION (TYP.)
- REFER TO LANDSCAPE



NORTH ELEVATION

SCALE 1 : 50


 THE CITY OF WINNIPEG
 ASSETS & PROJECT MANAGEMENT
 DEPARTMENT
 MUNICIPAL ACCOMMODATIONS DIVISION
 3-65 GARRY STREET, R3C 4K4

PROJECT
 PEMBINA TRAILS COLLEGIATE
 VOCATIONAL WING
 50 FRONTIER TRAIL, WINNIPEG, MANITOBA, R3Y 2H1

SHEET TITLE
 TANK STORAGE SHED
 ELEVATIONS

DRAWN BY:
 HW

CHECKED BY:
 HW

DESIGNED BY:
 HW

APPROVED BY:
 JT

DATE:
 2024.04.01
 eFILE:
 1929V_PTCV_ARCH_2023.rvt

SCALE:
 1 : 50
 PROJECT No: 2020-127

SHEET No:
AP2.22

A

ROOF CONSTRUCTION:

PREFINISHED STEEL CLADDING
 22 mm FURRING CHANNELS @ 400 mm O.C.
 AIR/VAPOUR BARRIER MEMBRANE
 16 mm PRESURE TREATED PLYWOOD
 OVER PRE-ENGINEERED WOOD JOISTS @ 600 mm O.C.

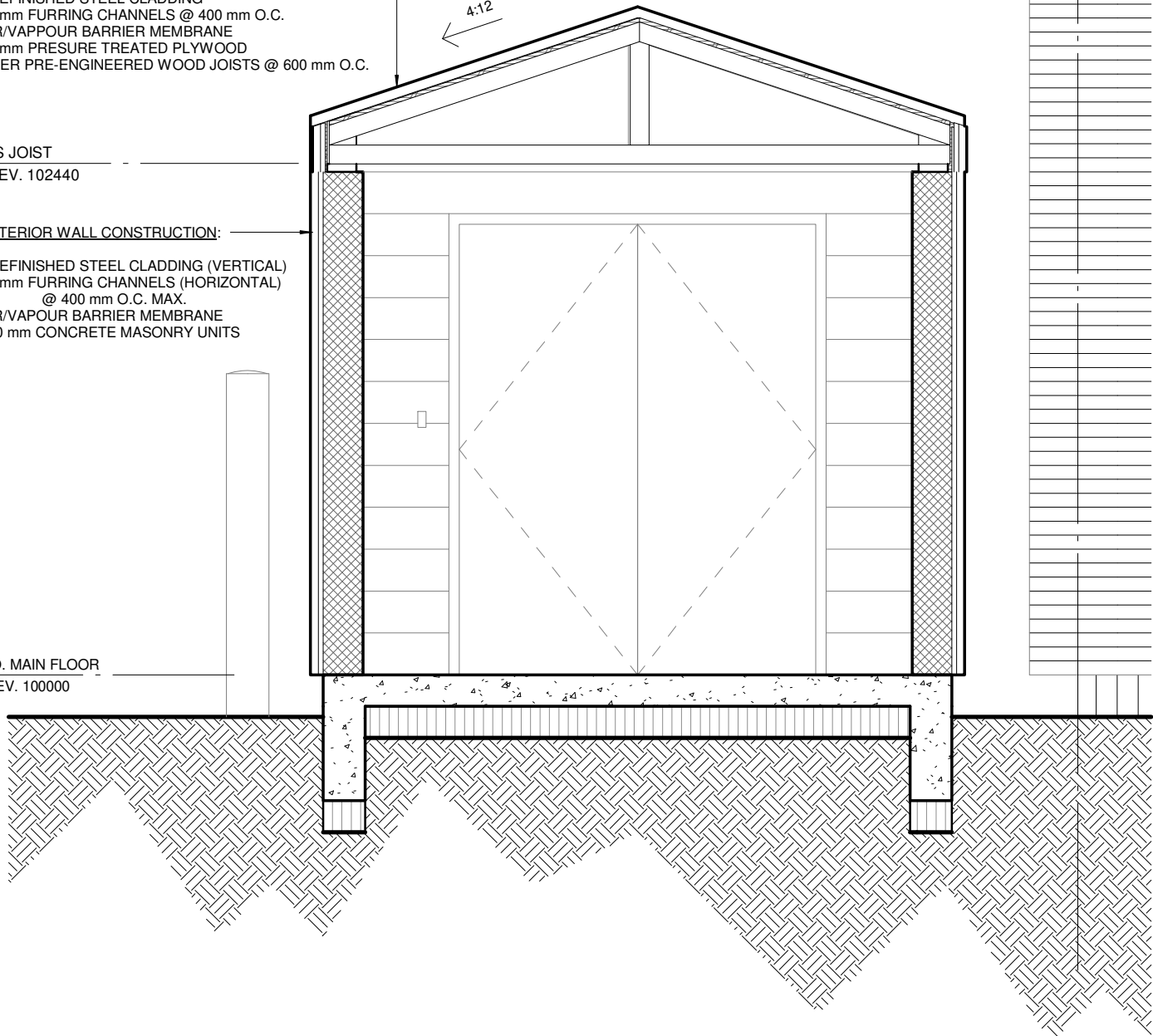
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U/S JOIST
 ELEV. 102440

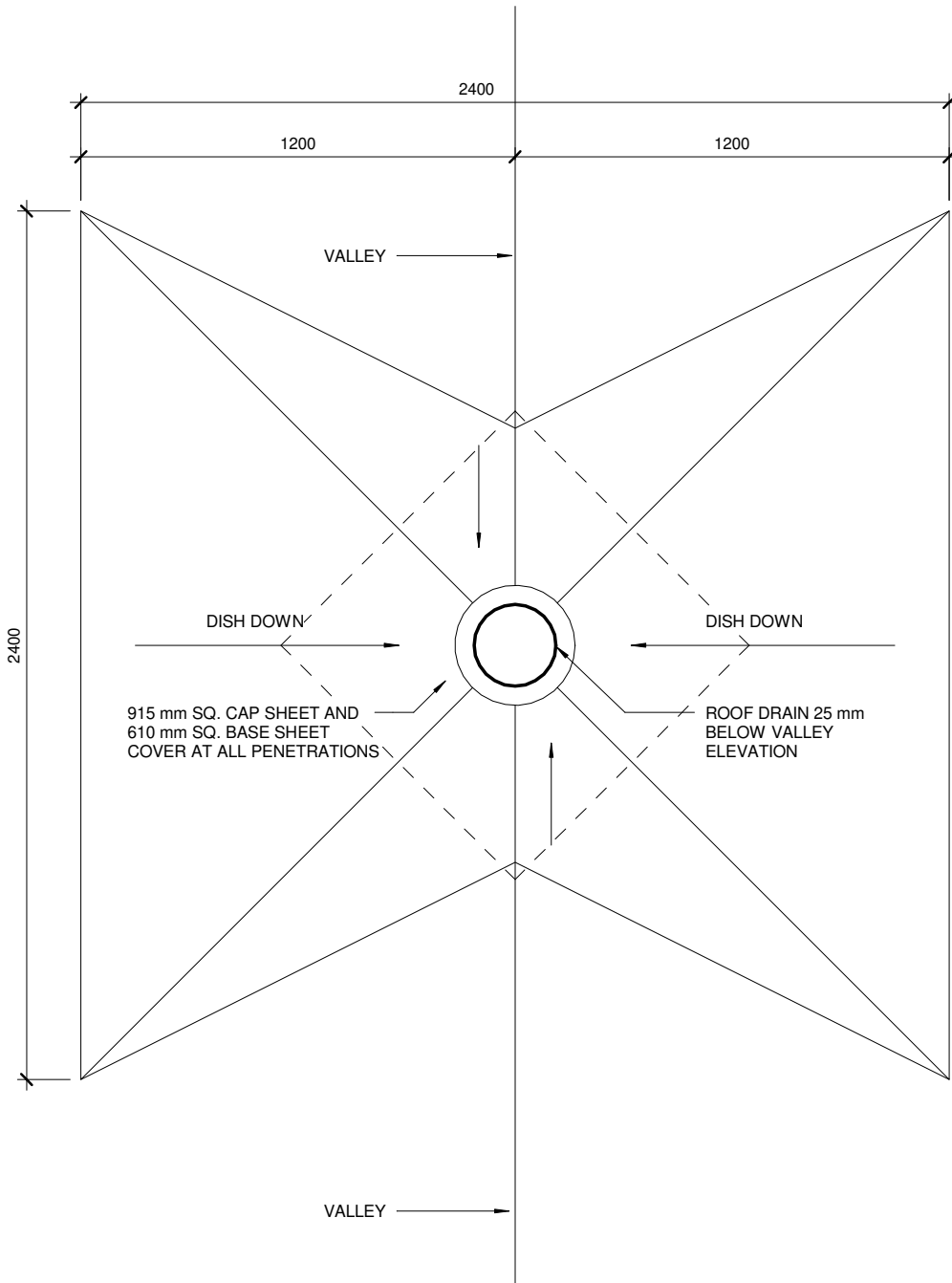
EXTERIOR WALL CONSTRUCTION:

PREFINISHED STEEL CLADDING (VERTICAL)
 22 mm FURRING CHANNELS (HORIZONTAL)
 @ 400 mm O.C. MAX.
 AIR/VAPOUR BARRIER MEMBRANE
 190 mm CONCRETE MASONRY UNITS

T.O. MAIN FLOOR
 ELEV. 100000

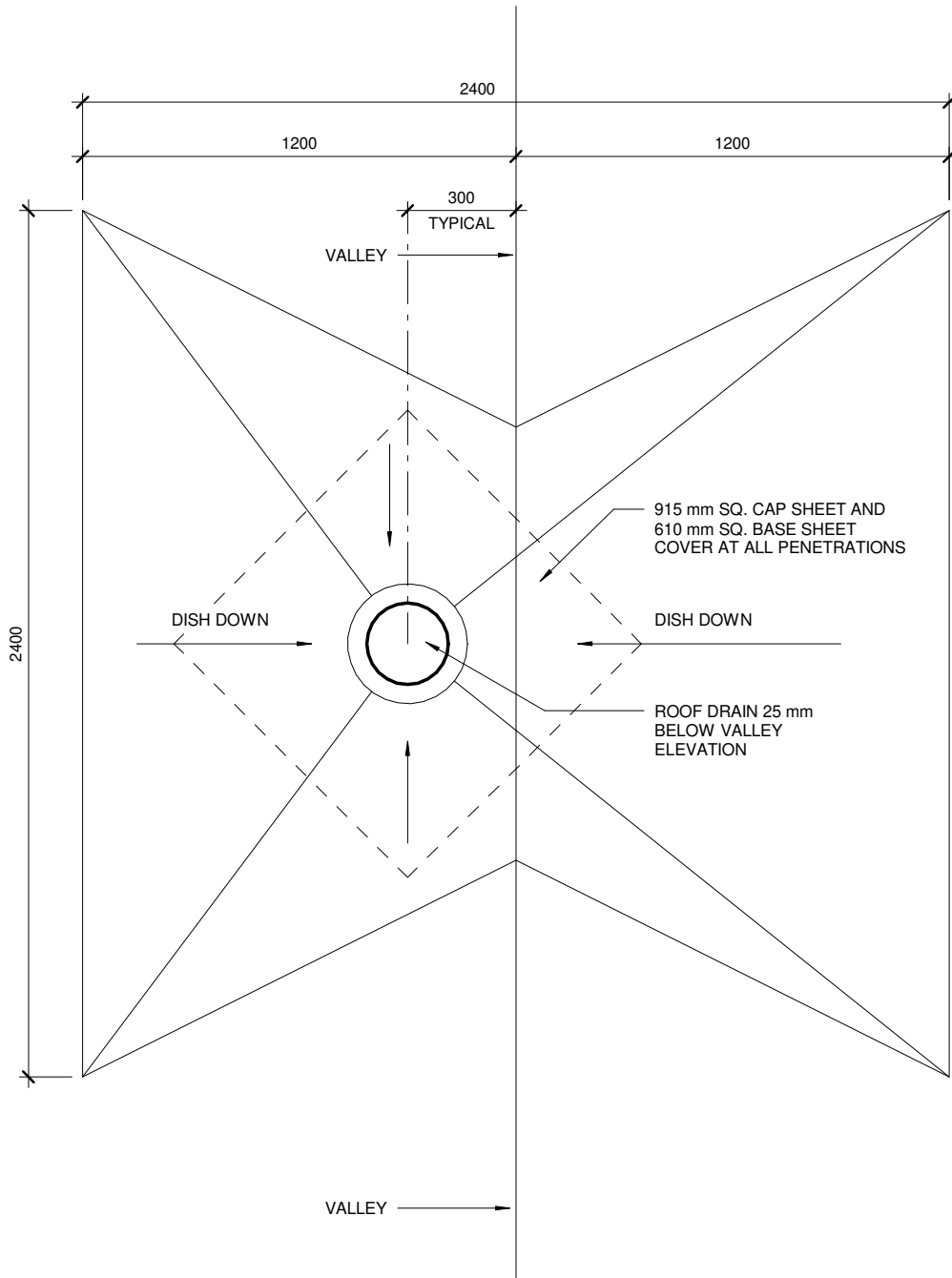


 THE CITY OF WINNIPEG ASSETS & PROJECT MANAGEMENT DEPARTMENT MUNICIPAL ACCOMMODATIONS DIVISION 3-65 GARRY STREET, R3C 4K4		PROJECT PEMBINA TRAILS COLLEGIATE VOCATIONAL WING 50 FRONTIER TRAIL, WINNIPEG, MANITOBA, R3Y 2H1			SHEET TITLE TANK STORAGE SHED SECTION		
DRAWN BY:	CHECKED BY:	DESIGNED BY:	APPROVED BY:	DATE:	SCALE:	SHEET No:	
HW	HW	HW	JT	2024.04.01	1:30	AP2.23	
				eFILE: 1929V_PTCV_ARCH_2023.rvt	PROJECT No: 2020-127		



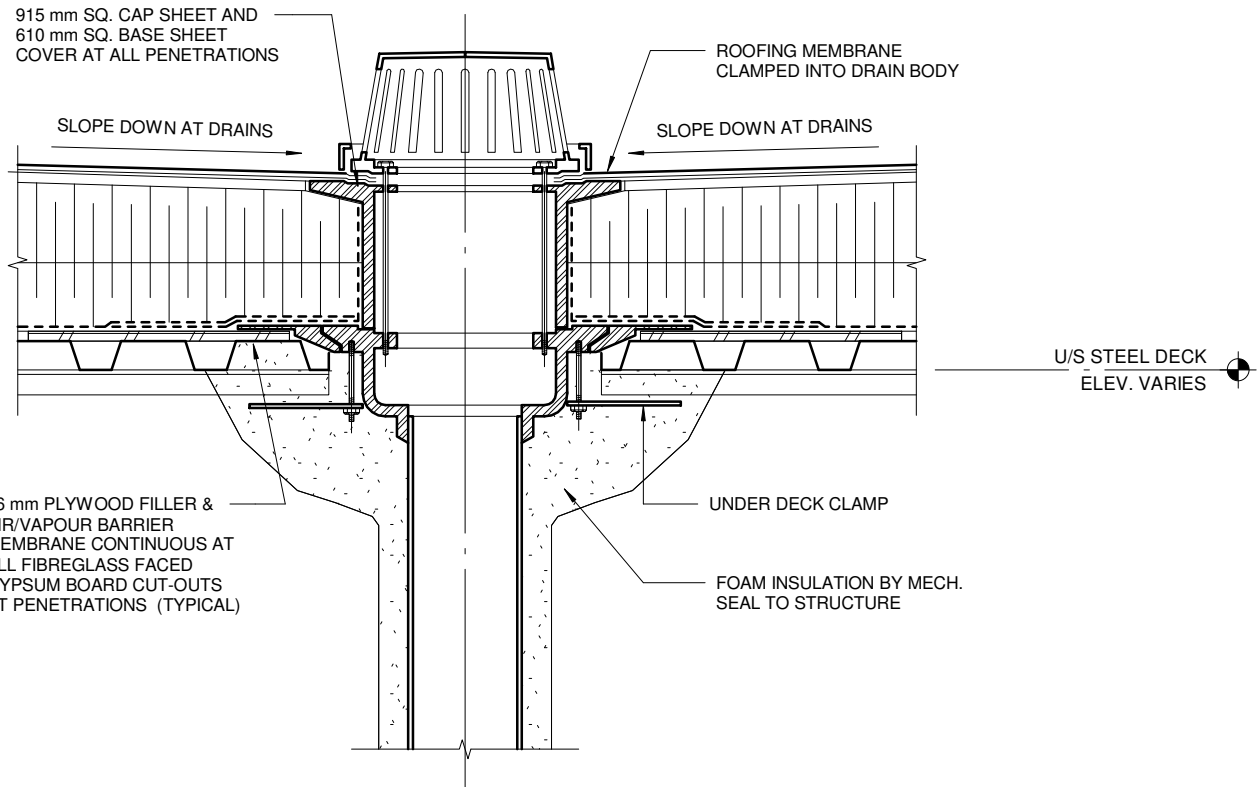
NOTE:
 DISH ROOF DRAIN DOWN 25 mm ± FROM VALLEY ELEVATION AT ALL DRAINS 2400 x 2400 mm

 THE CITY OF WINNIPEG ASSETS & PROJECT MANAGEMENT DEPARTMENT MUNICIPAL ACCOMMODATIONS DIVISION 3-65 GARRY STREET, R3C 4K4		PROJECT PEMBINA TRAILS COLLEGIATE VOCATIONAL WING 50 FRONTIER TRAIL, WINNIPEG, MANITOBA, R3Y 2H1			SHEET TITLE TYPICAL ROOF DRAIN BASIN	
DRAWN BY:	CHECKED BY:	DESIGNED BY:	APPROVED BY:	DATE:	SCALE:	SHEET No:
HW	HW	HW	JT	2024.04.01	1:20	AP2.50
				eFILE: 1929V_PTCV_ARCH_2023.rvt	PROJECT No: 2020-127	



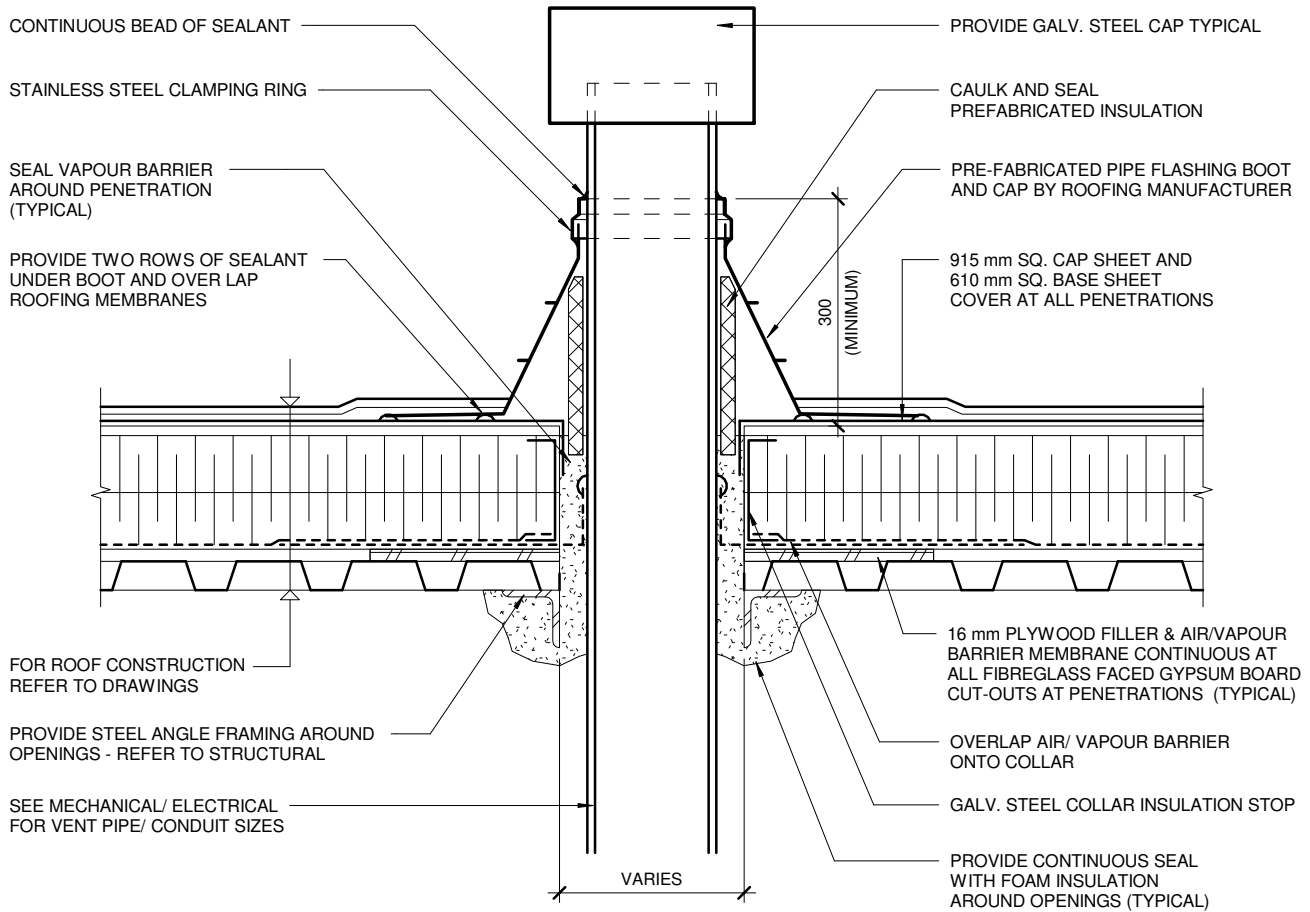
NOTE:
 DISH ROOF DRAIN DOWN 25 mm ± FROM VALLEY ELEVATION AT ALL DRAINS 2400 x 2400 mm

 THE CITY OF WINNIPEG ASSETS & PROJECT MANAGEMENT DEPARTMENT MUNICIPAL ACCOMMODATIONS DIVISION 3-65 GARRY STREET, R3C 4K4		PROJECT PEMBINA TRAILS COLLEGIATE VOCATIONAL WING 50 FRONTIER TRAIL, WINNIPEG, MANITOBA, R3Y 2H1			SHEET TITLE ROOF DRAIN BASIN STRUCTURAL STEEL BELOW		
DRAWN BY:	CHECKED BY:	DESIGNED BY:	APPROVED BY:	DATE:	SCALE:	SHEET No:	
HW	HW	HW	JT	2024.04.01	1:20	AP2.51	
				eFILE: 1929V_PTCV_ARCH_2023.rvt	PROJECT No: 2020-127		



NOTE:
 DISH ROOF DRAIN DOWN 25 mm ± AT ALL DRAINS 2400 x 2400 mm

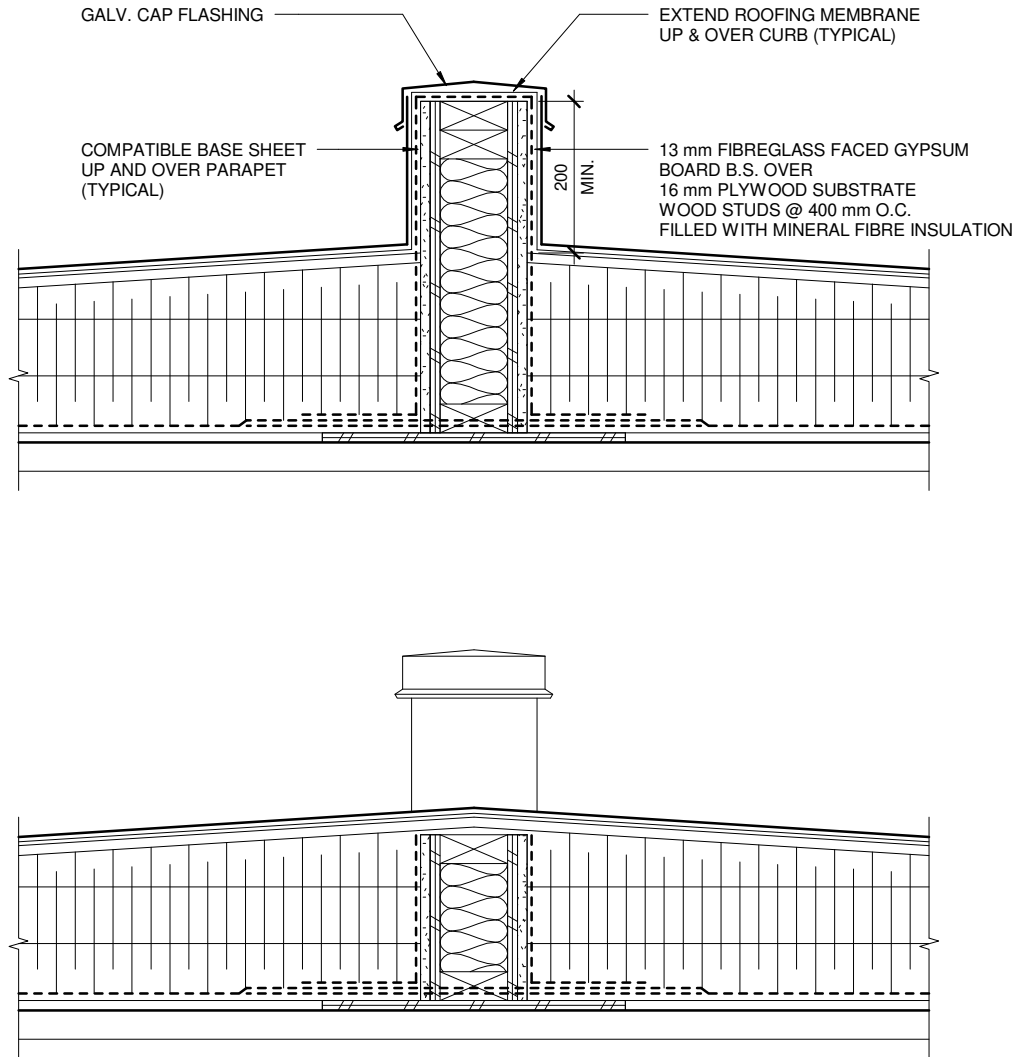
 THE CITY OF WINNIPEG ASSETS & PROJECT MANAGEMENT DEPARTMENT MUNICIPAL ACCOMMODATIONS DIVISION 3-65 GARRY STREET, R3C 4K4		PROJECT PEMBINA TRAILS COLLEGIATE VOCATIONAL WING 50 FRONTIER TRAIL, WINNIPEG, MANITOBA, R3Y 2H1			SHEET TITLE ROOF DRAIN DETAIL	
DRAWN BY: HW	CHECKED BY: HW	DESIGNED BY: HW	APPROVED BY: JT	DATE: 2024.04.01	SCALE: 1 : 10	SHEET No: AP2.52
				eFILE: 1929V_PTCV_ARCH_2023.rvt	PROJECT No: 2020-127	



NOTE:

1. PIPE SURFACE MUST BE FREE OF ALL RUST, GREASE, ETC.
2. PIPE MUST BE ANCHORED TO BOTTOM SIDE OF ROOF STRUCTURE TO ASSURE STABILITY.
3. PROVIDE (600 mm X 600 mm) ± x 16 mm PLYWOOD OVER ALL ROOF PENETRATIONS. CENTRE ON OPENINGS SIZE MAY VARY ENSURE BEARING MID SPAN OF FLUTES (TYP.)

