ISSUE FOR TENDER

SPECIFICATIONS AND DRAWINGS

for

Department of Fisheries and Oceans Canada (DFO)
Inuvik Office
Lab Upgrade – New Fume Hood

DFO Building
8 Arctic Road, Inuvik, NT

PROJECT NO. GOC6533145

PART 1 GENERAL

1.1 DOCUMENT RESPONSIBILITY

.1 Professional seals if applied next to company names in the project directory (below) govern only the respective discipline's specifications, schedules, and drawings.

1.2 PROJECT DIRECTORY

.1 Owner:

Inuvialuit Regional Corporation (IRC)
107 Mackenzie Rd,
Inuvik, NT, X0E 0T0

.2 Engineer(s):

Williams Engineering Canada Inc.
Suite 1800, 10065 Jasper Avenue
Edmonton, AB T5J 3B1

PERMIT TO PRACTICE
WILLIAMS ENGINEERING CANADA INC
Signature
Date
26 Jan. 2026
L1817
PERMIT NUMBER: P646
NWT/NU Association of Professional Engineers and Geoscientists

Mechanical Engineer

REGISTERED PROFESSIONAL ENGINEER
D.C. BROWN
LICENSEE
NT/NU
2026-01-26

Electrical Engineer

REGISTERED PROFESSIONAL ENGINEER
IFT
J. TRAN
LICENSEE
NT/NU
2026-01-26

NOTE: The undersigned assumes responsibility solely for the content, accuracy, or completeness of the following specification sections: Division 23 – Mechanical and Division 26 – Electrical.
Responsibility for all remaining sections rests solely with their respective authors or consultants.

END OF SECTION

Part 1 General

END OF SECTION

Part 1 General

1.1 Drawing List

DRAWING NO.	DESCRIPTION	[REVISION NO].
M01	Legends, Schedules, Details	N/A
M02	Mechanical Demolition Plan	N/A
M03	Mechanical Construction Plan	N/A
E01	Demolition Plan	N/A
E02	Construction Plan	N/A

Part 2 Products

2.1 Not Used

.1 Not Used

Part 3 Execution

3.1 Not Used

.1 Not Used

END OF SECTION

Part 1 General

1.1 INVITATION

.1 Bid Call

.1 Ensure offers are signed under seal, executed, and dated and are received by Owner Consultant located at 2:00 pm local time on the 13th day of February 2026.

.2 Offers submitted after above time will be returned to Bidder unopened.

.3 Submit Supplementary Bid Information Form within 48 hours after [Bid] closing time.

.4 Offers will be opened privately immediately after time for receipt of Bids.

.5 Amendments to submitted offer will be permitted if received in writing prior to Bid closing and if endorsed by same party or parties who signed and sealed offer.

1.2 INTENT

.1 Intent of this Bid call is to obtain an offer to perform Work to complete Lab Upgrades located at 8 Arctic Road, Inuvik, NT for Stipulated Price contract, in accordance with Contract Documents.

.2 Perform Work Prior to March 30, 2026, within time stated in Section 01 11 00 Summary of Work.

.3 Initiate Work within 1 week of receipt of notice of contract award, time stated in Section 01 11 00 - Summary of Work.

1.3 CONTRACT DOCUMENTS IDENTIFICATION

.1 Contract Documents are identified as GOC6533145 as prepared by consultant, project located at 8 Arctic Road, Inuvik, NT.

1.4 CONTRACT/BID DOCUMENTS

.1 Agreement Form.

.2 Definitions:

.1 Contract Document: defined in CCDC 2.

.2 Bid Document: Contract Documents supplemented with Instructions to Bidders, Bid Form, and Bid Supplementary Forms identified.

.3 Bid, Offer, or Bidding: act of submitting an offer under seal.

.4 Bid Price: monetary sum identified in Bid Form as an offer to perform Work.

.3 Availability

.1 Electronic versions of Bid Documents can be downloaded at RFP/RFQ/REOI | Inuvialuit Regional Corporation.

.4 Examination

.1 Bid Documents may be viewed via download.

.2 Electronic versions of Bid Documents are available for viewing at RFP/RFQ/REOI | Inuvialuit Regional Corporation.

.3 Upon receipt of Bid Documents verify that documents are complete.

.4 Immediately notify issuer upon finding discrepancies or omissions in Bid Documents.

.5 Queries/Addenda

.1 Direct questions to Procurement at IRC by e-mail at Procurement@inuvialuit.com..

.2 Addenda may be issued during Bidding period. Addenda will become part of Contract Documents. Include costs in Bid Price.

