SECTION 00 01 10

TABLE OF CONTENTS

SECTIONS **PAGES**

PART 1 GENERAL

1.1 REFERENCES

.1 CCDC 2 – 2020, Stipulated Price Contract

1.2 WORDS AND TERMS

.1 Refer to and acknowledge other words, terms, and definitions in CCDC 2.

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. Should any discrepancy appear between documents which leave doubt as to the intent or meaning, abide by the "Precedence of Documents" article below or obtain direction from the Consultant.

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

.3 Install components to physically conserve headroom, to minimize furring spaces, to accommodate installed Work, or other obstructions.

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

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

1.4 DESCRIPTION OF THE WORK

.1 Work of this Contract consist of replacing the existing roof-top unit with a high-efficiency unit with integrated heat recovery at Turtle Island Neighbourhood Centre located at 510 King Street.. New roof-top unit shall be provided with a security cage to prevent theft and vandalism. Work includes, but not limited to, the following:

.2 Demolition:

- .1 Removal and disposal of existing roof top unit serving office and classroom space.

.3 Construction:

- .1 Supply and installation of new roof top unit serving office and classroom space.
- .2 Supply and installation of new roof ductwork and connect to existing supply and return plenum
- .3 Supply and installation of new condensate pipe from new roof top unit to nearest building internal drain.
- .4 Wire and connect new roof top unit as indicated on plans.

.4 Division of the Work among subcontractors, suppliers or vendors is solely the Contractor's responsibility. Neither The City of Winnipeg nor Consultant 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 Relations and responsibilities are between the Contractor and The City of Winnipeg.

.3 Provide the required bonds, liability insurance, to ensure such specified assurances to The City of Winnipeg.

.4 Assigned Subcontractors are required to provide requested bonds covering faithful performance of subcontracted work, to the The City of Winnipeg plus payment of any related obligations.

.5 Assume responsibility for assigned contracts or Subcontracts forming part of the Work.

.6 Contract Documents were prepared by the Consultant for The City of Winnipeg. 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 ConsultantThe City of Winnipeg accepts no responsibility for any damages suffered by any third party as a result of decisions made or actions based on the Contract Documents.

.7 For purposes of reference in these Contract Documents, the term "Contractor" shall mean the primary party or parties in contract with The City of Winnipeg to manage and construct the Work.

1.6 DOCUMENTS PROVIDED

.1 The Contractor is responsible to provide the number of Contract Documents for construction purposes, including a set for “As Built” purposes.

.2 Contractors may obtain additional sets of Contract Documents at the cost of printing, handling and shipping.

.3 An electronic set of documents will be provided near the end of the Project for purposes of transferring changed information recorded on as-built documents, to the electronic “Record Documents”.

1.7 WORK SEQUENCE

.1 Construct the Work in stages to accommodate The City of Winnipeg’s continuous use and occupation of the facility during the construction period. Submit a construction schedule to The City of Winnipeg for review and approval prior to the start of demolition and construction. Work to be completed in the following sequential stages:

.1 Stage 1: Replace existing roof-top unit.

.1 Demo existing roof top unit and associated ductwork and pipe on roof.

.2 Supply and install new roof top unit, connect ductwork, pipe and controls to existing.

.3 Downtime for roof-top unit to be minimized, as this unit provides ventilation air to building.

.2 Coordinate Progress Schedule with The City of Winnipeg use during construction.

.3 Maintain fire access and control of fire protection equipment.

1.8 THE CITY OF WINNIPEG OCCUPANCY

.1 The City of Winnipeg will occupy premises during entire construction period for execution of normal operations.

.2 Cooperate with The City of Winnipeg in scheduling operations to minimize conflict, utility usage, and to facilitate such usage.

.3 Maintain fire and life safety systems and public access to exits during all stages of the Work.

END OF SECTION

PART 1 GENERAL

1.1 REFERENCES

.1 CCDC 2 – 2020, Stipulated Price Contract

.2 CCDC 9A – 2018, Statutory Declaration of Progress Payment Distribution by Contractor

.3 CCDC 24 – 2022 – A Guide to Model Forms and Support Documents

1.2 APPLICATIONS FOR PROGRESS PAYMENT

.1 Submit a CCDC 24 electronic form using an authorized electronic signature or other company form.

.2 Make applications for payment on account as monthly as Work progresses.

.3 Accompany applications with a CCDC 9A, Statutory Declaration form.

.4 Date applications for payment last day of agreed payment period and ensure amount claimed is for value, proportionate to amount of Contract, of Work performed and Products delivered to Place of Work as of that date.

.5 Submit to Consultant for review, minimum fourteen (14) days before first application for payment, schedule of values for parts of Work, aggregating total amount of Contract Price, so as to facilitate evaluation of applications for payment.

.6 Submit required support documentation with applications for payment, including statutory declarations and workers' compensation clearance certificates.

1.3 PROGRESS PAYMENT

.1 Submit a progress payment schedule on CCDC 24 electronic form using an authorized electronic signature or other company form.

.2 Accompany applications with a CCDC 9A - Statutory Declaration form.

.3 Consultant will issue to The City of Winnipeg, no later than ten (10) days after receipt of an application for payment, certificate for payment in amount applied for or in such other amount as Consultant determines to be properly due.

.4 If Consultant amends application, Consultant will give notification in writing giving reasons for amendment.

1.4 PROGRESSIVE RELEASE OF HOLD-BACK

.1 Where legislation permits, if Consultant has certified that Work has been performed prior to Substantial Performance of the Work, The City of Winnipeg will pay hold-back amount retained for such Work, or products supplied, on day following expiration of hold-back period for such Work stipulated in lien legislation applicable to Place of the Work.

.2 Notwithstanding provisions of preceding paragraph, and notwithstanding wording of such certificates, ensure that Subcontract Work or Products is protected pending issuance of final certificate for payment and be responsible for correction of defects or Work not performed regardless of whether or not such was apparent when such certificates were issued.

1.5 SUBSTANTIAL PERFORMANCE OF THE WORK

.1 Submit a schedule of payments on CCDC 24 electronic form using an authorized electronic signature or other company form.

.2 Accompany applications with a CCDC 9A - Statutory Declaration form.

.3 Prepare and submit to Consultant a comprehensive list of items to be completed or corrected. Failure to include an item on the list does not alter responsibility to complete the Contract.

.4 Request Consultant review to establish Substantial Performance of the Work.

.5 Where permitted by local lien legislation, Contractor may apply for substantial performance of a designated portion of the Work, subject to The City of Winnipeg acceptance of that portion of the Work being substantially performed.

.6 No later than ten (10) days after receipt of list and application, Consultant will review Work to verify validity of application, and no later than seven (7) days after completing review, will notify Contractor if the Work, or the designated portion of the Work, is substantially performed.

.7 Consultant will state in their certificate the date of Substantial Performance of the Work, or the date of the designated portion of the Work, as applicable.

.8 Immediately following issuance of certificate of Substantial Performance of the Work, in consultation with Consultant, establish reasonable date for finishing Work.

1.6 PAYMENT OF HOLD-BACK ON SUBSTANTIAL PERFORMANCE OF THE WORK

.1 After issuance of Certificate of Substantial Performance of the Work:

.1 Submit an application for payment of hold-back amount.

.2 Submit sworn statement that all accounts for labour, subcontracts, products, construction machinery and equipment, and other indebtedness which may have been incurred in Substantial Performance of the Work and for which The City of Winnipeg might in any way be held responsible have been paid in full, except for amounts properly retained as hold-back or as identified amount in dispute.

.2 After receipt of application for payment and sworn statement, Consultant will issue certificate for payment of hold-back amount.

.3 Where hold-back amount has not been placed in a separate hold-back account, The City of Winnipeg will, within ten (10) days prior to expiry of hold-back period stipulated in lien legislation applicable to Place of the Work, place hold-back amount in bank account in joint names of The City of Winnipeg and Contractor.

.4 Amount authorized by certificate for payment of hold-back amount is due and payable on day following expiration of hold-back period stipulated in lien legislation applicable to Place of the Work.

.1 Where lien legislation does not exist or apply, hold-back amount is due and payable in accordance with other legislation, industry practice, or provisions which may be agreed to between parties.

.2 The City of Winnipeg may retain out of hold-back amount any sums required by law to satisfy any liens against Work or, if permitted by lien legislation applicable to Place of the Work, other third party monetary claims against Contractor which are enforceable against The City of Winnipeg.

1.7 FINAL PAYMENT

.1 Submit an application for final payment on a CCDC 24 electronic form using an authorized electronic signature or other company form.

.2 Consultant will, no later than ten (10) days after receipt of an application for final payment, review Work to verify validity of application. Consultant will give notification that application is valid or give reasons why it is not valid, no later than seven (7) days after reviewing Work.

.3 Consultant will issue final certificate for payment when application for final payment is determined valid.

END OF SECTION

PART 1 GENERAL

1.1 SECTION INCLUDES

.1 Coordination Work with other Contractors and work by The City of Winnipeg under the administration of the Consultant.

1.2 COORDINATION

.1 Perform coordination of progress schedules, submittals, use of site, construction facilities, and construction Work under instructions of the Consultant

1.3 PROJECT MEETINGS

.1 Schedule and administer bi-weekly project meetings throughout progress of Work as determined by the Consultant.

.2 Schedule and administer pre-installation meetings when specified in sections and when required to coordinate related or affected Work.

.3 Record minutes. Include significant proceedings and decisions. Identify action by parties.

.4 Reproduce and distribute copies of minutes within three (3) days after each meeting and transmit to meeting participants, the affected parties not in attendance and the Consultant.

1.4 ON-SITE DOCUMENTS

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

- .1 Contract drawings.
- .2 Specifications.
- .3 Addenda.
- .4 Reviewed shop drawings.
- .5 Change orders.
- .6 Other modifications to Contract.
- .7 Field test reports.
- .8 Copy of approved Work schedule.
- .9 Manufacturers' installation and application instructions.

1.5 SCHEDULES

.1 Submit preliminary construction progress schedule as specified in Section 01 32 00 to Consultant coordinated with Consultant's project schedule.

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

.3 During progress of Work revise and resubmit as directed by Consultant.

1.6 SUBMITTALS

.1 Prepare and issue submittals to Consultant for review.

1.7 COORDINATION DRAWINGS

.1 Provide information required by Consultant for preparation of coordination Drawings.

.2 Review and approve revised Drawings for submittal to Consultant.

1.8 CLOSEOUT PROCEDURES

.1 Notify Consultant when Work is considered ready for Substantial Performance.

.2 Accompany Consultant on preliminary inspection to determine items listed for completion or correction.

.3 Comply with Consultant's instructions for correction of items of Work listed in executed certificate of Substantial Performance and for access to The City of Winnipeg-occupied areas.

.4 Notify Consultant of instructions for completion of items of Work determined in Consultant's final inspection.

END OF SECTION

PART 1 GENERAL

1.1 SCHEDULES

.1 Submit schedules as follows:

- .1 Submittal Schedule for Shop Drawings and Product Data.
- .2 Submittal Schedule for timeliness of The City of Winnipeg-furnished Products.
- .3 Product Delivery Schedule.
- .4 Cash Allowance Schedule for acquiring Products only or Products and Installation, or Installation only.
- .5 Shutdown or closure activity.

.2 Schedule Format

- .1 Prepare schedule in form of a horizontal Gantt bar chart.
- .2 Provide a separate bar for each major item of work.
- .3 Split horizontally for projected and actual performance.
- .4 Provide horizontal time scale identifying first Working Day of each week.
- .5 Format for listings: Table of Contents of the Project Manual.
- .6 Identification of listings: By specification Section numbers.

.3 Schedule Submission

- .1 Submit initial format of schedules within fifteen (15) working days after award of Contract.
- .2 Submit one (1) opaque reproduction, plus two (2) copies to be retained by Consultant.
- .3 Consultant will review schedule and return review copy within ten (10) days after receipt.
- .4 Resubmit finalized schedule within seven (7) days after return of review copy.
- .5 Submit revised progress schedule with each application for payment.
- .6 Distribute copies of revised schedule to:
  - .1 Job site office.
  - .2 Subcontractors.
  - .3 Other concerned parties.
- .7 Instruct recipients to report to Contractor within ten (10) days, any problems anticipated by timetable shown in schedule.

1.2 CONSTRUCTION PROGRESS SCHEDULING

.1 Submit initial schedule in duplicate within fifteen (15) days after date of The City of Winnipeg-Contractor Agreement.

.2 Revise and resubmit as required.

END OF SECTION

PART 1 GENERAL

1.1 ADMINISTRATIVE

.1 Submit to Consultant 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.

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

.3 Present Shop Drawings, product data, samples and mock-ups in Imperial inch-pound units.

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

.5 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.

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

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

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

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

.10 Keep one (1) reviewed copy of each submission on site.

1.2 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.

.3 Allow ten (10) working days for Consultant's review of each submission.

.4 Adjustments made on Shop Drawings by Consultant are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to Consultant prior to proceeding with Work.

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

.6 Accompany submissions with duplicate transmittal letter, containing:

.1 Date.

.2 Project title and number.

.3 Contractor's name and address.

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

.5 Other pertinent data.

.7 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.

.8 After Consultant's review, distribute copies.

.1 Submit one (1) electronic copy of Shop Drawings for each requirement requested in specification Sections and as consultant may reasonably request.

.2 Submit one (1) electronic copy of product data sheets or brochures for requirements requested in specification sections and as requested by Consultant where Shop Drawings will not be prepared due to standardized manufacture of product.

.3 Delete information not applicable to project.

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

.5 If upon review by Consultant, no errors or omissions are discovered or if only minor corrections are made, copies will be returned and fabrication and installation of Work may proceed. If Shop Drawings are rejected, noted 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.

END OF SECTION

PART 1 GENERAL

1.1 RELATED SECTIONS

.1 Section 01 31 00 - Project Managing and Coordination.

.2 Section 01 33 00 - Submittal Procedures.

.3 This section describes requirements applicable to all Sections within Divisions 02 to 49.

1.2 REFERENCES

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

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

.1 Material Safety Data Sheets (MSDS).

.3 Province of Manitoba Occupational Health and Safety Act, Regulation and Code, current enacted version at the place of Work.

1.3 SAFETY PLAN

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

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

.3 The "Prime Contractor" according applicable local jurisdiction, is responsible for health and safety of persons on site, safety of property on site and for protection of persons adjacent to site and environment to extent that they may be affected by conduct of Work.

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

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

1.4 SUBMITTALS

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

.2 Submit site-specific Health and Safety Plan: Within seven (7) days after date of Notice to Proceed and prior to commencement of Work. Health and Safety Plan must include:

.1 Results of site specific safety hazard assessment.

.2 Results of safety and health risk or hazard analysis for site tasks and operation.

.3 Submit electronic PDF copies of Contractor's authorized representative's work site health and safety inspection reports to The City of Winnipeg and the consultant.

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

.5 Submit copies of incident and accident reports.

.6 Submit Material Safety Data Sheets (MSDS) to The City of Winnipeg.

.7 The City of Winnipeg and Consultant will review Contractor's site-specific Health and Safety Plan and provide comments to Contractor within 7 days after receipt of plan. Revise plan as appropriate and resubmit plan to The City of Winnipeg and Consultant within 7 days after receipt of comments from Consultant.

.8 The City of Winnipeg and Consultant's review of Contractor's final Health and Safety plan should not be construed as tacit approval and does not reduce or alter the Contractor's overall responsibility for construction Health and Safety.

.9 Medical Surveillance: Where prescribed by legislation, regulation or safety program, submit certification of medical surveillance for site personnel prior to commencement of Work, and submit additional certifications for any new site personnel to The City of Winnipeg and Consultant.

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

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

1.5 SAFETY ACTIVITIES

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

1.6 HEALTH AND SAFETY COORDINATOR

.1 Employ and assign to Work, competent and authorized representative as Health and Safety Coordinator. Health and Safety Coordinator must:

.1 Have site-related working experience specific to activities associated with asbestos abatement.

.2 Have working knowledge of occupational safety and health regulations.

.3 Be responsible for completing Contractor's Health and Safety Training Sessions and ensuring that personnel not successfully completing required training are not permitted to enter site to perform Work.

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

.5 Be on site during execution of Work.

1.7 POSTING OF DOCUMENTS

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

1.8 CORRECTION OF NON-COMPLIANCE

.1 Immediately address health and safety non-compliance issues identified by authority having jurisdiction or by The City of Winnipeg and/or Consultant.

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

.3 The City of Winnipeg and/or Consultant may stop Work if non-compliance of health and safety regulations is not corrected.

1.9 WORK STOPPAGE

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

1.10 FIRE PROTECTION

.1 Provide and maintain temporary fire protection equipment during performance of Work required by governing codes, regulations and bylaws.

.2 Burning rubbish and construction waste materials is not permitted on site.

.3 Maintain placed or installed firestopping to protect the portions of the Work during construction.

END OF SECTION

PART 1 GENERAL

1.1 REFERENCES

.1 ISO/IEC 17025:2005 - General Requirements for the Competence of Testing and Calibration Laboratories.

.2 SCC (Standards Council of Canada).

1.2 INSPECTION BY AUTHORITY

.1 Allow Authorities Having Jurisdiction, to the access to Work. If part of the Work is in preparation at locations other than the Place of Work, allow access to such Work whenever it is in progress.

.2 Give timely notice requesting inspection whenever portions of the Work are designated for special tests, inspections or approvals, either when described in the Contract Documents or when required by law in the Place of the Work.

.3 If the Contractor covers or permits to be covered Work that has been designated for special tests, inspections or approvals before such is made, uncover such Work, have inspections or tests satisfactorily completed and make good such Work.

1.3 REVIEW BY CONSULTANT

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

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

.3 If such Work is found in accordance with Contract Documents, The City of Winnipeg will pay cost of review and replacement.

1.4 ACCESS TO WORK

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

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

1.5 PROCEDURES

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

1.6 REJECTED WORK

.1 Refer to CCDC, GC 2.4.

.2 Remove defective Work, whether result of poor workmanship, use of defective products or damage and whether incorporated in Work or not, which has been rejected by the Consultants failing to conform to Contract Documents. Replace or re-execute in accordance with Contract Documents.

.3 Make good other Contractor's work damaged by such removals or replacements promptly.

.4 If in opinion of the Consultant it is not expedient to correct defective Work or Work not performed in accordance with Contract Documents, The City of Winnipeg may deduct

from the Contract Price, the difference in value between Work performed and that called for by the Contract Documents, the amount of which shall be determined by Consultant.

1.7 REPORTS

.1 Submit one (1) electronic copy of signed inspection and test reports to Consultant.

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

.3 Copies of inspection and test reports shall be included in the O&M Manual submission. Refer to Section 01 33 00 Submittal Procedures and Section 01 78 00 Closeout Submittals.

1.8 EQUIPMENT AND SYSTEMS

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

END OF SECTION

PART 1 GENERAL

1.1 TERMINOLOGY

.1 New: Produced from new materials.

.2 Renewed: Produced or rejuvenated from an existing material to like-new condition to serve a new or existing service.

.3 Defective: A condition determined exclusively by the Consultant.

1.2 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 Consultant.

.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.

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

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

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

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

1.5 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.

1.6 PRODUCT CHANGES

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

1.7 EXISTING UTILITIES

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

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

1.8 MANUFACTURER'S WRITTEN INSTRUCTIONS

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

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

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

1.9 QUALITY OF WORK

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

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

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

1.10 COORDINATION

.1 Ensure cooperation of workers in laying out Work. Maintain efficient and continuous supervision.

.2 Be responsible for coordination and placement of openings, sleeves and accessories.

1.11 CONCEALMENT

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

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

1.12 REMEDIAL WORK

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

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

1.13 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.

1.14 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.

1.15 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 Consultant.

END OF SECTION

PART 1 GENERAL

1.1 SUBSTITUTIONS

.1 Instructions to Bidders specify time restrictions for submitting requests for Substitutions during the bidding period to requirements specified in this section.

.2 Document each request with complete data substantiating compliance of proposed Substitution with Contract Documents.

.3 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 of Winnipeg.
- .4 Waives claims for additional costs or time extension which may subsequently become apparent.
- .5 Will reimburse The City of Winnipeg and Consultant for review or redesign services associated with re-approval by authorities.

.4 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.

.5 Substitution Submittal Procedure:

- .1 Submit one (1) copy of request for Substitution for consideration. Limit each request to one (1) proposed Substitution.
- .2 Submit shop drawings, product data, and certified test results attesting to the proposed Product equivalence. Burden of proof is on proposer.
- .3 The Consultant will notify Contractor in writing of decision to accept or reject request.

END OF SECTION

PART 1 GENERAL

1.1 SUBMITTALS

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

- .1 Structural integrity of any element of Project.
- .2 Integrity of weather-exposed or moisture-resistant elements.
- .3 Efficiency, maintenance, or safety of any operational element.
- .4 Visual qualities of sight-exposed elements.
- .5 Work of Owner or separate contractor.

.2 Include in request:

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

1.2 TOLERANCES

.1 Monitor fabrication and installation tolerance control of Products to produce acceptable Work.