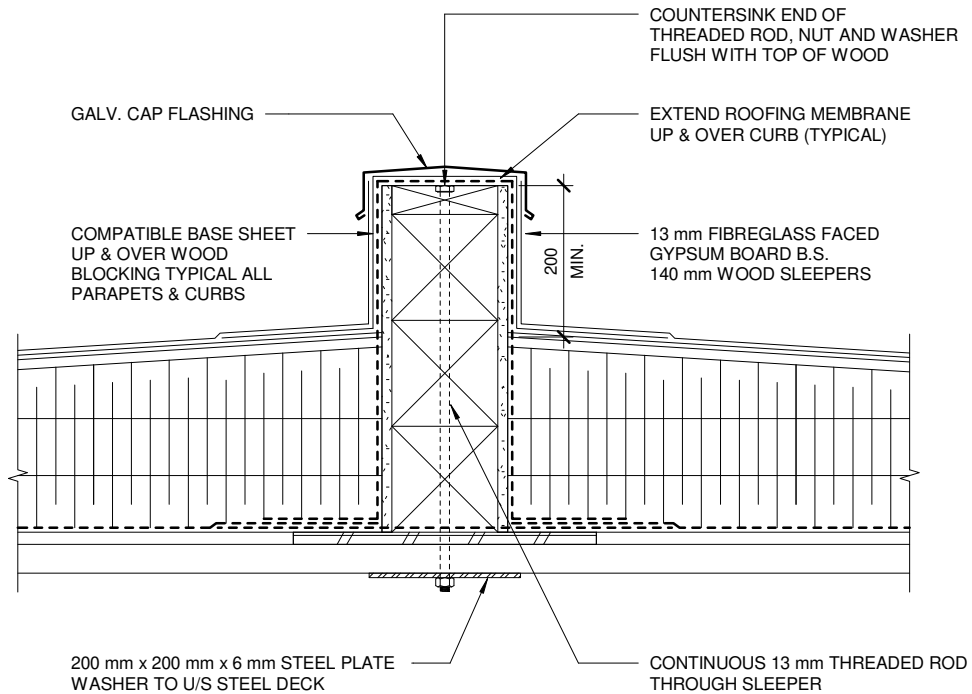
 <p>THE CITY OF WINNIPEG ASSETS & PROJECT MANAGEMENT DEPARTMENT MUNICIPAL ACCOMMODATIONS DIVISION 3-65 GARRY STREET, R3C 4K4</p>		<p>PROJECT PEMBINA TRAILS COLLEGIATE VOCATIONAL WING 50 FRONTIER TRAIL, WINNIPEG, MANITOBA, R3Y 2H1</p>			<p>SHEET TITLE TYPICAL ROOF VENT (CONDUIT DETAIL SIMILAR)</p>		
DRAWN BY: HW	CHECKED BY: HW	DESIGNED BY: HW	APPROVED BY: JT	DATE: 2024.04.01	SCALE: 1 : 10	SHEET No:	
				eFILE: 1929V_PTCV_ARCH_2023.rvt	PROJECT No: 2020-127	AP2.53	



NOTE:

1. PROVIDE 16 mm x 400 mm (MIN.) PLYWOOD NAILING STRIPS UNDER CURBS (ALL JOINTS SUPPORTED)
2. AIR/VAPOUR BARRIER MEMBRANE TO BE CONTINUOUS UNDER ALL CURBS AND PARAPETS (TYPICAL)
3. PROVIDE 400 mm OPENING THRU CONTROL JOINT C/W DOUBLE BASE SHEET - SEE DRAWING SHEET A2.3

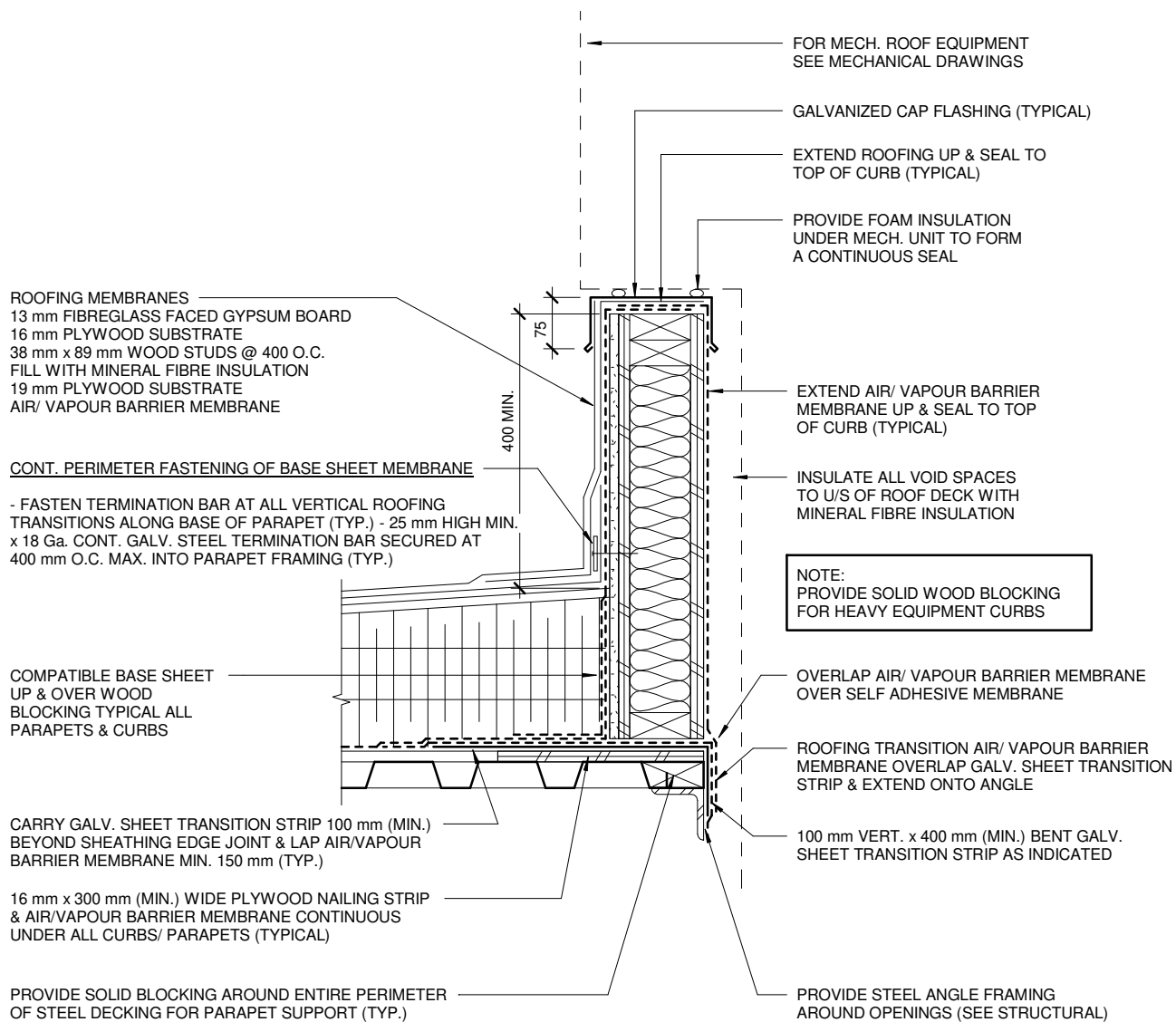
 THE CITY OF WINNIPEG ASSETS & PROJECT MANAGEMENT DEPARTMENT MUNICIPAL ACCOMMODATIONS DIVISION 3-65 GARRY STREET, R3C 4K4		PROJECT PEMBINA TRAILS COLLEGIATE VOCATIONAL WING 50 FRONTIER TRAIL, WINNIPEG, MANITOBA, R3Y 2H1			SHEET TITLE CONTROL JOINT DETAILS		
DRAWN BY:	CHECKED BY:	DESIGNED BY:	APPROVED BY:	DATE:	SCALE:	SHEET No:	
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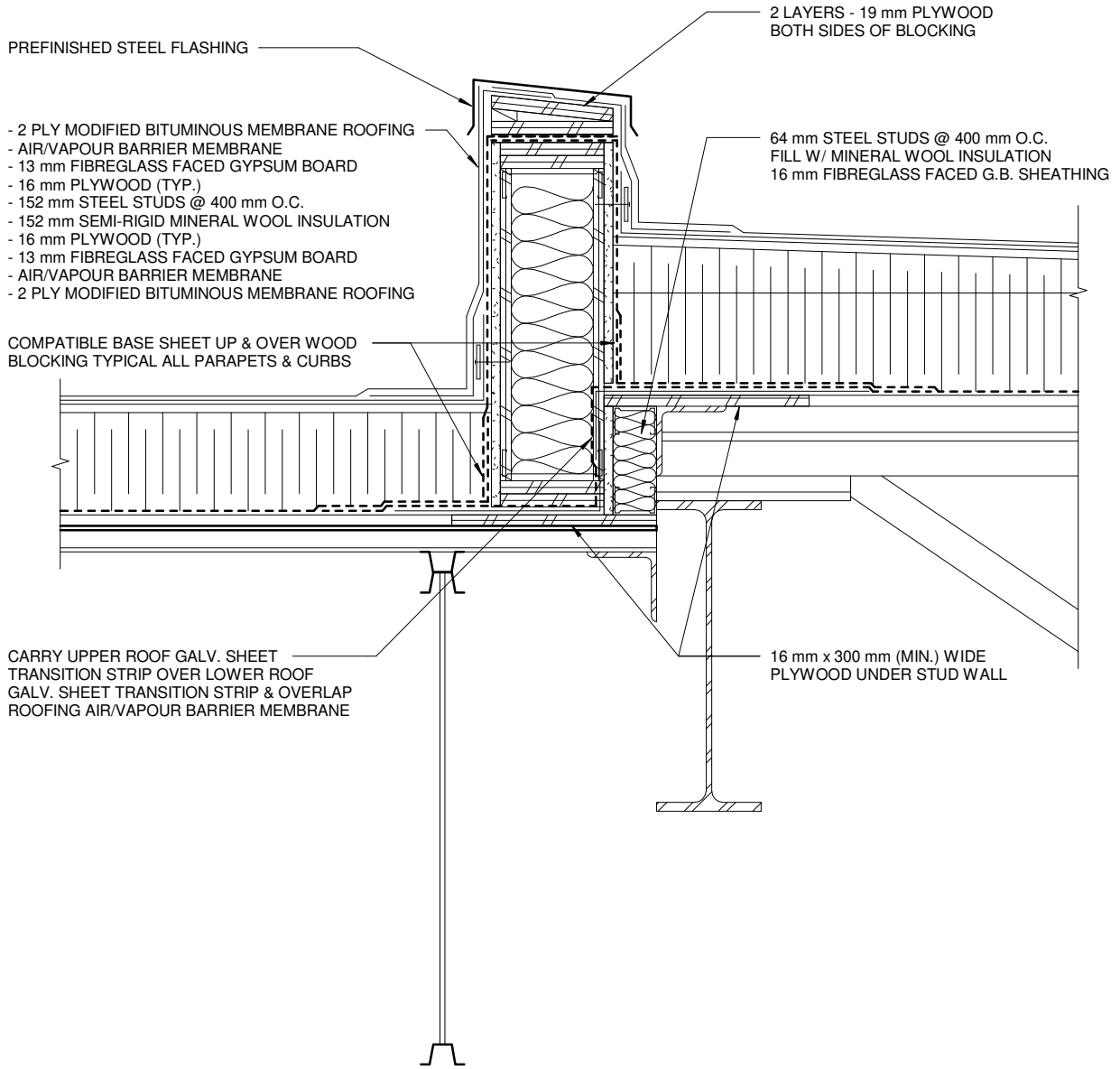
NOTE:

- PROVIDE 16 mm x 400 mm (MIN.) PLYWOOD NAILING STRIPS UNDER CURBS (ALL JOINTS SUPPORTED)
- AIR/VAPOUR BARRIER MEMBRANE TO BE CONTINUOUS UNDER ALL CURBS AND PARAPETS (TYPICAL)
- PROVIDE ONE THREADED ROD EACH END OF EACH SLEEPER (TYPICAL)

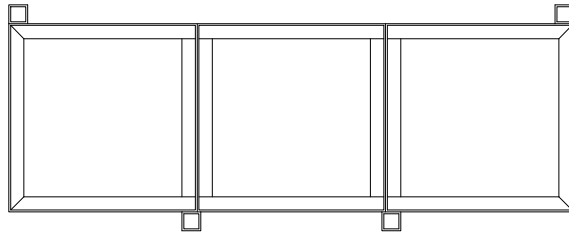
 THE CITY OF WINNIPEG ASSETS & PROJECT MANAGEMENT DEPARTMENT MUNICIPAL ACCOMMODATIONS DIVISION 3-65 GARRY STREET, R3C 4K4		PROJECT PEMBINA TRAILS COLLEGIATE VOCATIONAL WING 50 FRONTIER TRAIL, WINNIPEG, MANITOBA, R3Y 2H1			SHEET TITLE ROOF EQUIPMENT CURB DETAIL		
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HW	HW	HW	JT	2024.04.01	1 : 10	AP2.55	
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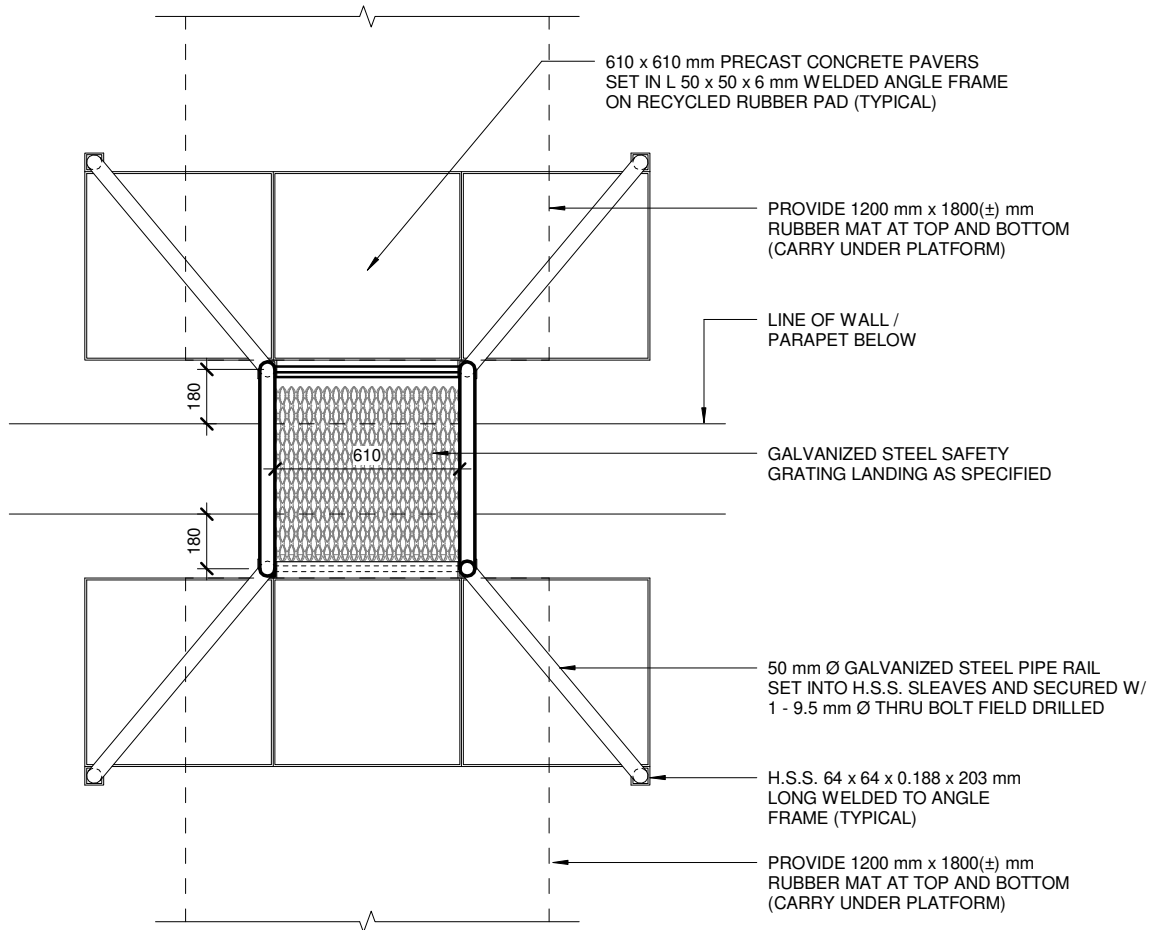
 <p>THE CITY OF WINNIPEG ASSETS & PROJECT MANAGEMENT DEPARTMENT MUNICIPAL ACCOMMODATIONS DIVISION 3-65 GARRY STREET, R3C 4K4</p>		<p>PROJECT PEMBINA TRAILS COLLEGIATE VOCATIONAL WING 50 FRONTIER TRAIL, WINNIPEG, MANITOBA, R3Y 2H1</p>			<p>SHEET TITLE MECHANICAL CURB DETAIL</p>		
DRAWN BY:	CHECKED BY:	DESIGNED BY:	APPROVED BY:	DATE:	SCALE:	SHEET No:	
HW	HW	HW	JT	2024.04.01	1:10	AP2.56	
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 <p>THE CITY OF WINNIPEG ASSETS & PROJECT MANAGEMENT DEPARTMENT MUNICIPAL ACCOMMODATIONS DIVISION 3-65 GARRY STREET, R3C 4K4</p>		<p>PROJECT PEMBINA TRAILS COLLEGIATE VOCATIONAL WING 50 FRONTIER TRAIL, WINNIPEG, MANITOBA, R3Y 2H1</p>			<p>SHEET TITLE ROOF TRANSITION DETAIL</p>	
DRAWN BY:	CHECKED BY:	DESIGNED BY:	APPROVED BY:	DATE:	SCALE:	SHEET No:
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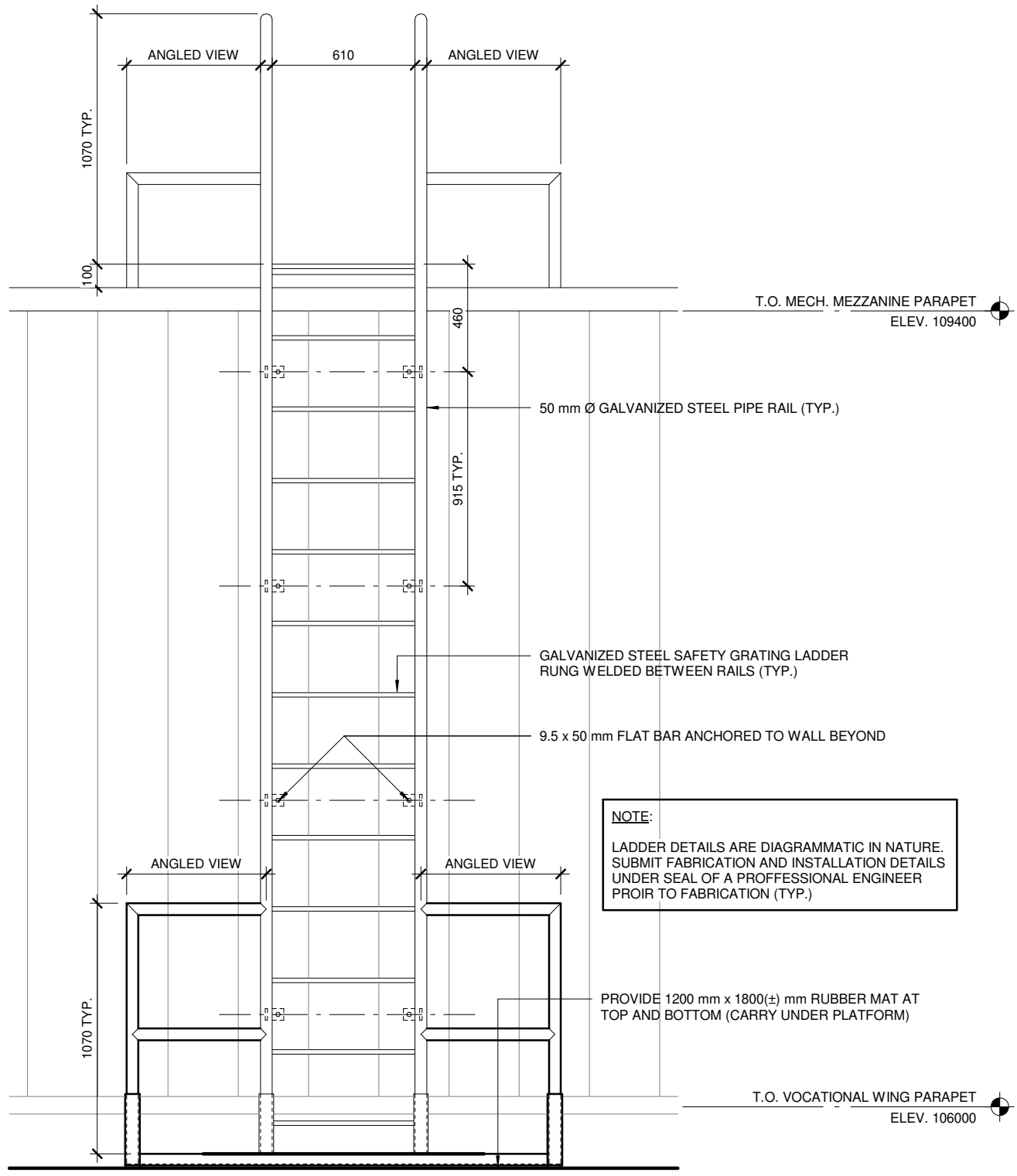
ANGLE FRAME PLAN




NOTE:

- ALL LADDER COMPONENTS TO BE HOT DIPPED GALVANIZED
- LADDER DETAILS ARE DIAGRAMMATIC IN NATURE. SUBMIT FABRICATION AND INSTALLATION DETAILS UNDER SEAL OF A PROFESSIONAL ENGINEER PRIOR TO FABRICATION (TYP.)
- TRAFFIC CAP SHEET TO EXTEND UNDER ANGLE FRAME / CONCRETE PAVERS (TYP.)

 THE CITY OF WINNIPEG ASSETS & PROJECT MANAGEMENT DEPARTMENT MUNICIPAL ACCOMMODATIONS DIVISION 3-65 GARRY STREET, R3C 4K4		PROJECT PEMBINA TRAILS COLLEGIATE VOCATIONAL WING 50 FRONTIER TRAIL, WINNIPEG, MANITOBA, R3Y 2H1			SHEET TITLE ROOF ACCESS LADDER - PLAN		
DRAWN BY:	CHECKED BY:	DESIGNED BY:	APPROVED BY:	DATE:	SCALE:	SHEET No:	
HW	HW	HW	JT	2024.04.01	1 : 25	AP2.58	
				eFILE: 1929V_PTCV_ARCH_2023.rvt	PROJECT No: 2020-127		




 THE CITY OF WINNIPEG
 ASSETS & PROJECT MANAGEMENT
 DEPARTMENT
 MUNICIPAL ACCOMMODATIONS DIVISION
 3-65 GARRY STREET, R3C 4K4

PROJECT
PEMBINA TRAILS COLLEGIATE
VOCATIONAL WING
 50 FRONTIER TRAIL, WINNIPEG, MANITOBA, R3Y 2H1

SHEET TITLE
ROOF ACCESS LADDER - ELEVATION

DRAWN BY:
 HW

CHECKED BY:
 HW

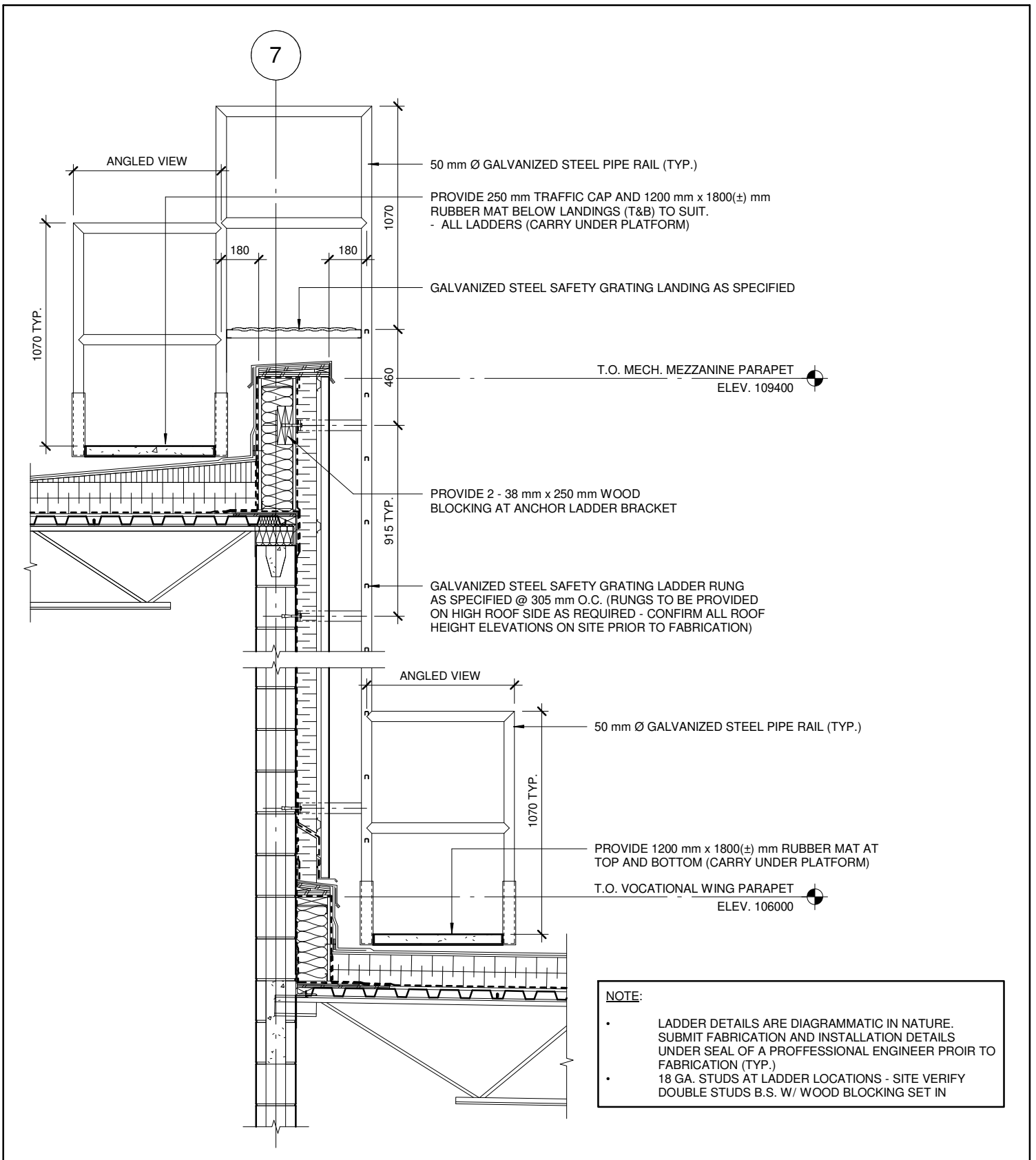
DESIGNED BY:
 HW

APPROVED BY:
 JT

DATE:
 2024.04.01
 eFILE:
 1929V_PTCV_ARCH_2023.rvt

SCALE:
1 : 25
 PROJECT No: 2020-127

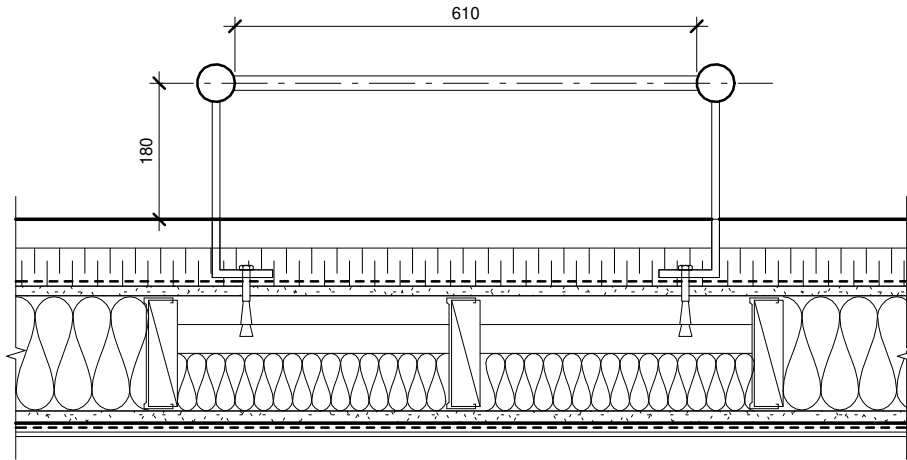
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AP2.59



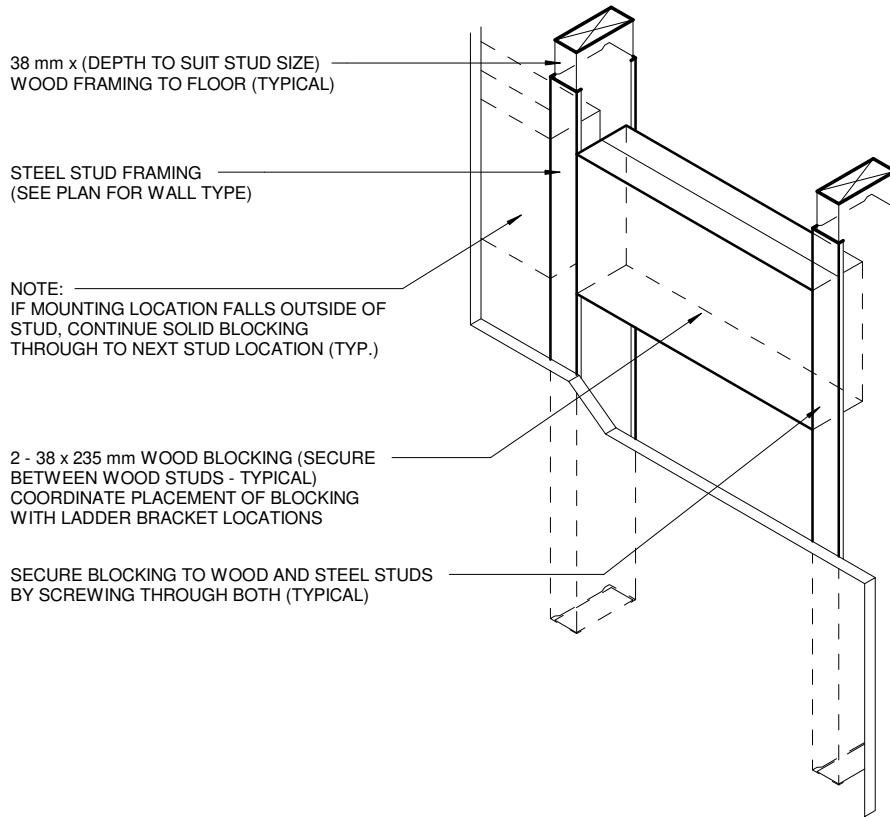
NOTE:

- LADDER DETAILS ARE DIAGRAMMATIC IN NATURE. SUBMIT FABRICATION AND INSTALLATION DETAILS UNDER SEAL OF A PROFESSIONAL ENGINEER PRIOR TO FABRICATION (TYP.)
- 18 GA. STUDS AT LADDER LOCATIONS - SITE VERIFY DOUBLE STUDS B.S. W/ WOOD BLOCKING SET IN

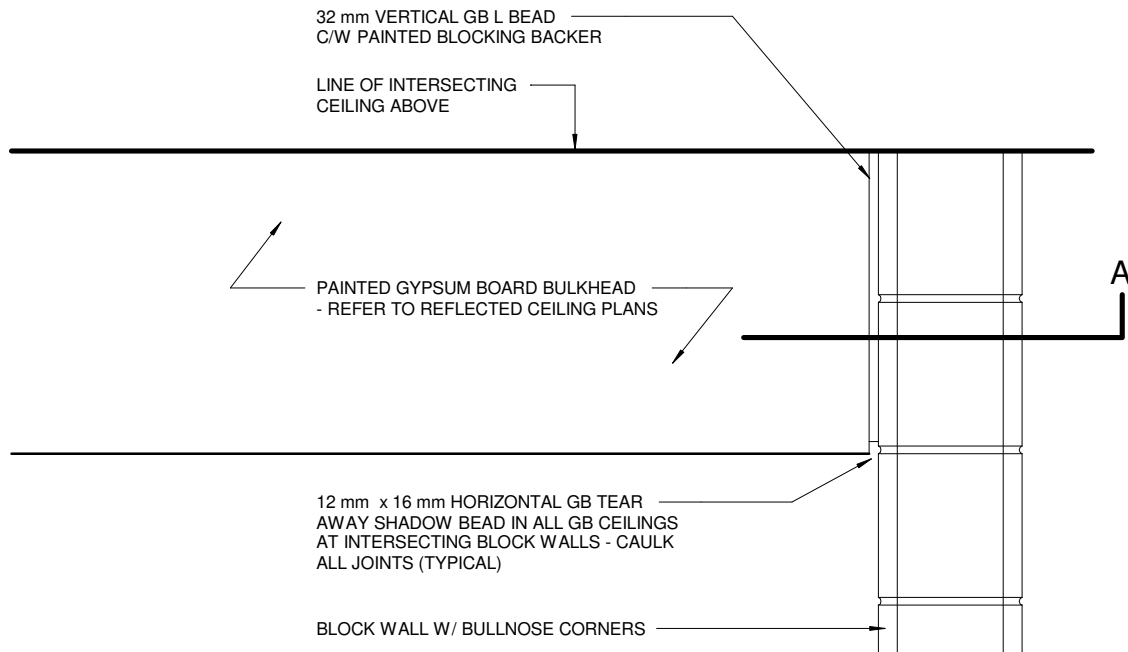
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DRAWN BY:	CHECKED BY:	DESIGNED BY:	APPROVED BY:	DATE:	SCALE:	SHEET No:
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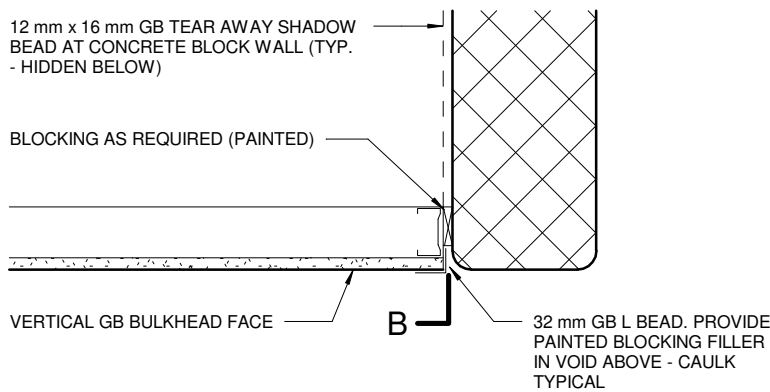
PLAN DETAIL



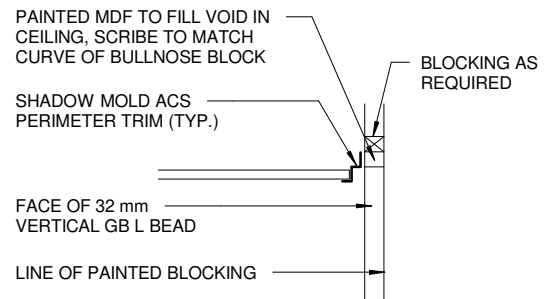
 THE CITY OF WINNIPEG ASSETS & PROJECT MANAGEMENT DEPARTMENT MUNICIPAL ACCOMMODATIONS DIVISION 3-65 GARRY STREET, R3C 4K4		PROJECT PEMBINA TRAILS COLLEGIATE VOCATIONAL WING 50 FRONTIER TRAIL, WINNIPEG, MANITOBA, R3Y 2H1			SHEET TITLE BLOCKING IN PARAPET WALL FOR ROOF ACCESS LADDER		
DRAWN BY:	CHECKED BY:	DESIGNED BY:	APPROVED BY:	DATE:	SCALE:	SHEET No:	
HW	HW	HW	JT	2024.04.01	1 : 10	AP2.61	
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BULKHEAD ELEVATION AT BULLNOSED BLOCK WALL