.3 Verbal answers are only binding when confirmed by written addenda.

.4 Clarifications requested by Bidders must be in writing not less than seven days before date set for receipt of Bids. Reply will be in form of an addendum. Copy of addendum will be forwarded to known Bidders no later than 5 working days before receipt of Bids.

.6 Product/System Options.

.1 Where Bid Documents stipulate a particular product, substitutions will be considered up to 10 days before close.

.2 When request to substitute product is made, Consultant may approve substitution and will issue Addendum to known Bidders.

.3 In submission of substitutions to products specified, Bidders are to include in their Bid, changes required in Work to accommodate such substitutions. Later claim by Bidder for addition to Contract Price a result of changes in Work necessitated by use of substitutions will not be considered.

.4 Substituted products will be considered if submitted as an attachment to Bid Form.

.5 Ensure submission provides sufficient information to enable Consultant to determine acceptability of such products.

.6 Provide complete information on required revisions to other work to accommodate each substitution, dollar amount of additions to or reductions from Bid Price, including revisions to other work.

.7 Provide specified products unless substitutions are submitted as noted and subsequently accepted.

.8 Approval to submit substitutions prior to submission of Bids is not required.

1.5 SITE ASSESSMENTS

.1 Site Examination

.1 Non-Mandatory visit to project site has been arranged as follows: 8 Arctic Road, Inuvik, NT at 11:00am on February 2nd, 2026.

.2 To Bidders Briefing

.1 Bidders briefing has been scheduled to take place at non-mandatory visit.

.2 General Contractor is invited.

.3 Representatives of Owner will be in attendance.

.4 Minutes will not form part of Contract Documents.

.5 Questions that arise from the walkthrough, should be directed in writing to Procurement@inuvialuit.com.

1.6 QUALIFICATIONS

.1 Acceptance or rejection of this submittal will be made 48 hours.

.2 Subcontractors:

.1 Owner reserves right to reject proposed subcontractor for reasonable cause.

1.7 BID SUBMISSION

.1 Bid Depository

.1 All trades to use Bid Depository system of Bid collection.

.2 Rules and regulations of Bid Depository, in force on day of Bid submission apply.

.2 Bid Ineligibility

.1 Bids that are unsigned, improperly signed or sealed, conditional, illegible, obscure, contain arithmetical errors, erasures, alterations, or irregularities of any kind, will be declared informal at Owner's discretion.

.2 Bids with Bid Forms and enclosures which are improperly prepared will be declared informal at Owner's discretion.

.3 Bids that fail to include security deposit, bonding or insurance requirements may be declared informal at Owner's discretion.

.3 Submissions

.1 Bidders are solely responsible for delivery of their [Bids] in manner and time prescribed.

.2 Submit two copies of executed offer on [Bid] Forms provided, signed and with corporate seal together with required security to Procurement@inuvialuit.com clearly identified with RFP Title in the subject line.

.3 Improperly completed information, irregularities in Security Deposit [Bid Bond], will be cause not to open [Bid] envelope and declare Bid informal.

1.8 BID ENCLOSURES/REQUIREMENTS

.1 Security Deposit:

.1 Bids are to be accompanied by security deposit as follows: Bid Bond in amount not less than 10 percent of Bid price.

.2 Endorse Bid Bond in name of Owner as obligee, signed and sealed by principal (Contractor) and surety.

.3 Use most current edition CCDC approved bond forms.

.4 Security deposit will be returned after delivery to Owner of required Performance and Labour and Materials Payment Bond(s) by accepted Bidder.

.5 If no contract is awarded, security deposits will be returned.

.2 Consent of Surety:

.1 Submit with Bid Form and Bid Bond, Consent of Surety stating that surety providing Bid Bond is willing to supply Performance and Labour and Materials Payment Bond specified.

.2 Include cost of bonds in Bid Price.

.3 Performance Assurance

.1 Accepted Bidder must provide Performance and Labour and Materials Payment Bond as described in Supplementary Conditions.

.2 Include cost of bonds in Bid Price.

.4 Insurance:

.1 Provide signed "Undertaking of Insurance" on standard form provided by insurance company stating intention to provide insurance to Bidder in accordance with insurance requirements of Contract Documents.

.5 Bid Form Requirements:

.1 State in Bid Form, time required to complete Work. Completion date in Agreement must be completion time added to commencement date.

.2 Bidder, in submitting an offer, accepts time period stated in Contract documents for performing Work. Completion date in Agreement is completion time added to commencement date.