.2 Do not permit tolerances to accumulate beyond effective or practical limits.

.3 Comply with manufacturers' tolerances. In case of conflict between manufacturers' tolerances and Contract Documents, request clarification from Consultant before proceeding.

.4 Adjust Products to appropriate dimensions; position and confirm tolerance acceptability, before permanently securing Products in place.

1.3 EXECUTION

.1 Execute cutting, fitting, and patching to complete the Work.

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

.3 Uncover Work to install ill-timed Work.

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

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

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

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

.8 Employ qualified workers to perform cutting and patching for weather-exposed and moisture-resistant elements, and sight-exposed surfaces.

.9 Cut rigid materials using masonry saw or core drill. Pneumatic or impact tools not allowed on masonry or concrete work without prior approval.

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

.11 Fit Work reasonably close to opening size to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.

.12 At penetration of fire rated wall, ceiling, or floor construction, completely seal voids with firestopping material, for full thickness of the constructed element.

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

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

END OF SECTION

PART 1 GENERAL

1.1 REFERENCES

.1 CCDC 2 – 2020, Stipulated Price Contract

PART 2 PRODUCTS

2.1 CLEANING MATERIALS

.1 Cleaning Agents and Materials: Low VOC content.

PART 3 EXECUTION

3.1 PROGRESSIVE CLEANING

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

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

.3 Clear snow and ice from area of construction, bank or pile snow in designated areas only.

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

.1 Containers:

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

.2 Provide and use clearly marked, separate bins for recycling.

.5 Remove waste material and debris from site at end of each working day.

.6 Dispose of waste materials and debris off site.

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

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

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

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

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

3.2 CLEANING PRIOR TO ACCEPTANCE

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

.2 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 Owner, or other Contractors.

.5 Remove waste materials from site at regularly scheduled times or dispose of as directed by Consultant. Do not burn waste materials on site, unless approved by Consultant.Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.

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

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

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

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

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

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

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

.13 Remove dirt and other disfiguration from exterior surfaces.

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

.15 Sweep and wash clean paved areas.

.16 Clean equipment and fixtures to a sanitary condition; clean or replace filters of mechanical equipment.

.17 Clean roof surfaces, down-spouts, and drainage components.

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

.19 Remove snow and ice from access to facilities.

3.3 FINAL PRODUCT CLEANING

.1 Execute final cleaning prior to final project assessment.

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

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

.4 Replace filters of operating equipment.

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

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

END OF SECTION

PART 1 GENERAL

1.1 DEFINITIONS

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

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

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

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

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

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

.7 Recycle: To remove a waste material from the Project site to another site for re-manufacture into a new product for reuse by others.

.8 Recycling: The process of sorting, cleansing, treating and reconstituting solid waste and other discarded materials for the purpose of using the altered form. Recycling does not include burning, incinerating, or thermally destroying waste.

.9 Return: To give back reusable items or unused products to vendors for credit.

.10 Reuse: To reuse a construction waste material in some manner on the Project site.

.11 Salvage: To remove a waste material from the Project site to another site for resale or reuse by others.

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

.13 Source Separation: The act of keeping different types of waste materials separate beginning from the first time they become waste.

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

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

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

- .1 Solvents in paints and other coatings.
- .2 Wood preservatives; strippers and household cleaners.
- .3 Adhesives in particle board, fibreboard, and some plywood; and foam insulation.
- .4 When released, VOC's can contribute to the formation of smog and can cause respiratory tract problems, headaches, eye irritations, nausea, damage to the liver, kidneys, and central nervous system, and possibly cancer.

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

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

1.2 STORAGE, HANDLING AND PROTECTION

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

.2 Unless specified otherwise, materials for removal become Contractor's property.

.3 Protect, stockpile, store and catalogue salvaged items.

.4 Separate non-salvageable materials from salvaged items. Transport and deliver non-salvageable items to licensed disposal facility.

.5 Protect surface drainage, storm sewers, sanitary sewers, and utility services from damage and blockage.

PART 2 PRODUCTS

2.1 NOT USED

PART 3 EXECUTION

3.1 PREPARATION

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

3.2 USE OF SITE AND FACILITIES

.1 Execute work with least possible interference or disturbance to normal use of premises.

.2 Maintain security measures established by existing facility.

.3 Provide temporary security measures as approved by Consultant.

3.3 WASTE MANAGEMENT PLAN IMPLEMENTATION

.1 Manager: Designate an on-site party responsible for instructing workers and overseeing and documenting results of the Waste Management Plan for Project.

.2 Distribution: Distribute copies of the Waste Management Plan to the Job Site Foreman, each Subcontractor, The City of Winnipeg, and the Consultant.

.3 Instruction: Provide on-site instruction of appropriate separation, handling, and recycling, salvage, reuse, and return methods to be used by parties at appropriate stages of Project.

.4 Separation facilities: Lay out and label a specific area to facilitate separation of materials for potential recycling, salvage, reuse, and return. Recycling and waste bin areas are to be kept neat and clean and clearly marked in order to avoid contamination of materials.

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

.6 Application for Progress Payments: Submit with each Application for Progress Payment a Summary of Waste Generated by the Project:

.1 Failure to submit information shall render Application for Payment incomplete and delay Progress Payment.

.2 Submit summary on a form acceptable to The City of Winnipeg containing the following information:

.1 Amount in tonnes or cubic metres (tons or cubic yards) of material land filled from the Project,

.2 Identity of the landfill, and total amount of tipping fees paid at the landfill, and

.3 Total disposal cost. Include manifests, weight tickets, receipt, and invoices.

.4 Each material recycled, reused, or salvaged from the Project.

.5 Amount tonnes or cubic metres (tons or cubic yards).

.6 Date removed from the job site, the receiving party, and the transportation cost.

.7 Amount of any money paid or received for the recycled or salvaged material.

.8 Net total cost or savings of salvage or recycling each material.

.3 Attach manifests, weight tickets, receipts, and invoices.

3.4 CLEANING

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

.2 Clean-up work area as work progresses.

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

END OF SECTION

PART 1 GENERAL

1.1 INSPECTIONS AND DECLARATIONS

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

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

.2 Request Consultant's review.

.2 Consultant and The City of Winnipeg's Review: Consultant and Contractor will perform review of Work to identify defects or deficiencies. Correct defective and deficient Work accordingly.

.3 Completion: Submit written certificate that following have been performed:

.1 Work has been completed and inspected for compliance with Contract Documents.

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

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

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

.5 Operation of systems have been demonstrated to The City of Winnipeg's personnel.

.6 Work is complete and ready for Final Review.

.4 Final Review: When items noted above are completed, request final review of Work by Consultant, The City of Winnipeg, and Contractor. If Work is deemed incomplete by Consultant, The City of Winnipeg or Contractor, complete outstanding items and request re-review.

.5 Declaration of Substantial Performance: when Consultant, The City of Winnipeg and Contractor consider deficiencies and defects have been corrected and it appears requirements of Contract have been substantially performed, make application for Substantial Performance of the Work.

.6 Commencement of Warranty Periods: the date of Substantial Performance of the Work shall be the date for commencement of the warranty period.

.7 Commencement of Lien Periods: the date of publication of the certificate of Substantial Performance of the Work shall be the date for commencement of the lien period, unless required otherwise by the lien legislation applicable at the Place of the Work.

.8 Final Payment: When Consultant considers final deficiencies and defects have been corrected and it appears requirements of Contract have been completed, make application for final payment.

.9 Payment of Hold-back: After issuance of certificate of Substantial Performance of the Work, submit an application for payment of hold-back amount.

1.2 CLOSEOUT SUBMITTALS

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

.2 Copy will be returned after final review with Consultant's comments.

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

.4 Two (2) weeks prior to Substantial Performance of the Work, submit to the Consultant, four (4) final copies of operating and maintenance manuals in Canadian English.

.5 On acceptance of the operating and maintenance manual, provide a final PDF copy and four (4) printed copies. Submit final electronic copy to the Consultant and The City of Winnipeg. Submit final printed copies to the The City of Winnipeg.

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

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

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

.9 Pay costs of transportation.

1.3 OPERATION AND MAINTENANCE MANUAL FORMAT

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

.2 Binders: vinyl, hard covered, 3 'D' ring, loose leaf 219 x 279 mm (8.5 x 11 inch) with spine and face 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 type or printed title 'Project Record Documents'; list title of project and identify subject matter of contents.

.5 Arrange content by systems under Section numbers and sequence of Table of Contents.

.6 Provide tabbed fly leaf for each separate product and system, with typed description of product and major component parts of equipment.

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

.8 Drawings: provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.

.9 Drawings: 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.

1.4 CONTENTS - EACH VOLUME

.1 Table of Contents: Provide:

- .1 Title of project.
- .2 Date of submission.
- .3 Names, addresses, and telephone numbers of Consultant and Contractor with name of responsible parties.
- .4 Schedule of products and systems, indexed to content of volume.

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

.3 Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation; delete inapplicable information. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions specified in Section 01 45 00.

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

.5 Certificate of Acceptance: Relevant certificates issued by authorities having jurisdiction, including code compliance certificate, life safety systems performance certificate, and pressure vessel acceptance.

.6 Training: Refer to Section 01 79 00.

1.5 RECORDING ACTUAL SITE CONDITIONS

.1 Record information on set of black line opaque drawings, and within the Project Manual, provided by Consultant or The City of Winnipeg.

.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 depths of elements of foundation in relation to finish first floor datum.

.2 Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.

.3 Measured locations of internal utilities and appurtenances, referenced to visible and accessible features of construction.

.4 Field changes of dimension and detail.

.5 Changes made by change orders.

.6 Details not on original Contract Drawings.

.7 References to related shop drawings and modifications.

.5 Specifications: 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 and field test records required by individual specifications sections.

1.6 RECORD (AS-BUILT) DOCUMENTS AND SAMPLES

.1 In addition to requirements in General Conditions, maintain at the site for Consultant, The City of Winnipeg and Contractor one (1) 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 Label as-built documents and file in accordance with section number listings in List of Contents of the Project Manual. Label each document "AS-BUILT DOCUMENTS" in neat, large, printed letters.

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

.4 Keep as-built documents and samples available for review by Consultant

1.7 RECORD DOCUMENTS

.1 Prior to Substantial Performance of the Work, electronically transfer the marked up information from the as-built documents to a master set of drawing and specification files provided by the Consultant, as follows:

.1 Drawings: Scan the full sized field verified as-built drawing set and save to PDF format. Scans shall be in colour and with good resolulation to ensure drawings and markups are legible.

.2 Specifications: Adobe Acrobat (PDF).

.2 Mark revised documents as "RECORD DOCUMENTS". Include all revisions, with special emphasis on mechanical, electrical, structural steel, and reinforced concrete.

.3 Submit completed electronic record documents to The City of Winnipeg and Consultant by electronic file transfer.

1.8 WARRANTIES AND BONDS

.1 Separate each warranty or bond with index tab sheets keyed to Table of Contents listing.

.2 List subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.

.3 Obtain warranties and bonds, executed in duplicate by subcontractors, suppliers, and manufacturers, within ten (10) days after completion of the applicable item of work.

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

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

.6 Co-execute submittals when required.

.7 Retain warranties and bonds until time specified for submittals.

END OF SECTION

PART 1 GENERAL

1.1 DESCRIPTION

.1 Demonstrate operation and maintenance of equipment and systems to Owner's personnel two (2) weeks prior to date of performance.

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

1.2 COMPONENT DEMONSTRATION

.1 Manufacturer to provide authorized representative to demonstrate operation of equipment and systems.

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

1.3 SUBMITTALS

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

.2 Submit reports within one (1) week after completion of demonstration, that demonstration and instructions have been satisfactorily completed.

.3 Give time and date of each demonstration, with list of persons present complete with signatures.

1.4 CONDITIONS FOR DEMONSTRATIONS

.1 Equipment has been inspected and put into operation:

.2 Testing, adjusting, and balancing have been performed in accordance with Section 23 05 93 and 1 91 00, and equipment and systems are fully operational.

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

PART 2 PRODUCTS

2.1 NOT USED

.1 Not used.

PART 3 EXECUTION

3.1 PREPARATION

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

.2 Verify that designated personnel are present.

.3 Present system demonstrations.

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

3.2 DEMONSTRATION AND INSTRUCTIONS

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

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

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

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

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

3.3 TIME ALLOCATED FOR INSTRUCTION

.1 Provide one, two hour demonstration of training sessions.

END OF SECTION

PART 1 GENERAL

1.1 DEFINITIONS

.1 Commissioning: The process for achieving, verifying, and documenting that the facility and its systems are planned, designed, installed, and tested to ensure that they meet the original project requirements established by The City of Winnipeg.

.2 Commissioning Team:

.1 The City of Winnipeg's Representative: Representative of The City of Winnipeg, as defined in the Agreement.

.2 Consultant: as defined in the Agreement.

.3 Contractor Representatives: Representatives of the Construction Manager, including any sub-contractors whose scope of work includes items requiring commissioning.

.3 Commissioning Documents:

.1 Commissioning Plan: A project-specific document which defines the scope and approach to commissioning of this facility.

.2 Submittal: Contract submittal, as specified in Contract Documents.

.3 Static check certificate: A document used to verify equipment data actually installed, prior to start-up or operation.

.4 Operating check certificate. A document used to verify equipment operation, including performance statistics.

.5 Startup Reports: Report prepared by equipment start-up personnel, including start-up sequence, and performance statistics. Refer to Section 01 75 16.

.6 Balancing Report: Report prepared by the balancing agency, indicating initial and final system performance, to Section 01 75 19.

.7 Maintenance Manual: A document containing detailed descriptions and technical information about start-up, operation and maintenance of equipment, to Section 01 78 40.

1.2 METHODOLOGY

.1 The Commissioning Manager shall develop a Commissioning Plan, including as a minimum the management of commissioning meetings, and the management of project-specific commissioning documents.

.2 Commissioning Plan to include:

.1 Assembly of The City of Winnipeg's requirements, including design criteria, performance goals, budgets, and schedules.

.2 Scheduling and chairing of commissioning meetings between team members.

.3 Development of static and operating check certificates for individual equipment.

.4 Assembly of commissioning reports, including testing and balancing reports, maintenance manuals, start-up reports, and testing reports.

.3 Execute the commissioning plan.

1.3 REGULATORY REQUIREMENTS

.1 Arrange for regulatory authorities to witness those commissioning start up procedures which are also required by regulatory authorities.

.2 Obtain certificates of approval and for compliance with regulations from Authorities Having Jurisdiction; include copies of certificates with start up reports.

1.4 CONTRACT COMMISSIONING REQUIREMENTS

.1 Witnessing: Allow commissioning team members to witness starting, testing, adjusting, and balancing procedures.

.2 Costs: Pay costs associated with starting, testing, adjusting, and relevant instruments and supplies required to perform those duties.

.3 Employ experienced personnel for equipment startup and commissioning, who are able to interpret results of readings and tests, and report the system status in a clear and concise manner.

.4 Provide all equipment required to perform testing, balancing, and commissioning of systems. Calibrate instruments used in start up as accurate; provide calibration certificates if requested by the Commissioning Manager.

.5 Utilize equipment check certificates and other commissioning documents required by the Commissioning Manager.

.6 Verify that equipment is installed in accordance with Contract Documents, and reviewed shop drawings. Sign and date static check certificates.

.7 Do not start up equipment unless static check sheets have been completed and submitted.

.8 Complete in detail, and sign operating check certificates.

PART 2 PRODUCTS

2.1 NOT USED

PART 3 EXECUTION

3.1 COMMISSION TESTING

.1 Complete the attached commissioning forms:

.1 Roof top unit, RTU-1

END OF SECTION

PART 1 GENERAL

1.1 WORDS AND TERMS

.1 Conform to the following definitions and their defined meanings in addition to those referenced in 20 05 00 – Common Work for Mechanical:

.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 Consultant.

1.2 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 Consultant 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 The 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 the drawings, specifications, and schedules and related Work for all other Sections to ensure that Work can be satisfactorily executed. Conflicts or additional Work beyond the Work described shall be brought to the attention of the Consultant.

.9 All specification sections of the Project Manual and Drawings are affected by requirements of Division 01 sections.

1.3 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 of Winnipeg nor Consultant assumes any responsibility to act as an arbiter to establish subcontract terms or disagreements between sectors or disciplines of the Work.

1.4 CONTRACT METHOD

.1 Construct Work under the contract requirements in the applicable Division 00 sections.

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

1.5 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 ASME Code, CSA Code and the Provincial Labour Department shall cover the design, manufacture, installation, welding and tests of pressure vessel and refrigeration piping and other equipment as specified hereafter.

.3 Obtain Registration Certificates for all pressure vessels, with suitable metal-framed clear covers installed where directed. Furnish all certificates required by Local Authorities before acceptance of building by The City of Winnipeg.

.4 The City of Winnipeg may request the Mechanical Subcontractor to operate device or material installed for such time as Consultant 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 Consultant 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 of Winnipeg against defects and deficiencies and not to superintend the

execution of the work, which is the Mechanical Subontractor's and their Subcontractors' responsibility.

1.6 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 Consultant'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.

1.7 CLOSEOUT SUBMITTALS

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

.2 Draft Submissions

.1 Four (4) weeks prior to Substantial Performance of the Work, submit to the Consultant digital copies of operating and maintenance manuals and record drawings in Canadian English.

.2 Copy will be returned with Consultant's comments.

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

.3 Final Submission

.1 Two (2) weeks prior to Substantial Performance of the Work, submit to the Consultant final digital copies of operating and maintenance manuals and record drawings. If required, further revise as per Consultant's comments.

.2 On Consultant's acceptance of the operating and maintenance manuals and record drawings, produce 2 hard copies (or quantity as required by Section 01 78 10) of the closeout documents and ship to The City of Winnipeg. Pay costs of transportation. Provide digital copy to The City of Winnipeg by electronic file transfer or physical media.

.4 Spare Parts, Materials and Tools

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

.2 Provide complete list of parts and supplies included location of where parts and supplies were stored in the building. List to include parts and supplies recommended, but not specified, for use within the first two years of operation. Listed parts and supplies to be reviewed with The City of Winnipegs Representative and marked by The City of Winnipegs Representative as reviewed and accepted.

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

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

1.8 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

.2 Operation and Maintenance Data: submit operation and maintenance data and incorporate into manual.

- .1 Operation and maintenance manual approved by, and final copies submitted to Consultant before final inspection.
- .2 Operation data to include:
  - .1 Control schematics for systems including environmental controls.
  - .2 Description of systems and their controls.
  - .3 Description of operation of systems at various loads together with reset schedules and seasonal variances.
  - .4 Operation instruction for systems and component.
  - .5 Description of actions to be taken in event of equipment failure.
  - .6 Valves schedule and flow diagram.
  - .7 Colour coding chart.
- .3 Maintenance data to include:
  - .1 Servicing, maintenance, operation and trouble-shooting instructions for each item of equipment.
  - .2 Data to include schedules of tasks, frequency, tools required and task time.
- .4 Performance data to include:
  - .1 Equipment manufacturer’s performance datasheets with point of operation as left after commissioning is complete.
  - .2 Equipment performance verification test results.
  - .3 Special performance data as specified.
  - .4 Testing, adjusting and balancing reports as specified in Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.
- .5 Approvals:
  - .1 Submit 2 copies of draft Operation and Maintenance Manual to Consultant for approval. Submission of individual data will not be accepted unless directed by Consultant.
  - .2 Make changes as required and re-submit as directed by Consultant.
- .6 Additional data:
  - .1 Prepare and insert into operation and maintenance manual additional data when need for it becomes apparent during specified demonstrations and instructions.
- .7 Site records:
  - .1 Consultant will provide 1 set of reproducible mechanical drawings. Provide sets of white prints as required for each phase of work. Mark changes as work progresses and as changes occur. Include changes to existing mechanical systems, control systems and low voltage control wiring.
  - .2 Use different colour waterproof ink for each service.
  - .3 Make available for reference purposes and inspection.
- .8 As-built drawings:
  - .1 Prior to start of Testing, Adjusting and Balancing for HVAC, finalize production of as-built drawings.

.2 Identify each drawing in lower right hand corner in letters at least 12 mm high as follows: - “AS BUILT DRAWINGS: THIS DRAWING HAS BEEN REVISED TO SHOW MECHANICAL SYSTEMS AS INSTALLED” (Signature of Contractor) (Date).

.3 Submit to Consultant for approval and make corrections as directed.

.4 Perform testing, adjusting and balancing for HVAC using as-built drawings.

.5 Submit completed reproducible as-built drawings with Operating and Maintenance Manuals.

.9 Submit copies of as-built drawings for inclusion in final TAB report.

1.9 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data: Submit manufacturer’s instructions, product literature, and data sheets for products and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:

.1 Indicate on drawings:

.1 Mounting arrangements.

.2 Operating and maintenance clearances.

.2 Shop drawings and product data accompanied by:

.1 Detailed drawings of bases, supports, and anchor bolts.

.2 Acoustical sound power data, where applicable.

.3 Points of operation on performance curves.

.4 Manufacturer to certify current model production.