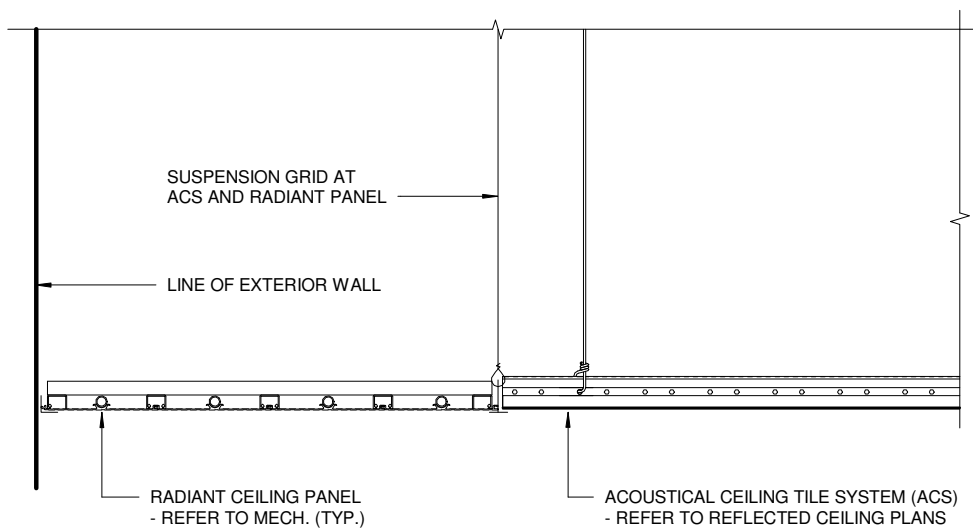
PLAN SECTION 'A' AT BULLNOSED BLOCK WALL



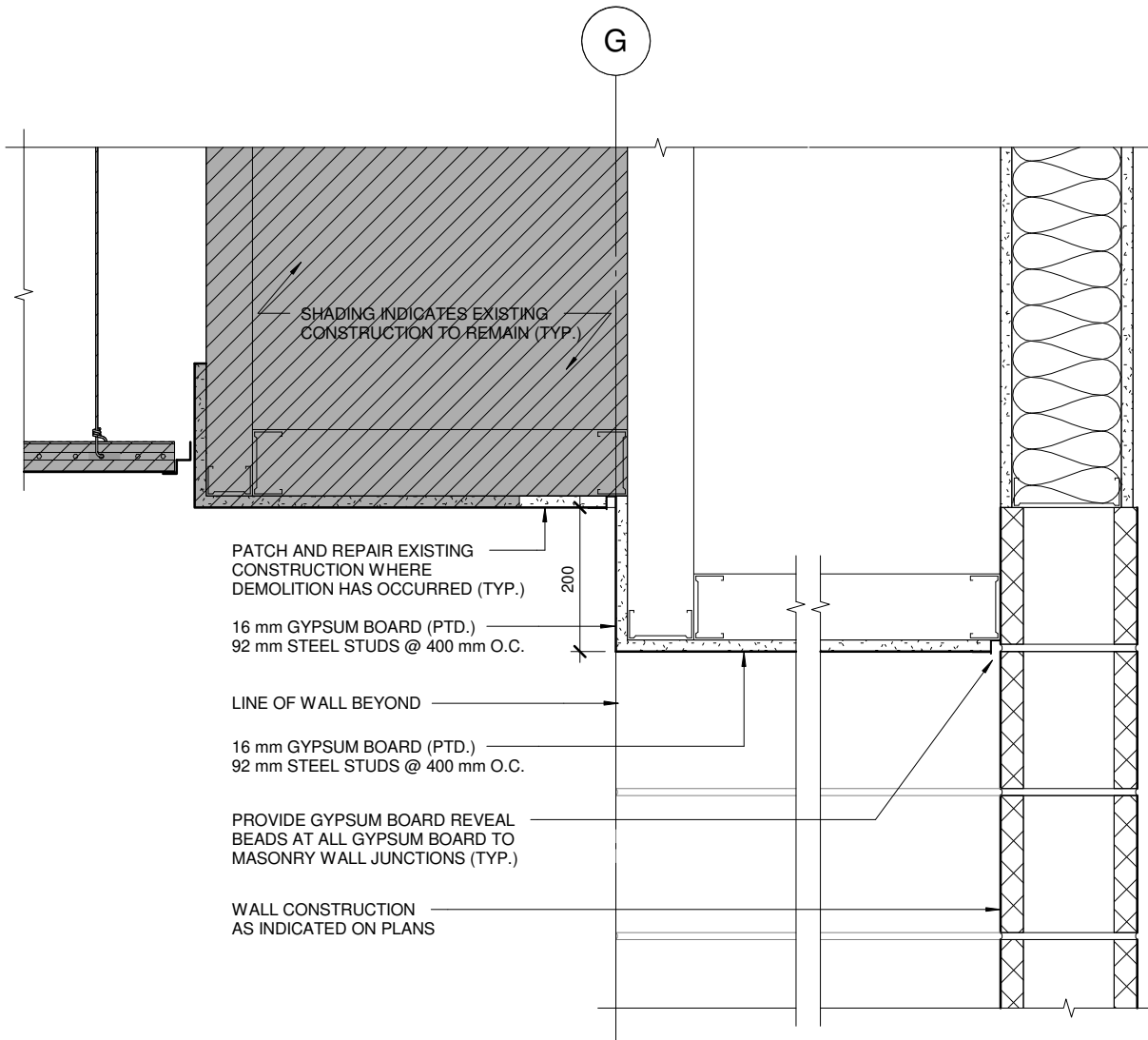
BULKHEAD SECTION 'B' AT FILLER

NOTE: CAULK/PAINT GYPSUM BOARD REVEAL AT MASONRY - TYPICAL ALL LOCATIONS.

 THE CITY OF WINNIPEG ASSETS & PROJECT MANAGEMENT DEPARTMENT MUNICIPAL ACCOMMODATIONS DIVISION 3-65 GARRY STREET, R3C 4K4		PROJECT PEMBINA TRAILS COLLEGIATE VOCATIONAL WING 50 FRONTIER TRAIL, WINNIPEG, MANITOBA, R3Y 2H1			SHEET TITLE TYPICAL BULKHEAD DETAIL AT BULLNOSED BLOCK		
DRAWN BY:	CHECKED BY:	DESIGNED BY:	APPROVED BY:	DATE:	SCALE:	SHEET No:	
TM	HW	DN	SS	2024.04.01	1:10	AP3.01	
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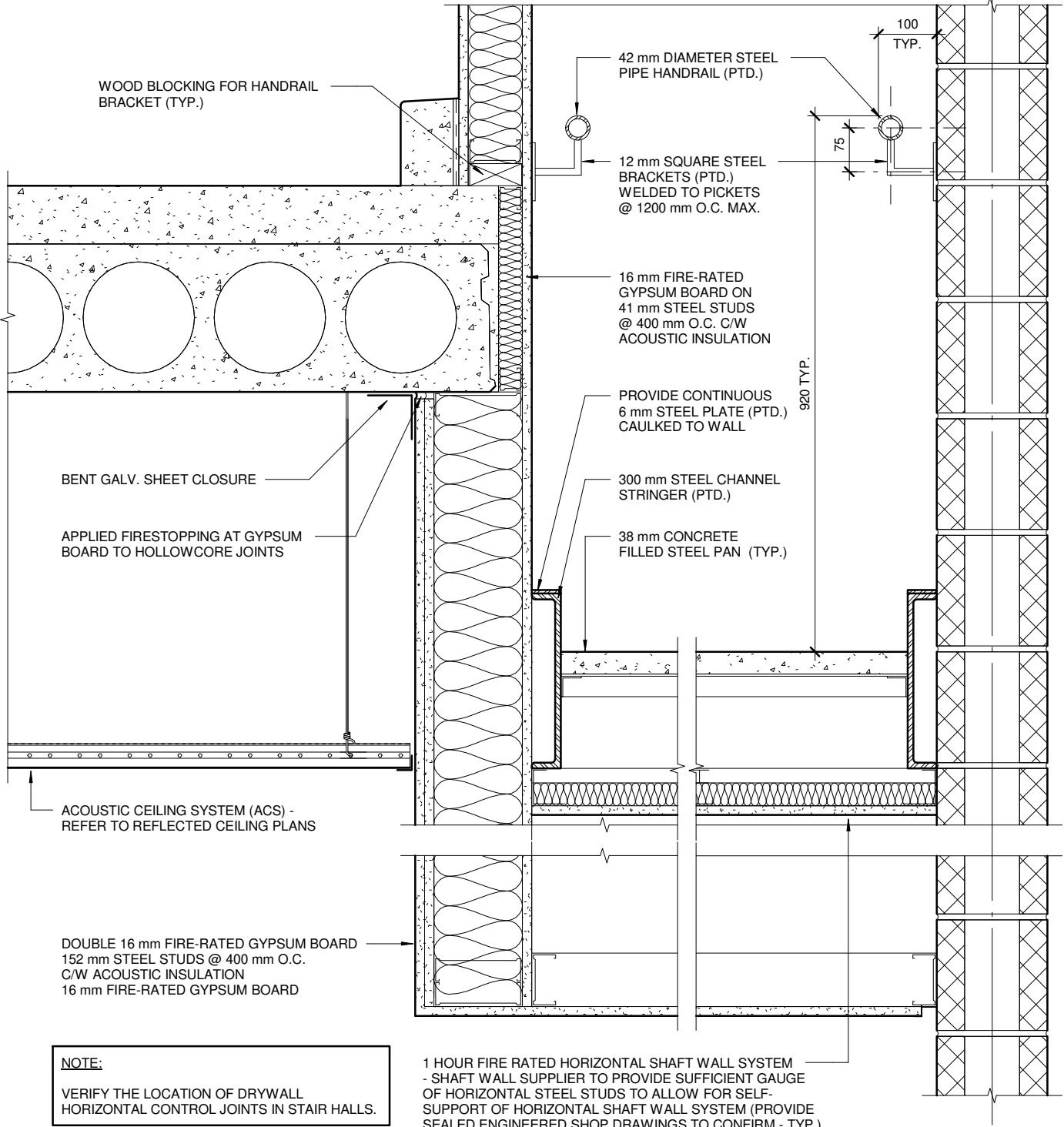


 THE CITY OF WINNIPEG ASSETS & PROJECT MANAGEMENT DEPARTMENT MUNICIPAL ACCOMMODATIONS DIVISION 3-65 GARRY STREET, R3C 4K4		PROJECT PEMBINA TRAILS COLLEGIATE VOCATIONAL WING 50 FRONTIER TRAIL, WINNIPEG, MANITOBA, R3Y 2H1			SHEET TITLE RADIANT PANEL DETAIL		
DRAWN BY:	CHECKED BY:	DESIGNED BY:	APPROVED BY:	DATE:	SCALE:	SHEET No:	
TM	HW	DN	SS	2024.04.01	1 : 10	AP3.02	
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 THE CITY OF WINNIPEG ASSETS & PROJECT MANAGEMENT DEPARTMENT MUNICIPAL ACCOMMODATIONS DIVISION 3-65 GARRY STREET, R3C 4K4		PROJECT PEMBINA TRAILS COLLEGIATE VOCATIONAL WING 50 FRONTIER TRAIL, WINNIPEG, MANITOBA, R3Y 2H1			SHEET TITLE CORRIDOR BULKHEAD AT VENDING MACHINE ALCOVE		
DRAWN BY:	CHECKED BY:	DESIGNED BY:	APPROVED BY:	DATE:	SCALE:	SHEET No:	
HW	HW	TM	SS	2024.04.01	1:10	AP3.03	
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F

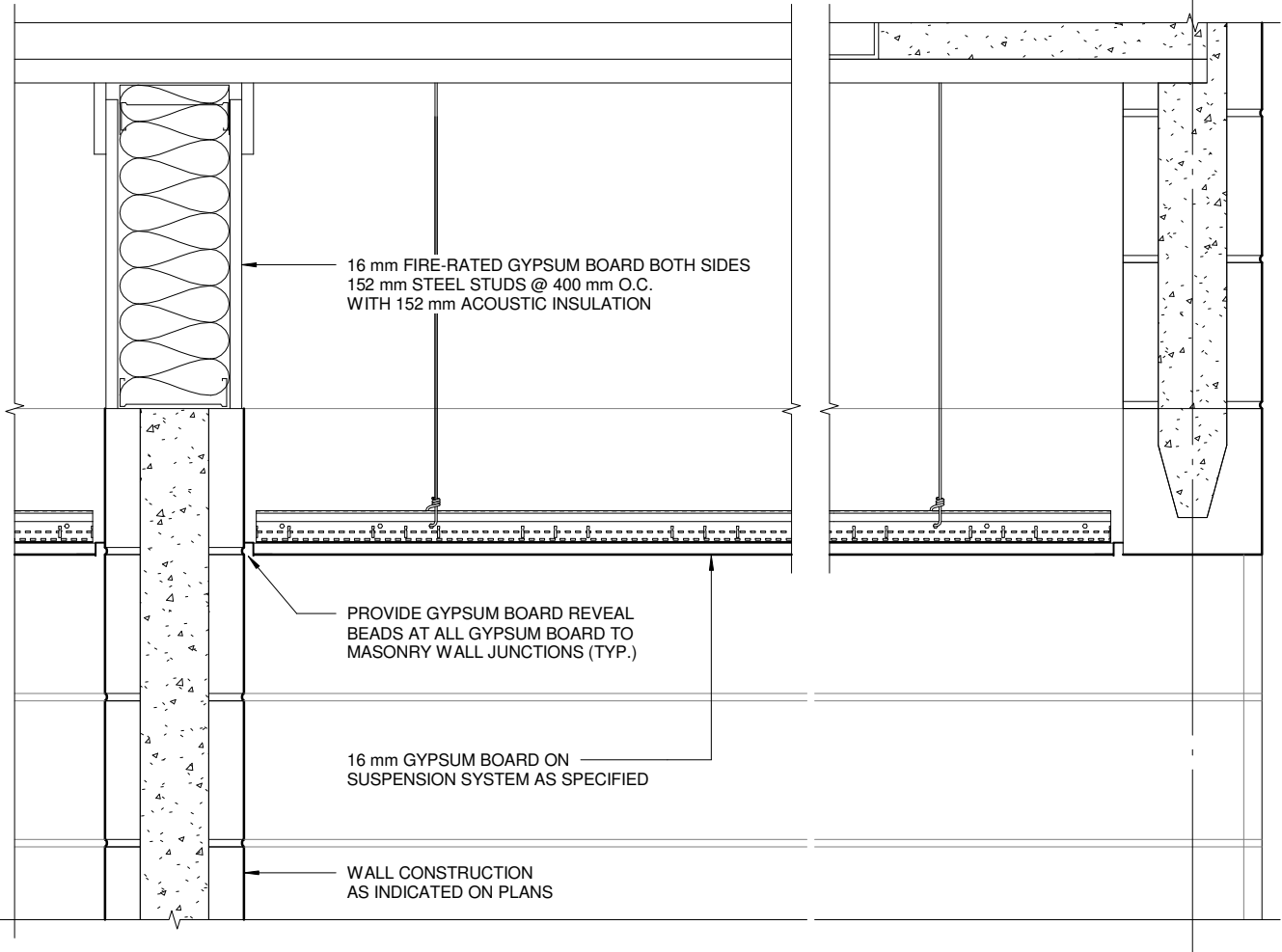


NOTE:
VERIFY THE LOCATION OF DRYWALL
HORIZONTAL CONTROL JOINTS IN STAIR HALLS.

1 HOUR FIRE RATED HORIZONTAL SHAFT WALL SYSTEM
- SHAFT WALL SUPPLIER TO PROVIDE SUFFICIENT GAUGE
OF HORIZONTAL STEEL STUDS TO ALLOW FOR SELF-
SUPPORT OF HORIZONTAL SHAFT WALL SYSTEM (PROVIDE
SEALED ENGINEERED SHOP DRAWINGS TO CONFIRM - TYP.)

 <p>THE CITY OF WINNIPEG ASSETS & PROJECT MANAGEMENT DEPARTMENT MUNICIPAL ACCOMMODATIONS DIVISION 3-65 GARRY STREET, R3C 4K4</p>		<p>PROJECT PEMBINA TRAILS COLLEGIATE VOCATIONAL WING 50 FRONTIER TRAIL, WINNIPEG, MANITOBA, R3Y 2H1</p>			<p>SHEET TITLE FIRE-RATED BLKHD BELOW MECH. MEZZ. STAIR</p>		
DRAWN BY:	CHECKED BY:	DESIGNED BY:	APPROVED BY:	DATE:	SCALE:	SHEET No:	
HW	HW	HW	JT	2024.04.01	1 : 10	AP3.04	
				eFILE: 1929V_PTCV_ARCH_2023.rvt	PROJECT No: 2020-127		

7



16 mm FIRE-RATED GYPSUM BOARD BOTH SIDES
152 mm STEEL STUDS @ 400 mm O.C.
WITH 152 mm ACOUSTIC INSULATION

PROVIDE GYPSUM BOARD REVEAL
BEADS AT ALL GYPSUM BOARD TO
MASONRY WALL JUNCTIONS (TYP.)

16 mm GYPSUM BOARD ON
SUSPENSION SYSTEM AS SPECIFIED

WALL CONSTRUCTION
AS INDICATED ON PLANS

NOTE:
INTUMESCENT CAULKING T/B ALL SIDES TO MAINTAIN INTEGRITY OF FIRE SEPARATION (TYP.)

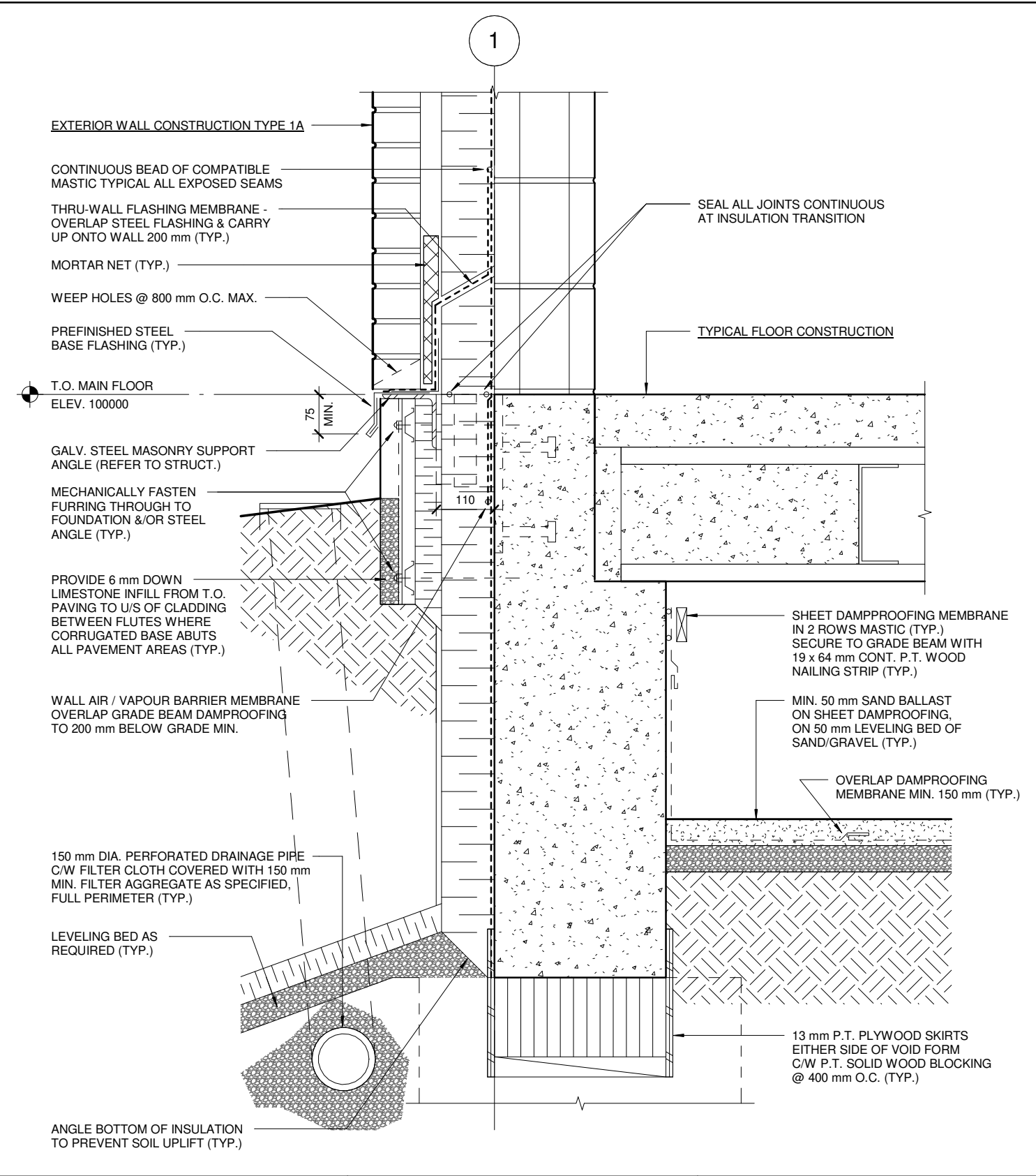


THE CITY OF WINNIPEG
ASSETS & PROJECT MANAGEMENT
DEPARTMENT
MUNICIPAL ACCOMMODATIONS DIVISION
3-65 GARRY STREET, R3C 4K4

PROJECT
PEMBINA TRAILS COLLEGIATE
VOCATIONAL WING
50 FRONTIER TRAIL, WINNIPEG, MANITOBA, R3Y 2H1

SHEET TITLE
CEILING BULKHEAD AT
MACHINE & WOOD TECHNOLOGY

DRAWN BY: HW	CHECKED BY: HW	DESIGNED BY: TM	APPROVED BY: SS	DATE: 2024.04.01 eFILE: 1929V_PTCV_ARCH_2023.rvt	SCALE: 1 : 10 PROJECT No: 2020-127	SHEET No: AP3.05
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 <p>THE CITY OF WINNIPEG ASSETS & PROJECT MANAGEMENT DEPARTMENT MUNICIPAL ACCOMMODATIONS DIVISION 3-65 GARRY STREET, R3C 4K4</p>		<p>PROJECT PEMBINA TRAILS COLLEGIATE VOCATIONAL WING 50 FRONTIER TRAIL, WINNIPEG, MANITOBA, R3Y 2H1</p>			<p>SHEET TITLE TYPICAL BASE CONSTRUCTION DETAIL</p>	
DRAWN BY:	CHECKED BY:	DESIGNED BY:	APPROVED BY:	DATE:	SCALE:	SHEET No:
RS	HW	RS	JT	2024.04.01	1:10	AP5.01
				eFILE: 1929V_PTCV_ARCH_2023.rvt	PROJECT No: 2020-127	

CONTINUOUS BEAD OF COMPATIBLE MASTIC AT ALL EXPOSED SEAMS (TYP.)

THROUGH WALL MEMBRANE FLASHING - OVERLAP STEEL FLASHING & ONTO WALL 200 mm MIN. (TYP.)

MORTAR NET (TYP.)

WRAP AIR / VAPOUR BARRIER MEMBRANE FLASHINGS INTO OPENINGS ALL SIDES & OVER PLYWOOD BLOCKING AS INDICATED (SEAL TO WINDOW FRAME - TYP.)

WEEP HOLES @ 800 mm O.C. MAX. (TYP.)

GALVANIZED STEEL ANGLE MASONRY SUPPORT - PAINT (REFER TO STRUCTURAL)

PREFINISHED STEEL DRIP FLASHING (TYP.)

PREFINISHED STEEL CLOSURE TRIM - CONT. CAULK TO ANGLE (TYP.)

CONTINUOUS ROD & CAULK FULL PERIMETER (TYP.)

LAP AIR / VAPOUR BARRIER MEMBRANE OVER FLASHINGS & BLOCKING - PROVIDE POSITIVE SEAL FULL PERIMETER (TYP.)

PREFINISHED FIBREGLASS WINDOW UNIT C/W TRIPLE GLAZING (TYP.)

LAP AIR / VAPOUR BARRIER MEMBRANE OVER FLASHINGS & BLOCKING - PROVIDE POSITIVE SEAL FULL PERIMETER (TYP.)

CONTINUOUS ROD & CAULK FULL PERIMETER (TYP.)

PREFINISHED STEEL SILL FLASHING (TYP.)

2 LAYERS - 19 mm P.T. PLYWOOD (C/W 13 mm SLOPE AT SILL ONLY) AND P.T. WOOD BLOCKING ALL AROUND OPENING (TYP.)

WRAP AIR / VAPOUR BARRIER MEMBRANE FLASHINGS INTO OPENINGS ALL SIDES & OVER PLYWOOD BLOCKING AS INDICATED (SEAL TO WINDOW FRAME - TYP.)

EXTERIOR WALL CONSTRUCTION TYPE 1A

2 LAYERS - 19 mm P.T. PLYWOOD AND P.T. WOOD BLOCKING ALL AROUND OPENING (TYP.)

FOAM INSULATION IN VOIDS (TYP.)

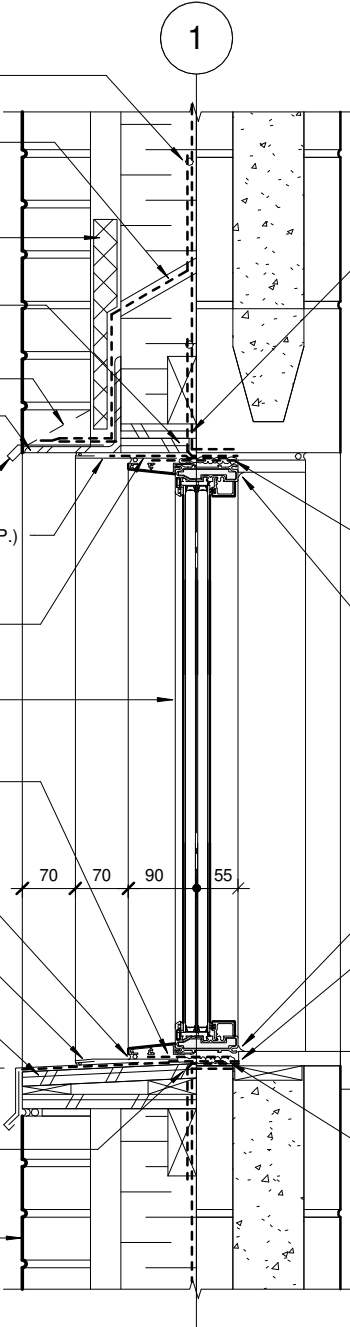
CONTINUOUS ROD & CAULK FULL PERIMETER (TYP.)

CONTINUOUS ROD & CAULK FULL PERIMETER (TYP.)

PREFINISHED DRYWALL RETURN MOULDING FULL PERIMETER (TYP.)

PLASTIC LAMINATE SILL C/W SOLID HARDWOOD EDGE (REFER TO AP8.23 - TYP.)

FOAM INSULATION IN VOIDS (TYP.)



NOTE:

- APPLY TRANSLUCENT CAULKING AT PLASTIC LAMINATE SILL TO DRYWALL (WHERE APPLICABLE)
- APPLY LATEX CAULKING AT PERIMETER OF WINDOW FRAME (TYPICAL)



THE CITY OF WINNIPEG
ASSETS & PROJECT MANAGEMENT
DEPARTMENT
MUNICIPAL ACCOMMODATIONS DIVISION
3-65 GARRY STREET, R3C 4K4

PROJECT
PEMBINA TRAILS COLLEGIATE
VOCATIONAL WING
50 FRONTIER TRAIL, WINNIPEG, MANITOBA, R3Y 2H1

SHEET TITLE
TYPICAL CLEARSTORY WINDOW DETAIL

DRAWN BY:
RS

CHECKED BY:
HW

DESIGNED BY:
RS

APPROVED BY:
JT

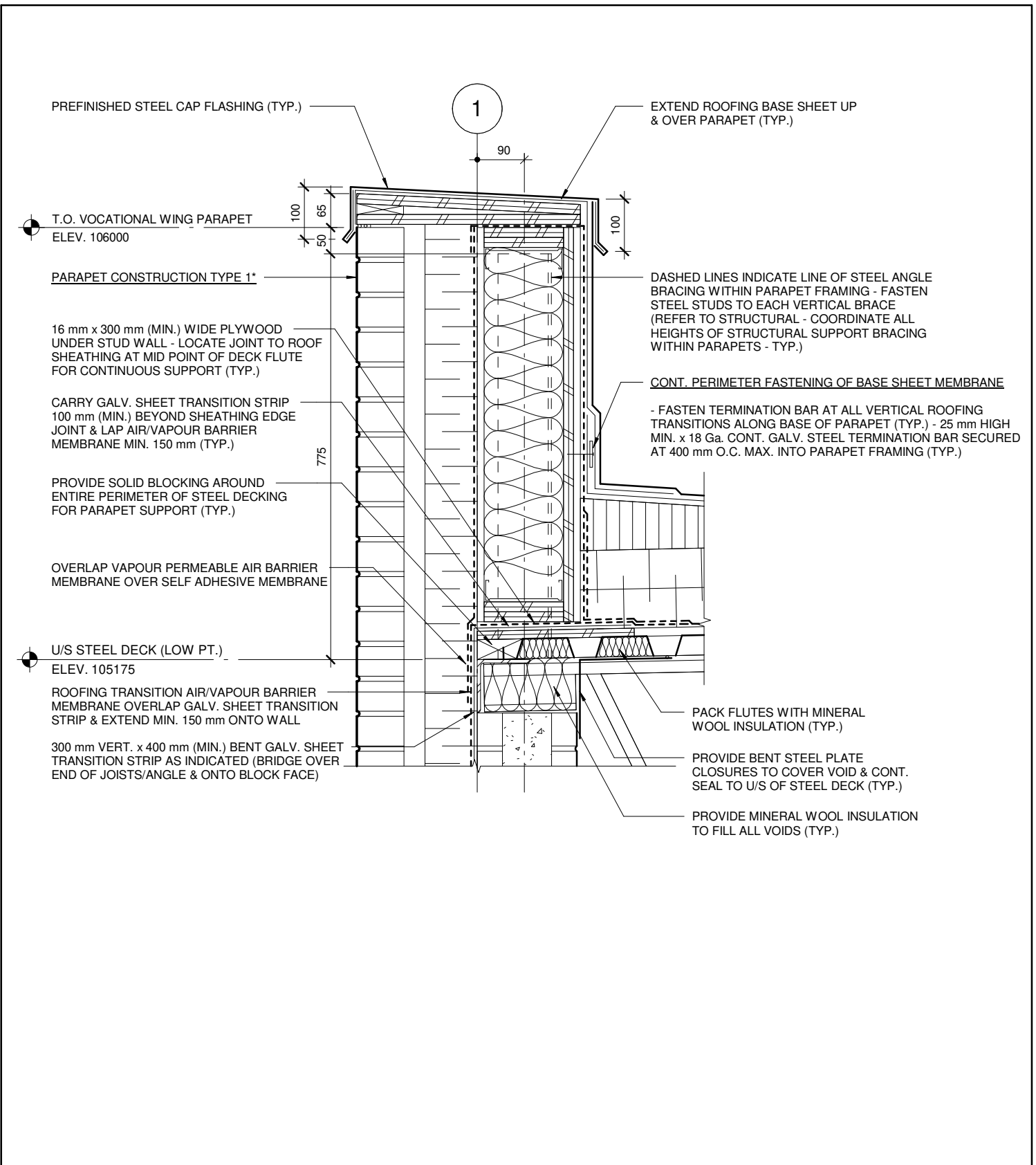
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SCALE:
1 : 10

PROJECT No: 2020-127

SHEET No:

AP5.02



 THE CITY OF WINNIPEG ASSETS & PROJECT MANAGEMENT DEPARTMENT MUNICIPAL ACCOMMODATIONS DIVISION 3-65 GARRY STREET, R3C 4K4		PROJECT PEMBINA TRAILS COLLEGIATE VOCATIONAL WING 50 FRONTIER TRAIL, WINNIPEG, MANITOBA, R3Y 2H1			SHEET TITLE TYPICAL PARAPET DETAIL - TYPE 1*	
DRAWN BY:	CHECKED BY:	DESIGNED BY:	APPROVED BY:	DATE:	SCALE:	SHEET No:
RS	HW	RS	JT	2024.04.01	1 : 10	AP5.03
				eFILE: 1929V_PTCV_ARCH_2023.rvt	PROJECT No: 2020-127	

5

PREFINISHED STEEL CAP FLASHING (TYP.)