.3 Bidder, in submitting an offer, agrees to complete Work by date indicated in Contract Documents , but may propose a revision to contract time with adjustment to Bid price.

.4 Refer to Supplementary Conditions for inclusion of taxes and procedures for tax rebate claims by Owner.

.6 Fees for Changes in Work

.1 Include in Bid Form, percentage markup for overhead and profit applicable for changes in Work, whether additions to or deductions from Work on which Bid price is based.

.2 Include in Bid Form, fees proposed for subcontract work for changes (both additions and deductions) in Work. Contractor may apply markup as noted, to subcontractor's gross (net plus markup) costs on additional work.

.7 Bid Signing

.1 Bid Form to be signed under seal by Bidder.

.2 Sole Proprietorship: signature of sole proprietor in presence of witness who shall also sign. Insert words "Sole Proprietor" under signature. Affix seal.

.3 Partnership: signature of all partners in presence of witness who shall also sign. Insert word ‘Partner' under each signature. Affix seal to each signature.

.4 Limited Company: signature of duly authorized signing officer(s) in normal signatures. Insert officer's capacity in which signing officer acts, under each signature. Affix corporate seal. If Bid is signed by officials other than President and Secretary of company, or President-Secretary-Treasurer of company, copy of by-law resolution of Board of Directors authorizing them to do so must also be submitted with Bid.

.5 Incorporated Company: signature of duly authorized signing officer(s) in normal signatures. Insert officer's capacity in which signing officer acts, under each signature. Affix corporate seal. If Bid is signed by officials other than President and Secretary of company, or President-Secretary-Treasurer of company, copy of by-law resolution of Board of Directors authorizing them to do so must also be submitted with Bid.

.6 Joint Venture: each party of joint venture must execute Bid under respective seals in manner appropriate to such party as described above, similar to requirements of Partnership.

.8 Appendices to Bid Form:

.1 Appendix A - Contract Documents: include complete listing of documents and information issued by which [Bid] price was derived. [complete listing as scheduled in Contract Documents].

.2 Appendix B - Subcontractors: include names of Subcontractors and portion of Work Bidder will perform.

.3 Appendix C - Unit Prices: include listing of unit prices specifically requested in Bid Documents.

.9 Supplementary Bid Information:

.1 Lowest Bidder will be requested to complete Supplementary Bid Information.

1.9 OFFER ACCEPTANCE/ REJECTION

.1 Duration of Offer:

.1 Bids to remain open to acceptance, and irrevocable for 60 days after Bid closing date.

.2 Acceptance of Offer:

.1 Owner reserves right to accept or reject any or all offers.

.2 After acceptance by Owner, Consultant will issue to successful Bidder, written Bid acceptance.

.3 After Bid has been accepted, unsuccessful Bids will be returned to respective Bidders with submitted Bid securities.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 WORK COVERED BY CONTRACT DOCUMENTS

.1 Work of this Contract comprises renovation for GOC6533145 Lab Upgrade, located at 8 Arctic Road, Inuvik NT; and further identified as Fume Hood Replacement.

.1 The following project scope consists of:
- Removal of existing fume hood and associated exhaust fan and accessories.
- Removal of existing AH-1 lab supply fan, heating coil, and accessories. Note, retain humidifier for re-use.
- Installation of a new fume hood, exhaust fan system and associated accessories.
- Installation of a new AH-1 lab supply fan and associated accessories.
- Installation of controls and electrical systems required to accommodate mechanical system scope.
- Commissioning of fume hood and lab ventilation system.

1.2 CONTRACT METHOD

.1 Construct Work under single stipulated price contract CCDC 2.

1.3 SUBMITTALS

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

.2 Submit Project construction progress schedule in accordance with Section 01 32 16.19 - Construction Progress Schedule - Bar (GANTT) Chart.

.3 Submit site-specific and Work Plan Health and Safety Plan in accordance with Section 01 35 29.06 - Health and Safety Requirements.

1.4 WORK BY OTHERS

.1 Co-operate with other Contractors in carrying out their respective works and carry out instructions from Consultant.

.2 Co-ordinate work with other contractors. If any part of work under this Contract depends for its proper execution or result upon work of another contractor, report promptly to Consultant, in writing, any defects which may interfere with proper execution of Work.

.3 Verify work of Project executed before start of Work of this Contract, and which is specifically excluded from this Contract:

.4 Verify work of Project which will be executed after completion of Work covered under this Contract, and which is specifically excluded from this Contract:

1.5 WORK SEQUENCE

.1 Co-ordinate Progress Schedule and co-ordinate with Owner Occupancy during construction.