.5 Certification of compliance to applicable codes.

.3 In addition to transmittal letter referred to in Section 01 33 00 - Submittal Procedures use MCAC “Shop Drawing Submittal Title Sheet”. Identify Section and paragraph number.

1.10 OPERATION AND MAINTENANCE MANUAL

.1 Refer also to Section 01 78 00 for contents and formats for manuals. Where there is a discrepancy with this section, follow the requirements 01 78 00.

.2 Contents

.1 Table of Contents - provide:

.1 Title of project.

.2 Date of submission.

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

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

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

.3 Permits and certifications: Provide copy of permits and notice of permit closeout, relevant certificates issued by authorities having jurisdiction, including code compliance certificate, life safety systems performance certificate, pressure vessel acceptance.

.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 – Quality Control.

.5 Installation and Operation Manuals (IOM): Provide IOM for each available component installed grouped by specification division. Provide listing of manual at the beginning of each division section.

.6 Verification documentation: Provide documentation relating to verifications including but not limited to balancing reports, fire damper tests, water treatment tests and equivalent reports.

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

.8 Training: Refer to Demonstration and Training in this Section.

.3 Manual

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

.2 Digital:

.1 Provide all files in PDF format.

.2 Provide bookmarks in single bound files or files located in identified folders.

.3 Drawings: Provide mechanical drawings in PDF format separate from IOM file.

.3 Hard copy binders:

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

.2 When multiple binders are used, correlate data into related consistent groupings. Identify contents of each binder on spine.

.3 Provide tabbed fly leaf for each separate product and system, with typed description of product and major component parts of equipment.

.4 Cover: Identify each binder with type or printed title 'Project Record Documents'; list title of project and identify subject matter of contents.

.5 Drawings: provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.

1.11 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 Addendums and 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 installed, including identifying 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.

1.12 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: 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.

.2 Specifications: Adobe Acrobat (PDF).

.2 Mark revised documents as "RECORD DOCUMENTS". Include all revisions.

.3 Submit completed record documents to Consultant by electronic transfer or physical electronic media.

1.13 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.

1.14 QUALITY ASSURANCE

.1 Product Standard Compliance:

.1 Products tested to meet codes and standard must be performed by organizations recognized by the Authority Having Jurisdiction.

.2 Testing Services;

.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.

1.15 DEMONSTRATION AND TRAINING

.1 Instruct The City of Winnipeg'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.

.2 Provide two (2) weeks prior notice to The City of Winnipeg to schedule the training.

.3 The City of Winnipeg will provide list of personnel to receive instructions and will coordinate their attendance at agreed-upon times.

.4 Upon completion of instructions, forward to Consultant with a copy to The City of Winnipeg a letter indicating person instructed and dates that the instruction took place. If

in Consultant's opinion, this is not done satisfactorily, Consultant may direct such instruction, and charge all costs involved to relevant section.

1.16 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.

1.17 SHOP DRAWINGS - ADMINISTRATIVE REQUIREMENTS

.1 Shop drawings shall be submitted electronically in PDF format documents to shopdrawings@eppsiepman.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 Consultant submittals listed for review. Submit with reasonable promptness and in orderly sequence to not cause delay in Work. Failure to submit in ample time is not considered sufficient reason for an extension of Contract Time and no claim for extension by reason of such default will be allowed.

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

.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 Consultant, 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 and deviations in submission from requirements of Contract Documents is not relieved by Consultant review.

.12 Keep one (1) reviewed copy of each submission on site.

1.18 SHOP DRAWINGS AND PRODUCT DATA SUBMISSIONS

.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 15 working days for Consultant's review of each submission.

.6 Adjustments made on Shop Drawings are not intended to change Contract Price. If adjustments affect value of Work, state such in writing prior to proceeding with Work.

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

.8 Accompany submissions with transmittal letter, containing:

- .1 Date.
- .2 Project title and number.
- .3 Contractor's name and address.
- .4 Identification and quantity of each shop drawing, product data and sample.
- .5 Other pertinent data.

.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.

.6 Submissions must clearly indicate the products being submitted and all options associated with the submitted product.

.10 After submission has been reviewed, distribute copies.

.11 Submit one (1) copy of submissions as a pdf document by email attachment for each requirement requested in specification Sections and as consultant 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 Consultant 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 Consultant 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 Consultant, 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 Consultant does not constitute acceptance of responsibility. Such checking constitutes assistance only to the Mechanical Division in the proper execution of their work.

1.19 PRODUCT CHANGES & SUBSTITUTIONS

.1 Change in Product/Products: Submit request for substitution or alternative in accordance with this Section, the Instructions to Bidders , and Section 01 62 00 – Product Exchange Procedures. 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 including consultant fees required to incorporate the substituted material shall be the responsibility of the Mechanical Division. Review the maximum dimensions and weights when provided in the specification and schedules, and where not specified review the drawings for space limitations. The Bidder may be required to submit to the Consultant drawings in plan and sections to prove that the substituted item will fit in the allowable space.

.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 of Winnipeg.

.4 Waives claims for additional costs or time extension which may subsequently become apparent.

.5 Will reimburse The City of Winnipeg and Consultant 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.

1.20 CERTIFICATES AND TRANSCRIPTS

.1 Where certification of industry standards, registration with industry organizations or similar documentation of contractor’s qualifications is required, provide documentation on request.

1.21 PRODUCT SUPPLIED

.1 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 Consultant.

.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.

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

.3 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.

.4 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 of Winnipeg, and make good any such damage.

1.22 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 Section 23 01 31 - Air Duct Cleaning for HVAC Systems 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 Schedule cleaning operations so that resulting dust and other contaminants will not fall on wet, newly painted surfaces, infiltrate into occupied areas, or trigger fire alarm smoke or dust detectors.

.9 Replace heating, ventilating and air conditioning filters if units were operated during construction.

.10 Do not start air-handling systems unless the systems and associated ductwork are clean. Failure to properly clean the equipment and ductwork shall make the Contractor responsible to clean, repair or replace equipment and ductwork rendered deficient.

.11 At the end of construction all systems shall be left ready for operation.

.12 This Section shall be responsible for repair work as may be necessary to remove dents and touch-up of factory finishes.

1.23 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.

1.24 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 Consultant in writing, of conflicts between specifications and manufacturer's instructions, so that course of action can be established.

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

1.25 QUALITY OF WORK

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

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

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

.4 Assume full responsibility for layout of own work and for any damage caused to property of others through improper location or poor workmanship.

.5 ACCESSIBILITY OF EQUIPMENT

.1 The City of Winnipeg 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 a 2.4 to 3 m (8 to 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 Consultant/The City of Winnipeg 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.

.6 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.

.7 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.

.8 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.

1.26 WORK FOR OTHER TRADES

.1 The Mechanical Contractor 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.

1.27 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.

1.28 CONCEALMENT

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

.2 Before installation, inform Consultant if there is interference and install as directed.

1.29 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,

equivalent to Acudor, type to suit application. Instruct relevant section for proper location of access panels. Final locations subject to Consultant'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.

.2 Duct mounted access panels supplied and installed by Division 23.

1.30 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.

1.31 ALTERATION WORK

.1 Where work is to be done in existing buildings, accurately survey, provide for avoidance of damage and interference to existing work and rectify any such damage due to work under Mechanical Sections. Accept existing work as it exists at time of tendering.

.2 Carefully dismantle existing mechanical equipment to be removed or relocated. Temporarily disconnect, remove, and reinstall existing equipment, piping, ductwork, conduit, light fixtures, and similar items, which interfere with the new installation after completion of new work or of existing installations to be demolished. Store equipment and materials on the premises as directed by The City of Winnipeg.

.3 All usable salvaged equipment and materials shall remain the property of The City of Winnipeg unless specifically noted otherwise. Such material shall be removed from the building and be safely and neatly stored on the site for removal by The City of Winnipeg. The Contractor shall remove all rejected salvage from the site and legally dispose of it off site.

.4 Reuse existing equipment in new work after first repairing and reconditioning any defective items where noted. Safely cap and seal disconnected mechanical services within finished surfaces.

.5 The abandonment of existing equipment and material in place is not acceptable. All redundant services are to be removed back to active mains, which shall then be capped at existing point of connection.

.6 All mechanical equipment conflicting with new equipment being installed shall be moved or disconnected, without damage, by Contractor and shall remain property of The City of Winnipeg. Remove ducts and piping not required in revised systems and interfering with new installation. This material shall become property of Contractor.

.7 Disconnect existing equipment indicated, intended to be reused, rough-in in new position, and after replacement connect fully, ready for use.

.8 Removal and relocation of mechanical equipment by relevant Mechanical Sections.

.9 Operation of HVAC equipment serving occupied areas during renovation

.1 Protect HVAC air handling equipment from collecting odours and pollutants during demolition & construction by implementing the following measures:

.1 Shut-down HVAC equipment in coordination with The City of Winnipeg’s representative during heavy construction or demolition.

.2 Isolate the functional HVAC system from the renovation to prevent intake of pollutants.

.3 Seal all return system openings in and immediately adjacent to the construction area where isolation of the renovation area is possible.

.4 Install and maintain temporary filters on return air openings from the renovation space when system is in operation and connection to the renovation space is necessary. Replace these filters at the end of the project.

.5 Avoid storage of waste and construction materials in the mechanical room.

.6 Use high-efficiency filters (MERV 13) for central filtration when operating the system during construction. Inspect filters daily and replace as required over the duration of the project.

.7 Protect diffusers, VAV boxes, ducts and other HVAC system components.

.8 Final cleaning of existing ducts, diffusers, and window units is required upon completion of work if evidence of contamination is found.

1.32 TEMPORARY USE OF EQUIPMENT

.1 No portion of any mechanical system or equipment provided under Mechanical Sections may be used for temporary heating without Consultant'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 of Winnipeg. 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 of Winnipeg.

.5 If permission for temporary use of mechanical equipment is granted, use Canadian Plumbing and Mechanical Contractors Association standard form of agreement as basis of responsibilities. Guarantee on complete installation shall not start until acceptance of building by The City of Winnipeg.

.2 Where air handling systems are permitted to be operated before turnover to The City of Winnipeg:

.1 All return air grilles/openings shall be equipped with MERV 8 filters to keep return air system clean of dust and dirt. Monitor all HVAC filters for dust loading and replace filters.

.2 Replace non-LED lamps if used for more than one month.

1.33 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 Consultant.

1.34 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 contractor.

.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 contractor.

PART 2 PRODUCTS

PART 3 EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed are acceptable installation in accordance with manufacturer's instructions.

.1 Visually inspect substrate in presence of Consultant.

.2 Inform Consultant of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Consultant.

3.2 SITE QUALITY CONTROL

.1 Site Tests: conduct following tests in accordance with 01 45 00 - Quality Control and submit report as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.

.2 Manufacturer's Site Services:

.1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Site Reports as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.

.2 Provide manufacturer's site services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

3.3 ADJUSTING

.1 Prime and touch up marred finished paintwork to match original.

.2 Restore finishes which have been damaged to a "like new" condition.

3.4 CLEANING

.1 Final Cleaning: Perform in accordance with Section 01 74 00 – Cleaning and clean interior and exterior of all systems.

3.5 DEMONSTRATION

.1 Consultant will use equipment and systems for test purposes prior to acceptance. Supply labour, material, and instruments required for testing.

.2 Supply tools, equipment and personnel to demonstrate and instruct operating and maintenance personnel in operating, controlling, adjusting, trouble-shooting and servicing of all systems and equipment during regular work hours, prior to acceptance.

.3 Use operation and maintenance manual, as-built drawings, and audio-visual aids as part of instruction materials.

.4 Instruction duration time requirements as specified in appropriate Sections.

.5 Contractor will record these demonstrations for future reference.

3.6 PROTECTION

.1 Protect equipment and systems openings from dirt, dust, and other foreign materials with materials appropriate to system.

END OF SECTION

PART 1 GENERAL

1.1 DESCRIPTION OF THE WORK

.1 Division of the Work among other contractors or subcontractors is solely the Contractor's responsibility. Neither The City of Winnipeg nor Consultant assumes any responsibility to act as an arbiter to establish subcontract terms or disagreements between sectors or disciplines of the Work.

1.2 CONTRACT METHOD

.1 Construct Work under the contract requirements in the applicable Division 00, 01 and 02 sections.

1.3 PERMITS, INSPECTION AND TESTING

.1 File all necessary notices, obtain and pay for all approvals and permits applicable to each Mechanical Section.

.2 Make changes required to secure Local Authorities approval, without extra cost. Where conflicting requirements occur, comply with most stringent regulation.

1.4 EXAMINATION

.1 Inspect existing conditions, including elements or adjacent buildings subject to irregularities, damage, movement, or other that could result from demolition Work.

.2 Hazardous containing materials may be present within existing buildings. Conform to applicable regulatory procedures when discovering hazardous or contaminated materials. If hazardous material are discovered during construction, notify Consultant immediately and do not proceed until written direction provided by Consultant.

.3 Coordinate full extent of demolition work with all disciplines. Coordinate on site with all trades prior to commencement of demolition.

.4 Beginning of demolition means installer accepts existing conditions.

1.5 ELECTRICAL REQUIREMENTS

.1 Division 26 shall disconnect power from all mechanical equipment and components prior to mechanical section beginning demolition. Coordinate with Division 26 to confirm power disconnection requirements.

1.6 WASTE MANAGEMENT

.1 In accordance with Section 01 74 00 – Cleaning And Waste Processing.

END OF SECTION

PART 1 GENERAL

1.1 RESPONSIBILITIES

.1 The Contractor shall:

.1 Attend mandatory site commissioning meetings to review completed forms.

.2 Provide all coordination required to schedule, coordinate, and complete all commissioning activities. Due to interdependency of the various systems and items of equipment, significant coordination will be required to facilitate commissioning.

.3 Complete all **Equipment commissioning Forms** specific to the actual equipment involved on this project. Forms are included as part of this section.

.4 The Contractor is responsible for the sub-trades and their respective specialists and suppliers in participating in commissioning work and in providing the services required for the commissioning.

.5 Complete forms and sign off when each form is satisfactorily completed.

.6 Provide instruction and training on all components to Facility Staff.

.2 The Consultant Team shall:

.1 Review and verify completed Equipment and Installation Forms

.2 Attend mandatory site commissioning meetings to review completed forms.

.3 Sign off Forms when satisfactorily completed by the Contractor.

.4 Maintain Master Deficiency List

.3 The City of Winnipegs Advocate shall:

.1 Ensure that all forms have been signed off by the responsible parties.

.2 Attend mandatory site commissioning meetings to review completed forms.

.3 Receive deficiency lists and forward to the Primary Consultant for inclusion in the Master Deficiency List.

.4 Sign off completed Forms and return to Contractor.

1.2 DESCRIPTION

.1 Commissioning activities to be performed by the contractor include but are not limited to the following:

.1 Verification that all equipment has been supplied to the project in accordance with the specification. Every piece of equipment requires the satisfactory completion of a **Static Verification Forms.** Static verification shall be done shortly after equipment delivery to site and well in advance of the functional testing to allow time to resolve deficiencies that may be identified at this stage.

.2 Verification of equipment startup, and completion of **Start-Up Forms.**

.3 Verification that each system has been **functionally tested** and that the system components act and react interdependently and as per design. The Contractor(s) perform the testing as required to allow the Design Team and The City of Winnipeg to verify systems operation. The Contractor is responsible to record the information and results of this work in the **Functional Performance Test Forms.**

.4 All deficiencies are to be satisfactorily completed prior to substantial completion.

END OF SECTION

PART 1 PRE-TRAINING

1.1 GENERAL

.1 Mechanical contractor training record to comply with Section 01 79 00-Demonstration and Training and 20 05 00 – Common Work For Mechanical.

1.2 PRE-TRAINING REQUIREMENTS

.1 Submit pre-training setup and any other required information as defined in Sections 01 79 00 and 21 05 00 to Owner's representative a minimum 2 weeks ahead of proposed training date. Training date to be minimum two weeks ahead of substantial performance.

.2 Mechanical commissioning sign off date determined by Consultant

.3 Acceptable training date and list of personnel will be based on Owner's personnel availability. Owner to provide date and personnel list within 3 days of receipt of pre-training setup.

1.3 PRE-TRAINING SETUP

Mechanical Commissioning Sign Off Date	
Training and Demonstration Date(s) and Time(s) Proposed	
Training and Demonstration Agenda and Schedule	
List of Excluded Systems	

PART 2 TRAINING RECORD

2.1 TRAINING RECORD CLOSEOUT

.1 Submit training close out record within 5 days of completion of training. Attendees listed to sign record verifying attendance and receipt of training and demonstration as scheduled on completion of training.

Training Date(s), Time(s)	
Contractors Attendees	
Owner's Attendees	
Training and Demonstration Provided	

PART 1 GENERAL

1.1 REFERENCE STANDARDS

.1 American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE):

.1 ANSI/ASHRAE/IES 90.1-2013, Energy Standard for Buildings Except Low-Rise Residential Buildings

.2 ASTM International (ASTM):

.1 ASTM C335/C335M-17, Standard Test Method for Steady-State Heat Transfer Properties of Pipe Insulation

.2 ASTM C411-19, Standard Specification for Hot-Surface Performance of High-Temperature Thermal Insulation

.3 ASTM C449/C449M-07, Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement

.4 ASTM C547-22a, Standard Specification for Mineral Fiber Pipe Insulation

.5 ASTM C1767M-21, Standard Specification for Stainless Steel Jacketing for Insulation

.3 Midwest Insulation Contractors Association (MICA):

.1 North American Commercial and Industrial Insulation Standards (NACIIS) Manual, 9th edition

.4 National Research Council (NRC)

.1 National Energy Code for Buildings of Canada (NECB) 2020

.2 Manitoba Energy Code for Buildings (MECB) 2024

.5 ULC Standards (ULC):

.1 CAN/ULC-S102-10, Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies

.2 CAN/ULC-S702.1-14, Standard for Mineral Fibre Thermal Insulation for Buildings, Part 1: Material Specification

1.2 DEFINITIONS

.1 For the purposes of this Section:

.1 Concealed means insulated mechanical services in suspended ceilings, or in non-accessible chases, or in furred-in spaces.

.2 Exposed means not concealed.

.3 Jacketing is synonymous with insulation cladding and lagging.

.4 Mineral fibre is synonymous with glass fibre, rock wool, or slag wool.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer’s product literature, specifications, and datasheets. Include product characteristics, performance criteria, and limitations.

.2 Submit WHMIS Safety Data Sheet (SDS).

.3 Shop Drawings:

.1 Submit drawings with a list of insulation for each service location, insulation type, thickness, and jacketing type.

.4 Certificates: When requested, submit manufacturer's certificates certifying that materials comply with specified performance characteristics and physical properties.

.5 Manufacturers' Instructions: Submit manufacturer's installation instructions.

1.4 QUALITY ASSURANCE

.1 Qualifications:

.1 Installer: Specialist in performing work of this Section with at least three years successful experience in this type and size of project, member of Thermal Insulation Association of Canada (TIAC).

1.5 DELIVERY, STORAGE, AND HANDLING

.1 Perform in accordance with Section 01 61 00 - Common Product Requirements.

.2 Protect insulation, canvas, and other moisture-sensitive materials from moisture.

PART 2 PRODUCTS

2.1 DESCRIPTION

.1 Regulatory Requirements:

.1 Combustible piping materials, including adhesives in accordance with CAN/ULC-S102:

.1 Flame-spread rating: Maximum 25.

.2 Smoke developed classification: Maximum 50.

2.2 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 20 05 00 Common Work for Mechanical

.2 Insulation: ASTM C547; rigid moulded, non-combustible.

.1 'ksi' ('K') value : ASTM C335, 0.035 at 24°C (0.24 at 75°F).

.2 Minimum Service Temperature: -28.9°C (-20°F).

.3 Maximum Service Temperature: 454°C (850°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.

2.3 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 White fire retardant lagging adhesive.

.1 Bakelite 120-18 or equivalent.

.3 Lagging Coating

.1 Finish with two full brush coats of white fire retardant lagging coating.

.1 Bakelite 120-09 or equivalent.

2.4 INSULATION ACCESSORIES

.1 Shield: galvanized steel; size to match external pipe insulation radius

.2 Pipe support inserts:

.1 Non-crushing support of fibreglass blocks, wood blocks, calcium silicate or welded metal offsets suitable to temperature of pipe contents.

.2 Minimum 150 mm (6 inches) long, of same thickness and contour as adjoining insulation; may be factory fabricated.

.3 Welded metal and calcium silicate to be used for steam applications.

.3 Fittings and valves

.1 Insulating removable covers.

PART 3 EXECUTION

3.1 INSTALLATION

.1 Install materials to manufacturer's written instructions.

.2 Provide aluminum jacketing on all outdoor refrigeration piping.

.3 On exposed piping, locate insulation and cover seams in least visible locations.

.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: at piping supports

.3 Inserts: Between support shield and piping and under the finish jacket.

.7 Finish insulation at supports, protrusions, and interruptions.