EXTEND ROOFING BASE SHEET UP & OVER PARAPET (TYP.)

T.O. MECH. MEZZANINE PARAPET
ELEV. 109400

100
65

COMPATIBLE BASE SHEET UP & OVER WOOD
BLOCKING TYPICAL ALL PARAPETS & CURBS

2 LAYERS - 19 mm PLYWOOD BOTH SIDES
OF BLOCKING (SLOPE 20 mm MIN. - TYP.)

2 LAYERS CONT. 19 mm PLYWOOD BLOCKING
TOP & BOTTOM TYPICAL ALL PARAPETS & CURBS

PARAPET CONSTRUCTION TYPE 2*

CONT. PERIMETER FASTENING OF BASE SHEET MEMBRANE

- FASTEN TERMINATION BAR AT ALL VERTICAL ROOFING
TRANSITIONS ALONG BASE OF PARAPET (TYP.) - 25 mm HIGH
MIN. x 18 Ga. CONT. GALV. STEEL TERMINATION BAR SECURED
AT 400 mm O.C. MAX. INTO PARAPET FRAMING (TYP.)

OVERLAP VAPOUR PERMEABLE AIR BARRIER
MEMBRANE OVER SELF ADHESIVE MEMBRANE

16 mm x 300 mm (MIN.) WIDE PLYWOOD
UNDER STUD WALL - LOCATE JOINT TO
ROOF SHEATHING AT MID POINT OF DECK
FLUTE FOR CONTINUOUS SUPPORT (TYP.)

ROOFING TRANSITION AIR/ VAPOUR BARRIER
MEMBRANE OVERLAP GALV. SHEET TRANSITION
STRIP & EXTEND MIN. 150 mm ONTO WALL

CARRY GALV. SHEET TRANSITION STRIP
100 mm (MIN.) BEYOND SHEATHING
EDGE JOINT & LAP AIR/VAPOUR
BARRIER MEMBRANE MIN. 150 mm (TYP.)

U/S STEEL DECK
ELEV. 108700

PROVIDE BENT STEEL PLATE
CLOSURES TO COVER VOID & CONT.
SEAL TO U/S OF STEEL DECK (TYP.)

T.O. MASONRY
ELEV. 108600

300 mm VERT. X 400 mm (MIN.) BENT GALV. SHEET
TRANSITION STRIP AS INDICATED (BRIDGE OVER
END OF JOISTS/ANGLE & ONTO BLOCK FACE)

PACK FLUTES WITH MINERAL
WOOL INSULATION (TYP.)

PROVIDE MINERAL WOOL INSULATION
TO FILL ALL VOIDS (TYP.)

EXTERIOR WALL CONSTRUCTION TYPE 2A

PROVIDE SOLID BLOCKING AROUND ENTIRE PERIMETER
OF STEEL DECKING FOR PARAPET SUPPORT (TYP.)

THE CITY OF WINNIPEG
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MUNICIPAL ACCOMMODATIONS DIVISION
3-65 GARRY STREET, R3C 4K4

PROJECT
PEMBINA TRAILS COLLEGIATE
VOCATIONAL WING
50 FRONTIER TRAIL, WINNIPEG, MANITOBA, R3Y 2H1

SHEET TITLE
TYPICAL PARAPET DETAIL - TYPE 2*

DRAWN BY:
RS

CHECKED BY:
HW

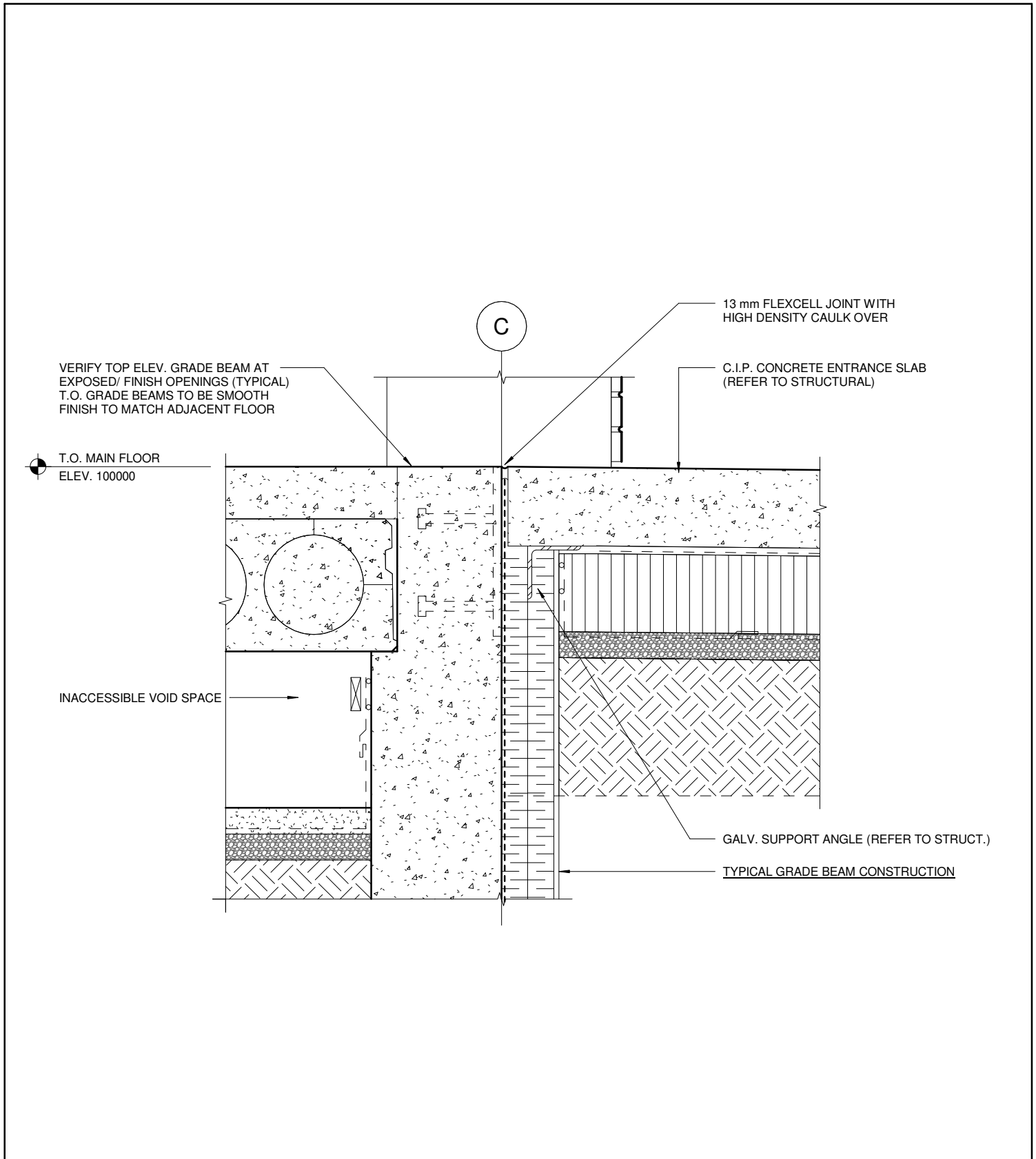
DESIGNED BY:
RS

APPROVED BY:
JT

DATE:
2024.04.01
eFILE:
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SCALE:
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PROJECT No: 2020-127

SHEET No:
AP5.04



 THE CITY OF WINNIPEG ASSETS & PROJECT MANAGEMENT DEPARTMENT MUNICIPAL ACCOMMODATIONS DIVISION 3-65 GARRY STREET, R3C 4K4		PROJECT PEMBINA TRAILS COLLEGIATE VOCATIONAL WING 50 FRONTIER TRAIL, WINNIPEG, MANITOBA, R3Y 2H1			SHEET TITLE TYPICAL OVERHEAD SECTIONAL DOOR BASE DETAIL	
DRAWN BY: RS	CHECKED BY: HW	DESIGNED BY: RS	APPROVED BY: JT	DATE: 2024.04.01 eFILE: 1929V_PTCV_ARCH_2023.rvt	SCALE: 1 : 10 PROJECT No: 2020-127	SHEET No: AP5.05



EXTENDED ALUM. THRESHOLD
C/W P.T. WOOD BLOCKING IN VOID

T.O. CONCRETE SLAB TO BE 10 mm
BELOW T.O. FLOOR SLAB AT ALL
ENTRANCE LOCATIONS - SLOPE AWAY
FROM ENTRANCE (REFER TO CIVIL - TYP.)

C.I.P. CONCRETE ENTRANCE SLAB
(REFER TO STRUCTURAL)

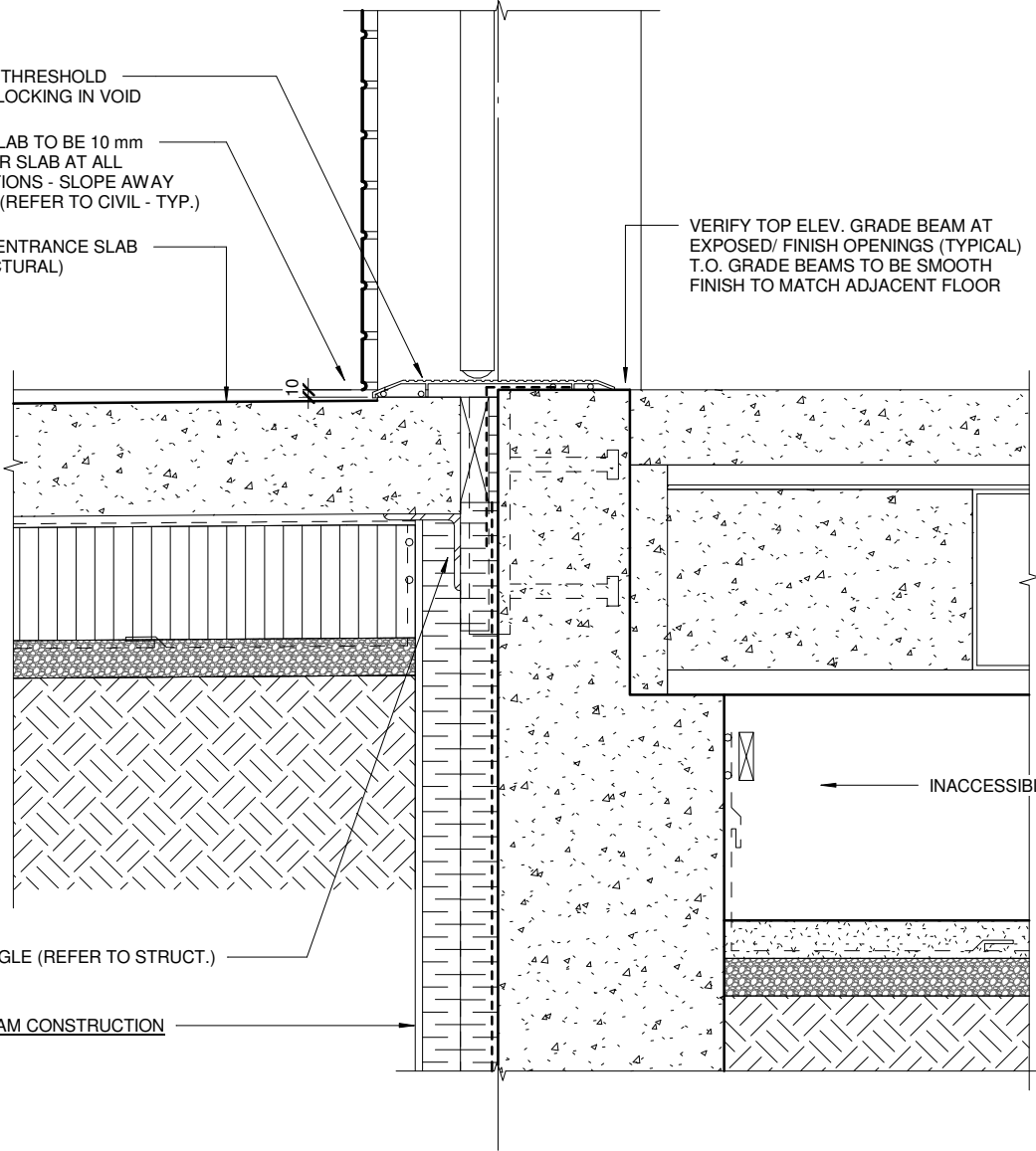
VERIFY TOP ELEV. GRADE BEAM AT
EXPOSED/ FINISH OPENINGS (TYPICAL)
T.O. GRADE BEAMS TO BE SMOOTH
FINISH TO MATCH ADJACENT FLOOR

T.O. MAIN FLOOR
ELEV. 100000

INACCESSIBLE VOID SPACE

GALV. SUPPORT ANGLE (REFER TO STRUCT.)

TYPICAL GRADE BEAM CONSTRUCTION



THE CITY OF WINNIPEG
ASSETS & PROJECT MANAGEMENT
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3-65 GARRY STREET, R3C 4K4

PROJECT
PEMBINA TRAILS COLLEGIATE
VOCATIONAL WING
50 FRONTIER TRAIL, WINNIPEG, MANITOBA, R3Y 2H1

SHEET TITLE
BASE DETAIL AT ENTRANCE SLAB
THROUGH EXTERIOR DOOR

DRAWN BY:
RS

CHECKED BY:
HW

DESIGNED BY:
RS

APPROVED BY:
JT

DATE:
2024.04.01
eFILE:
1929V_PTCV_ARCH_2023.rvt

SCALE:
1 : 10

PROJECT No: 2020-127

SHEET No:
AP5.06



EXTENDED ALUM. THRESHOLD
C/W P.T. WOOD BLOCKING IN VOID

T.O. CONCRETE SLAB TO BE 10 mm
BELOW T.O. FLOOR SLAB AT ALL
ENTRANCE LOCATIONS - SLOPE AWAY
FROM ENTRANCE (REFER TO CIVIL - TYP.)

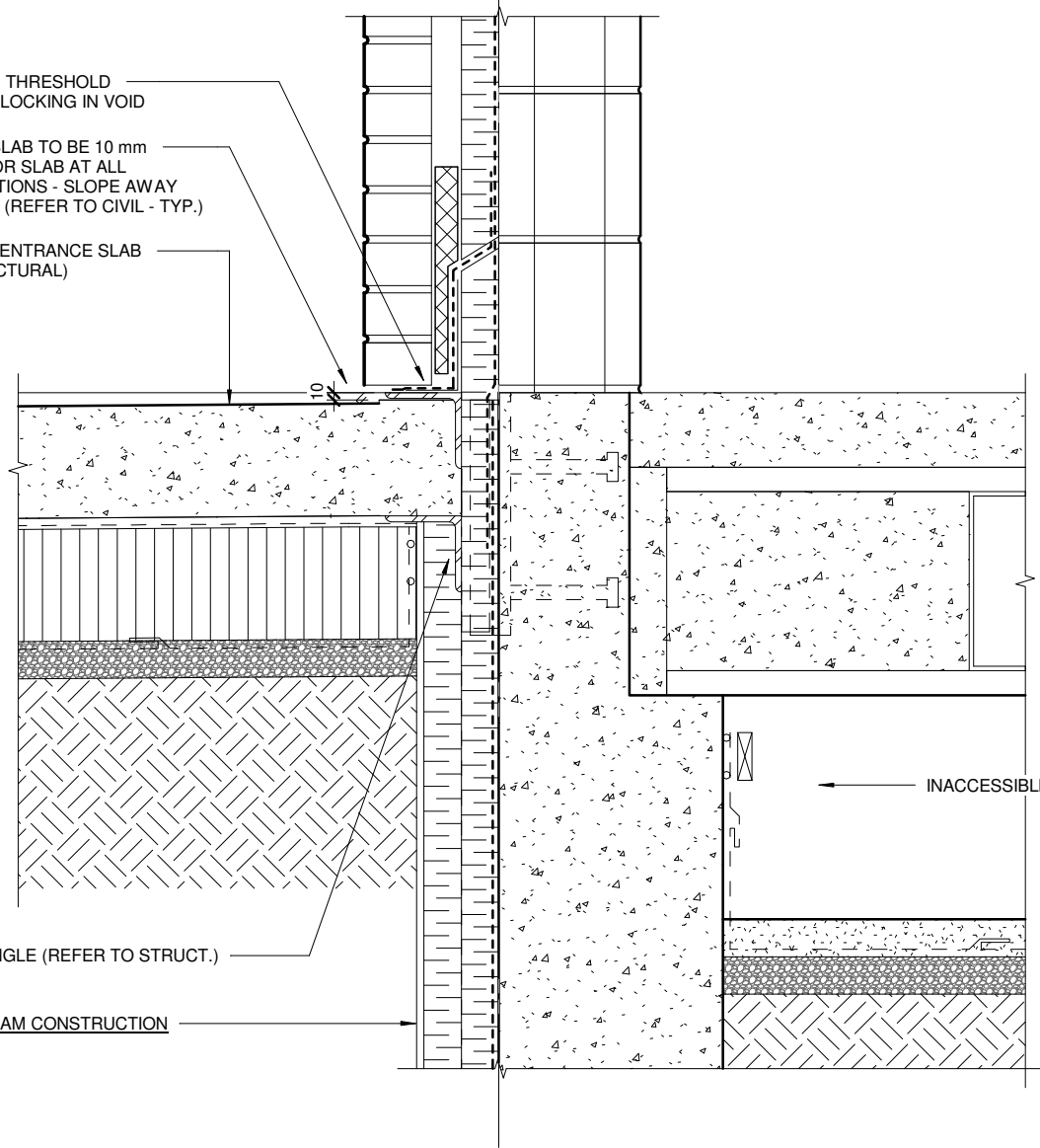
C.I.P. CONCRETE ENTRANCE SLAB
(REFER TO STRUCTURAL)


T.O. MAIN FLOOR
ELEV. 100000

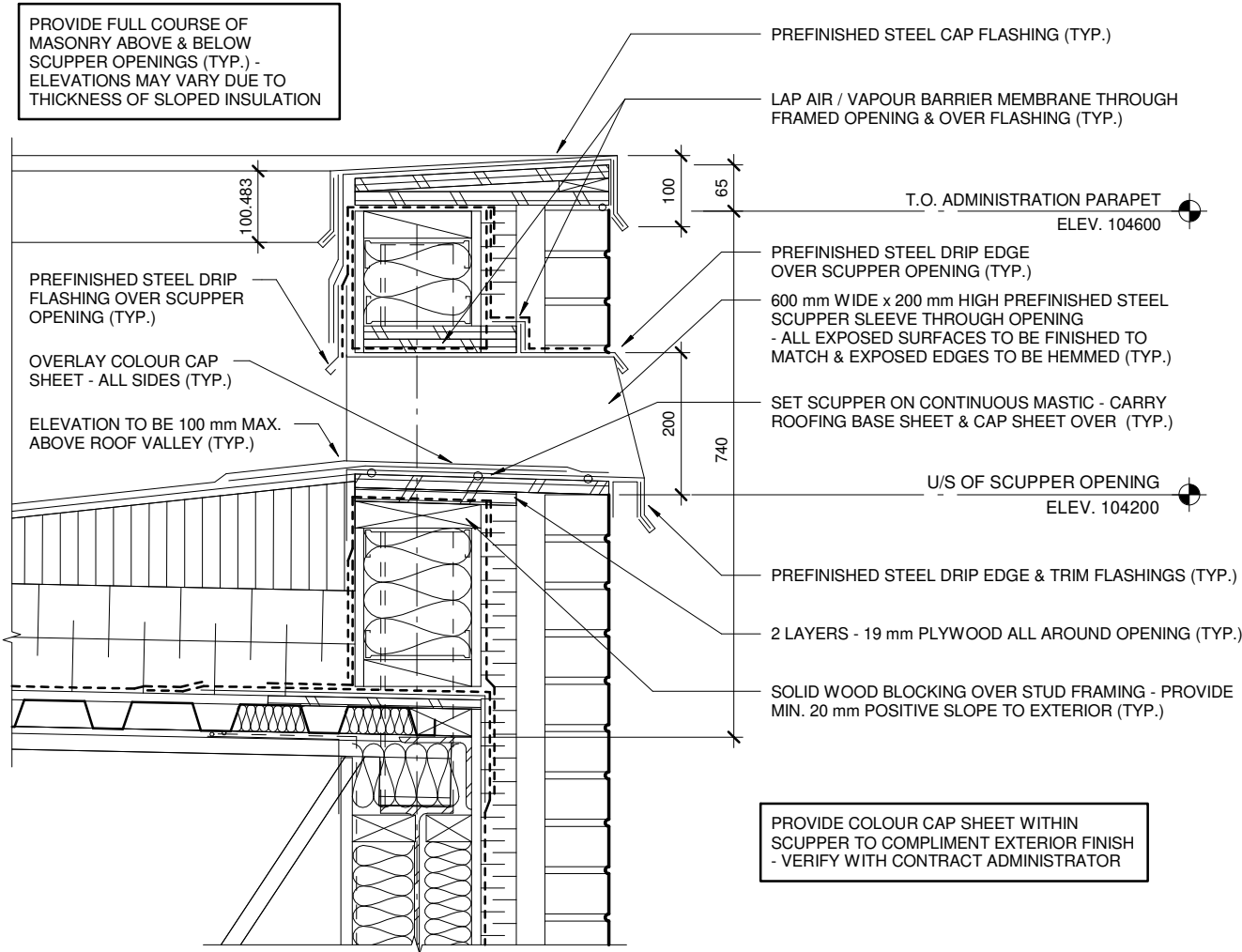
← INACCESSIBLE VOID SPACE

GALV. SUPPORT ANGLE (REFER TO STRUCT.)

TYPICAL GRADE BEAM CONSTRUCTION



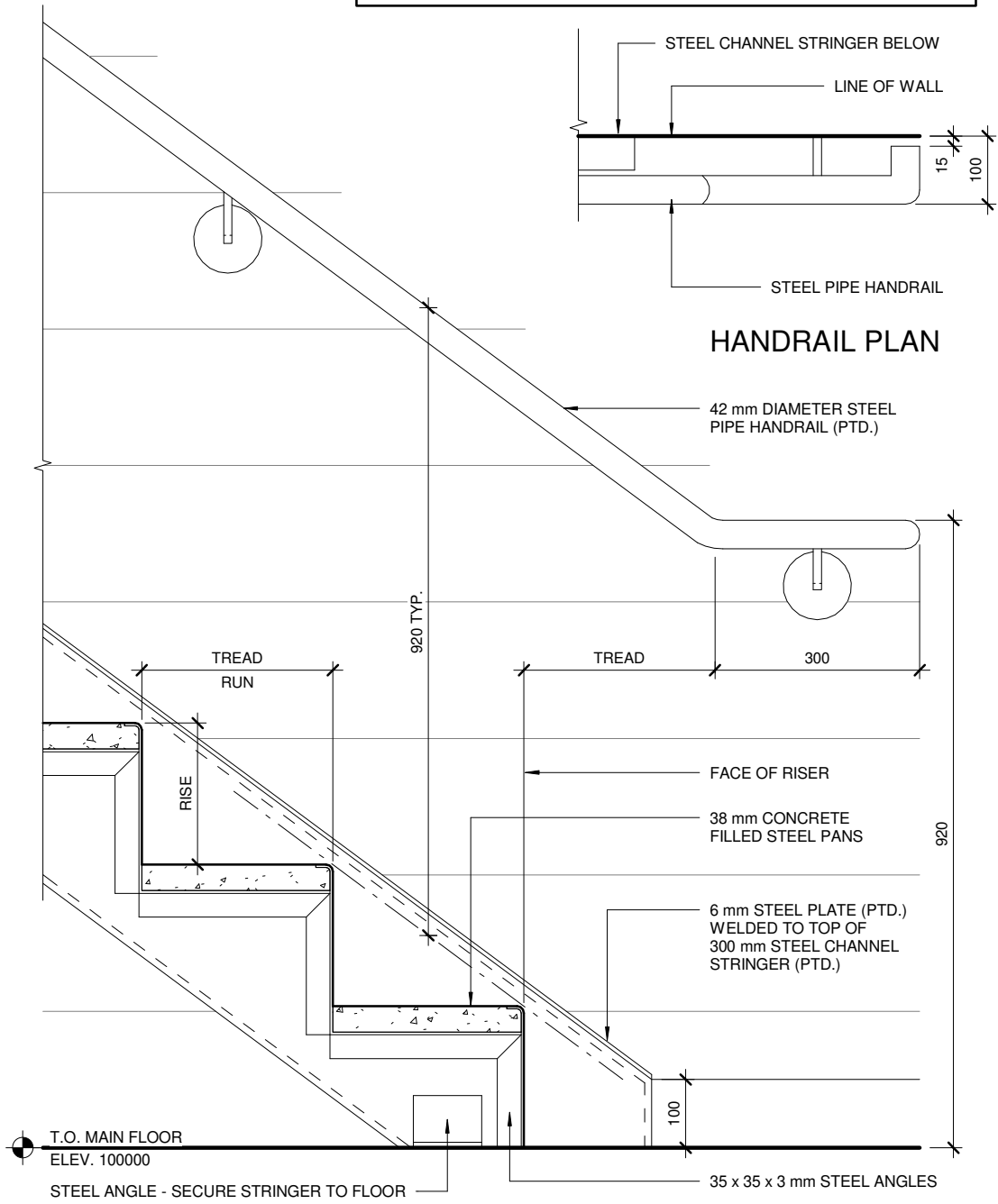
 THE CITY OF WINNIPEG ASSETS & PROJECT MANAGEMENT DEPARTMENT MUNICIPAL ACCOMMODATIONS DIVISION 3-65 GARRY STREET, R3C 4K4		PROJECT PEMBINA TRAILS COLLEGIATE VOCATIONAL WING 50 FRONTIER TRAIL, WINNIPEG, MANITOBA, R3Y 2H1			SHEET TITLE BASE DETAIL AT ENTRANCE SLAB	
DRAWN BY:	CHECKED BY:	DESIGNED BY:	APPROVED BY:	DATE:	SCALE:	SHEET No:
RS	HW	RS	JT	2024.04.01	1:10	AP5.07
				eFILE: 1929V_PTCV_ARCH_2023.rvt	PROJECT No: 2020-127	



 THE CITY OF WINNIPEG ASSETS & PROJECT MANAGEMENT DEPARTMENT MUNICIPAL ACCOMMODATIONS DIVISION 3-65 GARRY STREET, R3C 4K4		PROJECT PEMBINA TRAILS COLLEGIATE VOCATIONAL WING 50 FRONTIER TRAIL, WINNIPEG, MANITOBA, R3Y 2H1			SHEET TITLE TYPICAL SCUPPER DETAIL		
DRAWN BY:	CHECKED BY:	DESIGNED BY:	APPROVED BY:	DATE:	SCALE:	SHEET No:	
RS	HW	RS	JT	2024.04.01	1:10	AP5.08	
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NOTE:

- RETURN RAIL TO WALL AS INDICATED TYPICAL AT TOP AND BOTTOM
- PROVIDE CLOSED END TO PIPE HANDRAIL



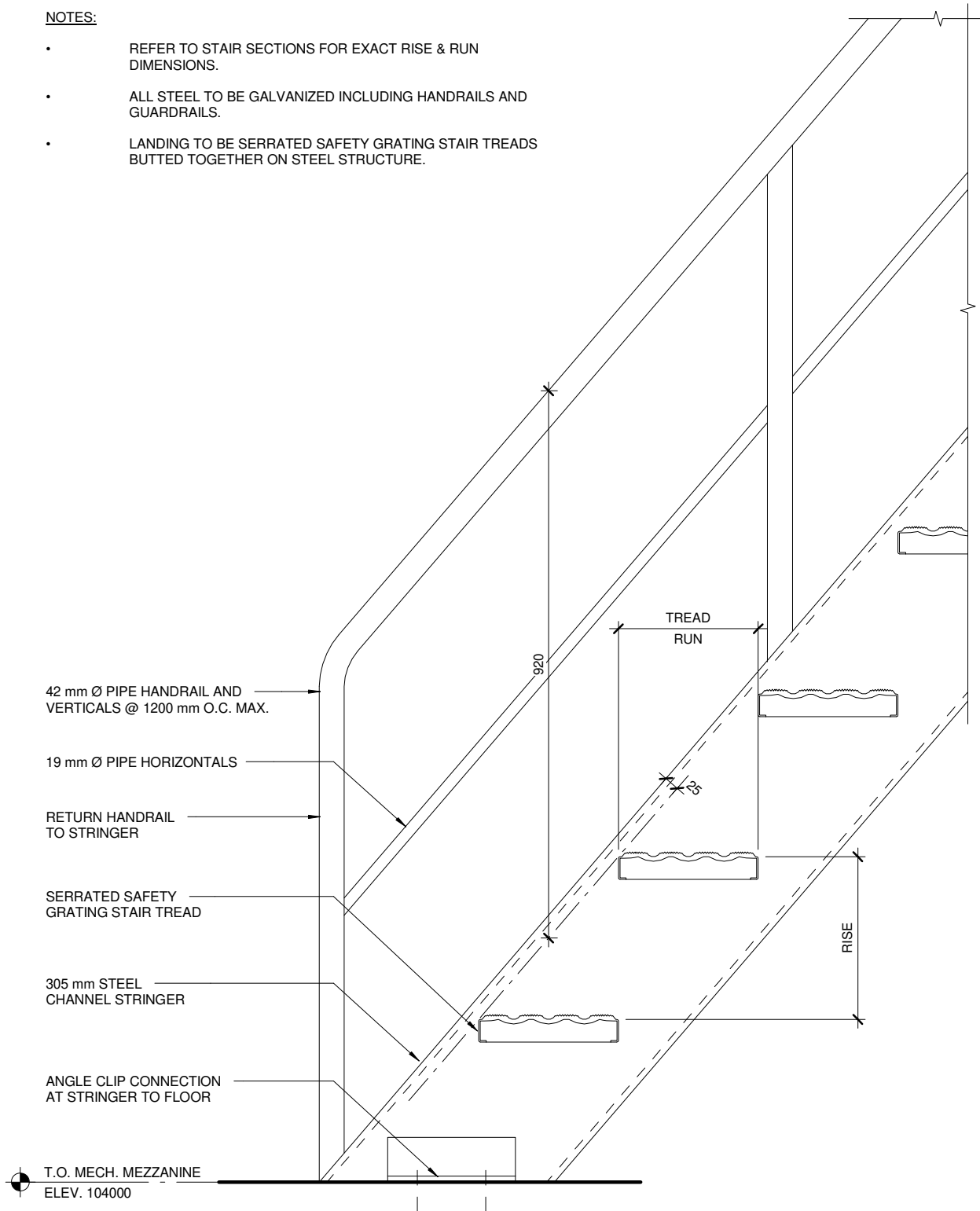
NOTE:

TREADS SHALL HAVE 2 PENCIL RODS PER TREAD AND LANDINGS SHALL HAVE 10 M REINFORCING B.W. @ 300 mm O.C.