.2 Construct Work in stages to provide for continuous public usage. Do not close off public usage of facilities until use of one stage of Work will provide alternate usage.

.3 Maintain fire access/control.

.4 Protect workers and public safety.

1.6 CONTRACTOR USE OF PREMISES

.1 Unrestricted use of site until Substantial Performance.

.2 Limit use of premises for Work, for storage, and for access, to allow:

.1 Partial owner occupancy.

.2 Work by other contractors.

.3 Co-ordinate use of premises under direction of Consultant and Owner.

.4 Obtain and pay for use of additional storage or work areas needed for operations under this Contract.

.5 Remove or alter existing work to prevent injury or damage to portions of existing work which remain.

.6 Repair or replace portions of existing work which have been altered during construction operations to match existing or adjoining work, as directed by Consultant.

.7 Ensure that operations conditions of exiting work at completion are still the same, equal to or better than that which existed before new work started.

1.7 OWNER OCCUPANCY

.1 Owner will occupy premises during entire construction period for execution of normal operations.

.2 Co-operate with Owner in scheduling operations to minimize conflict and to facilitate Owner usage.

1.8 PARTIAL OWNER OCCUPANCY

.1 Schedule and substantially complete designated portions of Work for Owner's occupancy prior to Substantial Performance of entire Work.

.2 Designated areas for Owner's occupancy are as follows:

.3 Owner will occupy designated areas for purpose of installation of equipment.

.4 Execute Certificate of Substantial Performance for each designated portion of Work prior to Owner occupancy. Contractor shall allow:

.1 Access for Owner personnel.

.2 Use of parking facilities.

.3 Operation of HVAC and electrical systems.

.5 On occupancy, Owner will provide for occupied areas:

.1 Operation of HVAC and electrical systems.

.2 Maintenance.

.3 Security.

.6 Execute Partial Interim Certificate of Completion for each designated portion of Work prior to Owner occupancy. Contractor shall allow:

.1 Access for Owner personnel.

.2 Use of parking facilities.

.3 Operation of HVAC and electrical systems.

1.9 PRE-ORDERED PRODUCTS OR PRE-BID WORK

.1 Verify with Consultant and Owner if they have placed orders with suppliers for specific products, to expedite Work and for other purposes in Owner's interests.

.2 Take responsibility for purchasing, handling, and installing pre-ordered products same as for other Contractor-furnished products.

.3 Refer to manufacturer instructions for installation details.

.4 Sign a written agreement with designated supplier to require them to perform their work as provided in the Contract Document terms and conditions.

.5 Schedule of Pre-ordered Products

.1 Appendix A

.6 Obtain necessary shop drawings from Consultant for inclusion in maintenance manual in accordance with Section 01 33 00 - Submittal Procedures.

1.10 PRE-PURCHASED EQUIPMENT

.1 Refer to Section Appendix A for certain items of equipment have been pre-purchased.

.2 Ensure that the purpose for pre-purchasing these equipment is to ensure delivery to Site within required Project completion schedule.

.3 Obtain necessary shop drawings from Consultant and proceed to co-ordinate details for installation, expedite, receive, unload, install, connect and test specified equipment, and be responsible for warranty.

.4 Include equipment specifications for pre-purchased items at end of project specification, printed on coloured paper for confirmation only.

.5 Notify Consultant in writing at least 7 calendar days in advance of date on which materials and equipment are required.

.1 Pick up materials and equipment no later than 30 calendar days after such date.

.6 Receive equipment Free on Board (F.O.B.), store and maintain equipment until installation.

1.11 OWNER FURNISHED ITEMS

.1 Owner Responsibilities:

.1 Arrange for delivery of shop drawings, product data, samples, manufacturer's instructions, and certificates to Contractor.

.2 Deliver supplier's bill of materials to Contractor.

.3 Arrange and pay for delivery to site in accordance with Progress Schedule.

.4 Inspect deliveries jointly with Contractor.

.5 Submit claims for transportation damage.

.6 Arrange for replacement of damaged, defective or missing items.

.7 Arrange for manufacturer's field services; arrange for and deliver manufacturer's warranties and bonds to Contractor.

.2 Contractor Responsibilities:

.1 Designate submittals and delivery date for each product in progress schedule.

.2 Review shop drawings, product data, samples, and other submittals. Submit to Consultant notification of observed discrepancies or problems anticipated due to non-conformance with Contract Documents.

.3 Receive and unload products on Site.