.8 At penetrations through fire rated walls, provide firestopping at walls and run insulation to firestopping. Seal insulation ends. Where voids exist between fire stop seals within the cavity, fill void with mineral wool or alternative non-combustible insulation.

.9 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 piping conveying fluids below ambient temperature and larger than 3" (75 mm) in diameter provide insulation supports with sufficient compressive strength shall be used to support the weight of the piping system and with appropriate thickness for the required insulation values.

.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.

.10 For pipe exposed in mechanical equipment rooms or in finished spaces below 3 metres (10 feet) above finished floor, finish with canvas jacket sized for finish painting.

.11 For all pipe in exposed in occupied areas, finish with PVC jacket.

.12 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 removable aluminum jacket with seams located on bottom side of horizontal piping.

.13 Fittings and Valves

.1 Shall be insulated with pre-formed fiberglass fittings, fabricated sections of fibreglass 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.

.4 On fittings and valves requiring insulation removal, install with removable insulation not damaged by use, or insulation bag covers. Removable insulation must maintain insulation properties on replacement, and vapour barrier properties on cold systems.

.14 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."

3.2 SITE QUALITY CONTROL

.1 Non-Conforming Work: Replace insulation where there is damage to the vapour barrier and insulation is saturated with moisture.

3.3 TOLERANCE

.1 Substituted insulation materials: Thermal resistance within 10 percent at normal conditions, as materials indicated.

3.4 REQUIRED INSULATION

.1 Insulation to conform to National Energy Code for Buildings.

.2 Where piping insulation has a thermal conductivity that is different than the range indicated in the table:

.1 Thermal conductivity greater than table range: insulation thickness shall be increased by the ratio u2/u1, where u1 is the value at the higher end of the conductivity range for the operating temperature and u2 is the measured thermal conductivity of the insulation at the mean rating temperature

.2 Thermal conductivity lower than table range: insulation thickness may be decreased by the ratio u2/u1, where u1 is the value at lower end of the conductivity range for the operating temperature and u2 is the measured thermal conductivity of the insulation at the mean rating temperature.

.3 Insulation thickness based on installed thickness.

.4 Piping carrying fluids above 16°C and below 41°C do not require insulation unless otherwise indicated.

3.5 FIBROUS GLASS INSULATION SCHEDULE

	PIPING SYSTEMS	PIPE SIZE <Inch><mm>	THICKNESS <Inch><mm>
	Piping Exposed to Freezing with heat tracing	all	1” (25mm)

END OF SECTION

PART 1 GENERAL

1.1 REFERENCE STANDARDS

.1 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
- .1 Safety Data Sheets (SDS).

.2 National Research Council Canada (NRC)
- .1 National Plumbing Code of Canada 2020 (NPC).
- .2 Manitoba Plumbing Code 2024 (MPC)

.3 ASME A112.3.1

.4 ASTM A 666

.5 PLASTIC PIPING
- .1 ASTM International (ASTM)
  - .1 ASTM D2235- 04, Standard Specification for Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings.
  - .2 ASTM D2564- 04e1, Standard Specification for Solvent Cements for Poly (Vinyl-Chloride) (PVC) Plastic Piping Systems.
  - .3 ASTM D2855-20R24, Standard Practice for Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings
  - .4 ASTM F477-14R21, Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe
- .2 CSA Group (CSA)
  - .1 B137.3-20, Rigid polyvinylchloride (PVC) pipe and fittings for pressure applications
  - .2 CAN/CSA-Series B1800- 06, Thermoplastic Nonpressure Pipe Compendium - B1800 Series.
  - .3 CSA B602-20, Mechanical couplings for drain, waste, and vent pipe and sewer pipe
- .3 Green Seal Environmental Standards (GSES)
  - .1 Standard GS-36- 00, Commercial Adhesives.

.6 Underwriters of Canada Limited
- .1 CAN/ULC S-102.2-18R24, Standard Method of Test for Surface Burning Characteristics of Flooring, Floor Coverings, and Miscellaneous Materials and Assemblies

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:
- .1 Provide manufacturer’s printed product literature and datasheets for adhesives, and include product characteristics, performance criteria, physical size, finish and limitations.

1.3 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle in accordance with Section 20 05 00 – Common Work for Mechanical.

.2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

.3 Packaging Waste Management: In accordance with Section 01 74 20 - Waste Management and Disposal.

PART 2 PRODUCTS

2.1 SUSTAINABLE MATERIAL

2.2 SANITARY SEWER PIPING, ABOVE GRADE

.1 PVC Pipe: CAN/CSA B182.1

.1 Manufacturer: IPEX Building Sewer and Drain

.2 Fittings: PVC.

.3 Joints:

.1 No hub shielded coupling: CSA B602

.2 Flexible coupling: CSA B602

.3 Solvent weld coupling: ASTM D2855, solvent weld to ASTM D2564.

.2 PVC Pipe with FSR25: CAN/CSA B1800

.1 Fittings: PVC.

.2 Joints:

.1 No hub shielded coupling: CSA B602, CAN/ULCS-102.2

.2 Flexible coupling: CSA B602, CAN/ULCS-102.2

.3 Solvent weld coupling: ASTM D2855, solvent weld to ASTM D2564.

.3 PVC Pipe with FSR25/SDC50: CAN/CSA B1800

.1 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.

.2 Fittings: PVC.

.3 Joints:

.1 No hub shielded coupling: CSA B602, , CAN/ULCS-102.2

.2 Flexible coupling: CSA B602, , CAN/ULCS-102.2

.3 Solvent weld coupling: ASTM D2855, solvent weld to ASTM D2564.

.4 Manufacturer: IPEX System XFR or equal.

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 INSTALLATION

.1 In accordance with Section 23 05 15 - Common installation requirements for HVAC pipework.

.2 Install in accordance with National Plumbing Code.

3.3 TESTING

.1 Hydraulically test to verify grades and freedom from obstructions.

3.4 PERFORMANCE VERIFICATION

.1 Cleanouts:

.1 Ensure accessible and that access doors are correctly located.

.2 Open, cover with linseed oil and re-seal.

.3 Verify that cleanout rods can probe as far as the next cleanout, at least.

.2 Test to ensure traps are fully and permanently primed.

.3 Ensure that fixtures are properly anchored, connected to system and effectively vented.

.4 Affix applicable label (storm, sanitary, vent, pump discharge etc.) c/w directional arrows every floor or 4.5 m (whichever is less).

3.5 CLEANING

.1 Clean in accordance with Section 01 74 00 - Cleaning.

.2 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 20 - Waste Management and Disposal.

3.6 EXAMINATION

.1 Section 20 05 00 – Common Work for Mechanical: Verify existing conditions before starting work.

3.7 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.

3.8 INSTALLATION

.1 Install to manufacturer's written instructions.

.2 Use of materials

.1 Provide non-conducting dielectric connections wherever jointing dissimilar metals.

.2 Use shielded couplings on drainage piping, use of unshielded flexible couplings on drainage piping limited to applications where shear forces are minimal and where some flexibility in the joint is acceptable. Do not install flexible couplings at locations of high loads such as at the base of risers or underground installations.

.3 Provide access where valves and fittings are not exposed. Coordinate size and location of access doors with Section 08 31 13.

.3 Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.

.4 Install piping to maintain headroom, conserve space, and not interfere with use of space.

.5 Group piping whenever practical at common elevations.

.6 Hangers and support, refer to Section 23 05 29.

.1 Provide clearance in hangers, from structure and other equipment for installation of insulation and access to valves and fittings.

.2 Support all hangers from top chord of joists, spanning supports or in concrete decking for all piping. Decking clips are acceptable to 25 kg (50 lbs) loads.

.3 Roof decking clips to support up to 25 kg (50 lbs) with minimum 1 meter spacing between clips unless otherwise directed by the structural engineer. Roof decking support clip fasteners shall not penetrate the roof membrane. Storm water and waste water to be hung directly from structural members or from spanned supports between structural members only, no attachments to roof decking.

.4 Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.

.5 Provide support for utility meters to requirements of utility companies.

.6 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.

.7 Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.

.7 Install bell and spigot pipe with bell end upstream.

3.9 APPLICATION

.1 Use grooved mechanical couplings and fasteners only in accessible locations.

.2 Install unions downstream of valves and at equipment or apparatus connections.

.3 Where manufacturer's minimum pipe size is greater than pipe size indicated on drawings and within two standard pipe sizes, use manufacturer's minimum pipe size.

.4 Combustible buildings:

.1 Plastic piping installed in combustible buildings shall have a 25/50 flame and smoke rating when installed in plenums.

.5 Non-combustible buildings:

.1 Plastic piping installed in non-combustible buildings shall have a 25 smoke rating and must comply with the restrictions in the following table.

.2 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**	**Under-ground**
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

3.10 SYSTEM CLEANING

.1 Clean interior and exterior of all systems including strainers.

.2 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.

.3 Remove dirt, rubbish, grease, and dust for which this section is responsible from all exposed surfaces and fixtures.

.4 Thoroughly clean piping 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.

.5 Clean exposed surfaces of mechanical equipment, piping, etc., and polish plated work.

.6 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.

.7 Schedule cleaning operations so that resulting dust and other contaminants will not fall on wet, newly painted surfaces, infiltrate into occupied areas, or trigger fire alarm smoke or dust detectors.

END OF SECTION

PART 1 GENERAL

1.1 USE OF SYSTEMS

.1 Use of new and existing permanent heating and ventilating systems for supplying temporary heat or ventilation is not permitted

.2 Filters specified in this Section are over and above those specified in other Sections of this project.

.3 Exhaust systems are not included in approvals for temporary heating ventilation.

PART 2 PRODUCTS

2.1 NOT USED

PART 3 EXECUTION

3.1 NOT USED

END OF SECTION

PART 1 GENERAL

1.1 DEFINITIONS

.1 HVAC system: Complete air distribution system from exterior air intake louvres to furthest air supply terminal unit and including rigid supply and return ductwork, flexible ductwork, mixing plenum boxes, return air plenums including ceiling plenums, cooling and heating coils and compartments, condensate drain pans, eliminator blades, humidifiers, fans, fan blades, fan housing, filter housing and frames, acoustically insulated duct linings, diffusers, registers, and terminal units, dampers, and controls.

1.2 REFERENCE STANDARDS

.1 American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE):

.1 ANSI/ASHRAE 52.2-2017, Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size

.2 ANSI/ASHRAE 62.1-2016, Ventilation for Acceptable Indoor Air Quality

.3 ANSI/ASHRAE/ACCA Standard 180-2018, Standard Practice for Inspection and Maintenance of Commercial Building HVAC Systems

.2 ASTM International (ASTM):

.1 ASTM A653/A653M-18, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

.2 ASTM B209/B209M-21a, Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate

.3 ASTM C553-13, Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications

.3 National Air Duct Cleaners Association (NADCA):

.1 ACR, The NADCA Standard for Assessment, Cleaning, and Restoration of HVAC Systems, 2021 Edition

.4 National Fire Protection Association (NFPA):

.1 NFPA 90A-2024, Standard for the Installation of Air-Conditioning and Ventilating Systems

.5 North American Insulation Manufacturers Association (NAIMA):

.1 NAIMA AH122, Cleaning Fibrous Glass Insulated Air Duct Systems - Recommended Practices, 2007 Edition

.6 South Coast Air Quality Management District (SCAQMD):

.1 SCAQMD Rule 1168-2022, Adhesive and Sealant Applications

.7 Underwriters' Laboratories Inc. (UL):

.1 UL 2761-2011, Standard for Sustainability for Sealants and Caulking Compounds

.8 ULC Standards (ULC):

.1 CAN/ULC-S102-10, Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies

.2 CAN/ULC-S702.1-14, Standard For Mineral Fibre Thermal Insulation for Buildings, Part 1: Material Specification

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

1.4 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

.2 Post-cleaning inspection report:

.1 Final inspection report, including data collected, observations, recommendations, and:

.1 name and address of facility;

.2 name and address of HVAC cleaning Subcontractor;

.3 description of HVAC systems with drawings identifying systems cleaned;

.4 identification scheme for location points in HVAC systems inspected, with notes describing methods of inspection or tests used;

.5 identification of systems tested, observations, actions taken, and recommendations for future maintenance.

1.5 MAINTENANCE MATERIAL SUBMITTALS

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

.2 Extra stock materials:

.1 Supply four extra filters for each HVAC system cleaned. Supply filters of correct match, size, type, and configuration of each existing HVAC system.

1.6 QUALITY ASSURANCE

.1 HVAC system cleaners: Member in good standing with NADCA.

.1 Supervisor: Air system cleaning specialist (ASCS) certified by NADCA.

PART 2 PRODUCTS

2.1 MATERIALS

.1 Sheet aluminum: To ASTM B209/B209M, alloy and temper recommended by manufacturer for type of use indicated.

.2 Sheet Steel: To ASTM A653/A653M, galvannealed, galvanized, free of surface imperfections.

.3 Insulation: To CAN/ULC-S702.1, glass fibre.

.1 Surface burning characteristics: ToCAN/ULC-S102.

.1 Flame-spread rating, maximum: 25.

.2 Smoke developed classification, maximum: 50.

2.2 ACCESS DOORS AND PANELS

.1 Equipment access doors and panels: Construct from same materials as equipment panelling complete with sealing gasket and positive locking device.

.1 Size access doors and panels in equipment to allow for inspection and cleaning.

.2 Ductwork Access Doors: Construct access doors from 1.27 mm minimum sheet aluminum with gasketed seal.

.1 Provide access doors 25 mm greater in every dimension than access opening.

.2 Access door sizes:

.1 Body entry: 600 mm x 600 mm minimum.

.2 Hand entry: 300 mm x 300 mm minimum.

.3 Secure access doors with sheet metal screws at 75 mm on-centre minimum. Use three screws per side minimum.

.3 Acoustic lining for access doors and panels: Match existing.

.1 Self-adhesive glass fibre tape: Capable of adhering to both acoustic lining and metal access door or panel materials.

2.3 ACCESSORIES

.1 Replacement filters for each HVAC system cleaned: Correct match, size, type, and configuration of each existing HVAC system.

PART 3 EXECUTION

3.1 EXAMINATION

.1 Verification of conditions:

.1 Verify substrate and project conditions in accordance with Section 01 71 00 - Examination and Preparation, and:

.1 Locate and identify externally visible HVAC system features which may affect cleaning process including:

.1 control devices.

.2 fire and smoke control dampers.

.3 balancing dampers, indicate and record positions for resetting.

.4 air volume control boxes, indicate and record positions for resetting.

.5 fire alarm devices.

.6 monitoring devices and controls.

.2 If toxic or hazardous materials or deposits are suspected after initial inspection, immediately stop work and inform the Consultant.

.1 Suspend further inspection operations until receipt of written direction from the Consultant.

.2 Evaluation and assessment:

.1 Perform visual inspection of interior of HVAC systems using remote controlled robotic camera equipment. Inspect HVAC systems and ducting in accordance with ANSI/ASHRAE/ACCA Standard 180 (Tables 5-1) and NFPA 90A-Annex B.

.2 Insert camera at pre-established strategic locations to evaluate condition and cleanliness of HVAC systems and components.

.3 Identify location and type of internal components.

.4 Identify extent of potential complications.

.5 Identify damaged equipment and components.

3.2 PREPARATION

.1 Shut down HVAC systems

.2 Cut openings in equipment panels and ductwork for access to system interior.

.1 Square or rectangular opening sizes: 200 mm minimum each side.

.2 Circular opening sizes: 200 mm minimum diameter.

.3 Installation of access doors and panels:

.1 Install access doors and panels for inspection and cleaning of equipment:

.1 Heating and cooling coils;

.2 fan units;

.3 filters;

.4 dampers.

.5 sensors.

.4 Installation of Access Doors in Ductwork:

.1 Install access doors, for inspection and cleaning of ductwork, where required indicated on Drawings.

.2 Access door installation is not permitted in flexible ductwork.

.1 Inspect flexible ductwork by disconnecting from main ducts and inspecting from open ends.

.5 Repair acoustic lining cut for access with specified self-adhesive glass fibre tape and duct sealer.

.1 Adhere new acoustic lining to match existing to inside of access panel or door to ensure continuity of acoustic properties of system.

.6 Remove and reinstall ceiling tiles or panels to access HVAC systems as required.

.1 Replace ceiling tiles or panels damaged or soiled by air duct cleaning procedures.

3.3 AIR DUCT CLEANING EQUIPMENT

.1 Manually propelled full contact brushes:

.1 Brushes specifically manufactured and shaped to fit individual ducts, equipment, and components of HVAC systems.

.1 Use brushes sized to fit various duct sizes in HVAC systems.

.2 Use brushes that make scrubbing motion and full contact with HVAC system’s interior surfaces to be cleaned.

.2 Brushes: Manually propelled with integrally mounted motor or drive and nylon or other non-metallic material bristles.

.1 Use motor or drive able to continue to push brush after bristles are distorted.

.2 Replace worn and ineffective brushes when required.

3.4 MULTI-FUNCTIONAL ROBOTIC CLEANING SYSTEMS

.1 Robotic cleaning system: Self-propelled, remote controlled, track or wheeled drive equipped with camera and halogen lights, rotating or reciprocating brushes, air supply nozzle, vacuum, and spraying system attachment.

.1 Brushes:

.1 Specifically manufactured and shaped to fit individual ducts acoustic lined ducts, equipment, and components of HVAC systems.

.2 Use brushes that make scrubbing motion and full contact with HVAC system’s interior surfaces.

.3 Replace worn and ineffective brushes when required.

.2 Cameras: Fully rotational remote control focus and dustproof video with 720 lines of resolution, capable of storing 4 hours of recorded media.

.1 Camera lights: 2 x 20 watt halogen with dimmer.

3.5 DUCT CLEANING

.1 Clean ducts in accordance with NADCA's ACRrequirements.

.1 Clean HVAC supply air duct system and components where particulate sample collected from surfaces is greater than 75 mg of particulate per 0.01 m^2.

.2 Clean exhaust, return, transfer ductwork and plenums, equipment and components where particulate sample collected from surfaces is greater than 75 mg of particulate per 0.01 m^2.

.3 Where possible, perform cleaning through existing service openings.

.2 Isolate and clean sections in zones to ensure dirt deposits and debris from zone being cleaned does not pass through other zones which have already been cleaned.

.1 Isolate zone of duct using closed-cell polyurethane foam or air inflated zone bag before cleaning.

.3 Secure vacuum units and evacuation fans in place before starting cleaning operation of isolated section of HVAC air duct system.

.4 Clean equipment, components, and other features in isolated zone before moving to next zone of HVAC air duct system.

.5 Clean diffusers, registers, louvres, and other terminal units.

.6 Remove perforated supply diffusers from suspended tee-bar ceiling.

.1 Dismantle and clean perforated plates and supply diffuser duct collars.

.2 Re-assemble perforated plate diffusers and reconnect to HVAC system using supply diffuser duct collar after cleaning.

.7 Advise the Consultant minimum 72 hours before deactivation of fire alarm and smoke detectors for duct cleaning operations.

.1 The Owner will pay for costs of deactivation of fire alarm and smoke detector system.

.8 Perform coil cleaning, in accordance with NADCA's ACR, when visual inspection reveals contaminant collection or mould contamination on any portion of coil or drain.

3.6 ACOUSTICALLY LINED DUCTWORK CLEANING

.1 Clean glass fibre acoustically insulated ducts in accordance with NAIMA AH122.

.1 Use specifically designed robotic apparatus proven to not damage acoustic glass fibre lining.

.2 Monitor cleaning process progress by onboard camera.

3.7 SITE QUALITY CONTROL

.1 Site tests and inspections:

.1 Perform in accordance with Section 01 45 00 - Quality Control.

.2 Perform final inspection using robotic camera and other visual inspection methods after final cleaning has been completed.

.3 Perform video survey as directed by the Consultant.

.4 Include areas reviewed by the Consultant prior to cleaning.

.5 Identify access points used for inspection and cleaning on HVAC system record drawings.

.6 Collect and analyse new particulate samples from same locations original samples were collected before cleaning.

.7 If contaminants are found in the inspection, re-clean the areas of the system still contaminated and re-inspect.

.8 Reset components including dampers and sensors that have been disturbed during cleaning operations.

.9 If no visual contaminant is visible, HVAC Systems will be considered clean.

.10 Repeat duct cleanliness inspections, testing, and cleaning in accordance with the timeline requirements ofANSI/ASHRAE 62.1andNADCA's ACR.

3.8 SYSTEM STARTUP

.1 Install new system filters after cleaning operations are completed.

.2 Cover each inspection opening with access door or panel and secure in place after inspection and cleaning are completed.

.3 Restart each HVAC System.

3.9 CLEANING

.1 Clean in accordance with Section 01 74 00 - Cleaning And Waste Processing:

.2 Waste management:

.1 Manage waste in accordance with Section 01 74 20 - Waste Managing and Disposal.

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: Submit manufacturer's instructions, product literature, and data sheets for products and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:

.1 Indicate on drawings:

.1 Mounting arrangements.

.2 Operating and maintenance clearances.

.2 Shop drawings and product data accompanied by:

.1 Detailed drawings of bases, supports, and anchor bolts.