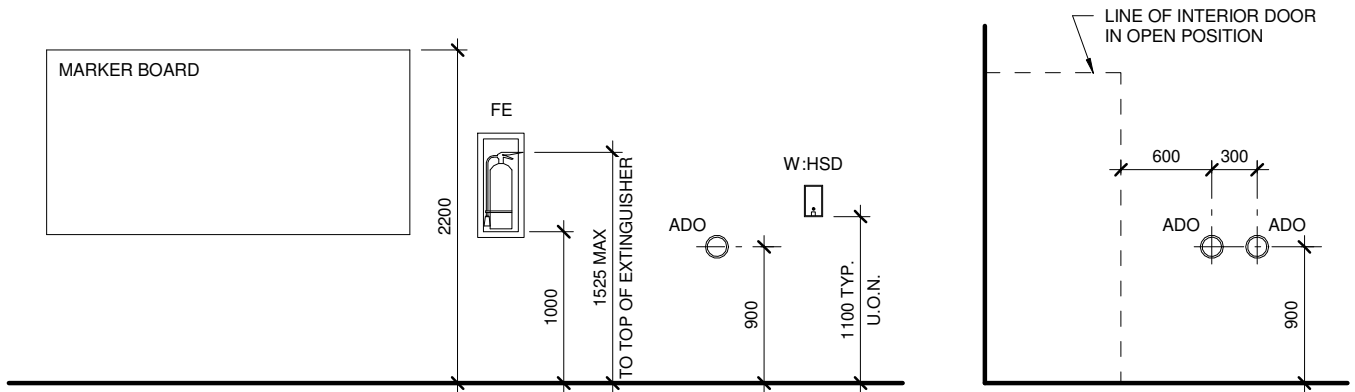
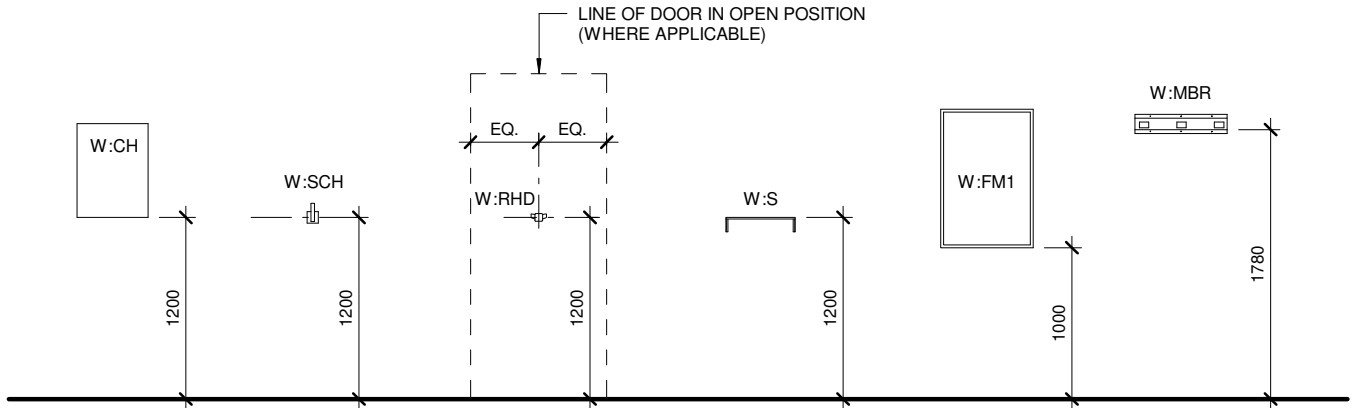
 <p>THE CITY OF WINNIPEG ASSETS & PROJECT MANAGEMENT DEPARTMENT MUNICIPAL ACCOMMODATIONS DIVISION 3-65 GARRY STREET, R3C 4K4</p>		<p>PROJECT PEMBINA TRAILS COLLEGIATE VOCATIONAL WING 50 FRONTIER TRAIL, WINNIPEG, MANITOBA, R3Y 2H1</p>			<p>SHEET TITLE STAIR DETAIL</p>	
<p>DRAWN BY: HW</p>	<p>CHECKED BY: HW</p>	<p>DESIGNED BY: TM</p>	<p>APPROVED BY: JT</p>	<p>DATE: 2024.04.01</p> <p>eFILE: 1929V_PTCV_ARCH_2023.rvt</p>	<p>SCALE: 1 : 10</p> <p>PROJECT No: 2020-127</p>	<p>SHEET No: AP6.01</p>

NOTES:

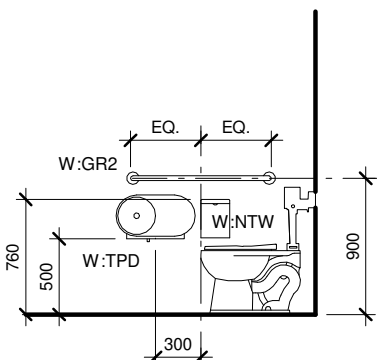
- REFER TO STAIR SECTIONS FOR EXACT RISE & RUN DIMENSIONS.
- ALL STEEL TO BE GALVANIZED INCLUDING HANDRAILS AND GUARDRAILS.
- LANDING TO BE SERRATED SAFETY GRATING STAIR TREADS BUTTED TOGETHER ON STEEL STRUCTURE.



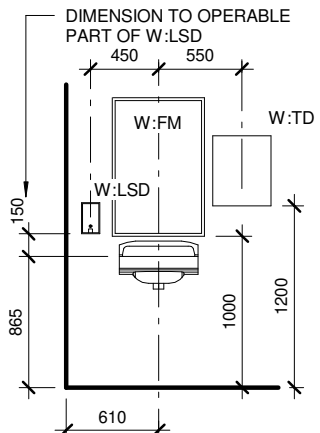
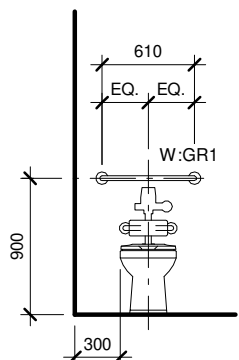
 <p>THE CITY OF WINNIPEG ASSETS & PROJECT MANAGEMENT DEPARTMENT MUNICIPAL ACCOMMODATIONS DIVISION 3-65 GARRY STREET, R3C 4K4</p>		<p>PROJECT PEMBINA TRAILS COLLEGIATE VOCATIONAL WING 50 FRONTIER TRAIL, WINNIPEG, MANITOBA, R3Y 2H1</p>			<p>SHEET TITLE SAFETY GRATING STAIR DETAIL</p>		
DRAWN BY: HW	CHECKED BY: HW	DESIGNED BY: TM	APPROVED BY: JT	DATE: 2024.04.01 eFILE: 1929V_PTCV_ARCH_2023.rvt	SCALE: 1 : 10 PROJECT No: 2020-127	SHEET No: AP6.02	



TYPICAL ADO LOCATIONS IN VESTIBULES



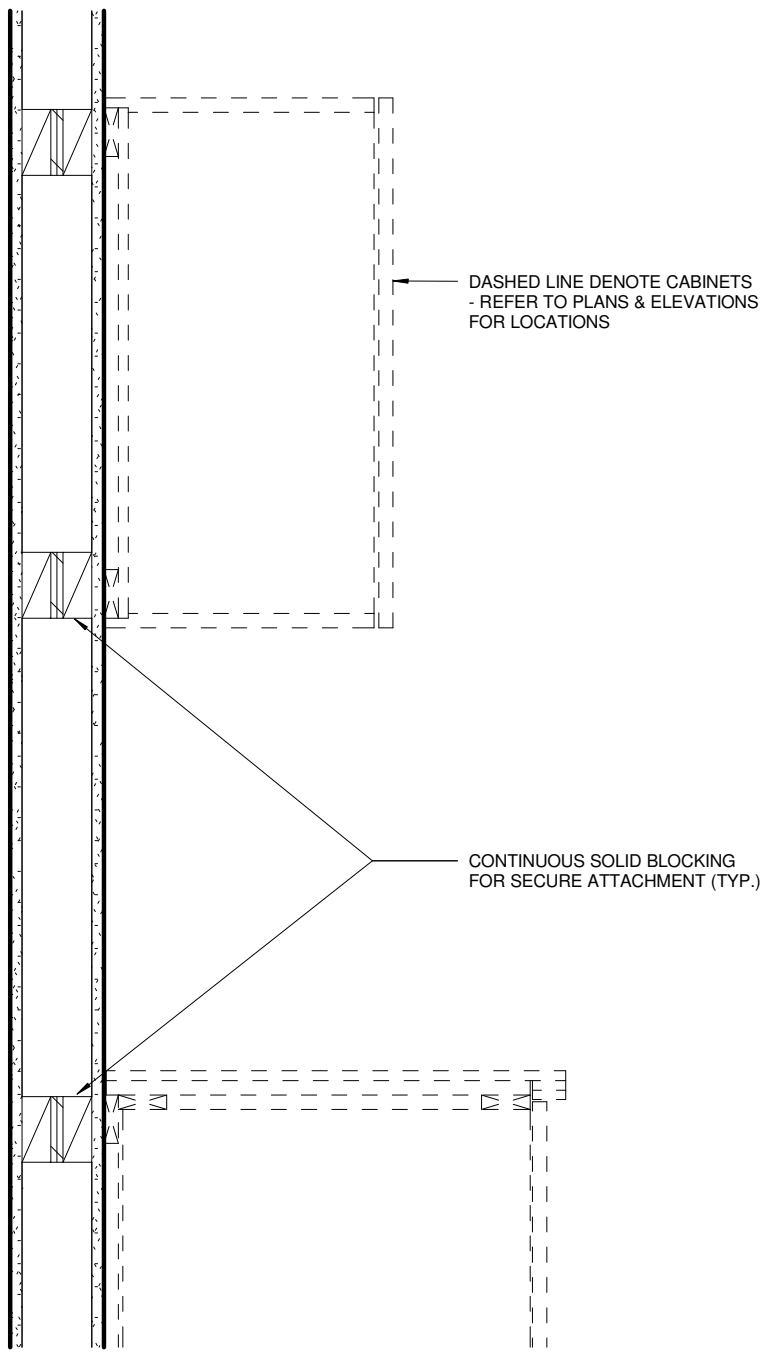
TYPICAL WC ACCESSORY LOCATIONS



TYPICAL LAVATORY ACCESSORY LOCATIONS

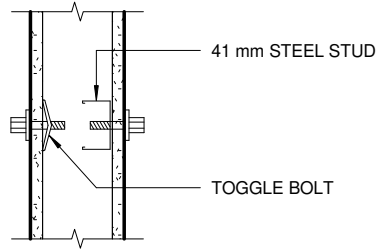
CONTRACTOR TO CONFIRM MOUNTING DIMENSIONS OF ALL ACCESSORIES WITH THE CITY AND CONTRACT ADMINISTRATOR PRIOR TO INSTALLATION. DIMENSIONS SHOWN ARE TYPICAL UNLESS OTHERWISE NOTED.

THE CITY OF WINNIPEG ASSETS & PROJECT MANAGEMENT DEPARTMENT MUNICIPAL ACCOMMODATIONS DIVISION 3-65 GARRY STREET, R3C 4K4		PROJECT PEMBINA TRAILS COLLEGIATE VOCATIONAL WING 50 FRONTIER TRAIL, WINNIPEG, MANITOBA, R3Y 2H1			SHEET TITLE STANDARD MOUNTING HEIGHTS AND ACCESSORY LOCATIONS	
DRAWN BY:	CHECKED BY:	DESIGNED BY:	APPROVED BY:	DATE:	SCALE:	SHEET No:
TM	TM	DN	SS	2024.04.01	1:50	AP7.01
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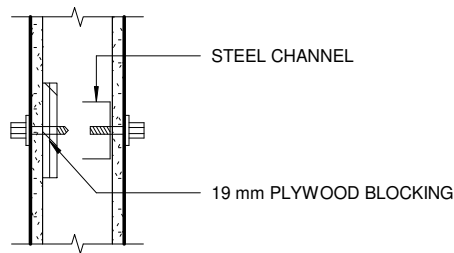


NOTE:
 COORDINATE BLOCKING W/ MECH/ELEC ROUGH -IN
 PROVIDE 18GA. STL PLATE AT VOID(S) WHERE REQUIRED.

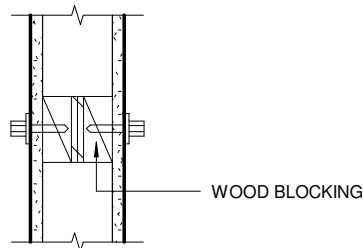
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DRAWN BY:	CHECKED BY:	DESIGNED BY:	APPROVED BY:	DATE:	SCALE:	SHEET No:
HW	HW	HW	SS	2024.04.01	1 : 10	AP7.02
				eFILE: 1929V_PTCV_ARCH_2023.rvt	PROJECT No: 2020-127	



**LIGHT - WEIGHT
OBJECTS (4.5 kg.)**



**MEDIUM - WEIGHT
OBJECTS (11 kg.)**



**HEAVY - WEIGHT
OBJECTS (22.6 kg.)**

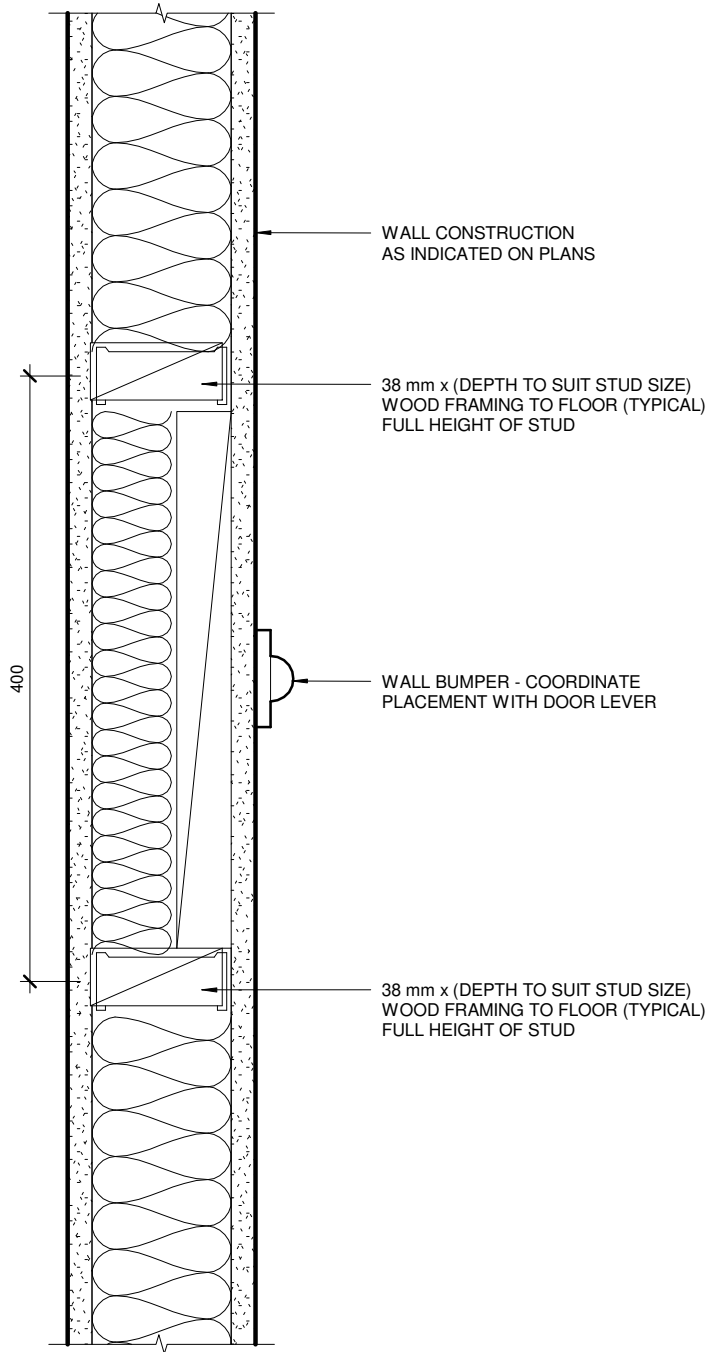


THE CITY OF WINNIPEG
ASSETS & PROJECT MANAGEMENT
DEPARTMENT
MUNICIPAL ACCOMMODATIONS DIVISION
3-65 GARRY STREET, R3C 4K4

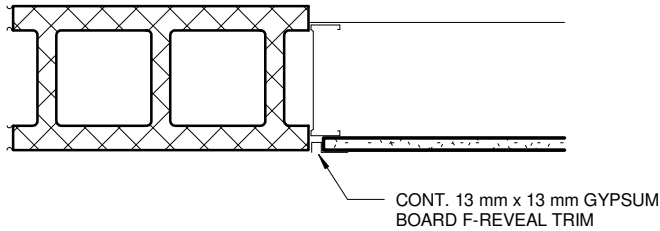
PROJECT
PEMBINA TRAILS COLLEGIATE
VOCATIONAL WING
50 FRONTIER TRAIL, WINNIPEG, MANITOBA, R3Y 2H1

SHEET TITLE
TYPICAL WALL ATTACHMENT DETAILS

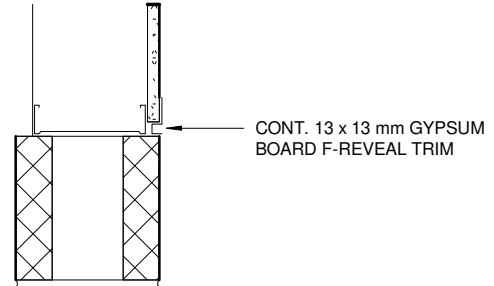
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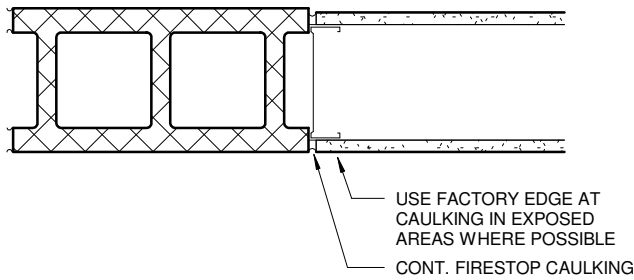
 THE CITY OF WINNIPEG ASSETS & PROJECT MANAGEMENT DEPARTMENT MUNICIPAL ACCOMMODATIONS DIVISION 3-65 GARRY STREET, R3C 4K4			PROJECT PEMBINA TRAILS COLLEGIATE VOCATIONAL WING 50 FRONTIER TRAIL, WINNIPEG, MANITOBA, R3Y 2H1			SHEET TITLE TYPICAL BLOCKING FOR WALL MOUNTED DOOR STOPS	
DRAWN BY:	CHECKED BY:	DESIGNED BY:	APPROVED BY:	DATE:	SCALE:	SHEET No:	
HW	HW	HW	SS	2024.04.01	1:5	AP7.04	
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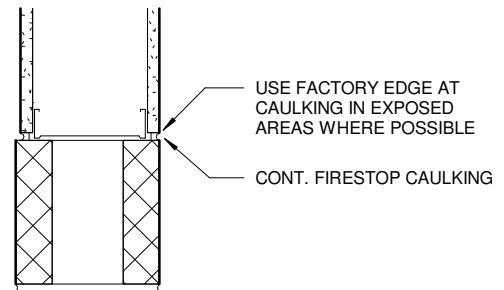
GB TO CMU VERTICAL TRANSITION



GB TO CMU HORIZONTAL TRANSITION



GB TO CMU VERTICAL TRANSITION - FIRE RATED WALLS

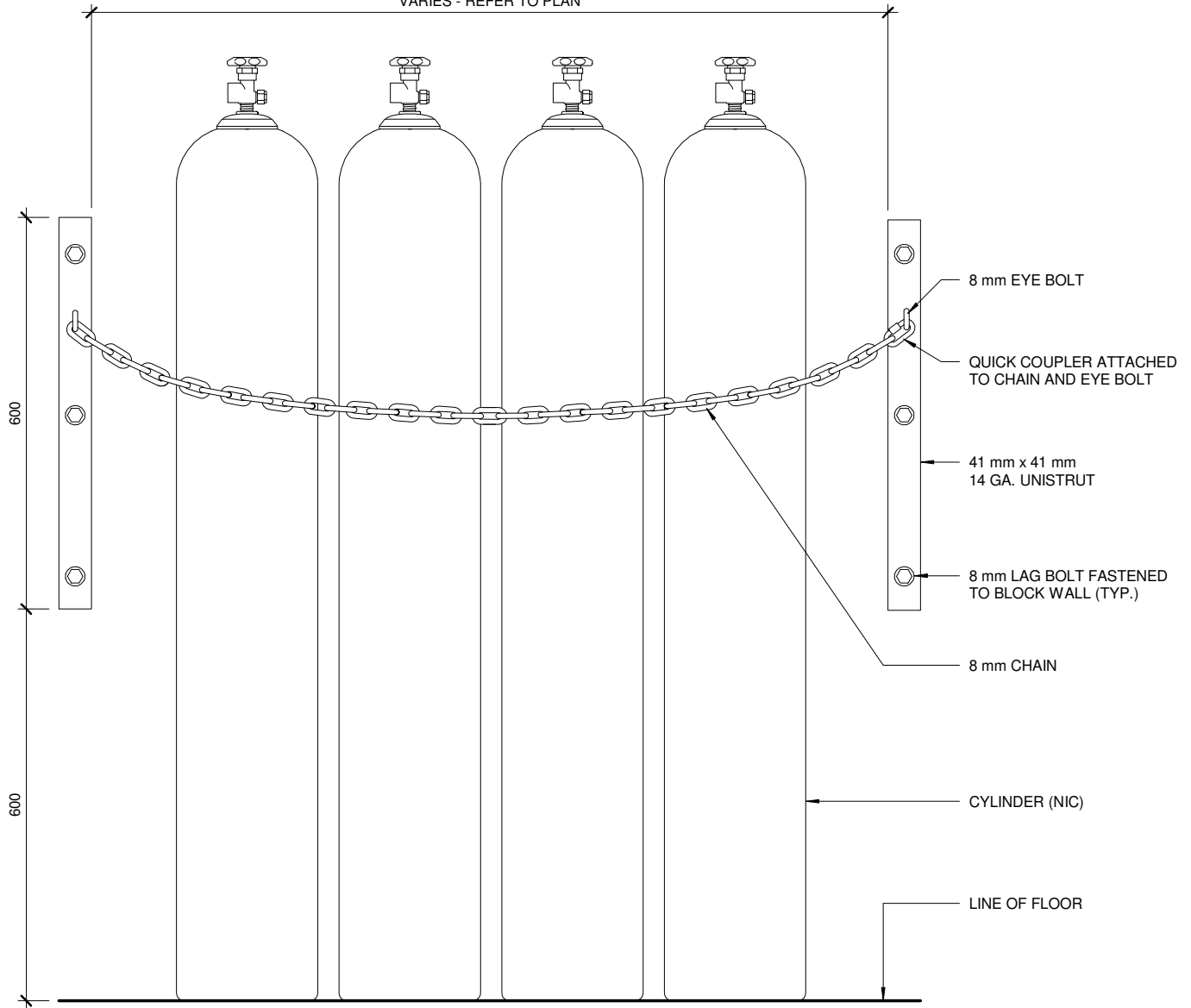


GB TO CMU HORIZONTAL TRANSITION - FIRE RATED WALLS

NOTE:
REFER TO PLANS FOR WALL TYPE DESIGNATIONS

 THE CITY OF WINNIPEG ASSETS & PROJECT MANAGEMENT DEPARTMENT MUNICIPAL ACCOMMODATIONS DIVISION 3-65 GARRY STREET, R3C 4K4		PROJECT PEMBINA TRAILS COLLEGIATE VOCATIONAL WING 50 FRONTIER TRAIL, WINNIPEG, MANITOBA, R3Y 2H1			SHEET TITLE TYPICAL GYPSUM BOARD (GB) TO CMU TRANSITIONS	
DRAWN BY:	CHECKED BY:	DESIGNED BY:	APPROVED BY:	DATE:	SCALE:	SHEET No:
TM	HW	TM	SS	2024.04.01	1 : 10	AP7.05
				eFILE: 1929V_PTCV_ARCH_2023.rvt	PROJECT No: 2020-127	

VARIES - REFER TO PLAN



- 8 mm EYE BOLT
- QUICK COUPLER ATTACHED TO CHAIN AND EYE BOLT
- 41 mm x 41 mm 14 GA. UNISTRUT
- 8 mm LAG BOLT FASTENED TO BLOCK WALL (TYP.)
- 8 mm CHAIN
- CYLINDER (NIC)
- LINE OF FLOOR

 <p>THE CITY OF WINNIPEG ASSETS & PROJECT MANAGEMENT DEPARTMENT MUNICIPAL ACCOMMODATIONS DIVISION 3-65 GARRY STREET, R3C 4K4</p>		<p>PROJECT PEMBINA TRAILS COLLEGIATE VOCATIONAL WING 50 FRONTIER TRAIL, WINNIPEG, MANITOBA, R3Y 2H1</p>			<p>SHEET TITLE TYPICAL CYLINDER RESTRAINT</p>	
DRAWN BY: HW	CHECKED BY: HW	DESIGNED BY: DN	APPROVED BY: JT	DATE: 2024.04.01	SCALE: 1 : 10	SHEET No: AP7.06
				eFILE: 1929V_PTCV_ARCH_2023.rvt	PROJECT No: 2020-127	

CODING KEY:

SUFFIX NUMBER INDICATES MILLWORK LENGTH
 LETTERS INDICATES MILLWORK TYPE
 LETTER INDICATES MILLWORK DESCRIPTION:
 U - UPPER CABINET
 L - LOWER CABINET
 B - BARRIER FREE
 S - SHELVING
 PREFIX NUMBER INDICATES HEIGHT → **7UA6**
 NUMBER INDICATES DEPTH AT → **(650 D)**
 ATYPICAL CONDITIONS

PREFIX AND SUFFIX NUMBER MEASUREMENTS:

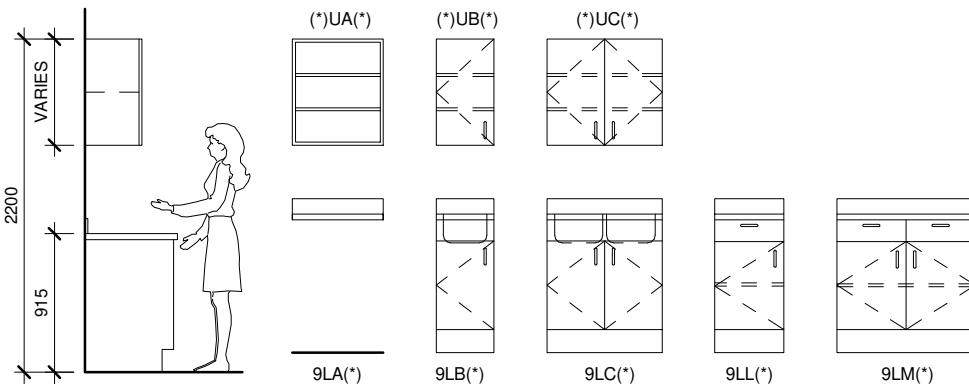
3 = 300	75 = 750	(L) = LENGTH TO SUIT
35 = 350	76 = 760	(H) = HEIGHT TO SUIT
4 = 400	8 = 800	
45 = 450	82 = 820 ±	
5 = 500	85 = 850	
55 = 550	9 = 900 (915*)	
6 = 600	10 = 1000	
65 = 650	11 = 1100	
7 = 700		

* LOWER CABINET HT. ONLY

GENERAL NOTES:

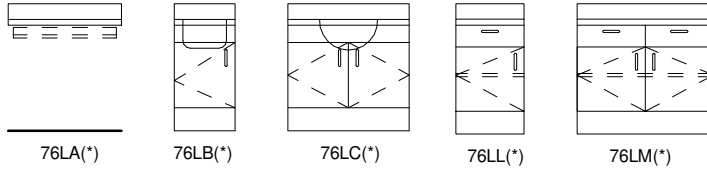
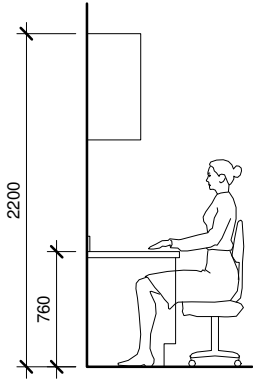
- ALL MILLWORK TO BE PLASTIC LAMINATE FACED CASEWORK UNLESS OTHERWISE INDICATED.
- COUNTERTOP SHALL BE CONTINUOUS WALL TO WALL UNLESS OTHERWISE INDICATED.
- TYPICAL COUNTERTOPS SHALL BE 650 mm DEEP UNLESS OTHERWISE INDICATED.
- ALL SHELVES TO BE ADJUSTABLE UNLESS OTHERWISE INDICATED. REFER TO INTERIOR ELEVATIONS FOR QUANTITIES.
- PROVIDE BACKSPLASH/SIDESPLASH AT ALL COUNTERTOP LOCATIONS UNLESS OTHERWISE INDICATED. ALL BACKSPLASHES/SIDESPLASHES TO BE 100 mm HIGH UNLESS OTHERWISE INDICATED.
- G.C. TO CONFIRM SIZES OF ALL APPLIANCES AND EQUIPMENT, (OPF, NIC. OR IN CONTRACT) LOCATED WITHIN MILLWORK PRIOR TO TIME OF FABRICATION.
- PROVIDE GROMMETS IN COUNTERTOPS AT ALL LOCATIONS WHERE EQUIPMENT IS INDICATED.
- MILLWORK INDICATED BELOW ARE STANDARD MODULES. REFER TO INTERIOR ELEVATIONS FOR MODULES USED IN THIS PROJECT.
- ALL MILLWORK DOORS AND DRAWERS TO BE LOCKING UNLESS INDICATED OTHERWISE. REFER TO INTERIOR ELEVATIONS.
- REFER TO SPEC SECTION 06 40 00 - ARCHITECTURAL WOODWORK FOR ALL MILLWORK PULL HARDWARE SIZE DISTRIBUTION.