.4 Inspect deliveries jointly with Owner; record shortages, and damaged or defective items.

.5 Handle products on Site, including uncrating and storage.

.6 Protect products from damage, and from exposure to elements.

.7 Assemble, install, connect, adjust, and finish products.

.8 Provide installation inspections required by public authorities.

.9 Repair or replace items damaged by [Contractor] [Design-Builder] or subcontractor on site (under his control).

1.12 ALTERATIONS, ADDITIONS OR REPAIRS TO EXISTING BUILDING

.1 Execute work with least possible interference or disturbance to building operations, occupants, and normal use of premises. Arrange with Consultant and Owner to facilitate execution of work.

1.13 EXISTING SERVICES

.1 Notify, Consultant and utility companies of intended interruption of services and obtain required permission if applicable.

.2 Where Work involves breaking into or connecting to existing services, give Owner and Consultant 48 hours notice for necessary interruption of mechanical or electrical service throughout course of work. Minimize duration of interruptions. Carry out work at times as directed by governing authorities with minimum disturbance to tenant operations.

.3 Submit schedule for approval by [Consultant] for any shut-down or closure of active service or facility including power and communications services. Adhere to approved schedule and provide notice to affected parties.

.4 Protect, relocate or maintain existing active services. When inactive services are encountered, cap off in manner approved by authorities having jurisdiction.

.5 Record locations of maintained, re-routed and abandoned service lines.

1.14 DOCUMENTS REQUIRED

.1 Maintain at job site, one copy of each document as follows:

.1 Contract Drawings.

.2 Specifications.

.3 Addenda.

.4 Reviewed Shop Drawings.

.5 List of Outstanding Shop Drawings.
.6 Change Orders.
.7 Other Modifications to Contract.
.8 Field Test Reports.
.9 Copy of Approved Work Schedule.
.10 Health and Safety Plan and Other Safety Related Documents.
.11 Other documents as specified.

Part 2 Products

2.1 NOT USED

.1 Not used.

Part 3 Execution

3.1 NOT USED

.1 Not used.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

1.2 ACCESS AND EGRESS

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

1.3 USE OF SITE AND FACILITIES

.1 Execute work with least possible interference or disturbance to normal use of premises. Make arrangements with Consultant and Owner to facilitate work as stated.

.2 Maintain existing services to building and provide for personnel and vehicle access.

.3 Where security is reduced by work provide temporary means to maintain security.

.4 Owner will assign sanitary facilities for use by Contractor's personnel. Keep facilities clean.

.5 Closures: protect work temporarily until permanent enclosures are completed.

1.4 ALTERATIONS, ADDITIONS OR REPAIRS TO EXISTING BUILDING

.1 Execute work with least possible interference or disturbance to building operations. occupants, and normal use of premises. Arrange with Owner to facilitate execution of work.

1.5 EXISTING SERVICES

.1 Notify, Consultant and Owner and utility companies of intended interruption of services and obtain required permission.

.2 Where Work involves breaking into or connecting to existing services, give Owner and Consultant 48 hours of notice for necessary interruption of mechanical or electrical service throughout course of work. Keep duration of interruptions minimum. Carry out interruptions after normal working hours of occupants, preferably on weekends.

1.6 SPECIAL REQUIREMENTS

.1 Carry out noise generating Work Monday to Friday from 8:30 AM to 5:00 PM, weekend arrange can be determined if required.

.2 Submit schedule in accordance with Section 01 32 16.19 - Construction Progress Schedule - Bar (GANTT) Chart.

.3 Ensure Contractor's personnel employed on site become familiar with and obey regulations including safety, fire, traffic and security regulations.

.4 Keep within limits of work and avenues of ingress and egress.

.5 Deliver materials outside of peak traffic hours 8:30 AM to 5:00 PM unless otherwise approved by Owner and Consultant.

1.7 BUILDING SMOKING ENVIRONMENT

.1 Comply with smoking restrictions. Smoking is not permitted.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 Owner/Contractor Agreement.

.2 Canadian Construction Documents Committee (CCDC)

.1 CCDC 2 - 2020, Stipulated Price Contract.

1.2 APPLICATIONS FOR PROGRESS PAYMENT

.1 Refer to CCDC 2.

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

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

.4 Submit to Consultant, at least 7 days before first application for payment. Schedule of values for parts of Work, aggregating total amount of Contract Price, to facilitate evaluation of applications for payment.

1.3 SCHEDULE OF VALUES

.1 Refer to CCDC 2.