.2 Acoustical sound power data, where applicable.

.3 Points of operation on performance curves.

.4 Manufacturer to certify current model production.

.5 Certification of compliance to applicable codes.

.3 In addition to transmittal letter referred to in Section 01 33 00 - Submittal Procedures: use MCAC "Shop Drawing Submittal Title Sheet". Identify Section and paragraph number.

1.2 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

.2 Operation and Maintenance Data: submit operation and maintenance data and incorporate into manual.

.1 Operation and maintenance manual approved by, and final copies submitted to Consultant before final inspection.

.2 Operation data to include:

.1 Control schematics for systems including environmental controls.

.2 Description of systems and their controls.

.3 Description of operation of systems at various loads together with reset schedules and seasonal variances.

.4 Operation instruction for systems and component.

.5 Description of actions to be taken in event of equipment failure.

.6 Valves schedule and flow diagram.

.7 Colour coding chart.

.3 Maintenance data to include:

.1 Servicing, maintenance, operation and trouble-shooting instructions for each item of equipment.

.2 Data to include schedules of tasks, frequency, tools required and task time.

.4 Performance data to include:

.1 Equipment manufacturer's performance datasheets with point of operation as left after commissioning is complete.

.2 Equipment performance verification test results.

.3 Special performance data as specified.

.4 Testing, adjusting and balancing reports as specified in Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.

.5 Approvals:

.1 Submit 2 copies of draft Operation and Maintenance Manual to Consultant for approval. Submission of individual data will not be accepted unless directed by Consultant.

.2 Make changes as required and re-submit as directed by Consultant.

.6 Additional data:

.1 Prepare and insert into operation and maintenance manual additional data when need for it becomes apparent during specified demonstrations and instructions.

.7 Site records:

.1 Provide sets of white prints as required for each phase of work. Mark changes as work progresses and as changes occur. Include changes to existing mechanical systems, control systems and low voltage control wiring.

.2 Use different colour waterproof ink for each service.

.3 Make available for reference purposes and inspection.

.8 As-built drawings:

.1 Prior to start of Testing, Adjusting and Balancing for HVAC, finalize production of as-built drawings.

.2 Identify each drawing in lower right hand corner in letters at least 12 mm high as follows: - “AS BUILT DRAWINGS: THIS DRAWING HAS BEEN REVISED TO SHOW MECHANICAL SYSTEMS AS INSTALLED” (Signature of Contractor) (Date).

.3 Submit to Consultant for approval and make corrections as directed.

.4 Perform testing, adjusting and balancing for HVAC using as-built drawings.

.5 Submit completed as-built drawings with Operating and Maintenance Manuals.

.9 Submit copies of as-built drawings for inclusion in final TAB report.

1.3 MAINTENANCE MATERIAL SUBMITTALS

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

.2 Supply one set of special tools required to service equipment as recommended by manufacturers.

1.4 DELIVERY, STORAGE, AND HANDLING

.1 Packaging Waste Management: Perform in accordance with Section 01 74 20 - Waste Management and Disposal.

PART 2 EXECUTION

2.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed are acceptable for installation in accordance with manufacturer’s instructions.

.1 Visually inspect substrate in presence of Consultant.

.2 Inform Consultant of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Consultant.

2.2 SITE QUALITY CONTROL

.1 Site Tests: conduct following tests in accordance with Section 01 45 00 - Quality Control and submit report as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.

.2 Manufacturer's Site Services:

.1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Site Reports as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.

.2 Provide manufacturer's site services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

2.3 ADJUSTING

.1 Prime and touch up marred finished paintwork to match original.

.2 Restore finishes which have been damaged to a "like new" condition.

2.4 CLEANING

.1 Final Cleaning: Perform in accordance with Section 01 74 00 - Cleaning and clean interior and exterior of all systems. Clean ductwork according to Section 23 01 31 – Air Duct Cleaning for HVAC Systems.

2.5 DEMONSTRATION

.1 Consultant will use equipment and systems for test purposes prior to acceptance. Supply labour, material, and instruments required for testing.

.2 Supply tools, equipment and personnel to demonstrate and instruct operating and maintenance personnel in operating, controlling, adjusting, trouble-shooting and servicing of all systems and equipment during regular work hours, prior to acceptance.

.3 Use operation and maintenance manual, as-built drawings, and audio-visual aids as part of instruction materials.

.4 Instruction duration time requirements as specified in appropriate Sections.

.5 Consultant may record these demonstrations for future reference.

2.6 PROTECTION

.1 Protect equipment and systems openings from dirt, dust, and other foreign materials with materials appropriate to system.

END OF SECTION

PART 1 GENERAL

1.1 DEFINITIONS

.1 Demolish: Detach items from existing construction and legally dispose of items off site, unless indicated as removed and salvaged, or removed and reinstalled.

.2 Remove: Planned deconstruction and disassembly of electrical items from existing construction including removal of conduit, junction boxes, cabling and wiring from electrical component to panel taking care not to damage adjacent assemblies designated to remain; legally dispose of items off site, unless indicated as removed and salvaged, or removed and reinstalled.

.3 Remove and Salvage: Detach items from existing construction and deliver them to Owner ready for reuse.

.4 Remove and Reinstall: Detach items from existing construction, prepare them for reuse, and reinstall them where indicated.

.5 Existing to Remain: Existing items of construction that are not removed and that are not otherwise indicated as being removed and salvaged, or removed and reinstalled.

.6 Hazardous Substances: Dangerous substances, dangerous goods, hazardous commodities and hazardous products may include asbestos, mercury and lead, PCB's, poisons, corrosive agents, flammable substances, radioactive substances, or other material that can endanger human health or wellbeing or environment if handled improperly as defined by the Federal Hazardous Products Act (RSC 1985) including latest amendments.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

1.3 ADMINISTRATIVE REQUIREMENTS

.1 Coordination: Coordinate work of this Section to avoid interference with work by other Sections.

.2 Scheduling: Section 01 32 00 - Construction Progress Schedule - Bar (GANTT) Chart.

1.4 QUALITY ASSURANCE

.1 Regulatory Requirements: Perform work of this Section in accordance with the following:

.1 Provincial Workers' Compensation Boards/Commissions

.2 Provincial Occupational Health and Safety Standards and Programs

1.5 SITE CONDITIONS

.1 Existing Conditions: Condition of materials identified as being salvaged or demolished are based on their observed condition on date that tender is accepted.

.2 Discovery of Hazardous Substances: Immediately notify Consultant if materials suspected of containing hazardous substances are encountered and perform the following activities:

.1 Stop work in the area of the suspected hazardous substances.

.2 Take preventative measures to limit users' and workers' exposure, provide barriers and other safety devices and do not disturb.

.3 Proceed only after written instructions have been received from Consultant.

1.6 SALVAGE AND DEBRIS MATERIALS

.1 Demolished items become Contractor's property and will be removed from Project site; except for items indicated as being reused, salvaged, or otherwise indicated to remain Owner's property.

.2 Carefully remove materials and items designated for salvage and store in a manner to prevent damage or devaluation of materials in accordance with Section 02 42 00 - Removal and Salvage of Construction Materials.

PART 2 PRODUCTS

2.1 MATERIALS

.1 General Patching and Repair Materials: Refer to Section 02 41 19.13 - Selective Building Demolition for listing of patching and repair materials incidental to removal or demolition of components associated with work of this Section.

.2 HVAC Repair Materials: Use only new materials required for completion or repair matching materials damaged during performance of work of this Section; new materials are required to meet assembly or system characteristics as existing systems indicated to remain and carry CSA approval labels required by the Authority Having Jurisdiction.

.3 Fire stopping Repair Materials: Use fire stopping materials compatible with existing fire stopping systems where removal or demolition work affects rated assemblies, restore to match existing fire rated performance.

PART 3 EXECUTION

3.1 EXAMINATION

.1 Verification of Existing Conditions: Visit site, thoroughly examine and become familiar with conditions that may affect the work of this Section before tendering the Bid; Consultant will not consider claims for extras for work or materials necessary for proper execution and completion of the Contract that could have been determined by a site visit.

3.2 PREPARATION

.1 Protection of Existing Systems to Remain: Protect systems and components indicated to remain in place during selective demolition operations and as follows:

- .1 Prevent movement and install bracing to prevent settlement or damage of adjacent services and parts of existing buildings scheduled to remain.
- .2 Notify Consultant and cease operations where safety of buildings being demolished, adjacent structures or services appears to be endangered and await additional instructions before resuming demolition work specified in this Section.
- .3 Prevent debris from blocking drainage inlets.
- .4 Protect mechanical systems that must remain in operation.

.2 Protection of Building Occupants: Sequence demolition work so that interference with the use of the building by the Owner and users is minimized and as follows:

- .1 Prevent debris from endangering the safe access to and egress from occupied buildings.

.2 Notify Consultant and cease operations where safety of occupants appears to be endangered and await additional instructions before resuming demolition work specified in this Section.

3.3 EXECUTION

.1 Demolition and Removal: Coordinate requirements of this Section with information contained in Section 02 41 19.13 - Selective Building Demolition and as follows:

.1 Disconnect and cap gas supply and electrical services in accordance with requirements of local Authority Having Jurisdiction.

.2 Do not disrupt active or energized utilities without approval of the Consultant.

.3 Erect and maintain dust proof and weather tight partitions to prevent the spread of dust and fumes to occupied building areas; remove partitions when complete.

.4 Demolish parts of existing building to accommodate new construction and remedial work as indicated.

.5 At end of each day's work, leave worksite in safe condition.

.6 Perform demolition work in a neat and workmanlike manner:

.1 Remove any tools or equipment after completion of work, and leave site clean and ready for subsequent renovation work.

.2 Repair and restore damages caused as a result of work of this Section to match existing materials and finishes.

3.4 CLOSEOUT ACTIVITIES

.1 Cleaning: In accordance with Section 01 74 00 – Cleaning and Waste Processing.

.2

END OF SECTION

PART 1 GENERAL

1.1 REFERENCE STANDARDS

.1 American Society of Mechanical Engineers (ASME)

- .1 ASME B31.1-07, Power Piping.
- .2 ASME B31.5 - Refrigeration Piping and Heat Transfer Components.
- .3 ASME B31.9 - Building Services Piping.

.2 ASTM International (ASTM)

- .1 ASTM A125-1996(2007), Standard Specification for Steel Springs, Helical, Heat-Treated.
- .2 ASTM A307-07b, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
- .3 ASTM A563-07a, Standard Specification for Carbon and Alloy Steel Nuts.

.3 Manufacturer's Standardization Society of the Valves and Fittings Industry (MSS)

- .1 MSS SP58-2002, Pipe Hangers and Supports - Materials, Design and Manufacture.
- .2 MSS SP69-2003, Pipe Hangers and Supports - Selection and Application.
- .3 MSS SP89-2003, Pipe Hangers and Supports - Fabrication and Installation Practices.

.4 National Research Council Canada (NRC)

- .1 National Plumbing Code of Canada 2020 (NPC).

.5 Canadian Standards Association

- .1 CSA B149.1 - Natural gas and propane installation code

.6 Manufacturers Standardization Society

- .1 ANSI/MSS SP58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

- .1 Provide manufacturer's printed product literature and data sheets for hangers and supports and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:

- .1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Manitoba of Canada.
- .2 Submit shop drawings for:
  - .1 Bases, hangers and supports.
  - .2 Connections to equipment and structure.
  - .3 Structural assemblies.

.4 Certificates:

- .1 Submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.5 Manufacturers' Instructions:

.1 Provide manufacturer's installation instructions.

.1 Consultant will make available 1 copy of systems supplier's installation instructions.

1.3 CLOSEOUT SUBMITTALS

.1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.

.2 Delivery and Acceptance Requirements:

.1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

.3 Packaging Waste Management: In accordance with Section 01 74 20 - Waste Managing and Disposal.

1.5 REGULATORY REQUIREMENTS

.1 Supports for natural gas pipe to CSA B149.1

PART 2 PRODUCTS

2.1 SYSTEM DESCRIPTION

.1 Design Requirements:

.1 Construct pipe hanger and support to manufacturer's recommendations utilizing manufacturer's regular production components, parts and assemblies.

.2 Base maximum load ratings on allowable stresses prescribed by ASME B31.1 or MSS SP58

.3 Ensure that supports, guides, anchors do not transmit excessive quantities of heat to building structure.

.4 Design hangers and supports to support systems under conditions of operation, allow free expansion and contraction, prevent excessive stresses from being introduced into pipework or connected equipment.

.5 Provide for vertical adjustments after erection and during commissioning. Amount of adjustment in accordance with MSS SP58

2.2 GENERAL

.1 Fabricate hangers, supports and sway braces in accordance with MSS SP58. ANSI B31.1 and

.2 Use components for intended design purpose only. Do not use for rigging or erection purposes.

2.3 PIPE HANGERS AND SUPPORTS

.1 Manufacturers:

.1 Anvil.

.2 Grinnel.

.3 Substitutions: Refer to Section 20 05 00 – Common Work Results For Mechanical.

.2 For roof mounted piping, provide supports equivalent to:

.1 Guided or Hung pipe supports

.1 PHP Systems portable pipe hanger model PP 10 roof supported strut style with pipe roller guides, channel or hanger.

.2 PHP Systems portable pipe hanger Model PSE-2-2 with clevis style hangers or supports with roof mount base for multiple pipes.

.3 Supports to be galvanized steel with stainless steel clamps and cast iron rollers. Membrane pads to be closed-cell extruded polystyrene insulation equal to Dow Chemical Roofmate. Pipe shall be a minimum of 8” above finished roof level.

.2 Pipe on roof support:

.1 Basis of Design: MIFAB C-Port Series

.2 Recycled UV resistant rubber, 165 mm (6.5”) high, for pipe or rooftop equipment support. Supports to be selected, sized, and configured to match installation requirements and roof construction. Pipe clamps on supports to be sized for one size larger than pipe for natural gas and propane piping. All metal work including strut or pipe clamps to be stainless steel.

2.4 DUCT HANGERS AND SUPPORTS

.1 Perforated strap or wire hangers not permitted.

.2 Strap hangers: of same material as duct but next sheet metal thickness heavier than duct.

.1 Maximum size duct supported by strap hanger: 500mm. Larger ducts to use trapeze hangers.

.3 Hanger configuration: to SMACNA.

.4 Hangers: galvanized steel angle with galvanized steel rods to SMACNA following table:

Duct Size	Angle Size	Rod Size (min.)
(mm)	(mm)	(mm)
up to 750	25 x 25 x 3	6
751 to 1050	40 x 40 x 3	6
1051 to 1500	40 x 40 x 3	10
1501 to 2100	50 x 50 x 3	10
2101 to 2400	50 x 50 x 5	10
2401 and over	50 x 50 x 6	10

.5 Upper hanger attachments:

.1 For concrete: manufactured concrete inserts.

.2 For steel joist: manufactured joist clamp or steel plate washer.

.3 For steel beams: manufactured beam clamps.

.6 Trapeze Hangers: Steel channels with welded spacers and hanger rods.

.7 Duct Supports – Roof Installations

.1 “H” frame constructed of galvanized steel with height adjustment. Frames to sit on roof mount pads of UV resistant rubber or similar load spreading design. Metal on roof pads not acceptable.

2.5 ACCESSORIES

.1 Hanger Rods: Mild steel threaded both ends, threaded one end, or continuous threaded.

2.6 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.

2.7 RISER CLAMPS

.1 Steel or cast iron pipe: carbon steel to MSS SP58, type 42, UL listed.

.2 Copper pipe: carbon steel copper plated to MSS SP58, type 42

.3 Bolts: to ASTM A307

.4 Nuts: to ASTM A563

2.8 CONSTANT SUPPORT SPRING HANGERS

.1 Springs: alloy steel to ASTM A125, shot peened, magnetic particle inspected, with +/-5% spring rate tolerance, tested for free height, spring rate, loaded height and provided with Certified Mill Test Report (CMTR)

.2 Load adjustability: 10% minimum adjustability each side of calibrated load. Adjustment without special tools. Adjustments not to affect travel capabilities.

.3 Provide upper and lower factory set travel stops.

.4 Provide load adjustment scale for field adjustments.

.5 Total travel to be actual travel + 20%. Difference between total travel and actual travel 25 mm minimum.

.6 Individually calibrated scales on each side of support calibrated prior to shipment, complete with calibration record.

2.9 VARIABLE SUPPORT SPRING HANGERS

.1 Vertical movement: 13 mm minimum, 50 mm maximum, use single spring pre-compressed variable spring hangers.

.2 Vertical movement greater than 50 mm: use double spring pre-compressed variable spring hanger with 2 springs in series in single casing.

.3 Variable spring hanger complete with factory calibrated travel stops. Provide certificate of calibration for each hanger.

.4 Steel alloy springs: to ASTM A125, shot peened, magnetic particle inspected, with +/-5 % spring rate tolerance, tested for free height, spring rate, loaded height and provided with CMTR

2.10 EQUIPMENT SUPPORTS

.1 Fabricate equipment supports not provided by equipment manufacturer from structural grade steel meeting requirements of Section 05 12 23 - Structural Steel for Buildings. Submit calculations with shop drawings.

2.11 EQUIPMENT ANCHOR BOLTS AND TEMPLATES

.1 Provide templates to ensure accurate location of anchor bolts.

2.12 OTHER EQUIPMENT SUPPORTS

.1 Submit structural calculations with shop drawings.

PART 3 EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

.1 Install to manufacturer's written instructions.

.2 Reference ANSI/MSS SP-58 for the selection, application and installation of hangers and supports.

3.3 INSERTS

.1 Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.

3.4 PIPE HANGERS AND SUPPORTS

.1 Install to manufacturer's written instructions.

.2 Perforated strap or wire hangers will not be permitted.

.3 Support horizontal piping as scheduled.

.4 Open web steel joists:

.1 All hangers attached to joists shall be from the top chord. The bottom chord is non-load supporting and not acceptable for supporting loads.

.2 Hangers between joists or where loads exceed acceptable structural ratings 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.

.5 In no case shall the hanging of piping directly from roof or ceiling decking be allowed, unless permission is obtained from the Consultant.

.6 Install hangers to provide minimum 13 mm (1/2 inch) space between finished covering and adjacent work.

.7 Place hangers within 300 mm (12 inches) of each horizontal elbow.

.8 Use hangers with 38 mm (1-1/2 inch) minimum vertical adjustment.

.9 Support horizontal cast iron pipe adjacent to each hub, with 1.5 m (5 feet) maximum spacing between hangers.

.10 Support all pipe with MJ couplings on both sides of the joint. At multiple fittings or short lengths, support every 300 mm (12").

.11 Support vertical piping at every floor. Support vertical cast iron pipe at each floor at hub or with pipe clamps on hubless pipe.

.12 Natural gas piping:

.1 Install piping to CSA B149, refer to additional authority having jurisdiction issued requirements where applicable.

.2 On flat rooftops, install piping on rubberized support blocks with pipe clamp sized for one size larger than the pipe.

.3 Support spacing to be based on CSA B149. Provide additional supports at threaded joints.

.13 Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.

.14 Where several pipes are installed at various elevations in the same vertical plane, piping below shall not be supported off the piping above.

.15 Support riser piping independently of connected horizontal piping.

.16 Materials

.1 Provide copper plated hangers and supports for copper piping.

.2 Supports shall be metallic and installed to avoid galvanic action between the piping or tubing and the supports.

.17 Design hangers for pipe movement without disengagement of supported pipe.

.18 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.

.19 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 Consultant for approval before fabrication.

.20 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').

.21 Vertical piping other than risers through floors shall be provided with suitable supports, sway braces, etc.

.22 Vertical piping shall be supported at the base in an approved manner.

.23 Prime coat exposed steel hangers and supports. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

3.5 DUCTWORK HANGERS AND SUPPORTS

.1 Ductwork is to be securely supported from building structure.

.2 Do not suspend any ducting or any other mechanical components from formed hollow steel decking.

.3 Install hanger so that rod or strap is vertical under operating conditions. Repair or replace hangers that are not vertical.

.4 Strap hangers permitted

.5 Adjust hangers to equalize load.

.6 Support from structural members. Where structural bearing does not exist or inserts are not in suitable locations, provide supplementary structural steel members.

.7 Size supports to accommodate the thickness of the insulation thickness of the duct type. Refer to 23 07 13 for thickness requirements. Hangers to be located outside of the insulation and insulation should not interfere with the vertical alignment of the hanger.

3.6 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 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.

3.7 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 Plastic (PVC, CPVC, PEX)

.1 As recommended by manufacturer for corresponding sizes and materials.

All sizes – do not exceed 1.2m (4 ft).

END OF SECTION

PART 1 GENERAL

1.1 REFERENCE STANDARDS

.1 American National Standards Institute

.1 ANSI / ASME Standard A13.1, Scheme For The Identification Of Piping

.2 Canadian Gas Association (CGA)

.1 CSA/CGA B149.1-20, Natural Gas and Propane Installation Code.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Product Data: standard manufacturers catalog data.