UPPER CABINETS

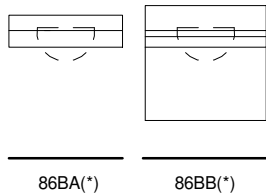
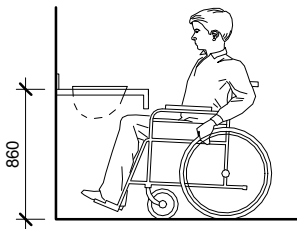


LOWER CABINETS

THE CITY OF WINNIPEG ASSETS & PROJECT MANAGEMENT DEPARTMENT MUNICIPAL ACCOMMODATIONS DIVISION 3-65 GARRY STREET, R3C 4K4		PROJECT PEMBINA TRAILS COLLEGIATE VOCATIONAL WING 50 FRONTIER TRAIL, WINNIPEG, MANITOBA, R3Y 2H1			SHEET TITLE STANDARD MILLWORK TYPES	
DRAWN BY: TM	CHECKED BY: HW	DESIGNED BY: DN	APPROVED BY: SS	DATE: 2024.04.01	SCALE: 1 : 50	SHEET No: AP8.01
				eFILE: 1929V_PTCV_ARCH_2023.rvt	PROJECT No: 2020-127	

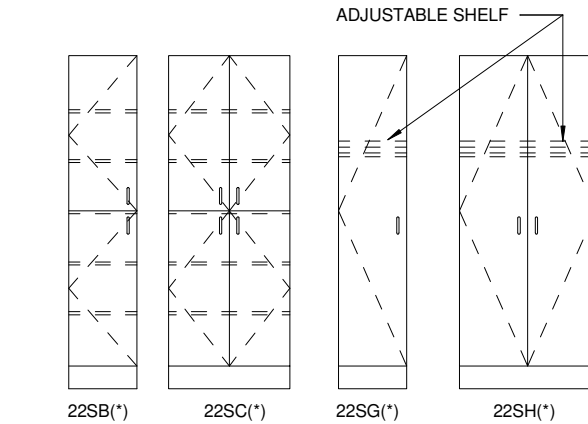
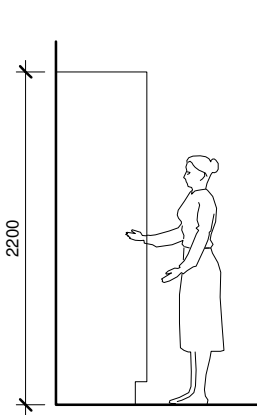


LOWER CABINETS



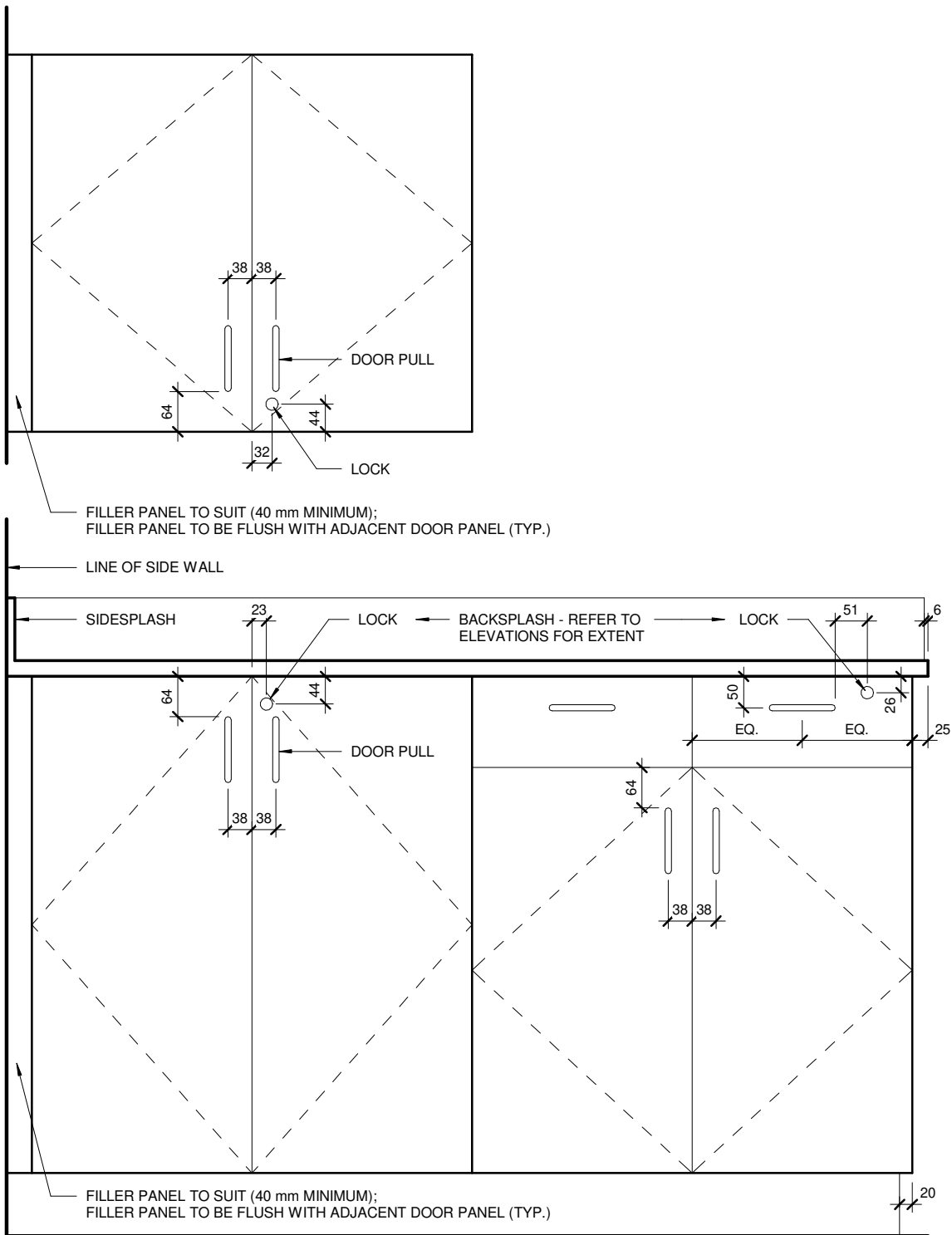
BARRIER-FREE UNITS

(NOTE: 865 mm MAX. TO RIM OF SINK)



SHELVING UNITS

 THE CITY OF WINNIPEG ASSETS & PROJECT MANAGEMENT DEPARTMENT MUNICIPAL ACCOMMODATIONS DIVISION 3-65 GARRY STREET, R3C 4K4		PROJECT PEMBINA TRAILS COLLEGIATE VOCATIONAL WING 50 FRONTIER TRAIL, WINNIPEG, MANITOBA, R3Y 2H1			SHEET TITLE STANDARD MILLWORK TYPES	
DRAWN BY:	CHECKED BY:	DESIGNED BY:	APPROVED BY:	DATE:	SCALE:	SHEET No:
TM	HW	DN	SS	2024.04.01	1:50	AP8.02
				eFILE: 1929V_PTCV_ARCH_2023.rvt	PROJECT No: 2020-127	



THE CITY OF WINNIPEG
 ASSETS & PROJECT MANAGEMENT
 DEPARTMENT
 MUNICIPAL ACCOMMODATIONS DIVISION
 3-65 GARRY STREET, R3C 4K4

PROJECT
 PEMBINA TRAILS COLLEGIATE
 VOCATIONAL WING
 50 FRONTIER TRAIL, WINNIPEG, MANITOBA, R3Y 2H1

SHEET TITLE
 TYPICAL CABINET ELEVATION

DRAWN BY:
 TM

CHECKED BY:
 HW

DESIGNED BY:
 DN

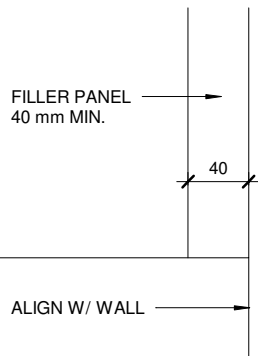
APPROVED BY:
 SS

DATE:
 2024.04.01
 eFILE:
 1929V_PTCV_ARCH_2023.rvt

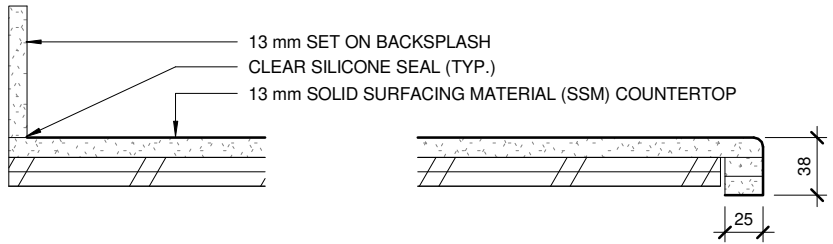
SCALE:
 1 : 10

PROJECT No: 2020-127

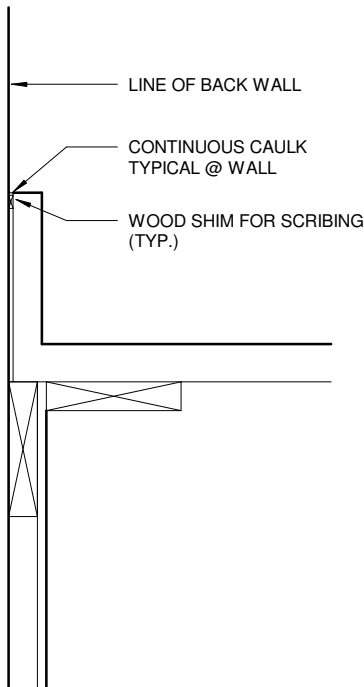
SHEET No:
AP8.03



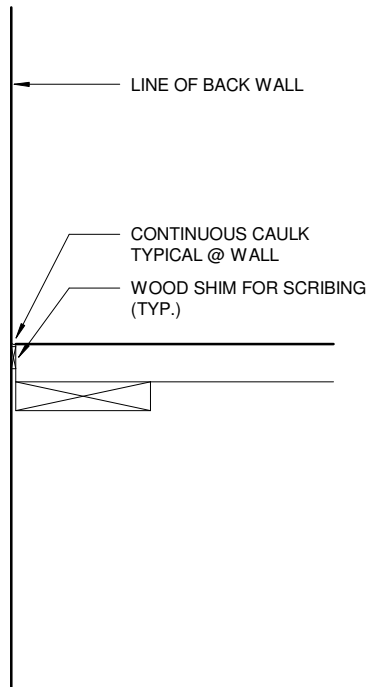
**ELEVATION @
UPPER CABINET**



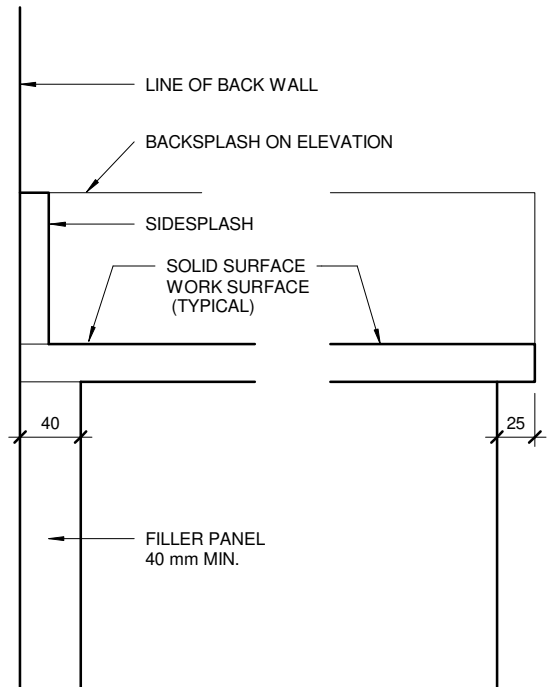
**SOLID SURFACE
COUNTERTOP**



**SECTION @
BACKSPLASH**



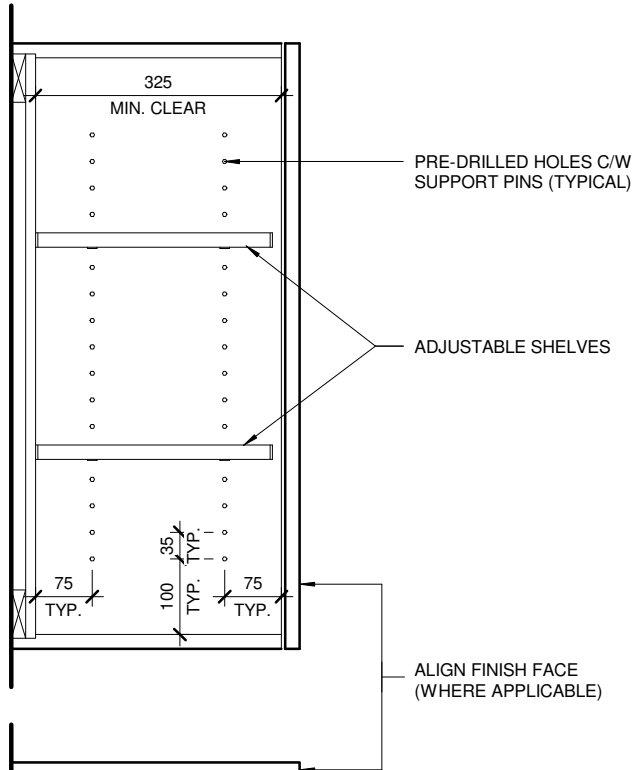
**SECTION @ WORK
SURFACE TO WALL**



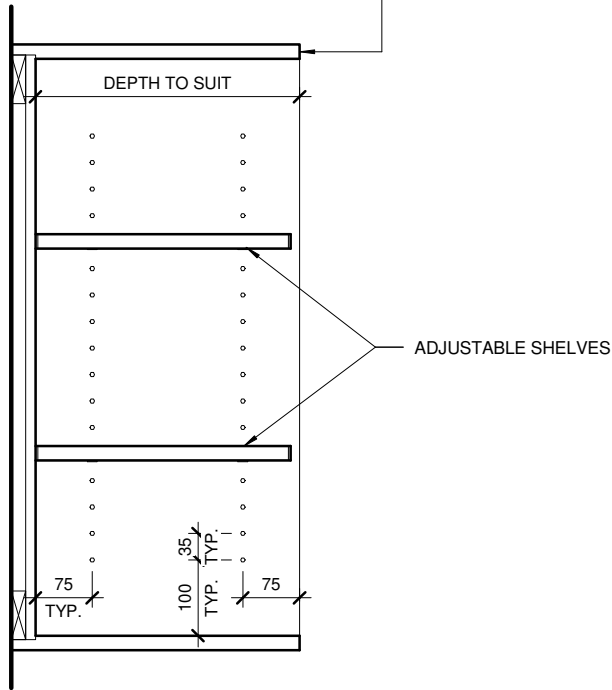
**ELEVATION @
LOWER CABINET**

 <p>THE CITY OF WINNIPEG ASSETS & PROJECT MANAGEMENT DEPARTMENT MUNICIPAL ACCOMMODATIONS DIVISION 3-65 GARRY STREET, R3C 4K4</p>		<p>PROJECT PEMBINA TRAILS COLLEGIATE VOCATIONAL WING 50 FRONTIER TRAIL, WINNIPEG, MANITOBA, R3Y 2H1</p>			<p>SHEET TITLE TYPICAL COUNTERTOP DETAILS</p>	
DRAWN BY: TM	CHECKED BY: HW	DESIGNED BY: DN	APPROVED BY: SS	DATE: 2024.04.01 eFILE: 1929V_PTCV_ARCH_2023.rvt	SCALE: 1:5	SHEET No: AP8.04
					PROJECT No: 2020-127	

TYPE UB/UC



TYPE UA



NOTE:

- PLASTIC LAMINATE FACED CASEWORK
- REFER TO ELEVATIONS FOR LOCATIONS OF LOCKING DOORS



THE CITY OF WINNIPEG
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MUNICIPAL ACCOMMODATIONS DIVISION
3-65 GARRY STREET, R3C 4K4

PROJECT
PEMBINA TRAILS COLLEGIATE
VOCATIONAL WING
50 FRONTIER TRAIL, WINNIPEG, MANITOBA, R3Y 2H1

SHEET TITLE
MILLWORK TYPES UA, UB & UC

DRAWN BY:
TM

CHECKED BY:
HW

DESIGNED BY:
DN

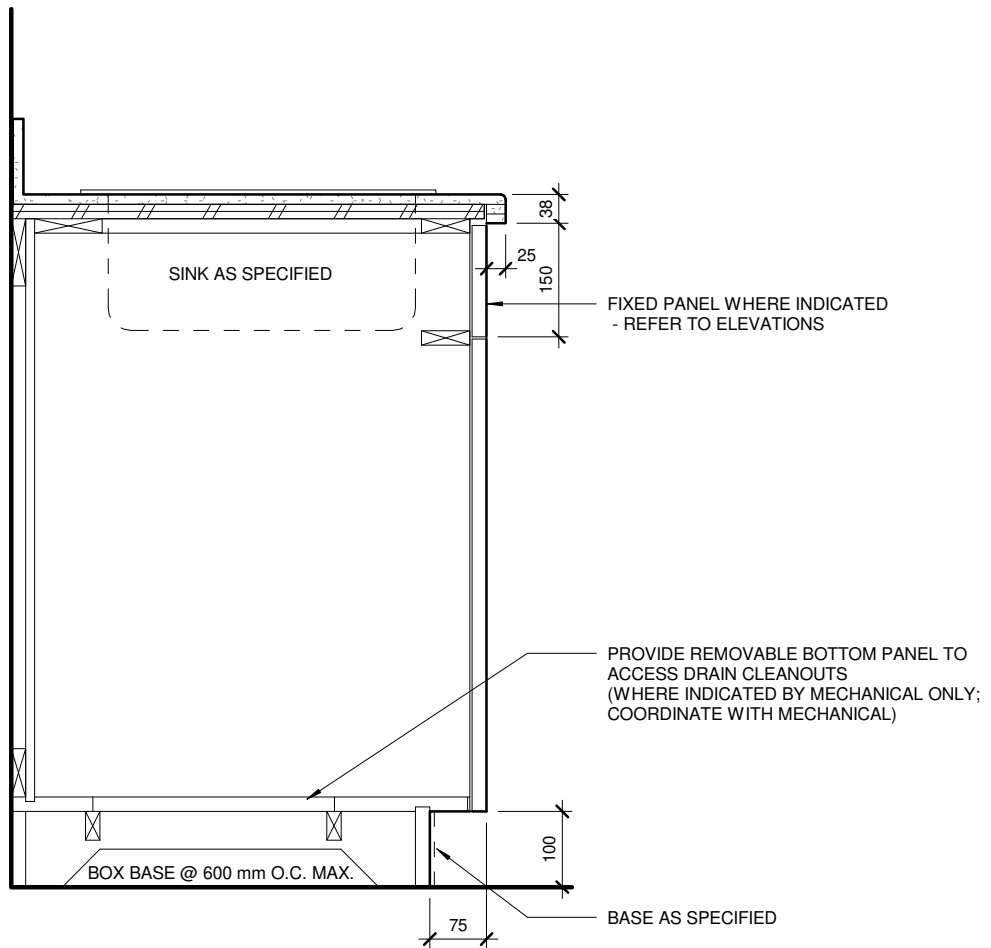
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SS

DATE:
2024.04.01
eFILE:
1929V_PTCV_ARCH_2023.rvt

SCALE:
1 : 10

PROJECT No: 2020-127

SHEET No:
AP8.05



NOTE:

- PLASTIC LAMINATE FACED CASEWORK
- SOLID SURFACE MATERIAL COUNTERTOP, BACKSPLASH, & SIDESPLASH (UNLESS OTHERWISE NOTED - REFER TO ELEVATIONS)
- DEPTH VARIES (REFER TO ENLARGED PLANS)
- REFER TO ELEVATIONS FOR LOCATIONS OF LOCKING DOORS



THE CITY OF WINNIPEG
 ASSETS & PROJECT MANAGEMENT
 DEPARTMENT
 MUNICIPAL ACCOMMODATIONS DIVISION
 3-65 GARRY STREET, R3C 4K4

PROJECT
PEMBINA TRAILS COLLEGIATE
VOCATIONAL WING
 50 FRONTIER TRAIL, WINNIPEG, MANITOBA, R3Y 2H1

SHEET TITLE
MILLWORK TYPES LB & LC

DRAWN BY:
 TM

CHECKED BY:
 HW

DESIGNED BY:
 DN

APPROVED BY:
 SS

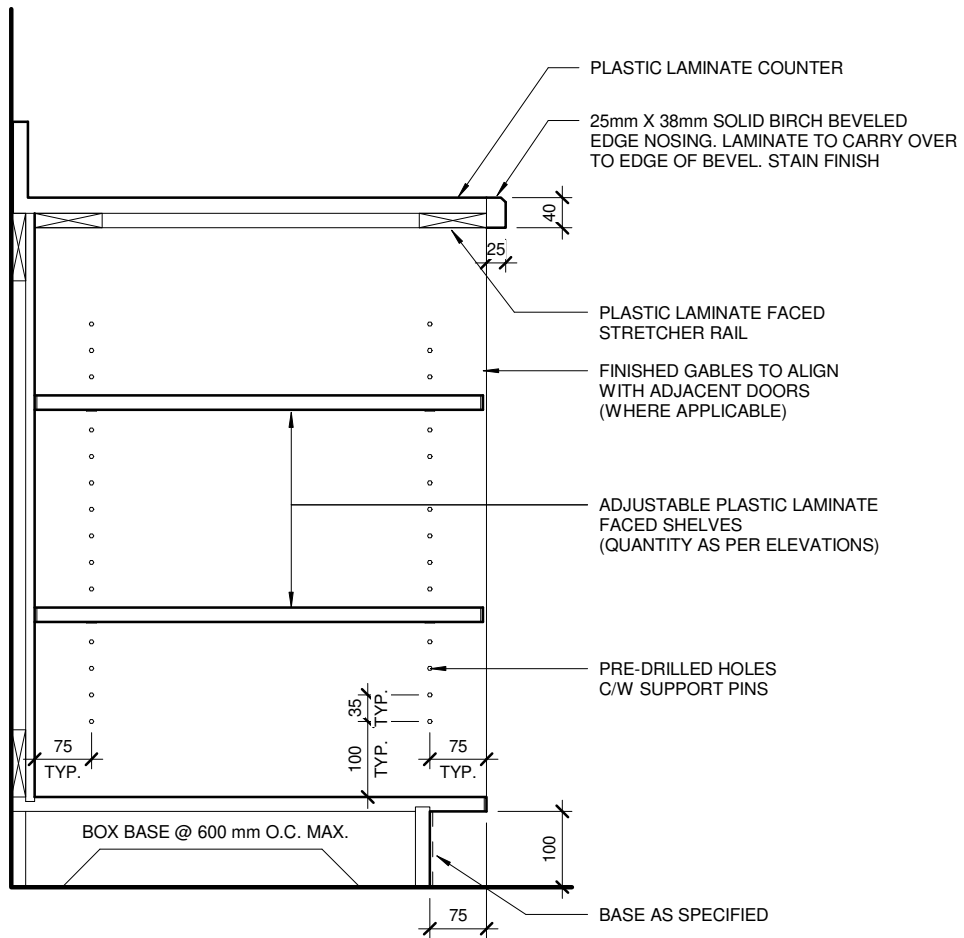
DATE:
 2024.04.01
 eFILE:
 1929V_PTCV_ARCH_2023.rvt

SCALE:
 1 : 10

PROJECT No: 2020-127

SHEET No:

AP8.06



NOTE:

- PLASTIC LAMINATE FACED CASEWORK



THE CITY OF WINNIPEG
ASSETS & PROJECT MANAGEMENT
DEPARTMENT
MUNICIPAL ACCOMMODATIONS DIVISION
3-65 GARRY STREET, R3C 4K4

PROJECT
PEMBINA TRAILS COLLEGIATE
VOCATIONAL WING
50 FRONTIER TRAIL, WINNIPEG, MANITOBA, R3Y 2H1

SHEET TITLE
MILLWORK TYPE LD

DRAWN BY:
TM

CHECKED BY:
HW

DESIGNED BY:
DN

APPROVED BY:
SS

DATE:
2024.04.01
eFILE:
1929V_PTCV_ARCH_2023.rvt

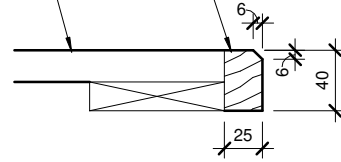
SCALE:
1 : 10

PROJECT No: 2020-127

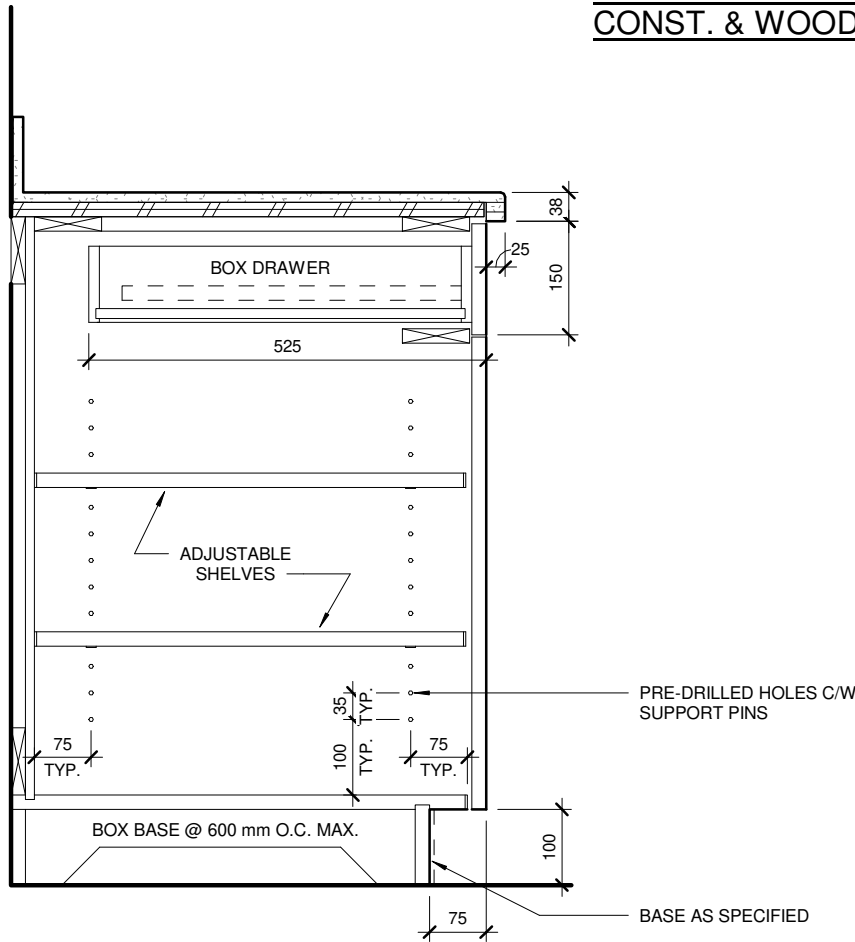
SHEET No:
AP8.07

25mm X 38mm SOLID BIRCH BEVELED
EDGE NOSING. LAMINATE TO CARRY OVER
TO EDGE OF BEVEL. STAIN FINISH

PLASTIC LAMINATE COUNTER



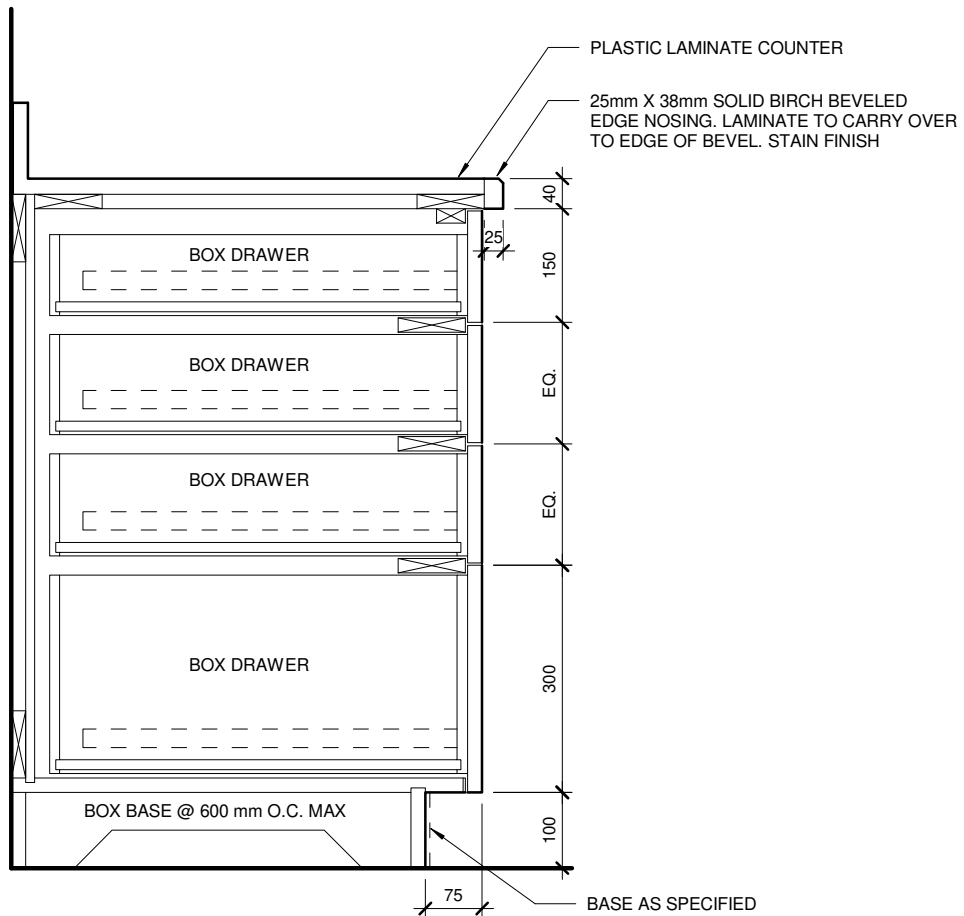
**COUNTERTOP EDGE DETAIL FOR MW @
CONST. & WOOD TECHNOLOGY 1:100**



NOTE:

- PLASTIC LAMINATE FACED CASEWORK
- REFER TO ELEVATIONS FOR LOCATIONS OF LOCKING DOORS AND DRAWERS

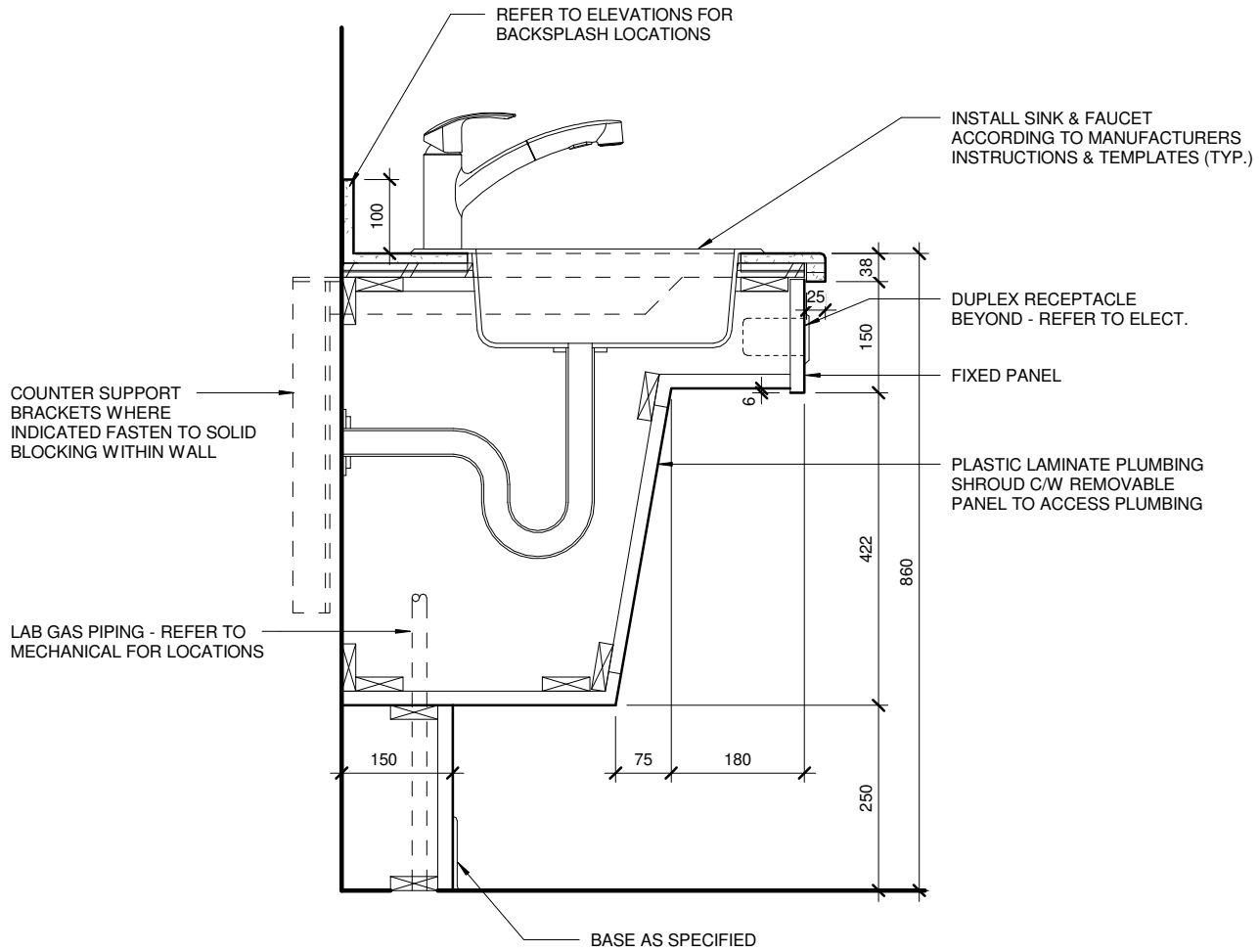
 <p>THE CITY OF WINNIPEG ASSETS & PROJECT MANAGEMENT DEPARTMENT MUNICIPAL ACCOMMODATIONS DIVISION 3-65 GARRY STREET, R3C 4K4</p>		<p>PROJECT PEMBINA TRAILS COLLEGIATE VOCATIONAL WING 50 FRONTIER TRAIL, WINNIPEG, MANITOBA, R3Y 2H1</p>			<p>SHEET TITLE MILLWORK TYPES LL & LM</p>	
DRAWN BY: TM	CHECKED BY: HW	DESIGNED BY: DN	APPROVED BY: SS	DATE: 2024.04.01 eFILE: 1929V_PTCV_ARCH_2023.rvt	SCALE: As indicated	SHEET No: AP8.08
					PROJECT No: 2020-127	



NOTE:

- PLASTIC LAMINATE FACED CASEWORK
- REFER TO ELEVATIONS FOR LOCATIONS OF LOCKING DOORS

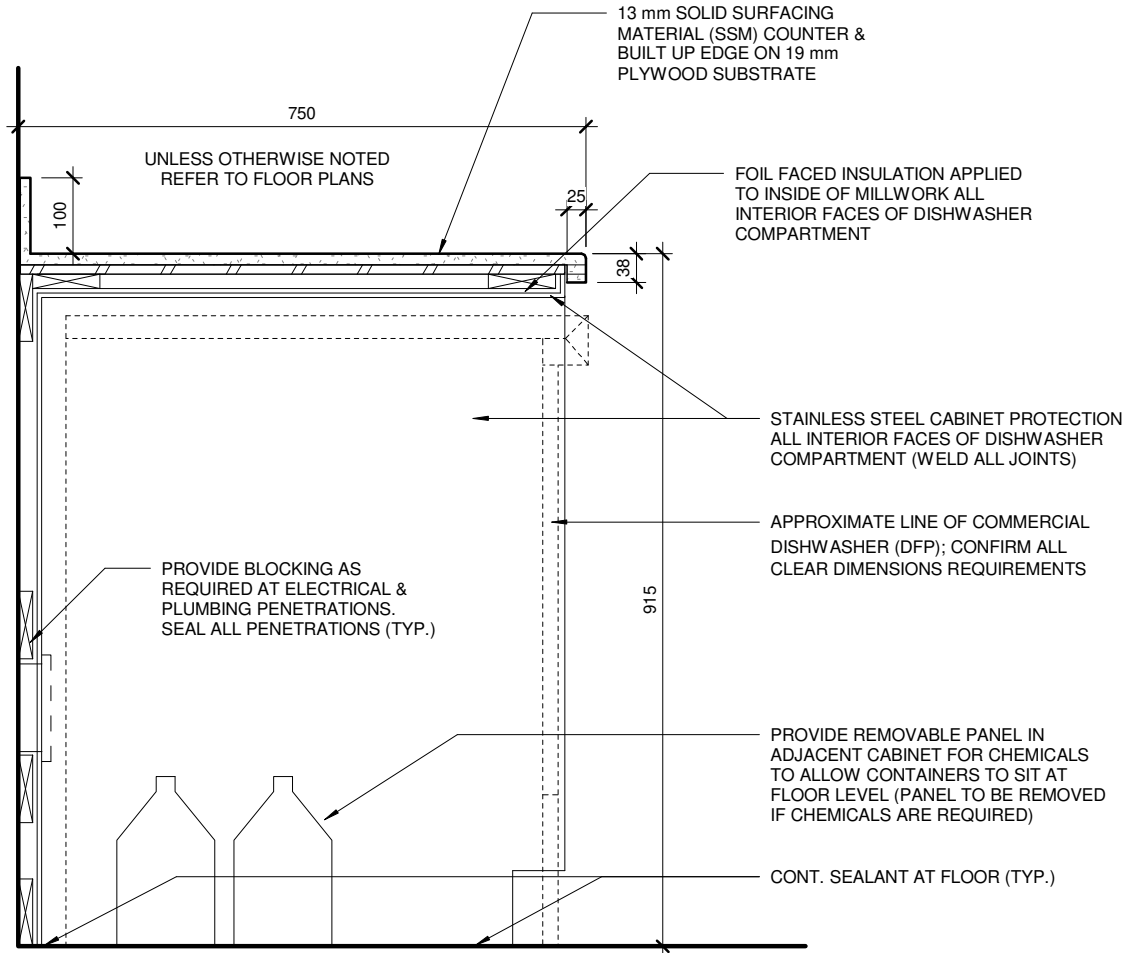
 <p>THE CITY OF WINNIPEG ASSETS & PROJECT MANAGEMENT DEPARTMENT MUNICIPAL ACCOMMODATIONS DIVISION 3-65 GARRY STREET, R3C 4K4</p>		<p>PROJECT PEMBINA TRAILS COLLEGIATE VOCATIONAL WING 50 FRONTIER TRAIL, WINNIPEG, MANITOBA, R3Y 2H1</p>			<p>SHEET TITLE MILLWORK TYPE LS</p>	
<p>DRAWN BY: TM</p>	<p>CHECKED BY: HW</p>	<p>DESIGNED BY: DN</p>	<p>APPROVED BY: SS</p>	<p>DATE: 2024.04.01</p>	<p>SCALE: 1 : 10</p>	<p>SHEET No: AP8.09</p>
				<p>eFILE: 1929V_PTCV_ARCH_2023.rvt</p>	<p>PROJECT No: 2020-127</p>	



NOTE:

- PLASTIC LAMINATE FACED COUNTERTOP & BACKSPASH
- SEMI-EXPOSED AND CONCEALED SURFACES TO BE PLASTIC LAMINATE FACED UNLESS OTHERWISE NOTED

 <p>THE CITY OF WINNIPEG ASSETS & PROJECT MANAGEMENT DEPARTMENT MUNICIPAL ACCOMMODATIONS DIVISION 3-65 GARRY STREET, R3C 4K4</p>		<p>PROJECT PEMBINA TRAILS COLLEGIATE VOCATIONAL WING 50 FRONTIER TRAIL, WINNIPEG, MANITOBA, R3Y 2H1</p>			<p>SHEET TITLE ACCESSIBLE SINK PLUMBING SHROUD</p>	
DRAWN BY: TM	CHECKED BY: HW	DESIGNED BY: DN	APPROVED BY: SS	DATE: 2024.04.01	SCALE: 1 : 10	SHEET No:
				eFILE: 1929V_PTCV_ARCH_2023.rvt	PROJECT No: 2020-127	AP8.10



NOTE:

TYPICAL AT ALL HIGH TEMPERATURE DISHWASHER LOCATIONS. CONFIRM CLEARANCE REQUIREMENTS WITH DIVISION'S EQUIPMENT.



THE CITY OF WINNIPEG
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DEPARTMENT
MUNICIPAL ACCOMMODATIONS DIVISION
3-65 GARRY STREET, R3C 4K4

PROJECT
PEMBINA TRAILS COLLEGIATE
VOCATIONAL WING
50 FRONTIER TRAIL, WINNIPEG, MANITOBA, R3Y 2H1

SHEET TITLE
DISHWASHER SHROUD DETAIL

DRAWN BY:
TM

CHECKED BY:
HW

DESIGNED BY:
DN

APPROVED BY:
SS

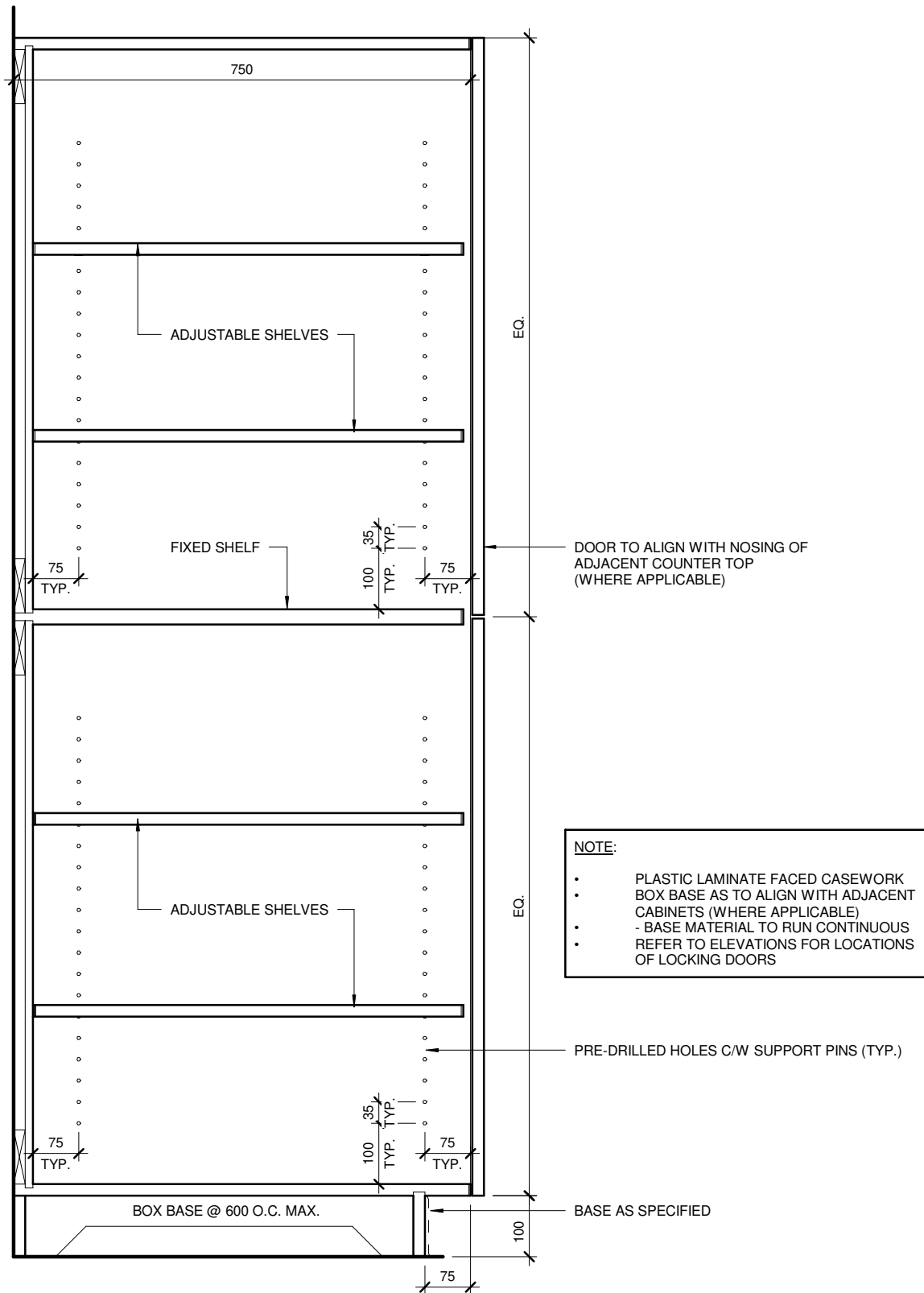
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2024.04.01
eFILE:
1929V_PTCV_ARCH_2023.rvt

SCALE:
1 : 10

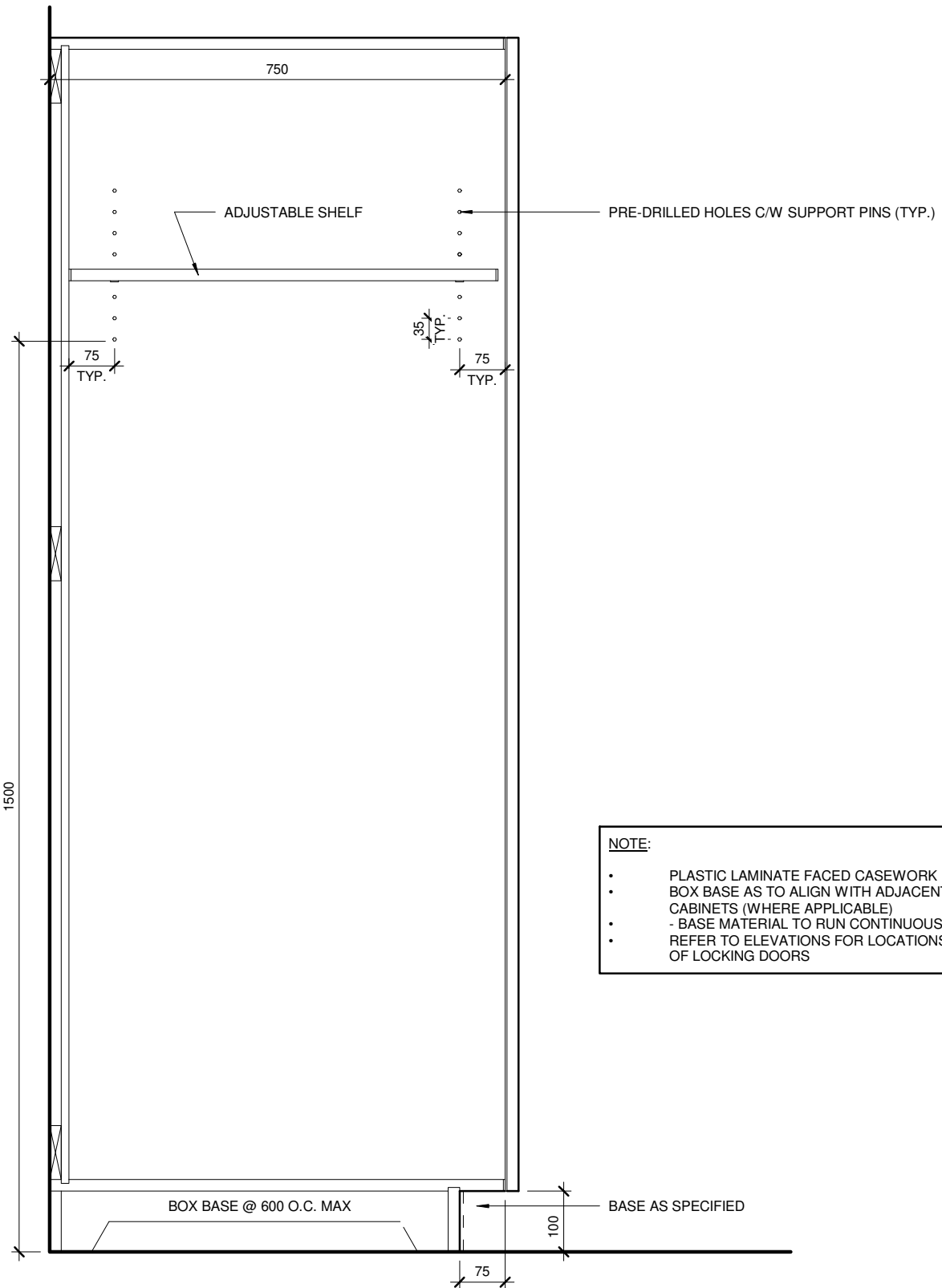
PROJECT No: 2020-127

SHEET No:

AP8.11



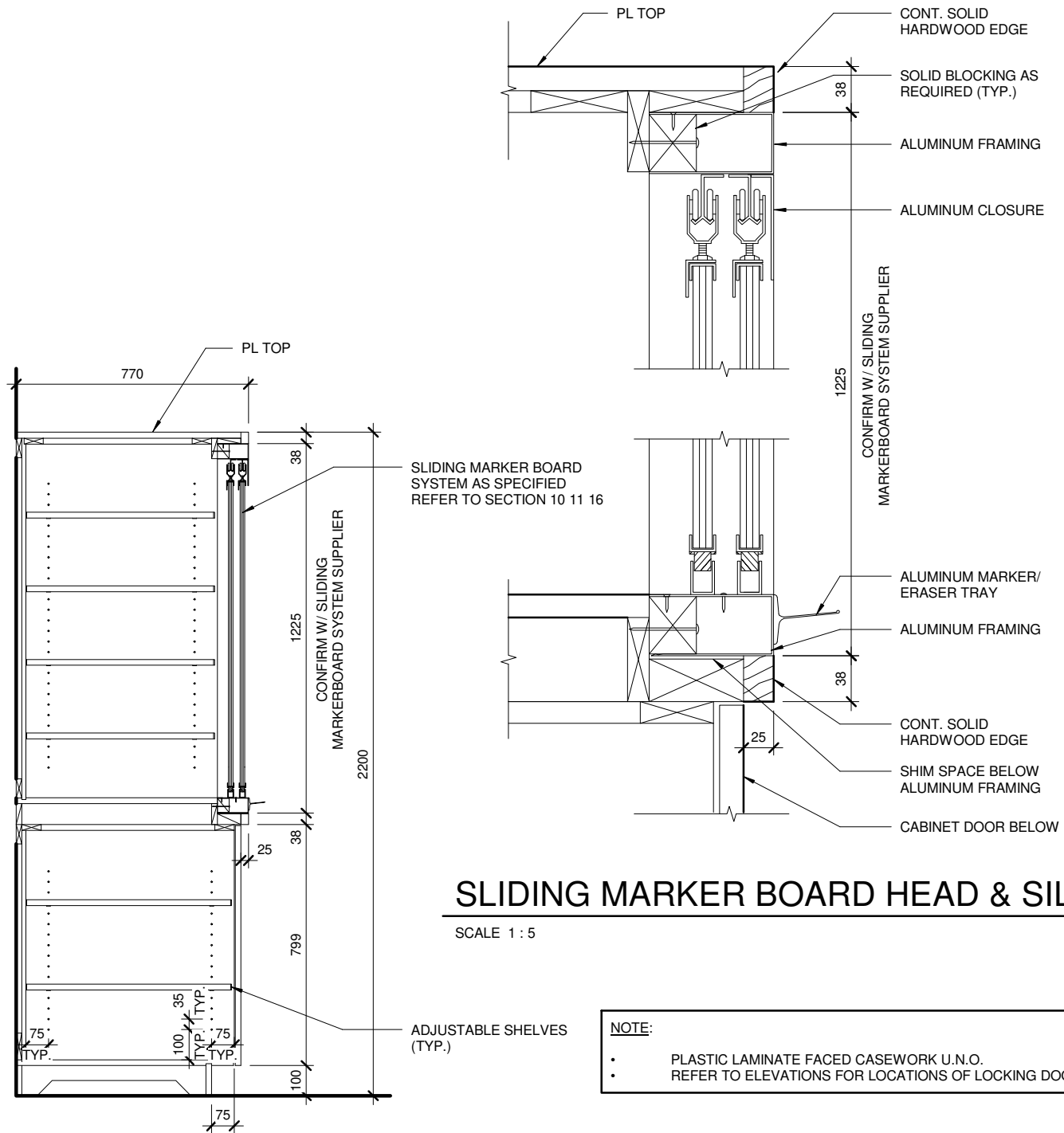
 <p>THE CITY OF WINNIPEG ASSETS & PROJECT MANAGEMENT DEPARTMENT MUNICIPAL ACCOMMODATIONS DIVISION 3-65 GARRY STREET, R3C 4K4</p>		<p>PROJECT PEMBINA TRAILS COLLEGIATE VOCATIONAL WING 50 FRONTIER TRAIL, WINNIPEG, MANITOBA, R3Y 2H1</p>			<p>SHEET TITLE MILLWORK TYPES SB & SC</p>	
DRAWN BY:	CHECKED BY:	DESIGNED BY:	APPROVED BY:	DATE:	SCALE:	SHEET No:
TM	HW	DN	SS	2024.04.01	1:10	AP8.12
				eFILE: 1929V_PTCV_ARCH_2023.rvt	PROJECT No: 2020-127	



NOTE:

- PLASTIC LAMINATE FACED CASEWORK
- BOX BASE AS TO ALIGN WITH ADJACENT CABINETS (WHERE APPLICABLE)
- - BASE MATERIAL TO RUN CONTINUOUS
- REFER TO ELEVATIONS FOR LOCATIONS OF LOCKING DOORS

 <p>THE CITY OF WINNIPEG ASSETS & PROJECT MANAGEMENT DEPARTMENT MUNICIPAL ACCOMMODATIONS DIVISION 3-65 GARRY STREET, R3C 4K4</p>		<p>PROJECT PEMBINA TRAILS COLLEGIATE VOCATIONAL WING 50 FRONTIER TRAIL, WINNIPEG, MANITOBA, R3Y 2H1</p>			<p>SHEET TITLE MILLWORK TYPES SG & SH</p>	
DRAWN BY:	CHECKED BY:	DESIGNED BY:	APPROVED BY:	DATE:	SCALE:	SHEET No:
TM	HW	DN	SS	2024.04.01	1 : 10	AP8.13
				eFILE: 1929V_PTCV_ARCH_2023.rvt	PROJECT No: 2020-127	



SLIDING MARKER BOARD HEAD & SILL

SCALE 1 : 5

NOTE:

- PLASTIC LAMINATE FACED CASEWORK U.N.O.
- REFER TO ELEVATIONS FOR LOCATIONS OF LOCKING DOORS



THE CITY OF WINNIPEG
 ASSETS & PROJECT MANAGEMENT
 DEPARTMENT
 MUNICIPAL ACCOMMODATIONS DIVISION
 3-65 GARRY STREET, R3C 4K4

PROJECT
 PEMBINA TRAILS COLLEGIATE
 VOCATIONAL WING
 50 FRONTIER TRAIL, WINNIPEG, MANITOBA, R3Y 2H1

SHEET TITLE
 SLIDING MARKER BOARD STORAGE

DRAWN BY:
 TM

CHECKED BY:
 HW

DESIGNED BY:
 DN

APPROVED BY:
 SS

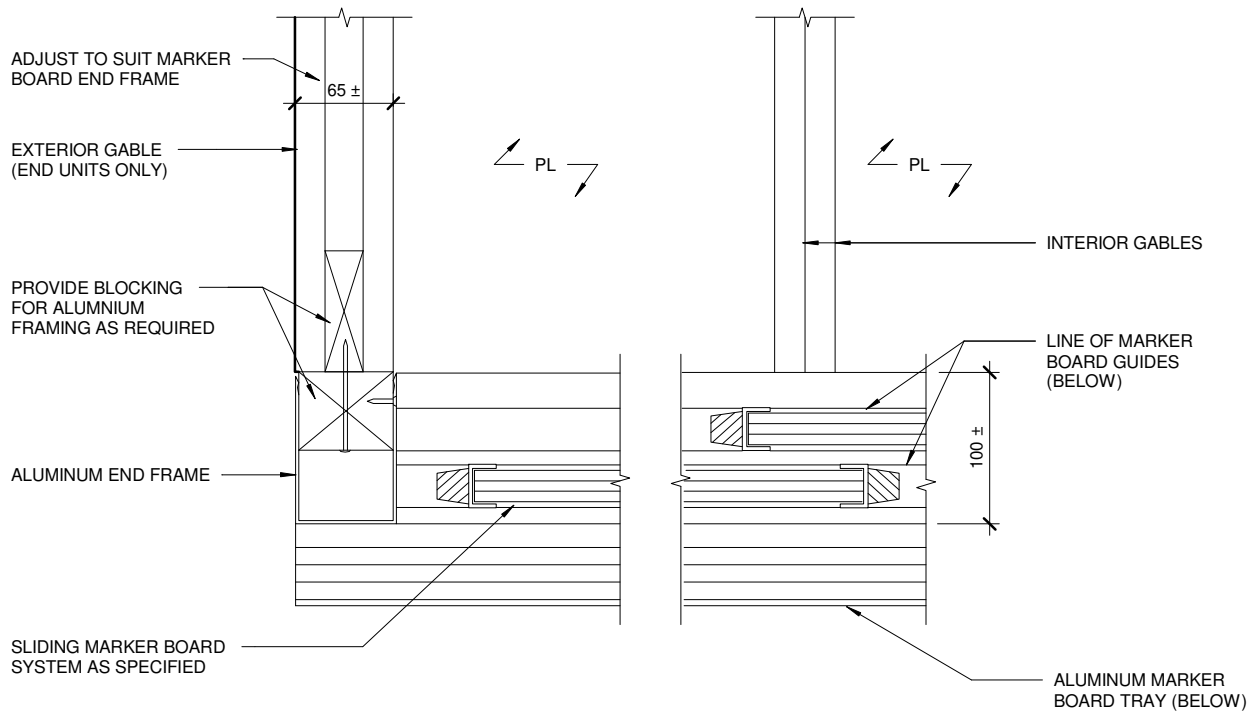
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SCALE:
 As indicated

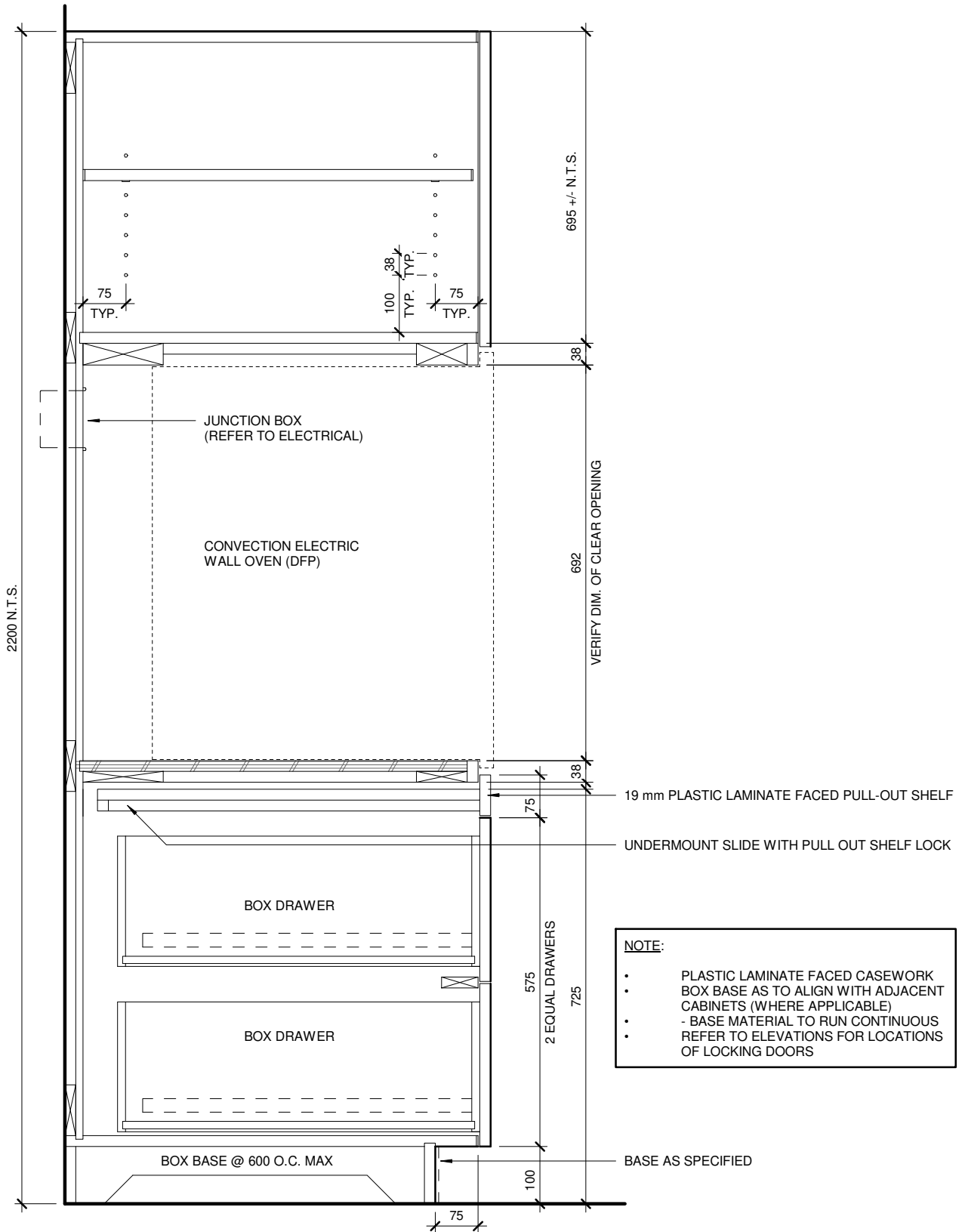
PROJECT No:
 2020-127


SHEET No:

AP8.14



 THE CITY OF WINNIPEG ASSETS & PROJECT MANAGEMENT DEPARTMENT MUNICIPAL ACCOMMODATIONS DIVISION 3-65 GARRY STREET, R3C 4K4		PROJECT PEMBINA TRAILS COLLEGIATE VOCATIONAL WING 50 FRONTIER TRAIL, WINNIPEG, MANITOBA, R3Y 2H1			SHEET TITLE SLIDING MARKER BOARD JAMB	
DRAWN BY:	CHECKED BY:	DESIGNED BY:	APPROVED BY:	DATE:	SCALE:	SHEET No:
TM	HW	DN	SS	2024.04.01	1:5	AP8.15
				eFILE: 1929V_PTCV_ARCH_2023.rvt	PROJECT No: 2020-127	




 THE CITY OF WINNIPEG
 ASSETS & PROJECT MANAGEMENT
 DEPARTMENT
 MUNICIPAL ACCOMMODATIONS DIVISION
 3-65 GARRY STREET, R3C 4K4

PROJECT
PEMBINA TRAILS COLLEGIATE
VOCATIONAL WING
 50 FRONTIER TRAIL, WINNIPEG, MANITOBA, R3Y 2H1

SHEET TITLE
MILLWORK SECTION THROUGH
WALL OVEN (OFF-B)

DRAWN BY:
 TM

CHECKED BY:
 HW

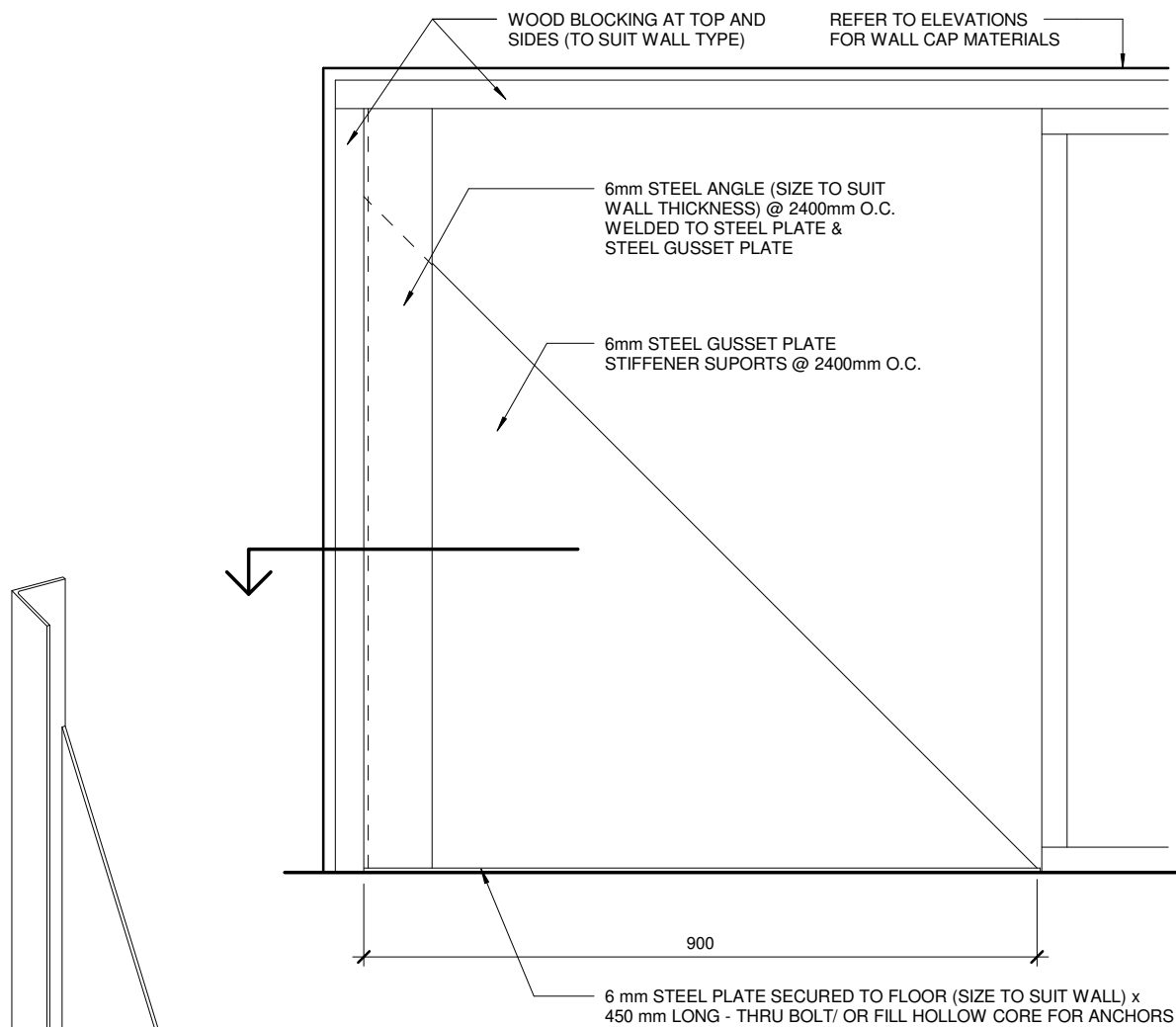
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APPROVED BY:
 SS