.2 Provide schedule of values supported by evidence as Consultant may reasonably direct and when accepted by Consultant, be used as basis for applications for payment.

.3 Include statement based on schedule of values with each application for payment.

.4 Support claims for products delivered to Place of Work but not yet incorporated into Work by such evidence as Consultant may reasonably require to establish value and delivery of products.

1.4 PREPARING SCHEDULE OF UNIT PRICE TABLE ITEMS

.1 Submit separate schedule of unit price items of Work requested in Bid form.

.2 Make form of submittal parallel to Schedule of Values, with each line item identified same as line item in Schedule of Values. Include in unit prices only:

.1 Cost of material.

.2 Delivery and unloading at site.

.3 Sales taxes.

.4 Installation, overhead and profit.

.3 Ensure unit prices multiplied by quantities given equal material cost of that item in Schedule of Values.

1.5 PROGRESS PAYMENT

.1 Refer to CCDC 2.

1.6 SUBSTANTIAL PERFORMANCE OF WORK

.1 Refer to CCDC 2.

1.7 PAYMENT OF HOLDBACK UPON SUBSTANTIAL PERFORMANCE OF WORK

.1 Refer to CCDC 2.

.2 After issuance of certificate of Substantial Performance of Work:

.1 Submit application for payment of holdback amount.

.2 Submit sworn statement that accounts for labour, subcontracts, products, construction machinery and equipment, and other indebtedness which may have been incurred in Substantial Performance of Work and for which Owner might in be held responsible have been paid in full, except for amounts properly retained as holdback or as identified amount in dispute.

.3 After receipt of application for payment and sworn statement, Consultant] will issue certificate for payment of holdback amount.

.4 Where holdback amount has not been placed in a separate holdback account, Owner will, 10 days prior to expiry of holdback period stipulated in lien legislation applicable to Place of Work, place holdback amount in bank account in joint names of Owner and Contractor.

.5 Amount authorized by certificate for payment of holdback amount is due and payable on day following expiration of holdback period stipulated in lien legislation applicable to Place of Work. Where lien legislation does not exist or apply, holdback amount is due and payable in accordance with other legislation, industry practice, or provisions which may be agreed to between parties. Owner may retain out of holdback amount sums required by law to satisfy liens against Work or, if permitted by lien legislation applicable to Place of Work, other third party monetary claims against Contractor which are enforceable against Owner.

1.8 PROGRESSIVE RELEASE OF HOLDBACK

.1 Refer to CCDC 2.

.2 Where legislation permits, if Consultant has certified that Work of subcontractor or supplier has been performed prior to Substantial Performance of Work, Owner will pay holdback amount retained for such subcontract Work, or products supplied by such supplier, on day following expiration of holdback period for such Work stipulated in lien legislation applicable to Place of Work.

1.9 FINAL PAYMENT

.1 Refer to CCDC 2, GC 5.7.

.2 Submit application for final payment when Work is completed.

.3 Consultant will, no later than 10 days after receipt of 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 7 days after reviewing Work.

.4 Consultant will issue final certificate for payment when application for final payment is found valid.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 ADMINISTRATIVE

.1 Meetings will be coordinated by the Consultant.

.2 Agenda will be provided by the Consultant.

.3 Meetings will be conducted via Teams.

.4 Consultant will record the meeting minutes. Include significant proceedings and decisions. Identify actions by parties.

.5 Consultant will reproduce and distribute copies of minutes within three days after meetings and transmit to meeting participants.

.6 Representative of Contractor, Subcontractor and suppliers attending meetings will be qualified and authorized to act on behalf of party each represents.

1.2 PRECONSTRUCTION MEETING

.1 Within 5 days after award of Contract, request a meeting of parties in contract to discuss and resolve administrative procedures and responsibilities.

.2 Establish time and location of meeting and notify parties concerned minimum 2 days before meeting.

.3 Incorporate mutually agreed variations to Contract Documents into Agreement, prior to signing.

.4 Agenda to include:

- .1 Appointment of official representative of participants in the Work.
- .2 Schedule of Work: in accordance with Section 01 32 16.19 - Construction Progress Schedule - Bar (GANTT) Chart.
- .3 Schedule of submission of shop drawings, samples, colour chips. Submit submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .4 Delivery schedule of specified equipment
- .5 Proposed changes, change orders, procedures, approvals required, mark-up percentages permitted, time extensions, overtime, administrative requirements.
- .6 Owner provided products.
- .7 Maintenance manuals in accordance with Section 01 78 00 - Closeout Submittals.
- .8 Take-over procedures, acceptance, warranties in accordance with Section 01 78 00 - Closeout Submittals.
- .9 Monthly progress claims, administrative procedures, photographs, hold backs.
- .10 Appointment of inspection and testing agencies or firms.
- .11 Insurances, transcript of policies.