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

.3 Submit list of wording, symbols, letter size, and colour coding for mechanical identification.

.4 Submit valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.

.5 Product Data: Provide manufacturers catalogue literature for each product required.

.6 Manufacturer's Installation Instructions: Indicate special procedures, and installation.

1.3 QUALITY ASSURANCE

.1 Quality assurance submittals: submit following in accordance with Section 01 33 00 - Submittal Procedures.

.2 Health and Safety:

.1 Do construction occupational health and safety in accordance with Section 20 05 00 – Common Work for Mechanical.

1.4 DELIVERY, STORAGE, AND HANDLING

.1 Packing, shipping, handling and unloading:

.1 Deliver, store and handle in accordance with Section 01 61 00 - Common Product Requirements.

.2 Deliver, store and handle materials in accordance with manufacturer’s written instructions.

.2 Waste Management and Disposal:

.1 Waste Management and Disposal: In accordance with Section 01 74 20 - Waste Managing and Disposal.

.2 Dispose of unused paint material at official hazardous material collections site approved by Consultant.

.3 Do not dispose of unused paint material into sewer system, into streams, lakes, onto ground or in locations where it will pose health or environmental hazard.

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 With clean cut symbols and letters of following size:

.1 Piping

Outside diameter of insulation or pipe	Colour field length	Letter height
20-30 mm (3/4 to 1-1/4 inch)	200 mm (8 inch)	15 mm (1/2 inch)
40-50 mm (1-1/2 to 2 inch)	200 mm (8 inch)	20 mm (3/4 inch)
65-150 mm (2-1/2 to 6 inch)	300 mm (12 inch)	30 mm (1-1/4 inch)
200-250 mm (8 to 10 inch)	600 mm (24 inch)	65 mm (2-1/2 inch)
Over 250 mm (10 inch)	800 mm (32 inch)	90 mm (3-1/2 inch)

.2 Ductwork and Equipment: minimum 65 mm (2-1/2 inch) high letters.

.2 Stencil Paint: As specified in Section 09 91 10 - Painting.

2.4 PIPE MARKERS

.1 Colour and size: 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 MANUFACTURER'S EQUIPMENT NAMEPLATES

.1 Metal or plastic laminate nameplate mechanically fastened to each piece of equipment by manufacturer.

.2 Lettering and numbers etched, stamped, engraved or printed.

.1 Nameplates to be resistant to physical and ultraviolet light damage when fastened externally.

.3 Information to include, as appropriate:

.1 Equipment: manufacturer's name, model, size, serial number, capacity and performance.

.2 Motor: voltage, Hz, phase, power factor, duty, frame size.

2.6 EXISTING IDENTIFICATION SYSTEMS

.1 Apply existing identification system to new work.

.2 Where existing identification system does not cover for new work, use identification system specified this section.

.3 Before starting work, obtain written approval of identification system from Consultant.

2.7 PIPING SYSTEMS GOVERNED BY CODES

.1 Identification:

.1 Natural gas: to CSA/CGA B149.1.

2.8 IDENTIFICATION OF PIPING SYSTEMS

.1 Identify contents by background colour marking, pictogram (as necessary), legend; direction of flow by arrows. To CAN/CGSB 24.3 except where specified otherwise

.2 Pictograms:

.1 Where required: Workplace Hazardous Materials Information System (WHMIS) regulations.

.3 Legend:

.1 Block capitals to sizes and colours listed in CAN/CGSB 24.3.

.4 Arrows showing direction of flow:

.1 Outside diameter of pipe or insulation less than 75 mm: 100 mm long x 50 mm high.

.2 Outside diameter of pipe or insulation 75 mm and greater: 150 mm long x 50 mm high.

.3 Use double-headed arrows where flow is reversible.

.5 Extent of background colour marking:

.1 To full circumference of pipe or insulation.

.2 Length to accommodate pictogram, full length of legend and arrows.

.6 Materials for background colour marking, legend, arrows:

.1 Pipes and tubing 20 mm and smaller: waterproof and heat-resistant pressure sensitive plastic pipe markers.

.2 Other pipes: vinyl with protective overcoating, waterproof contact adhesive undercoating

.3 Suitable for ambient of 100% RH and continuous operating temperature of 150°C and intermittent temperature of 200°C.

.7 Colours and Legends:

.1 Where not listed, obtain direction from Consultant.

.2 Colours for legends, arrows: to following table:

Background colour:	**Legend, arrows:**
Yellow	BLACK
Green	WHITE
Red	WHITE

.3 Background colour marking and legends for piping systems:

Contents	**Background colour marking**	**Legend**
Natural gas	to Codes	
Gas regulator vents	to Codes	
Condensate	to Codes	

2.9 IDENTIFICATION DUCTWORK SYSTEMS

.1 50 mm high stencilled letters and directional arrows 150 mm long x 50 mm high.

.2 Colours: black, or co-ordinated with base colour to ensure strong contrast.

2.10 VALVES, CONTROLLERS

.1 Brass tags with 12 mm stamped identification data filled with black paint.

.2 Include flow diagrams for each system, of approved size, showing charts and schedules with identification of each tagged item, valve type, service, function, normal position, location of tagged item.

2.11 CONTROLS COMPONENTS IDENTIFICATION

.1 Identify all systems, equipment, components, controls, sensors with system nameplates specified in this section.

.2 Inscriptions to include function and (where appropriate) fail-safe position.

2.12 LANGUAGE

.1 Identification in English.

PART 3 EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 TIMING

.1 Provide identification only after painting specified Section 09 91 23 - Interior Painting has been completed.

3.3 INSTALLATION

.1 Perform work in accordance with CAN/CGSB-24.3 except as specified otherwise

.2 Provide ULC or CSA registration plates as required by respective agency

.3 Identify systems, equipment to conform to PWGSC PMSS

3.4 PREPARATION

.1 Degrease and clean surfaces to receive adhesive for identification materials.

.2 Prepare surfaces to Section 09 91 10 for stencil painting.

3.5 PIPE MARKINGS

.1 Piping to be marked with pipe markers or stencils.

.1 Canvas covered piping to be marked with non-adhesive markers or stencils.

.2 Conform to ANSI/ASME A13.1

Pipe Contents	Colour Scheme	
	Text	Background
Inherently Low Hazard	White	Green

.3 Labelling dimensions

Outside diameter of pipe or covering	Minimum letter and number height	Length of colour field

mm	(mm)	(mm)
19 to 32	13	200
38 to 51	19	200
64 to 150	32	300
200 to 250	64	600
over 250	89	800

Pipes below 19 mm diameter: use tags or other markings.
Covering includes outside diameter of insulation coverings.

3.6 INSTALLATION

.1 Tags

.1 Install tags with corrosion resistant chain.

.2 Identify valves in main and branch piping with numbered tags.

.3 Identify air terminal units and radiator valves with numbered tags.

.2 Stencils

.1 Apply stencil painting to Section 09 91 10.

.3 Controls:

.1 Identify control panels and major control components outside panels with plastic nameplates.

.2 Identify thermostats relating to terminal boxes or valves with nameplates adhesive labels.

.3 Provide identification on all conduits and junction box covers indicating associated system, panel and circuit numbering using tags or labels.

.4 Provide identification on all control points indicating point name, panel #/address and part number using tags or labels.

.5 Tag automatic controls, instruments, and relays. Key to control schematic.

.4 Ductwork

.1 Identify ductwork with stencilled painting or adhesive labels, adhesive labels not acceptable on canvas surfaces.

.2 Identify with equipment identifier, air direction and source.

.1 Source identifiers:

.1 SA: Supply Air

.2 RA: Return Air

.3 EA: Exhaust Air

.4 OA: Outside Air

.3 Locate identification at air handling unit, at each side of penetration of structure or enclosure, and at each obstruction.

3.7 NAMEPLATES

.1 Locations:

.1 In conspicuous location to facilitate easy reading and identification from operating floor.

.2 Standoffs:

.1 Provide for nameplates on hot and/or insulated surfaces.

.3 Protection:

.1 Do not paint, insulate or cover.

3.8 LOCATION OF IDENTIFICATION ON PIPING AND DUCTWORK SYSTEMS

.1 On long straight runs in open areas in boiler rooms, equipment rooms, galleries, tunnels: at not more than 17 m intervals and more frequently if required to ensure that at least one is visible from any one viewpoint in operating areas and walking aisles.

.2 Adjacent to each change in direction.

.3 At least once in each small room through which piping or ductwork passes.

.4 On both sides of visual obstruction or where run is difficult to follow.

.5 On both sides of separations such as walls, floors, partitions.

.6 Where system is installed in pipe chases, ceiling spaces, galleries, confined spaces, at entry and exit points, and at access openings.

.7 At beginning and end points of each run and at each piece of equipment in run.

.8 At point immediately upstream of major manually operated or automatically controlled valves, and dampers. Where this is not possible, place identification as close as possible, preferably on upstream side.

.9 Identification easily and accurately readable from usual operating areas and from access points.

.1 Position of identification approximately at right angles to most convenient line of sight, considering operating positions, lighting conditions, risk of physical damage or injury and reduced visibility over time due to dust and dirt.

3.9 CLEANING

.1 In accordance with Section 01 74 00 - Cleaning.

.2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment

END OF SECTION

PART 1 GENERAL

1.1 REFERENCE STANDARDS

.1 American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE):

.1 ANSI/ASHRAE Standard 111-2008 (RA-2017), Testing, Adjusting, and Balancing of Building HVAC Systems

.2 Associated Air Balance Council (AABC)

.1 ANSI/AABC National Standards for Total System Balance, Seventh Edition, 2016

.1 Canadian Standards Association

.1 CSA B149.1 - Natural gas and propane installation code

.2 National Environmental Balancing Bureau (NEBB):

.1 NEBB Procedural Standard for Testing, Adjusting, and Balancing of Environmental Systems, Ninth Edition, 2019

.3 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA):

.1 SMACNA 4th edition 2023 - HVAC Systems - Testing, Adjusting and Balancing

1.2 ADMINISTRATIVE REQUIREMENTS

.1 Coordination:

.1 Test and balance each system independently and where interlocked with other systems, in unison with those systems.

.2 Scheduling:

.1 Schedule time required for work of this Section (including repairs, and re-testing) into Project schedules to ensure completion before scheduled completion date.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit proposed methodology and procedures for performing work of this Section.

.2 Before starting work of this Section, submit names and documented qualifications of personnel to perform work of this Section.

.3 Submit list of instruments and include serial numbers and calibration certificates.

.4 Testing and Balancing Report:

.1 Format in accordance with ANSI/AABC National Standards for Total System Balance and show results in imperial units.

.2 Include:

.1 Project record drawings

.2 System schematics

.3 Submit one electronic copy of the report to Consultant, in English, digital files, complete with index tabs.

1.4 QUALITY ASSURANCE

.1 Regulatory Requirements: Test and balance systems regulated by codes to the satisfaction of the authority having jurisdiction.

.2 Agency Qualifications: Company specializing in the testing, adjusting, and balancing of systems specified in this Section with minimum three years documented experience, certified by AABC.

.3 Where instrument manufacturer calibration recommendations are more stringent than those listed in TAB Standard, use manufacturer's recommendations.

PART 2 PRODUCTS

2.1 NOT USED

PART 3 EXECUTION

3.1 AGENCIES

.1 Air Movement Services Ltd.

.2 Airdronics Inc.

.3 D.F.C. Mechanical Testing & Balancing Ltd.

.4 AHS Testing & Balancing.

3.2 PREPARATION

.1 During construction, coordinate location and installation of measurement and balancing devices, equipment, accessories, measurement ports, and fittings.

.2 Calibrate instruments in accordance with requirements of most stringent of referenced standard for either applicable system or HVAC system.

.3 Calibrate instruments within three months of work. Submit certificate of calibration.

.4 Notify Consultant seven days before start of work.

.5 Provide instruments required for testing, adjusting, and balancing operations. Make instruments available to Consultant to facilitate spot checks during testing.

.6 Provide additional balancing devices as required.

3.3 VERIFICATION OF CONDITIONS

.1 Verify that building is substantially complete, including:

.1 Installation of ceilings, doors, windows, and other construction affecting the Work.

.2 Application of weatherstripping, sealing, and sealants.

.3 Pressure, leakage, and other tests specified elsewhere in Division 23.

.4 Provisions for Work are installed and operational.

.2 Verify proper, normal, and safe operation of mechanical and associated electrical and control systems affecting Work including but not limited to:

.1 Proper thermal overload protection in place for electrical equipment.

.2 Air systems:

.1 Filters in place are clean.

.2 Duct systems are clean.

.3 Ducts, air shafts, and ceiling plenums are airtight to within specified tolerances.

.4 Correct fan rotation.

.5 Fire, smoke, and volume control dampers are installed and open.

.6 Coil fins are combed and clean.

.7 Access doors are installed and closed.

.8 Outlets are installed and volume control dampers are open.

3.4 SYSTEM START-UP

.1 Follow start-up procedures as recommended by equipment manufacturer unless specified otherwise.

.2 Follow special start-up procedures specified in equipment Sections.

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 of Winnipeg.

.4 After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.

.5 Operate systems as required to perform the work and as required by Consultant for verification of reports.

.6 Test to verify proper and safe operation, to determine actual point of performance, and to evaluate qualitative and quantitative performance of equipment, systems and controls at design, average and low loads using actual or simulated loads.

.7 Adjust and regulate equipment and systems to meet specified performance requirements and to achieve specified interaction with other related systems under normal and emergency loads and operating conditions.

.8 Balance systems and equipment to regulate flow rates to match load requirements over full operating ranges.

3.6 SITE QUALITY CONTROL

.1 Reported results are may be subject to verification by Consultant. Verify number and location of results as directed by Consultant.

.2 Provide personnel and instrumentation to verify up to 30% of reported results.

.3 Repeat work as required until results fall within specified performance values.

3.7 CLOSEOUT ACTIVITIES

.1 After work is completed to satisfaction of Consultant replace drive guards, close access doors, lock devices in set positions, and ensure sensors are at required settings.

.2 Permanently mark settings to allow restoration at any time during life of facility. Do not eradicate or cover markings.

3.8 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.

.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.

3.9 INSTALLATION TOLERANCES

.1 Refer to maximum balanced pressure drop in equipment schedules. Adjust system pressure drop to be at or below the indicated value.

.2 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.

.3 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.

3.10 AIR SYSTEM PROCEDURE

.1 Test and balance air systems to ANSI/AABC National Standards for Total System Balance.

.2 Take measurements as appropriate for application, including but not limited to air velocity, static pressure, flow rate, pressure drop (or loss), temperatures (dry bulb, wet bulb, dewpoint), duct cross-sectional area, RPM, electrical power, voltage, noise, and vibration.

.3 Document locations of equipment measurements in report, including:

.1 Inlet and outlet of dampers, filter, coil, humidifier, fan, and other equipment causing changes in conditions.

.2 At controllers, controlled device.

.3 Main ducts, main branch, sub-branch, and terminals (grille, register or diffuser).

.4 Adjust air handling and distribution systems to provide required or design supply, return, and exhaust air quantities at site altitude.

.5 Test and record motor full load amperes.

.6 Make air quantity measurements in ducts by Pitot tube traverse of entire cross sectional area of duct.

.7 Measure air quantities at air inlets and outlets.

.8 Adjust distribution system to obtain uniform space temperatures free from objectionable drafts and noise.

.9 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.

.10 All outlets shall be adjusted to provide proper throw and directional distribution in accordance with the requirements on the drawings and/or schedules.

.11 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.

.12 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.

.13 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.

.14 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).

.15 Heat/Energy Recovery Units: Measure temperature conditions across the energy recovery section with no other heating/cooling inputs. Record energy recovered. Record conditions at minimum 60% of maximum outside air to return air temperature differential.

.16 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.

.17 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.

.18 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.

3.11 SCHEDULES

.1 Equipment requiring testing, adjusting and balancing:

.1 RTU-1

.2 ERV-1

.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 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

.6 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

.7 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

.8 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

.9 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 REFERENCE STANDARDS

.1 American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE):

.1 ANSI/ASHRAE/IES 90.1-2013, Energy Standard for Buildings Except Low-Rise Residential Buildings

.2 ASTM International (ASTM):

.1 ASTM C335/C335M-17, Standard Test Method for Steady-State Heat Transfer Properties of Pipe Insulation

.2 ASTM C449-07, Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement

.3 ASTM C553-13, Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications

.4 ASTM C612-14, Standard Specification for Mineral Fiber Block and Board Thermal Insulation

.5 ASTM C921-10, Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation

.6 ASTM C1423-21, Standard Guide for Selecting Jacketing Materials for Thermal Insulation

.7 ASTM C1729-21, Standard Specification for Aluminum Jacketing for Insulation

.3 NAIMA: North American Insulation Manufacturers Association

.1 National Insulation Standards.

.4 NFPA: National Fire Protection Association

.1 NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems

.2 NFPA 90B - Standard for the Installation of Warm Air Heating and Air-Conditioning Systems

.5 Green Seal Environmental Standards (GS):

.1 GS-36-13, Green Seal® Standard for Adhesives for Commercial Use

.6 South Coast Air Quality Management District (SCAQMD), California State:

.1 SCAQMD Rule 1168-17, Adhesive and Sealant Applications

.7 Midwest Insulation Contractors Association (MICA):

.1 National Commercial and Industrial Insulation Standards Manual

.8 SMACNA: Sheet Metal & Air Conditioning Contractors' National Association

.1 HVAC Duct Construction Standards - Metal and Flexible.

.9 Standards Council of Canada

.1 CAN/ULC S102 - Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies

.2 CAN/ULC-S701 - Standard for Thermal Insulation, Polystyrene, Boards and Pipe Covering.

.10 Thermal Insulation Association of Canada (TIAC):

.1 National Insulation Standards.

.11 ULC Standards (ULC):

.1 CAN/ULC-S102-10, Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies

.2 CAN/ULC-S702.1-14, Standard For Mineral Fibre Thermal Insulation for Buildings, Part 1: Material Specification

1.2 DEFINITIONS

.1 For purposes of this Section:

.1 ”Concealed” – means insulated mechanical services and equipment in suspended ceilings and non-accessible chases and furred-in spaces.

.2 ”Exposed” – means “not concealed” as previously defined.

.3 “Insulation systems” – means insulation material, fasteners, jackets, and other accessories.

.4 “Jacketing” – synonymous with cladding and lagging.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer’s product literature and datasheets for duct insulation, and include product characteristics, performance criteria, physical size, finishes, and limitations.

.3 Shop Drawings: Submit drawings.

.4 Manufacturers’ Instructions:

.1 Submit manufacturers’ duct insulation jointing recommendations and special handling criteria, installation sequence, and cleaning procedures.

1.4 QUALITY ASSURANCE

.1 Qualifications:

.1 Installer: Specialist in performing work of this Section, and have at least three years of successful experience in this type and size of Project, member of TIAC.

1.5 DELIVERY, STORAGE, AND HANDLING

.1 Perform in accordance with Section 01 61 00 - Product Requirements.

.2 Deliver materials to site in original factory packaging, labelled with manufacturer’s name, address, and ULC markings.

.3 Store at temperatures and conditions recommended by manufacturer.

.4 Packaging Waste Management: Perform in accordance with Section 01 74 20 - Waste Managing and Disposal.

PART 2 PRODUCTS

2.1 INSULATION

.1 Mineral Fibre: Glass fibre, rock wool, or slag wool.

.2 Fire/Smoke Rating: To CAN/ULC-S102.

.1 Maximum flame-spread rating: 25.

.2 Maximum smoke developed classification: 50.

.3 Thermal conductivity (”k” factor) not to exceed specified values at 24°C mean temperature when tested in accordance with ASTM C335/C335M.

2.2 ACCESSORIES

.1 Vapour Retarder Lap Adhesive: Water based, fire retardant type, and compatible with insulation.

.2 Indoor Vapour Retarder Finish: Vinyl emulsion type acrylic, compatible with insulation.

.3 Outdoor Vapour Retarder Finishes:

.1 Vinyl emulsion type acrylic, compatible with insulation.

.2 Reinforcing Fabric: Fibrous glass, untreated 305 g/m^2.

.4 Tape: Self-adhesive, aluminum, reinforced, 50 -mm-wide minimum.

.5 Contact Adhesive: Quick-setting

.6 Canvas Adhesive: Washable.

.7 Tie wire: 1.5-mm stainless steel.

.8 Banding: 12 -mm-wide, 0.5-mm-thick stainless steel.

.9 Facing: 25 mm galvanized steel hexagonal wire mesh stitched on one face of insulation.

.10 Fasteners: 2-mm-diameter pins with 35-mm- diameter clips, length to suit thickness of insulation.

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, 0.032-0.035 W/mK at 24°C (0.22-0.24 Btu in/hr ft² F at 75°F).

.2 Maximum service temperature: 121°C (250°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; ASTM C1136: 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 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.

2.5 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.

.1 'ksi ('K') value : ASTM C518, maximum 0.27 W/m K at 24°C (75°F).

.2 Maximum service temperature: 121°C (250°F).

.3 Maximum Velocity on Coated Air Side: 24.5 m/s (5,000 fpm).