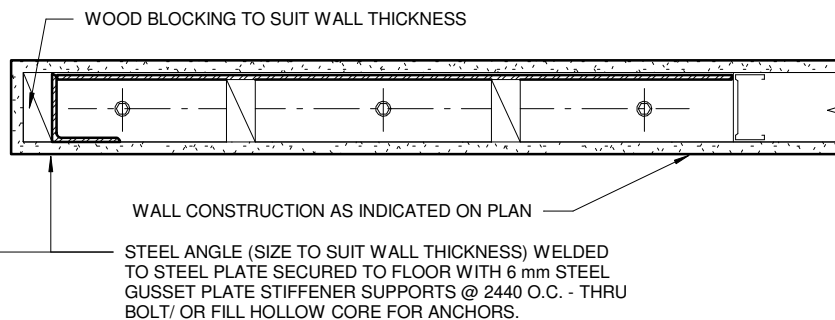
DATE:
 2024.04.01
 eFILE:
 1929V_PTCV_ARCH_2023.rvt

SCALE:
 1 : 10
 PROJECT No: 2020-127

SHEET No:
AP8.16



VERTICAL SECTION



PLAN SECTION

 <p>THE CITY OF WINNIPEG ASSETS & PROJECT MANAGEMENT DEPARTMENT MUNICIPAL ACCOMMODATIONS DIVISION 3-65 GARRY STREET, R3C 4K4</p>		<p>PROJECT PEMBINA TRAILS COLLEGIATE VOCATIONAL WING 50 FRONTIER TRAIL, WINNIPEG, MANITOBA, R3Y 2H1</p>			<p>SHEET TITLE LOW WALL SUPPORT DETAIL</p>	
DRAWN BY: TM	CHECKED BY: HW	DESIGNED BY: DN	APPROVED BY: SS	DATE: 2024.04.01 eFILE: 1929V_PTCV_ARCH_2023.rvt	SCALE: 1:10 PROJECT No: 2020-127	SHEET No: AP8.17

13 mm SOLID SURFACING MATERIAL (SSM)
WALL CAP OVER 13 mm PLYWOOD SUBSTRATE

3 mm SAWCUT
REVEAL

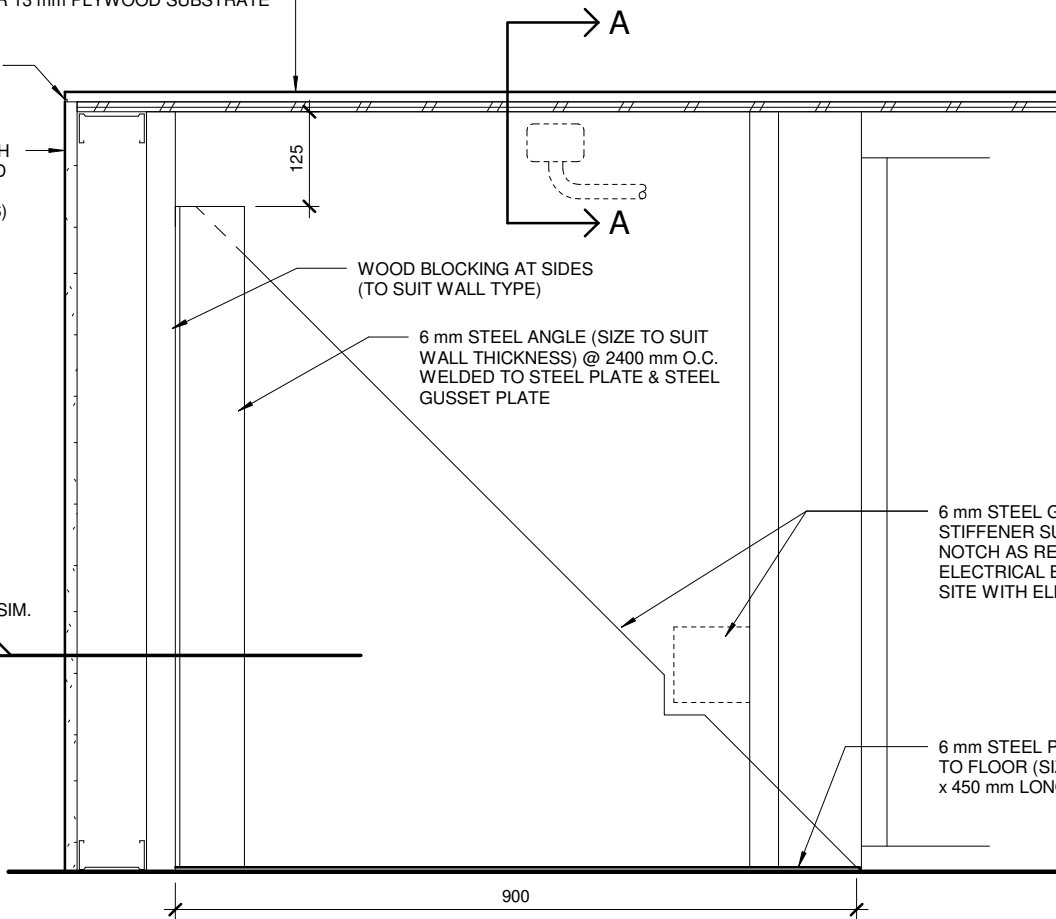
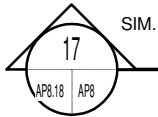
ALIGN SSM WITH
GYPSUM BOARD
ON END WALL
(TYP. ALL SIDES)

WOOD BLOCKING AT SIDES
(TO SUIT WALL TYPE)

6 mm STEEL ANGLE (SIZE TO SUIT
WALL THICKNESS) @ 2400 mm O.C.
WELDED TO STEEL PLATE & STEEL
GUSSET PLATE

6 mm STEEL GUSSET PLATE
STIFFENER SUPPORTS @ 2400 mm O.C.
NOTCH AS REQUIRED TO ACCEPT
ELECTRICAL BOXES, COORDINATE ON
SITE WITH ELECTRICAL

6 mm STEEL PLATE SECURED
TO FLOOR (SIZE TO SUIT WALL)
x 450 mm LONG

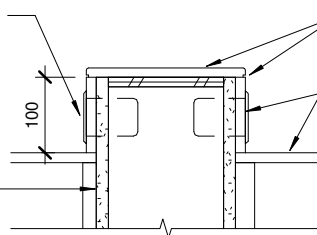


PROVIDE CUTOUTS FOR POWER
RECEPTACLES - COORDINATE
WITH ELECTRICAL

13 mm SSM WALL CAP C/W
CONTINUOUS 3 mm SAWCUT REVEAL
ALIGNED WITH BACKSPASH B.S.

LINE OF SSM COUNTER
& BACKSPASH

WALL CONSTRUCTION
AS INDICATED ON PLANS



SECTION A-A

SCALE 1 : 10



THE CITY OF WINNIPEG
ASSETS & PROJECT MANAGEMENT
DEPARTMENT
MUNICIPAL ACCOMMODATIONS DIVISION
3-65 GARRY STREET, R3C 4K4

PROJECT
PEMBINA TRAILS COLLEGIATE
VOCATIONAL WING
50 FRONTIER TRAIL, WINNIPEG, MANITOBA, R3Y 2H1

SHEET TITLE
LOW WALL SECTION

DRAWN BY:
TM

CHECKED BY:
HW

DESIGNED BY:
DN

APPROVED BY:
SS

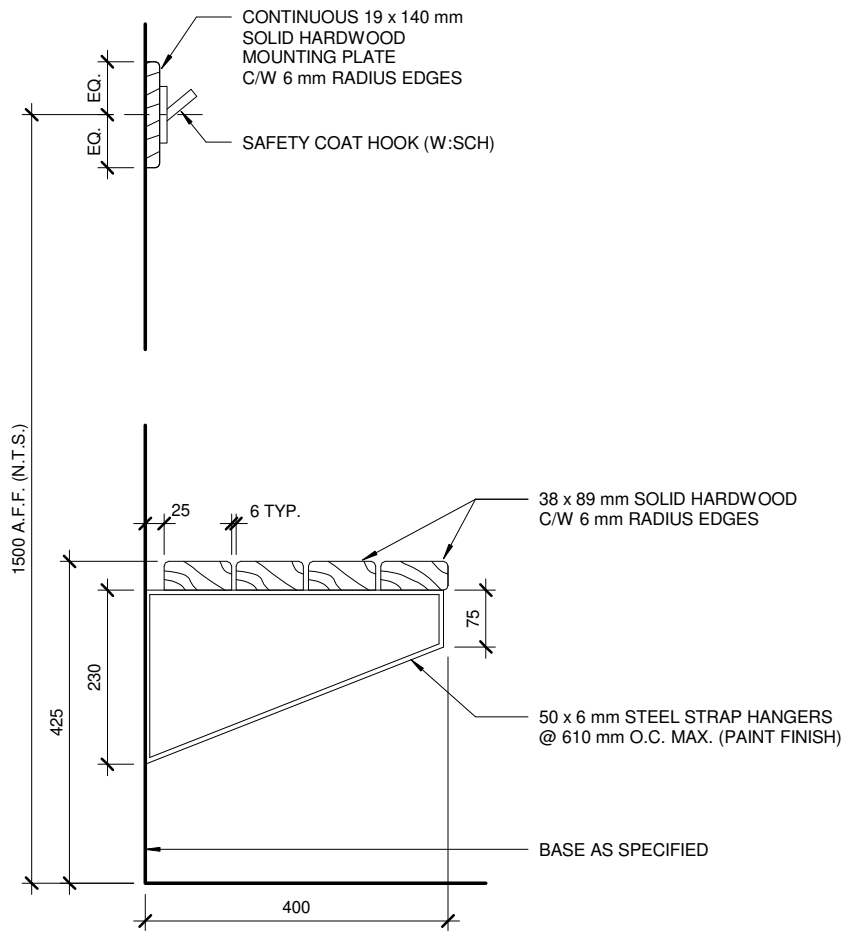
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2024.04.01
eFILE:
1929V_PTCV_ARCH_2023.rvt

SCALE:
1 : 10

PROJECT No: 2020-127

SHEET No:

AP8.18



NOTE:

- CONFIRM MOUNTING HEIGHT OF SAFETY COAT HOOK & MOUNTING PLATE WITH THE CITY
- ANCHORAGE OF EACH STRAP ANCHOR TO HAVE 16 mm DIAMETER THREADED RODS W/ HILTI HIT HY70 ADHESIVE ANCHORS TOP AND BOTTOM



THE CITY OF WINNIPEG
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3-65 GARRY STREET, R3C 4K4

PROJECT
PEMBINA TRAILS COLLEGIATE
VOCATIONAL WING
50 FRONTIER TRAIL, WINNIPEG, MANITOBA, R3Y 2H1

SHEET TITLE
LOCKER ROOM BENCH

DRAWN BY:
TM

CHECKED BY:
HW

DESIGNED BY:
DN

APPROVED BY:
SS

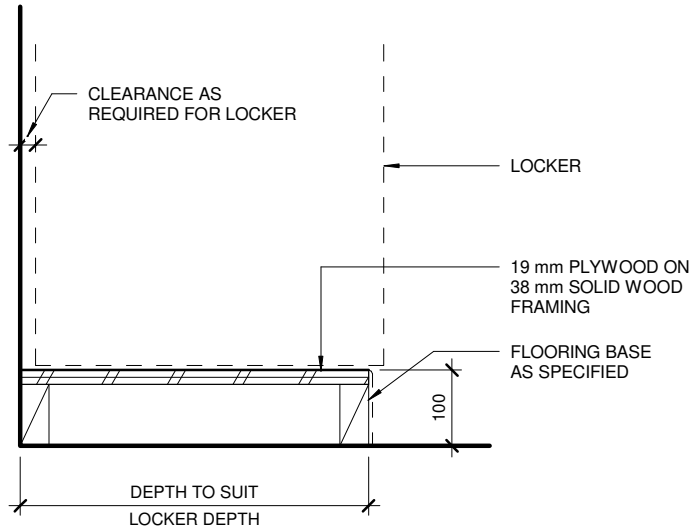
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2024.04.01
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SCALE:
1 : 10

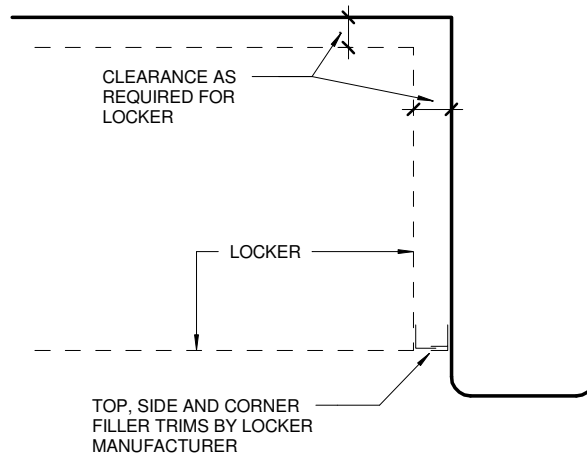
PROJECT No: 2020-127

SHEET No:

AP8.19



LOCKER BASE DETAIL



TYPICAL LOCKER TRIM

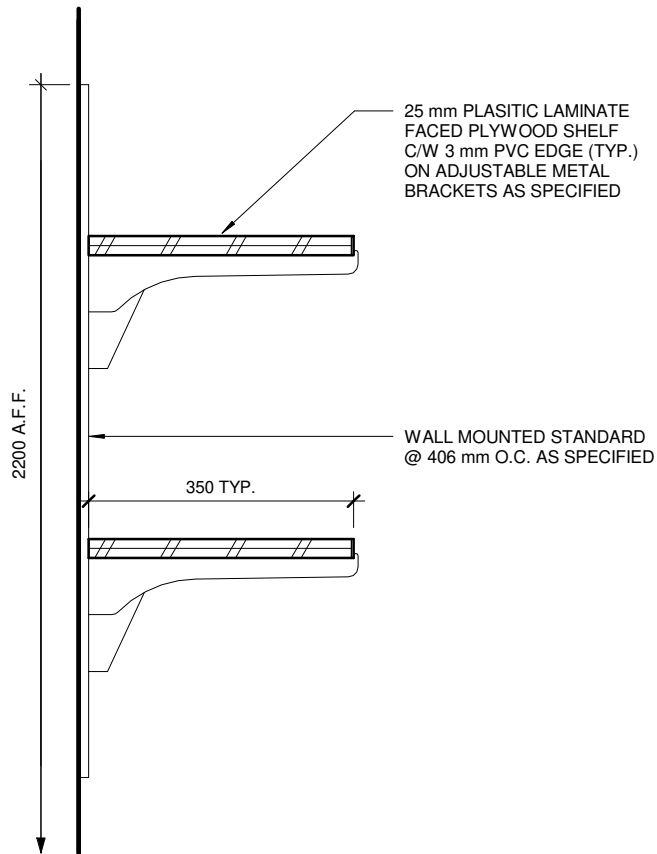


THE CITY OF WINNIPEG
 ASSETS & PROJECT MANAGEMENT
 DEPARTMENT
 MUNICIPAL ACCOMMODATIONS DIVISION
 3-65 GARRY STREET, R3C 4K4

PROJECT
 PEMBINA TRAILS COLLEGIATE
 VOCATIONAL WING
 50 FRONTIER TRAIL, WINNIPEG, MANITOBA, R3Y 2H1

SHEET TITLE
 TYPICAL LOCKER DETAILS

DRAWN BY: TM	CHECKED BY: HW	DESIGNED BY: DN	APPROVED BY: SS	DATE: 2024.04.01 eFILE: 1929V_PTCV_ARCH_2023.rvt	SCALE: 1:10 PROJECT No: 2020-127	SHEET No: AP8.20
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THE CITY OF WINNIPEG
ASSETS & PROJECT MANAGEMENT
DEPARTMENT
MUNICIPAL ACCOMMODATIONS DIVISION
3-65 GARRY STREET, R3C 4K4

PROJECT
PEMBINA TRAILS COLLEGIATE
VOCATIONAL WING
50 FRONTIER TRAIL, WINNIPEG, MANITOBA, R3Y 2H1

SHEET TITLE
TYPICAL JANITOR SHELF

DRAWN BY:

HW

CHECKED BY:

HW

DESIGNED BY:

DN

APPROVED BY:

SS

DATE:

2024.04.01

eFILE:

1929V_PTCV_ARCH_2023.rvt

SCALE:

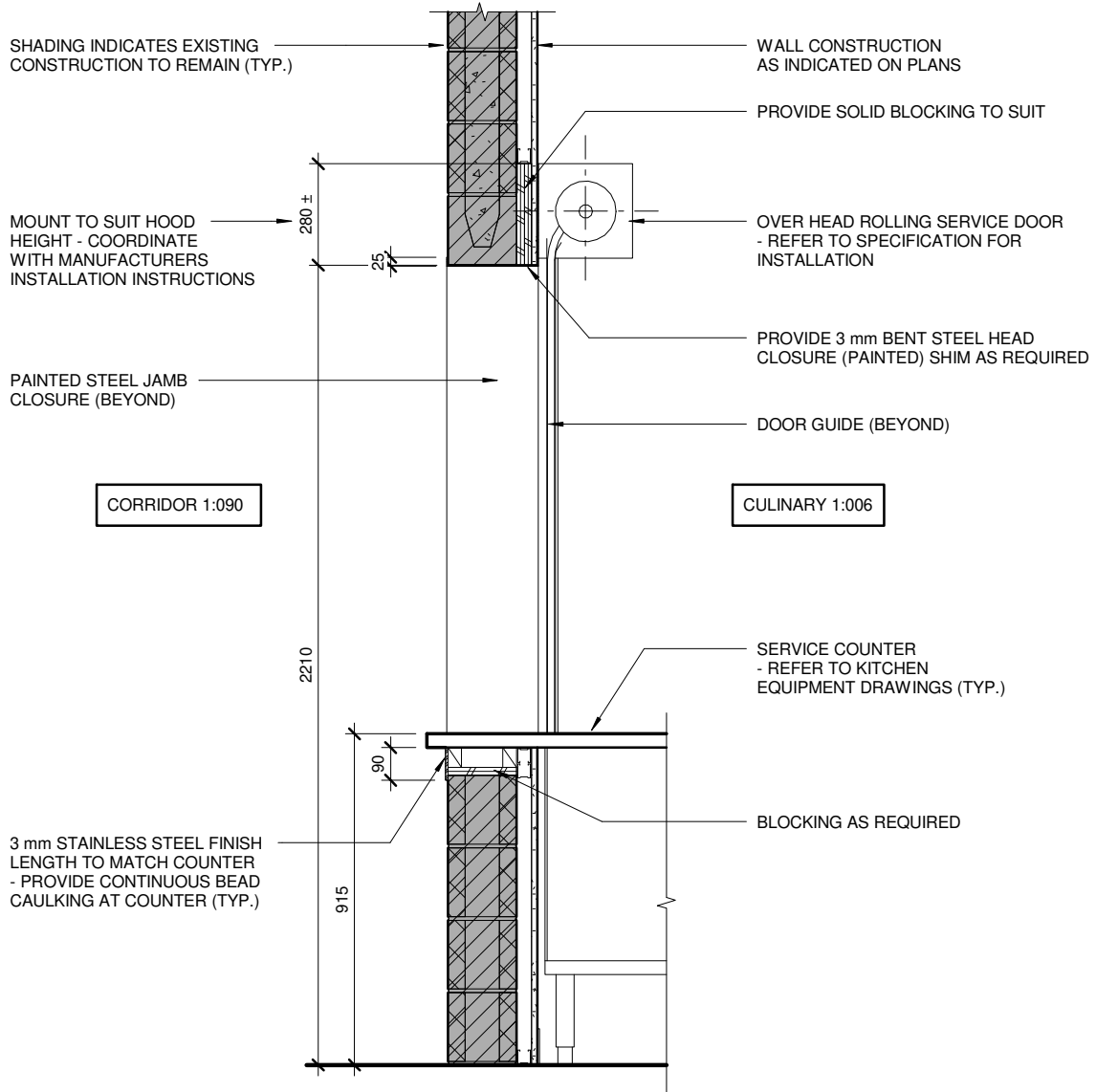
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PROJECT No:

2020-127

SHEET No:

AP8.21



 THE CITY OF WINNIPEG ASSETS & PROJECT MANAGEMENT DEPARTMENT MUNICIPAL ACCOMMODATIONS DIVISION 3-65 GARRY STREET, R3C 4K4		PROJECT PEMBINA TRAILS COLLEGIATE VOCATIONAL WING 50 FRONTIER TRAIL, WINNIPEG, MANITOBA, R3Y 2H1			SHEET TITLE SECTION THROUGH KITCHENETTE SERVICE OPENING		
DRAWN BY:	CHECKED BY:	DESIGNED BY:	APPROVED BY:	DATE:	SCALE:	SHEET No:	
TM	HW	DN	SS	2024.04.01	1:20	AP8.22	
				eFILE: 1929V_PTCV_ARCH_2023.rvt	PROJECT No: 2020-127		

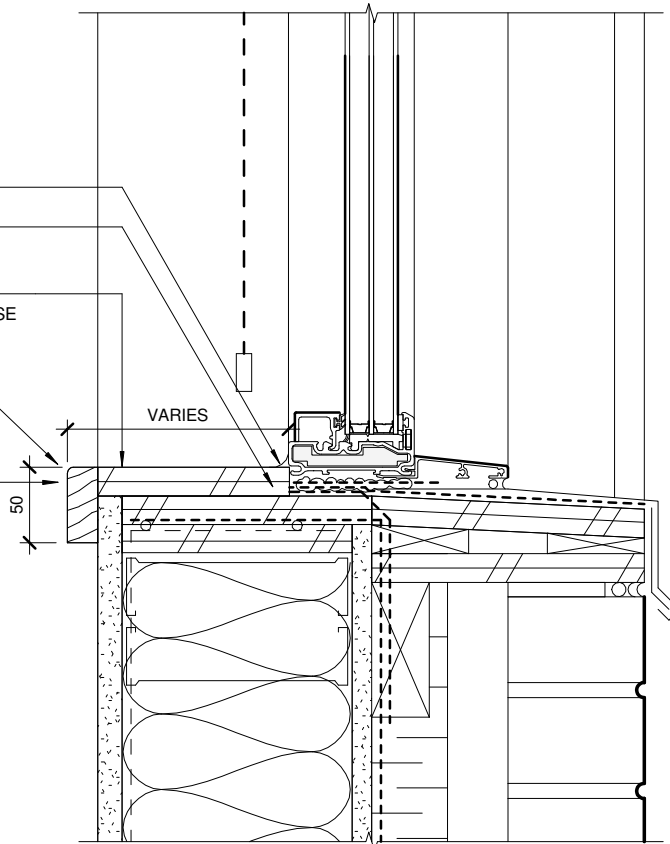
FOAM ROD AND CAULK

PREFINISHED DRYWALL RETURN
MOULDING FULL PERIMETER (TYP.)

19 mm PLASTIC LAMINATE FACED
PLYWOOD - SCRIBE AROUND BULLNOSE
CORNERS WHERE APPLICABLE

PENCIL EDGE RADIUS

20 mm THICK SOLID HARDWOOD
EDGE EXTEND PAST OPENING
50 mm BOTH SIDES (TYP.)



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PROJECT
PEMBINA TRAILS COLLEGIATE
VOCATIONAL WING
50 FRONTIER TRAIL, WINNIPEG, MANITOBA, R3Y 2H1

SHEET TITLE
TYPICAL SILL DETAIL

DRAWN BY:

HW

CHECKED BY:

HW

DESIGNED BY:

DN

APPROVED BY:

SS

DATE:

2024.04.01

eFILE:

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SCALE:

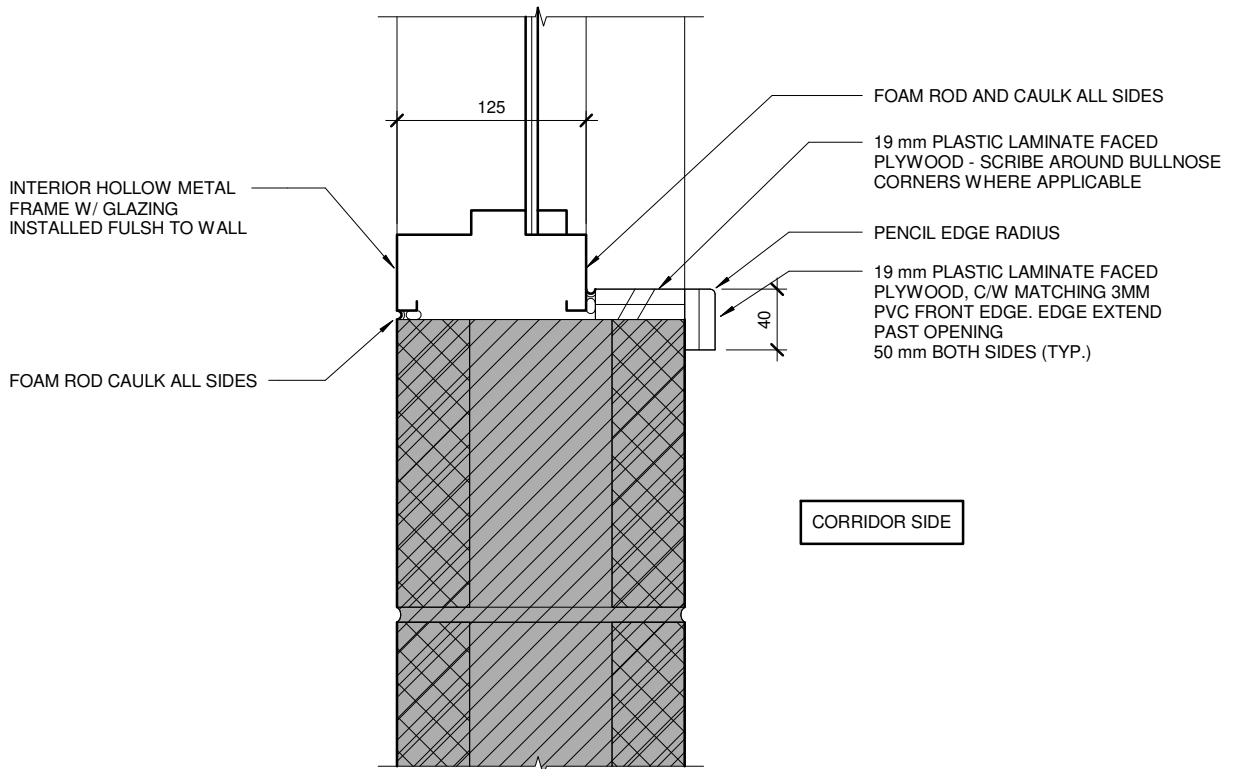
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PROJECT No:

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SHEET No:

AP8.23



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 MUNICIPAL ACCOMMODATIONS DIVISION
 3-65 GARRY STREET, R3C 4K4

PROJECT
 PEMBINA TRAILS COLLEGIATE
 VOCATIONAL WING
 50 FRONTIER TRAIL, WINNIPEG, MANITOBA, R3Y 2H1

SHEET TITLE
 DESIGN LAB 1:01 WINDOW DETAIL

DRAWN BY:
 TM

CHECKED BY:
 HW

DESIGNED BY:
 DN

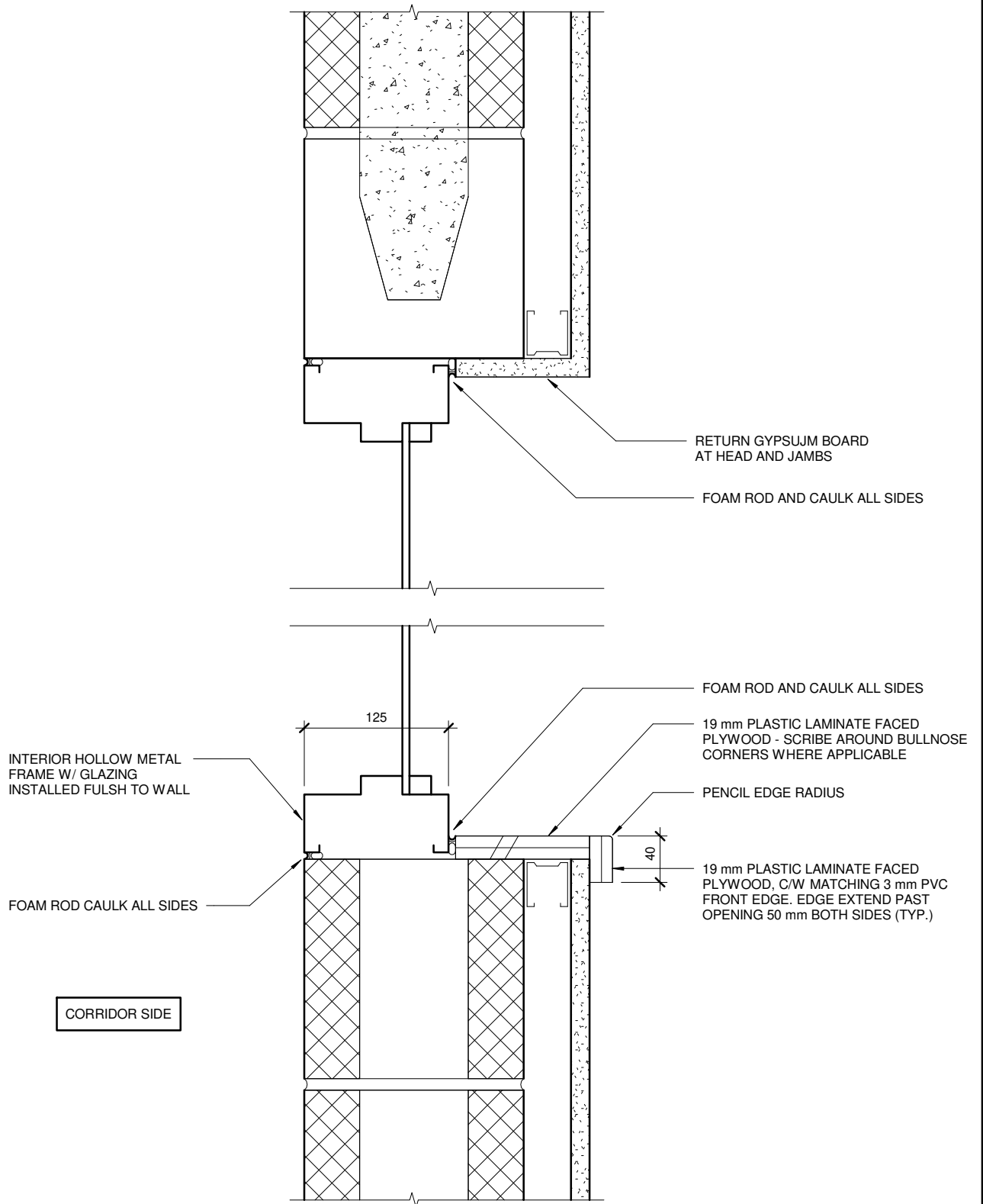
APPROVED BY:
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DATE:
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SCALE:
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PROJECT No: 2020-127

SHEET No:
AP8.24




 THE CITY OF WINNIPEG
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 MUNICIPAL ACCOMMODATIONS DIVISION
 3-65 GARRY STREET, R3C 4K4

PROJECT
PEMBINA TRAILS COLLEGIATE
VOCATIONAL WING
 50 FRONTIER TRAIL, WINNIPEG, MANITOBA, R3Y 2H1

SHEET TITLE
DESIGN LAB 1:01 WINDOW DETAIL

DRAWN BY:
 TM

CHECKED BY:
 HW

DESIGNED BY:
 DN

APPROVED BY:
 SS

DATE:
 2024.04.01
 eFILE:
 1929V_PTCV_ARCH_2023.rvt

SCALE:
1:5
 PROJECT No: **2020-127**

SHEET No:
AP8.25