1.3 PROGRESS MEETINGS

.1 During course of Work and 2 weeks prior to project completion, schedule progress meetings bi-weekly.

.2 Contractor, major Subcontractors involved in Work and Departmental Representative, DCC Representative, Consultant and Owner are to be in attendance.

.3 Consultant will record minutes of meetings and circulate to attending parties and affected parties not in attendance within 3 days after meeting.

.4 Agenda to include the following:

.1 Review, approval of minutes of previous meeting.

.2 Review of Work progress since previous meeting.

.3 Field observations, problems, conflicts.

.4 Problems which impede construction schedule.

.5 Review of off-site fabrication delivery schedules.

.6 Corrective measures and procedures to regain projected schedule.

.7 Revision to construction schedule.

.8 Progress schedule, during succeeding work period.

.9 Review submittal schedules: expedite as required.

.10 Maintenance of quality standards.

.11 Review proposed changes for affect on construction schedule and on completion date.

.12 Other business.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 DEFINITIONS

.1 Activity: element of Work performed during course of Project. Activity normally has expected duration, and expected cost and expected resource requirements. Activities can be subdivided into tasks.

.2 Bar Chart (GANTT Chart): graphic display of schedule-related information. In typical bar chart, activities or other Project elements are listed down left side of chart, dates are shown across top, and activity durations are shown as date-placed horizontal bars. Generally Bar Chart should be derived from commercially available computerized project management system.

.3 Baseline: original approved plan (for project, work package, or activity), plus or minus approved scope changes.

.4 Construction Work Week: Monday to Friday, inclusive, will provide five day work week and define schedule calendar working days as part of Bar (GANTT) Chart submission.

.5 Duration: number of work periods (not including holidays or other nonworking periods) required to complete activity or other project element. Usually expressed as workdays or workweeks.

.6 Master Plan: summary-level schedule that identifies major activities and key milestones.

.7 Milestone: significant event in project, usually completion of major deliverable.

.8 Project Schedule: planned dates for performing activities and the planned dates for meeting milestones. Dynamic, detailed record of tasks or activities that must be accomplished to satisfy Project objectives. Monitoring and control process involves using Project Schedule in executing and controlling activities and is used as basis for decision making throughout project life cycle.

.9 Project Planning, Monitoring and Control System: overall system operated by Owner and Consultant to enable monitoring of project work in relation to established milestones.

1.2 REQUIREMENTS

.1 Ensure Master Plan and Detail Schedules are practical and remain within specified Contract duration.

.2 Plan to complete Work in accordance with prescribed milestones and time frame.

.3 Limit activity durations to maximum of approximately 10 working days, to allow for progress reporting.

.4 Ensure that it is understood that Award of Contract or time of beginning, rate of progress, Interim Certificate and Final Certificate as defined times of completion are of essence of this contract.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit to Owner and Consultant within 5 working days of Award of Contract Bar (GANTT) Chart as Master Plan for planning, monitoring and reporting of project progress.

1.4 PROJECT MILESTONES

.1 Project milestones form interim targets for Project Schedule.

.1 Interior finishing and fitting, mechanical, and electrical work completed within 5 working days of Award of Contract date.

.2 Interim Certificate (Substantial Completion) within 5 working days of Award of Contract date.

1.5 MASTER PLAN

.1 Structure schedule to allow orderly planning, organizing and execution of Work as Bar Chart (GANTT).

.2 Owner and Consultant will review and return revised schedules within 5 working days.

.3 Revise impractical schedule and resubmit within 5 working days.

.4 Accepted revised schedule will become Master Plan and be used as baseline for updates.

1.6 PROJECT SCHEDULE

.1 Develop detailed Project Schedule derived from Master Plan.

.2 Ensure detailed Project Schedule includes as minimum milestone and activity types as follows:

.1 Award.

.2 Shop Drawings, Samples.

.3 Permits.

.4 Mobilization.

.5 Electrical.

.6 Piping.

.7 Ventilating

.8 Testing and Commissioning.

.9 Supplied equipment long delivery items.

.10 Engineer supplied equipment required dates.

1.7 PROJECT SCHEDULE REPORTING

.1 Update Project Schedule on bi-weekly basis reflecting activity changes and completions, as well as activities in progress.