.4 Minimum Noise Reduction Criteria: ASTM C1071

Thickness		NRC
25 mm	1”	0.55
38mm	1.5”	0.75
50 mm	2”	0.9

.5 Minimum 20% Certified Recycled Content.

.3 Adhesive:

.1 Waterproof , ASTM E162 fire-retardant type. CAN/ULC S102 25/50 compliant on dried surface.

.4 Liner Fasteners: Galvanized steel, with press-on head.

PART 3 EXECUTION

3.1 PREPARATION

.1 Section 20 05 00 – Common Work for Mechanical: Verification of existing conditions before starting work.

.2 Verify that pressure testing of ductwork systems is complete, witnessed, and certified.

.3 Verify that surfaces are clean, dry, and free from foreign material.

3.2 INSTALLATION

.1 Install to manufacturer's instructions, and in accordance with MICA National Commercial and Industrial Insulation Standards Manual.

.2 Apply materials in accordance with manufacturer's instructions.

.3 Insulation to be applied in applications as specified regardless of whether shown on the drawings. Insulation shown on drawings is for reference, clarification or to indicate conditions not in the specifications.

.4 Silencers are considered integral to ductwork system and shall have insulation applied to match performance of connected ductwork.

.5 Section 01 45 00 - Quality Control: Manufacturer's written instructions.

.6 Install to NAIMA National Insulation Standards.

.7 Use two layers with staggered joints when required nominal thickness exceeds 75 mm.

.8 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.

.9 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.

.10 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.

.11 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.

.12 Where ducts are acoustically lined to the equivalent R-value, no exterior duct insulation is required, except where exposed to outside temperature and weather.

.13 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.

.14 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.

.6 Do not line drainable section and sloped duct at outside air intakes. Refer to Section 23 31 00 – Duct Work and Section 23 37 00 – Air Outlets and Inlets.

.15 Use two layers of insulation with staggered joints when required nominal thickness exceeds 75 mm (3 inch).

.16 Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes. Duct insulation shall be continuous through wall and ceiling openings and sleeves, except where firestopping is required.

.1 Ensure hangers and supports are outside vapour retarder jacket and in accordance with Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment.

.17 Apply high compressive strength insulation where insulation may be compressed by weight of ductwork.

.18 Fasteners: Install at 300-mm (12 inch) on centre in horizontal and vertical directions, minimum two rows each side.

.19 At chilled ductwork, secure with banding. Fasteners penetrating puncturing the underlying vapour barrier are not acceptable.

3.3 SITE QUALITY CONTROL

.1 Non-Conforming Work:

.1 Replace insulation with vapour barrier damage and moisture-saturated insulation.

3.4 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.

3.5 EXTERNAL GLASS FIBRE RIGID INSULATION BOARD

DUCT SERVICE	**DUCT SIZE** mm (inch)	**THICKNESS** mm (inch)

DUCT SERVICE	**DUCT SIZE** mm (inch)	**THICKNESS** mm (inch)
Air conditioning supply plenums, before, including, and after cooling coils	all	50 mm (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	25 mm (1")

3.6 GLASS FIBRE DUCT LINER, RIGID

DUCT SERVICE	**DUCT SIZE** mm (inch)	**THICKNESS** mm (inch)
Rectangular air supply and return air ductwork where indicated on drawings by acoustic hatching symbol.	All	25 mm (1")

3.7 CLEANING

.1 Clean in accordance with Section 01 74 00 – Cleaning.

.2 Waste Management: Perform in accordance with Section 01 74 20 - Waste Managing and Disposal.

END OF SECTION

PART 1 GENERAL

1.1 REFERENCE STANDARDS

.1 American Society of Mechanical Engineers (ASME):

- .1 ASME B1.20.1-2013 (R2018), Pipe Threads, General Purpose (Inch)
- .2 ASME B16.5-20, Pipe Flanges and Flanged Fittings: NPS 1/2 through NPS 24, Metric/Inch Standard
- .3 ASME B16.18-18, Cast Copper Alloy Solder Joint Pressure Fittings
- .4 ASME B16.22-18, Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings
- .5 ASME B18.2.1-12, Square and Hex Bolts and Screws Inch Series

.2 ASTM International (ASTM):

- .1 ASTM A47/A47M-99(2018)e1, Standard Specification for Ferritic Malleable Iron Castings
- .2 ASTM A53/A53M-18, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc Coated, Welded and Seamless
- .3 ASTM B75M-20, Standard Specification for Seamless Copper Tube Metric
- .4 ASTM A106/A106M-19, Standard Specification for Seamless Carbon Steel Pipe for High-Temperature Service
- .5 ASTM B88-16, Standard Specification for Seamless Copper Water Tube
- .6 ASTM B837-19, Standard Specification for Seamless Copper Tube for Natural Gas and Liquefied Petroleum (LP) Gas Fuel Distribution Systems

.3 CSA Group (CSA):

- .1 ANSI Z21.24-2015/CSA 6.10-2015, Connectors for gas appliances
- .2 ANSI Z21.54-2014/CSA 8.4-2014, Gas hose connectors for portable outdoor gas-fired appliances
- .3 ANSI/LC 1-2018/CSA 6.26-2018, Fuel gas piping systems using corrugated stainless steel tubing (CSST)
- .4 ANSI/LC-4-2012/CSA 6.32-2012 (R2017), Press-connect metallic fittings for use in fuel gas distribution systems
- .5 CSA B137.4-17, Polyethylene (PE) piping systems for gas services
- .6 CSA B137.4.1-17, Electrofusion-type polyethylene (PE) fittings for gas services
- .7 CAN/CSA B149.1:20, Natural Gas And Propane Installation Code
- .8 CAN/CSA B149.1HB:20, Natural Gas and Propane Installation Code Handbook
- .9 CSA W47.1:19, Certification of Companies for Fusion Welding of Steel
- .10 CSA W117.2:19, Safety in welding, cutting, and allied processes

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

- .1 Safety Data Sheets (SDS)

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

- .1 Submit manufacturer’s product literature, specifications and datasheet for piping, fittings and equipment.
- .2 Indicate on manufacturers catalogue literature following: valves.

.3 Test Reports: submit certified test reports from approved independent testing laboratories indicating compliance with specifications for specified performance characteristics and physical properties.

.4 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.5 Instructions: submit manufacturer's installation instructions.

.6 Closeout Submittals: submit maintenance and engineering data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.3 REGULATORY REQUIREMENTS

.1 Licensed in the jurisdiction of work where licencing is legislated.

.2 Perform natural gas work to the latest version of the CSA B149.1 gas code, Manitoba Gas Notices and requirements of the local authority having jurisdiction.

1.4 ADMINISTRATIVE REQUIREMENTS

.1 Pre-Installation Meetings:

.1 Convene pre-installation meeting one week before beginning work of this Section and on-site installations in accordance with Section 20 05 00 – Common Work for Mechanical.

.1 Verify project requirements.

.2 Review installation and substrate conditions.

.3 Coordination with other building subtrades.

.2 Health and Safety:

.1 Do construction occupational health and safety in accordance with Section 01 35 23 - Health and Safety.

PART 2 PRODUCTS

2.1 PIPE

.1 Steel pipe: to ASTM A53/A53M or ASTM A106, Schedule 40, seamless as follows:

.1 NPS 1/2 to 2, screwed.

.2 NPS2 1/2 and over, plain end.

2.2 NATURAL GAS PIPING, ABOVE GRADE

.1 Steel:

.1 Pipe: ASTM A53/A106 Schedule 40 Black or ASTM A179 Schedule 40 seamless

.2 Fittings: CSA Z662 or ASME B16 series malleable iron or steel, or press fit certified to ANSI LC-4/CSA 6.32

.3 Joints: to CSA B149, press fit to CSA 6.32, flanged, threaded to ASME B1.20.1 or welded to CSA Z662 or otherwise by authority having jurisdiction.

.4 All joints NPS 2-1/2 or greater to be welded only.

2.3 JOINTING

.1 Screwed fittings: Compounds and tapes complying with CAN/ULC-S642, threaded to ASME B1.20.1

.2 Welded fittings: to CSA W47.1

.3 Flange gaskets: non-metallic flat.

.4 Brazing: melting point exceeding 525°C (1000°F)

2.4 FITTINGS

.1 Steel pipe fittings, screwed, flanged or welded:

.1 Malleable iron: screwed, banded, Class 150 for Schedule 40, Class 300 for Schedule 80.

.2 Steel pipe flanges and flanged fittings: to ASME B16.5

.3 Welding: butt-welding fittings.

.4 Unions: malleable iron, brass to iron, ground seat, to ASTM A47/A47M

.5 Bolts and nuts: to ASME B18.2.1

.6 Nipples: schedule 40, to ASTM A53/A53M

2.5 VALVES

.1 Provincial Code approved, lubricated plug type.

2.6 NATURAL GAS ACCESSORIES

.1 Regulators

.1 Provide regulators to requirements of CSA B149.1 and conforming to:

.1 ANSI Z21.18/CSA 6.3 for appliances

.2 ANSI Z21.78/CSA 6.20 for combination gas controls for gas appliances

.3 ANSI Z21.80/CSA 6.22 for line pressure regulators (natural gas and propane)

.2 Valves

.1 Manual shut off valve to CSA 3.11, CSA 3.16 or ANSI Z21.15/CSA 9.1

.2 Automatic appliance shutoff valves to ANSI Z21.21/CSA 6.5.

.3 Flexible Stainless Steel Gas Tubing (CSST): CSA 6.26 (ANSI LC 1); CSA 6.10 (ANSI Z21.24); CSA 6.27 (ANSI Z21.75)

.1 CSA listed for application.

.2 Stainless steel corrugated tubing with arc resistant jacketing.

.1 Jacketing to be yellow coloured.

.2 Maximum operating pressure of 5 psi (34.5 kPa), maximum transient pressure to never exceed 6.5 psi (44.8 kPa)

.3 Fittings: CSA 6.26

.4 Striker plates: CSA 6.26

.5 CSST piping components including gas manifolds, gas pressure regulators, manual gas valves to conform to CSA 6.26 requirements. CSST shall not be used as a gas connector.

.4 Gas connector: provide connectors applicable to the installation:

.1 Outdoor gas appliances and manufactured homes: CSA 6.27 (ANSI Z21.75)

PART 3 EXECUTION

3.1 PIPING

.1 Install in accordance with Section 23 05 05 - Installation of Pipework, applicable Provincial/Territorial Codes, CAN/CSA B149.1, supplemented as specified.

.2 Install drip points:

.1 At low points in piping system.

.2 At connections to equipment.

3.2 VALVES

.1 Install valves with stems upright or horizontal unless otherwise approved by Consultant.

.2 Install valves at branch take-offs to isolate pieces of equipment, and as indicated.

3.3 SITE QUALITY CONTROL

.1 Site Tests and Inspections:

.1 Test system in accordance with CAN/CSA B149.1 and requirements of authorities having jurisdiction.

.2 Obtain reports within 3 days of review and submit immediately to Consultant.

3.4 ADJUSTING

.1 Purging: purge after pressure test in accordance with CAN/CSA B149.1

.2 Pre-Start-Up Inspections:

.1 Check vents from regulators, control valves, terminate outside building in approved location, protected against blockage, damage.

.2 Check gas trains, entire installation is approved by authority having jurisdiction.

3.5 CLEANING

.1 Cleaning: in accordance with CAN/CSA B149.1, supplemented as specified.

.2 Perform cleaning operations as specified in Section 01 74 00 – Cleaning and in accordance with manufacturer’s recommendations.

3.6 EXAMINATION

.1 Section 20 05 00: Verify existing conditions before starting work.

.2 Verify that excavations are to required grade, dry, and not over-excavated.

3.7 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.

3.8 INSTALLATION

.1 Install to manufacturer's written instructions.

.2 Installation to CSA B149.1 and local authority having jurisdiction requirements. Refer to active technical bulletins by ITSM (Inspection and Technical Services Manitoba). Installations to be done by a gas fitter licensed in the jurisdiction of work.

.3 Inspections:

.1 Inspect buried joints to CSA B149 prior to concealment and witnessed by the utility or designated authority having jurisdiction.

.4 Installation of flexible connections for natural gas equipment.

.1 All components to be from single manufacturer's listed components. Inter-connection of tubing and fittings with other CSST manufacturers is prohibited.

.2 Provide bonding where required by manufacturer.

.3 Selection of flexible connections shall be conform to the requirements of the gas appliance application.

.5 Provide non-conducting dielectric connections wherever jointing dissimilar metals.

.6 Provide access where valves and fittings are not exposed. Coordinate size and location of access doors with Section 08 31 13.

.7 Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.

.8 Install piping to maintain headroom, conserve space, and not interfere with use of space.

.9 Hangers and support, refer to Section 23 05 29.

.10 Prepare exposed, unfinished pipe, fittings, supports, and accessories ready for finish painting. Refer to Section 09 91 10.

END OF SECTION

PART 1 GENERAL

1.1 REFERENCE STANDARDS

.1 American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE)

.2 ASTM International (ASTM)

.1 ASTM A240-22a, Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications

.2 ASTM A480/A480M-12, Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet and Strip.

.3 ASTM A635/A635M-09b, Standard Specification for Steel, Sheet and Strip, Heavy-Thickness Coils, Hot-Rolled, Alloy, Carbon, Structural, High-Strength Low-Alloy, and High-Strength Low-Alloy with Improved Formability, General Requirements for.

.4 ASTM A653/A653M-11, Standard Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process.

.3 HVAC Inspection, Cleaning and Restoration Association (formerly National Air Duct Cleaners Association) (NADCA)

.1 ACR, Standard for Assessment, Cleaning & Restoration of HVAC Systems

.2 General Specifications for the Cleaning of Commercial Heating, Ventilating and Air Conditioning Systems

.4 National Fire Protection Association (NFPA)

.1 NFPA 90A, Standard for the Installation of Air-Conditioning and Ventilating Systems.

.2 NFPA 90B, Standard for the Installation of Warm Air Heating and Air-Conditioning Systems.

.3 NFPA 96-14, Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations.

.5 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)

.1 SMACNA HVAC Duct Construction Standards - Metal and Flexible, 2020.

.2 SMACNA HVAC Air Duct Leakage Test Manual, 2012.

.3 ANSI/SMACNA 008-2008, IAQ Guideline for Occupied Buildings Under Construction

.6 South Coast Air Quality Management District (SCAQMD), California State, Regulation XI. Source Specific Standards

.1 SCAQMD Rule 1168, Adhesives and Sealants Applications.

.7 Underwriters Limited Canada

.1 CAN/ULC S-102 2010, Standard Method Of Test For Surface Burning Characteristics Of Building Materials And Assemblies

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for metal ducts and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:

.1 None

.4 Test and Evaluation Reports:

.1 Certification of Ratings:

.1 Catalogue or published ratings to be those obtained from tests carried out by manufacturer or independent testing agency signifying adherence to codes and standards.

1.3 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials off ground indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect metal ducts from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

.4 Packaging Waste Management: In accordance with Section 01 74 19 - Waste Management and Disposal.

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 Carbon steel: ASTM A635/A635M

.3 Fasteners: Rivets, bolts, or sheet metal screws.

.4 Hanger Rod: ASTM A36; steel, galvanized; threaded both ends, threaded one end, or continuously threaded.

2.2 SEALANTS

.1 Exterior installed ductwork joint applications:

.1 Basis of Design:

.1 Tremco 555

.2 Substitutions: Refer to Section 20 05 00 – Common Work Results For Mechanical

.2 CAN/CGSB 19.13

.3 High solids, one-part, solvent based acrylic sealant with UV resistance and flexible workability. Suitable for horizontal and vertical surfaces

.4 Cold climate resistant.

.2 Duct joints:

.1 Basis of Design: Duro-Dyne

.1 Substitutions: Refer to Section 20 05 00 – Common Work Results For Mechanical

.2 Compliance: UL 181 listed, CAN/ULC S102, NFPA 90A/90B

.3 Non-hardening, water resistant, fire resistive, mold and mildew resistant, compatible with mating materials; liquid used alone or with tape, or heavy mastic.

.4 Usage to be compatible with low and medium velocity air distributing systems.

.5 Suitable for use in both indoor and outdoor applications.

.6 Exceeds SMACNA pressure and sealing classes for the installed ductwork application.

2.3 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 +500 Pa +2" wg. 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.

2.4 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 Transverse Duct Connection System:

.1 SMACNA "B" rated rigidly class connection, interlocking angle and duct edge connection system with sealant, gasket, cleats, and corner clips.

2.5 TAPE

.1 Tape: polyvinyl treated, open weave fiberglass tape, 50 mm wide.

2.6 DUCT LEAKAGE

.1 In accordance with SMACNA HVAC Air Duct Leakage Test Manual.

2.7 FITTINGS

.1 Fabrication: to SMACNA.

.2 Radiused elbows:

.1 Rectangular: short radius with single thickness turning vanes centreline radius: 1.5 times width of duct.

.2 Round: smooth radius, centreline radius: 1.5 times diameter.

.3 Mitred elbows, rectangular:

.1 To 407 mm: with single thickness turning vanes.

.2 Over 407 mm: with double thickness turning vanes.

.4 Branches:

.1 Rectangular main and branch: with radius on branch 1.5 times width of duct 45 degrees entry on branch.

.2 Round main and branch: enter main duct at 45 degrees with conical connection.

.3 Provide volume control damper in branch duct near connection to main duct.

.4 Main duct branches: with splitter damper.

.5 Transitions:

.1 Diverging: 20 degrees maximum included angle.

.2 Converging: 30 degrees maximum included angle.

.6 Offsets:

.1 Short radiused elbow as indicated.

2.8 GALVANIZED STEEL

.1 Lock forming quality: to ASTM A653/A653M,Z90 zinc coating.

.2 Thickness, fabrication and reinforcement: to SMACNA.

.3 Joints: to SMACNA. Proprietary manufactured flanged duct joint to be considered to be a class A seal.

PART 3 EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for metal duct installation in accordance with manufacturer’s written instructions.

.1 Visually inspect substrate in presence of Consultant.

.2 Inform Consultant of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Consultant.

3.2 GENERAL

.1 Do work in accordance with NFPA 90A ASHRAE SMACNA as indicated.

.2 Do not break continuity of insulation vapour barrier with hangers or rods.

.1 Insulate strap hangers 100 mm beyond insulated duct.

.3 Support risers SMACNA as indicated.

.4 Install breakaway joints in ductwork on sides of fire separation.

.5 Install proprietary manufactured flanged duct joints in accordance with manufacturer's instructions.

.6 Manufacture duct in lengths and diameter to accommodate installation of acoustic duct lining.

3.3 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 Consultant. 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 of Winnipeg. 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 Ductwork Penetrations:

.1 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.

.2 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 Consultant before installation.

.3 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.

.4 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.

.9 Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.

.10 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.

.11 Duct supports and hanging:

.1 Use only threaded rod for duct support in exposed areas. Strapping not allowed.

.2 Use double nuts and lock washers on threaded rod supports.

.12 Connections

.1 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.

.2 Where flexible duct is permitted, 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.

.13 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.

.14 Active construction requirements:

.1 During construction provide temporary closures of metal or taped sheet plastic on open duct work to prevent construction dust from entering duct work system.

.2 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.

.15 Duct sealing

.1 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 an approved 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.

.2 All ductwork located outdoors shall have seams and joints sealed with an approved acrylic UV resistant sealant, applied with caulking gun and levelled with putty knife. Use material in accordance with manufacturer's printed recommendations.

.3 Duct sealing requirements

Static Pressure Class Pa	Seal Class	Sealing Requirements
≤500	C	Transverse joints only
> 500 and <1000	B	All Transverse joints and longitudinal seams only
≥1000	A	All Transverse joints, longitudinal seams, and duct wall penetrations

Refer to ANSI/SMACNA 006 for definitions of seal class.
Sealing pressure applies to positive and negative conditions.

.16 Install ductwork free from pulsation, chatter, vibration or objectionable noises.

.17 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 Consultant.

3.4 SEALING AND TAPING

.1 Apply sealant in accordance with SMACNA and to manufacturer's recommendations.

.2 Bed tape in sealant and recoat with minimum of 1 coat of sealant to manufacturers recommendations.

3.5 CLEANING

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

.2 Waste Management: In accordance with Section 01 74 20 - Waste Managing and Disposal.

.3 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.

3.6 SCHEDULES

3.7 DUCT WORK MATERIAL SCHEDULE

AIR SYSTEM	MATERIAL
Low Pressure Supply (Heating Systems)	Steel
Low Pressure Supply (With Cooling Coils)	Steel
Return and Relief	Steel
General Exhaust	Steel
Outside Air Intake	Steel
Medium Pressure Supply	Steel
High Pressure Supply	Steel

3.8 DUCT WORK PRESSURE CLASS SCHEDULE

AIR SYSTEM	PRESSURE CLASS
Supply (Heating Systems)	500 Pa (2 inch)
Supply (System with Cooling Coils)	500 Pa (2 inch)
Return and Relief	250 Pa (1 inch)
General Exhaust	250 Pa (1 inch)
Outside Air Intake	250 Pa (1 inch)
Intake and Exhaust	250 Pa (1 inch)

END OF SECTION

PART 1 GENERAL

1.1 REFERENCE STANDARDS

.1 American National Standards Institute/Air-Conditioning, Heating and Refrigeration Institute (ANSI/AHRI):

.1 ANSI/AHRI 210/240-2008, Performance Rating of Unitary Air-Conditioning and Air-Source Heat Pump Equipment

.2 AHRI 270-15, Sound Rating of Outdoor Unitary Equipment

.2 ASTM International (ASTM):

.1 ASTM B117-19, Standard Practice for Operating Salt Spray (Fog) Apparatus

.3 Fenestration & Glazing Industry Alliance (FGIA) (formerly American Architectural Manufacturers Association (AAMA)):

.1 AAMA 2604-21, Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels

.2 AAMA 2605-20, Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels

.4 ULC Standards (ULC):

.1 CAN/ULC-S111-13, Standard Method of Fire Tests for Air Filter Units

.5 Canadian Roofing Contractors Association (CRCA):

.1 CRCA Roofing Specifications Manual, (Latest version)

.6 CSA Group (CSA):

.1 CSA B52:18, Mechanical Refrigeration Code

.2 CSA C22.1-18, Canadian Electrical Code, Part I (24th edition), Safety Standard for Electrical Installations

.3 CSA C22.2 No.236-15, Heating and Cooling Equipment (Bi-national standard with UL 1995)

.7 National Fire Protection Association (NFPA):

.1 NFPA 90A-21, Standard for the Installation of Air-Conditioning and Ventilating Systems

1.2 ABBREVIATIONS AND ACRONYMS

.1 DBT: Dry bulb temperature

.2 DX: Direct expansion

.3 EA: Exhaust air

.4 OAD: Outside air damper

.5 PV: Performance verification

.6 RA: Return air

.7 RAD: Return air damper

.8 SA: Supply air

.9 WBT: Wet bulb temperature

1.3 RELATED REQUIREMENTS

.1 Section 23 08 16 - Cleaning and Start-Up of HVAC Piping Systems

1.4 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data: Submit manufacturer's instructions, product data for outdoor HVAC equipment and include product characteristics, performance criteria, physical size, finish, and limitations.

.3 Shop Drawings:

.1 Submit drawings.

.2 Drawings to indicate project layout and dimensions, including:

.1 Equipment, piping, connections, together with valves, strainers, control assemblies, thermostatic controls, auxiliaries and hardware.

.2 Size and recommended bypass connections for recommended ancillaries, which are mounted, wired and piped ready for final connection to building system.

.3 Piping, valves, and fittings shipped loose showing final location in assembly.

.4 Control equipment shipped loose, showing final location in assembly.

.5 Complete internal and external schematics and assembly of.

.6 Dimensions, internal and external construction details, recommended method of installation with proposed structural steel support, mounting curb details, sizes and location of mounting bolt holes; include mass distribution drawings showing point loads.

.7 Detailed composite wiring diagrams for control systems showing factory installed wiring and equipment on packaged equipment or required for controlling devices of ancillaries, accessories, and controllers.

.8 Pump and fan performance curves.

.9 Details of vibration isolation.

.10 Estimate of sound levels to be expected across individual octave bands in dB referred to as A-rating.

.11 Type of refrigerant.

.4 Certificates: Submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.5 Test Reports: When requested, submit certified test reports from approved independent testing laboratories indicating compliance with specified performance characteristics and physical properties.

.6 Manufacturer's Site Reports:

.1 Submit manufacturer's site reports as specified.

1.5 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

.2 Operation and Maintenance Data: Submit and incorporate into manual.

.1 Indicate: Brief description of unit, indexed with details of function, operation, control, and service for components.

.2 Include unit manufacturer's name, type, year, number of units, and capacity.

.3 Submit manufacturer's warranty.

1.6 DELIVERY, STORAGE, AND HANDLING

.1 Perform in accordance with Section 01 61 00 - Common Product Requirements.

.2 Deliver materials to site in original factory packaging with manufacturer's label.

.3 Storage and Handling Requirements:

.1 Store materials off ground in a dry, well-ventilated indoor location and in a way that protects outdoor HVAC equipment from deformation and abrupt bumps/impact forces in accordance with manufacturer's recommendations.

.4 Packaging Waste Management: In accordance with Section 01 74 19 - Waste Management and Disposal.

PART 2 PRODUCTS

2.1 MANUFACTURERS

.1 Engineered Air

.2 Substitutions: No substitutions

2.2 AIR CONDITIONING UNITS

.1 General: Roof mounted units having gas burner and electric refrigeration.

.2 Description: Self-contained, packaged, factory assembled and prewired, consisting of cabinet and frame, supply fan, heat exchanger and burner, controls, air filters, refrigerant cooling coil and compressor, condenser coil and condenser fan.

.3 Electrical Characteristics:

.1 Refer to Section 26 05 80.

.4 Disconnect Switch: Factory mount disconnect switch in control panel.

2.3 FABRICATION

.1 Cabinet: Galvanized steel with baked enamel finish, access doors or removable access panels shall be permanently attached, and recessed into the panel.

.2 Insulation: 1/2 inch thick neoprene coated glass fibre with edges protected from erosion.

.3 Heat Exchangers: Stainless steel, of welded construction.

.4 Belt-Driven Supply-Air Fans: Double width, forward curved, centrifugal; with permanently lubricated, single-speed motor installed on adjustable fan base resiliently mounted.

.5 Air Filters: Minimum arrestance to ASHRAE 52.1, and minimum efficiency reporting value (MERV) to ASHRAE 52.2:

.1 Two inch thick glass fibre disposable media in metal frames; minimum percent arrestance, and MERV 13.

2.4 BURNER

.1 Gas Burner: Induced draft type burner with adjustable combustion air supply, pressure regulator, gas valves, manual shut-off, intermittent spark or glow coil ignition, flame sensing device, and automatic 100 percent shut-off pilot.

.2 Gas Burner Safety Controls: Energize ignition, limit time for establishment of flame, prevent opening of gas valve until pilot flame is proven, stop gas flow on ignition failure,

energize blower motor, and after air flow proven and slight delay, allow gas valve to open.

.3 High Limit Control: Temperature sensor with fixed stop at maximum permissible setting, de-energize burner on excessive bonnet temperature and energize burner when temperature drops to lower safe value.

.4 Supply Fan Control: Temperature sensor sensing bonnet temperatures and independent of burner controls, with provisions for continuous fan operation.

2.5 EVAPORATOR COIL

.1 Coil: Copper tube aluminum fin coil assembly with galvanized drain pan and connection.

.2 Fixed orifice metering system.

2.6 COMPRESSOR

.1 Hermetic scroll compressors, 3600 rpm maximum, resiliently mounted with positive lubrication, crankcase heater, high and low pressure safety controls, motor overload protection, suction and discharge service valves and gauge ports, and filter drier.

.1 Five minute timed off circuit to delay compressor start.

.2 Outdoor thermostat to energize compressor above 60 degrees F ambient.

2.7 CONDENSER COIL

.1 Coil: Copper tube aluminum fin assembly with subcooling rows and coil guard.

.2 Fans: Direct drive propeller fans, resiliently mounted with fan guard, motor overload protection, wired to operate with compressor.

.3 Hail Guard.

2.8 MIXED AIR CASING

.1 Dampers: Outside, return, and relief dampers with damper operator and control package to automatically vary outside air quantity. Outside air damper to fall to closed position. Relief dampers may be gravity balanced.

.2 Damper Operator: 24 volt with gear train sealed in oil with spring return on units

.3 Mixed Air Controls: Maintain selected supply air temperature and return dampers to minimum position. Provide an economizer capable of introducing and relieving 100% outside air with barometric relief. Economizer control to be enthalpy control.

2.9 OPERATING CONTROLS

.1 Terminal strip on unit for connection of operating controls to remote panel by others. Allow for two stages of heating and two stages cooling.

.2 Low limit thermostat in supply air to close outside air damper and stop supply fan.

.3 Economizer Outdoor-Air Damper Operation:

.1 Occupied Periods: Open to fixed minimum intake, and maximum 100 percent of the fan capacity to comply with ASHRAE Cycle II. Permit air-side economizer operation when outdoor air is less than 15 deg C (60 deg F). mixed-air temperature and select between outdoor-air and return-air enthalpy to adjust mixing dampers. During economizer cycle operation, lock out cooling.

.2 Unoccupied Periods: Close outdoor-air damper and open return-air damper.

.3 Outdoor-Airflow Monitor: Accuracy maximum plus or minus 5 percent within 15 and 100 percent of total outdoor air. Adjust for temperature and provide output range from 2- to 10-V dc or 4 to 20 mA.

.4 Interface Requirements for HVAC Instrumentation and Control System: Connect new RTU controllers to existing building control system, BACnet compatible controller to be provided for future connections:

.1 scheduled operation,

.2 indication of fault,

.3 set point adjustment,

.4 monitoring of supply fan start, stop, and operation,

.5 data inquiry for outdoor air damper position, supply- and room-air temperature and humidity,

.6 monitoring of occupied and unoccupied operations.

2.10 REFRIGERANT LEAK DETECTION

.1 Factory-installed refrigerant leak detector packaged with the specified rooftop unit

.2 The detector shall comply with applicable codes and standards, including ASHRAE 15 & CSA B52.

.3 Rooftop unit shall shut down automatically if refrigerant is detected in the airstream.

2.11 PERFORMANCE

.1 Refer to schedule

2.12 SECURITY CAGE

.1 Fully enclosed Rampart 280 welded wire fence shall be installed around roof top unit with access doors for maintenance.

.2 MANUFACTURERS

.1 Wallace Perimeter Security – Rampart 280 Welded Wire

.2 Substitutions: Refer to Section 20 05 00 – Common Works for Mechanical

.3 FABRICATION

.1 Specific panel dimension: 211” (5360mm), 120” (3050mm) and 84” (2130mm) respectively as per standard drawings.

.1 Include 70” overhead barntrack gate with drop pinlock and bottom guide wheel.

.2 Wire mesh panels shall be precut to specified lengths of approximately 8’ 2”.

.3 Steel Wire mesh fence panels shall be welded by resistance welding per ASTM F2453 using pre-galvanized steel wire; using one Vertical 4 GA (6mm) pre-galvanized steel wire(s) and two Horizontal 0 GA (8mm) pre-galvanized steel wires to form a mesh opening of 2” x 8” (50mm x 200mm).

.4 One end of the vertical wires of the panel shall exceed 1” (25mm) from the first horizontal wire creating a spiked top.

.5 The cold rolled wire shall have a tensile strength of at least 74,000 psi (510 MPa) and 68,000 psi (469 MPa) shear strength. Wire strand shall be galvanized before welded (GBW), 0.50 ounces per square foot zinc coating conforming to the ASTM A641.

WPS Part Number	Pre-Galvanized Steel Wire Gauge		Mesh Size	Standard Panel Length	Approximate Standard Panel Height - ft [m]	Standard Panel Height - in. [mm]
	Horizontal	Vertical				
100483 (Galv.)	2 x 0 GA [8mm]	1 x 4 GA [6mm]	2" x 8" [50mm x 200mm]	6' [1.8m]	6' [1.8m]	72.0" [1830mm]

.4 COATING

.1 Hot-dip galvanized: The wire mesh is coated with 0.5 oz./sq. ft. (150 g/m2) zinc in conformity with ASTM A641 (1989) Class 1.

.2 Corrosion: The wires are galvanized according to ASTM A641/A641M with a minimum of 40 gr/m2. After the welding process the panels will be pre-treated and provided with a conversion layer for a better anti-corrosion effect and better adhesion of the polyester powder coating.

.5 MOUNTING

.1 Modular unit shall be shipped in sections for on-site assembly and welding.

.2 Security cage columns shall be mounted at designated HSS column locations as indicated on the structural roof plan. Structural shall provide horizontal HSS members between existing joists at each column location to facilitate proper support. Cage columns shall be anchored directly to the provided HSS framing.

.6 SHOP DRAWING

.1 Contractor shall submit shop drawings for review and approval prior to ordering the unit.

PART 3 EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: Verify that conditions of substrate previously installed are acceptable for outdoor HVAC equipment installation in accordance with manufacturer's instructions.

.1 Inspect substrate in presence of Consultant.

.2 Inform Consultant of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Consultant.

3.2 INSTALLATION

.1 Install per manufacturers' instructions on roof curbs as indicated on Drawings.

.2 Run drain line from cooling coil condensate drain pan to discharge as indicated on Drawings.

.3 Install to NFPA 90A & NFPA 90B.

.4 Mount units on factory built roof mounting curb adaptor and coordinate. Secure RTUs to upper curb rail.

.5 Install condensate drain, matching connection size, with trap and direct to roof, complete with concrete splash pad.

.6 Install ducts to termination at top of roof curb. Remove roof decking only as required for passage of ducts; do not cut out decking under entire roof curb.

.7 Connect gas piping to burner, full size of gas train inlet, with union and shutoff valve with sufficient clearance for burner removal and service.

.8 SECURITY CAGE

.1 All new installation shall be laid out by the contractor in accordance with the construction plans. The manufacturers' gate drawings shall identify the necessary gate hardware and installation recommendations required for the application.

3.3 MANUFACTURER'S FIELD SERVICES

.1 Prepare and start systems to Section 20 05 00 – Common Work for Mechanical.

.2 Provide initial start-up and shut-down during first year of operation, including routine servicing and check-out.

3.4 SITE QUALITY CONTROL

.1 Manufacturer to certify installation, supervise start-up and commission unit.

.2 Manufacturer's Site Services:

.1 Have manufacturer of products supplied under this Section review work involved with installation of its products, and submit reports, in acceptable format, to verify compliance of work with Contract.

.2 Provide manufacturer's site services, consisting of product use recommendations and periodic site visits for inspection of product installation, in accordance with manufacturer's instructions.

.3 Submit reports within three days of review to Consultant.

.4 Performance Verification:

.1 General:

.1 Conforms to Section 23 08 16 - Cleaning and Start-Up of HVAC Piping Systems.

.2 Rooftop Air Handling Units:

.1 Set zone mixing dampers for full cooling, except where diversity factor forms part of design then set that percentage of zone dampers to full heating.

.2 Set outside air and return air dampers for minimum outside air.

.3 Set face and bypass dampers so face dampers are fully open and bypass dampers are fully closed.

.4 Check for smooth, correct rotation of supply fan impeller with no vibration.

.5 Measure supply fan capacity.

.6 Adjust impeller speed as necessary and repeat measurement of fan capacity.

.7 Measure pressure drop of each component of air handling unit.

.8 Set outside air and return air dampers for the percentage of outside air required by design and repeat measurements of fan capacity.

.9 Reduce differences between fan capacity at minimum and maximum outside air less than 5%.

.10 Set face and bypass dampers to full bypass and repeat measurement of fan capacity.

.11 Reduce difference between fan capacity with face and bypass damper fully closed to bypass and fully open to bypass to less than 5%.

.12 Reduce difference between fan capacity at full cooling and fan capacity at full heating to less than 5%.

.13 OAD (outside air damper (actuator)): Verify for proper stroking, interlock with RAD (return air damper (actuator)).

.14 Measure DBT (dry bulb temperature), WBT (wet bulb temperature) of SA (supply air), RA (return air), and EA (exhaust air).

.15 Measure air cooled condenser discharge DBT.

.16 Measure flow rates (minimum and maximum) of SA, RA, and EA - relief air.

.17 Simulate maximum cooling load and measure refrigerant hot gas and suction temperatures and pressures.

.18 Use smoke test to verify no short-circuiting of EA, relieve air to outside air intake or to condenser intake.

.19 Simulate maximum heating load and

.1 verify temperature rise across heat exchanger,

.2 perform flue gas analysis. Adjust for peak efficiency,

.3 verify combustion air flow to heat exchanger, and

.4 simulate minimum heating load and repeat measurements.

.20 Measure radiated and discharge sound power levels under maximum heating demand and under maximum cooling demand with compressors running.

.21 Verify operating control strategies, including:

.1 Heat exchanger operating limit and high limit

.2 Early morning warm-up cycle

.3 Freeze protection

.4 Economizer cycle operation, temperature of change-over

.5 Alarms

.6 Voltage drop across thermostat wiring

.7 Operation of remote panel including pilot lights, and failure modes

.22 Set zone mixing dampers for full heating and repeat measurements.

.23 Measure leakage past zone mixing dampers by taking temperature measurements. Reduce leakage to less than 5%.

.24 Measure return fan capacity.

.25 Adjust impeller speed as necessary and repeat measurement of return fan capacity.

.26 Check capacity of heating unit.

.3 Start-Up: Comply with Section 23 08 16 - Cleaning and Start-Up of HVAC Piping Systems.

.4 Verify clear access and serviceability of components including motorized dampers, filter coils, fans, motors, operators, humidifiers, sensors, and electrical disconnects.

.5 Verify clear access, cleanability, and drainage of drain pans for coils and humidifiers.

.5 Equipment Commissioning Reports:

.1 Comply with Section 20 05 00 – Common Work for Mechanical. Include report forms and schematics.

3.5 DEMONSTRATION

.1 Training: In accordance with Section01 79 00 - Demonstration and Training: Training of O & M personnel, as specified.

3.6 CLEANING

.1 Progress Cleaning: Clean in accordance with Section 01 74 00 – Cleaning.

.2 Final Cleaning: Upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 – Cleaning.

.3 Perform cleaning operations in accordance with manufacturer’s recommendations.

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

END OF SECTION

PART 1 GENERAL

1.1 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.

.4 Contractor shall be responsible for disconnecting and reconnecting all existing hardwired connections to the RTU, and for updating the programming of the existing Johnson Metasys Building Automation System (BAS) to ensure full integration and functionality.

1.2 SUBMITTALS FOR REVIEW

.1 Section 20 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.

1.3 SUBMITTALS AT PROJECT CLOSEOUT

.1 Section 20 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

PART 3 EXECUTION

3.1 ROOF TOP UNIT (RTU-1)

.1 Packaged control for supply fan, gas burner, cooling coil, dampers, filter section.

.2 Schedule:

.1 Occupied Hours:

.1 Monday to Friday, 09:00 to 19:00 hours

.2 Unoccupied Hours:

.1 All other times outside of Occupied Hours

.3 Operation:

.1 Space Heating:

.1 72F during occupied hours

.2 60F during unoccupied hours

.2 Space Cooling:

.1 73F during occupied hours

.2 80F during unoccupied hours

.4 Dampers:

.1 The outside air damper shall open to 1309 CFM minimum outdoor air during occupied hours, and shall close during unoccupied hours.

.5 Supply Air Temperature Setpoint

.1 The controller will monitor the supply air temperature and will maintain a supply air temperature setpoint reset based on cooling and heating requirements.

.2 The supply air temperature setpoint for cooling shall be reset based on the cooling demand from the rooftop unit single zone thermostat as follows:

.1 The initial supply air temperature setpoint will be 55°F (adj.).

.2 As cooling demand increases, the setpoint will incrementally reset down to a minimum of 53°F (adj.).

.3 As cooling demand decreases, the setpoint will incrementally reset up to a maximum of 72°F (adj.).

.3 The supply air temperature setpoint for heating shall be reset based on the heating demand from the rooftop unit single zone thermostat as follows:

.1 The initial supply air temperature setpoint will be 82°F (adj.).

.2 As heating demand increases, the setpoint will incrementally reset up to a maximum of 100°F (adj.).

.3 As heating demand decreases, the setpoint will incrementally reset down to a minimum of 72°F (adj.).

.6 Cooling Stages:

.1 The controller will measure the supply air temperature and stage the cooling to maintain its cooling setpoint. To prevent short cycling, there will be a user definable (adj.) delay between stages, and each stage will have a user definable (adj.) minimum runtime.

.1 Cooling will be enable whenever:

.1 Outside air temperature is greater than 60F (adj.).

.2 AND the economizer is disabled or fully open.

.3 AND the supply fan status is on.

.4 AND the heating is not active.

.7 Gas Heating Stages:

.1 The controller will measure the supply air temperature and stage the heating to maintain its heating setpoint. To prevent short cycling, there will be a user definable (adj.) delay between stages, and each stage will have a user definable (adj.) minimum runtime.

.1 Heating will be enable whenever:

.1 Outside air temperature is less than 65F (adj.).

.2 AND the supply fan status is on.

.3 AND the cooling is not action.

.8 Economizer:

.1 The packaged RTU controller will enable economizing whenever outdoor air enthalpy is less than return air enthalpy, and there is a call for cooling.

.9 Alarms:

.1 RTU alarm status.

.2 Fan status:

.1 Fan on, but the status is off.

.2 Fan off, but the status is on.

.3 High Supply Air Temp: If the supply air temperature is 10°F (adj.) greater than setpoint.

.4 Low Supply Air Temp: If the supply air temperature is 10°F (adj.) less than setpoint.

.10 Monitor:

.1 Display the RTU enable status and alarms.

.2 Display the RTU supply air temperature.

END OF SECTION