.2 Include as part of Project Schedule, narrative report identifying Work status to date, comparing current progress to baseline, presenting current forecasts, defining problem areas, anticipated delays and impact with possible mitigation.

1.8 PROJECT MEETINGS

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

.2 Weather related delays with their remedial measures will be discussed and negotiated.

Part 2 Products

2.1 NOT USED

.1 Not used.

Part 3 Execution

3.1 NOT USED

.1 Not used.

END OF SECTION

Part 1 General

1.1 ADMINISTRATIVE REQUIREMENTS

.1 Submit to Consultant submittals listed for review. Submit promptly and in orderly sequence to not cause delay in Work. Failure to submit in ample time is not considered sufficient reason for extension of Contract Time and no claim for extension by reason of such default will be allowed.

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

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

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

.5 Review submittals before submission to Consultant. This review represents that necessary requirements have been determined and verified, or will be, and that each submittal has been checked and coordinated with requirements of Work and Contract Documents. Submittals not stamped, signed, dated and identified as to specific project will be returned without being examined and considered rejected.

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

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

.8 Contractor's responsibility for errors and omissions in submission is not relieved by 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 reviewed copy of each submission on site.

1.2 SHOP DRAWINGS AND PRODUCT DATA

.1 Refer to CCDC 2 GC 3.11.

.2 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.

.3 Submissions to include:

- .1 Date and revision dates.
- .2 Project title and number.
- .3 Name and address of:
  - .1 Subcontractor.
  - .2 Supplier.

.3 Manufacturer.

.4 Contractor's stamp, signed by Contractor's authorized representative certifying approval of submissions, verification of site measurements and compliance with Contract Documents.

.5 Details of appropriate portions of Work as applicable:

.1 Fabrication.

.2 Layout, showing dimensions, including identified site dimensions and clearances.

.3 Setting or erection details.

.4 Capacities.

.5 Performance characteristics.

.6 Standards.

.7 Operating weight.

.8 Wiring diagrams.

.9 Single line and schematic diagrams.

.10 Relationship to adjacent work.

.4 After Consultant's review, distribute copies.

.5 Submit electronic copy of shop drawings for each requirement requested in specification Sections and as Consultant may reasonably request.

.6 Submit 1 electronic copies of product data sheets or brochures for requirements requested in specification Sections and as requested by Consultant where shop drawings will not be prepared due to standardized manufacture of product.

.7 Submit 1 copies of test reports for requirements requested in specification Sections and as requested by Consultant and Owner.

.1 Report signed by authorized official of testing laboratory that material, product or system identical to material, product or system to be provided has been tested in accord with specified requirements.

.2 Testing must have been within 3 years of date of Contract award for project.

.8 Submit 1 electronic copies of certificates for requirements requested in specification Sections and as requested by Consultant.

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

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

.9 Submit 1 copy of manufacturers instructions for requirements requested in specification Sections and as requested by Consultant.

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

.10 Submit 1 copy of Manufacturer's Site Reports for requirements requested in specification Sections and as requested by Consultant.

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

.12 Submit 3 copies of Operation and Maintenance Data for requirements requested in specification Sections and as requested by Departmental Representative Owner and Consultant.

.13 Delete information not applicable to project.

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

.15 If upon review by Owner and 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 resubmission of corrected shop drawings, through same procedure indicated above, must be performed before fabrication and installation of Work may proceed.

1.3 SAMPLES

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

.2 Notify Owner and Consultant in writing, at time of submission of deviations in samples from requirements of Contract Documents.

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

.4 Adjustments made on samples Owner and Consultant are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to Owner and Consultant before proceeding with Work.

.5 Make changes in samples Owner and Consultant may require, consistent with Contract Documents.

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

1.4 MOCK-UPS

.1 Erect mock-ups in accordance with section 01 43 00 - Quality Assurance.

1.5 PHOTOGRAPHIC DOCUMENTATION

.1 Submit electronic copy of colour digital photography in jpg format, standard resolution as directed by the Consultant.

.2 Project identification: name and number of project and date of exposure indicated.

.3 Number of viewpoints: 2 locations.

.1 Viewpoints and their location as determined Consultant.

1.6 CERTIFICATES AND TRANSCRIPTS

.1 Immediately after award of Contract, submit Workers' Compensation Board status.

.2 Submit transcription of insurance immediately after award of Contract.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Hazardous Materials Report

1.2 REFERENCE STANDARDS

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

.2 Northwest Territories and Nunavut

.1 Safety Act, R.S.N.W.T. - Updated 2012.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

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

.1 Results of site specific safety hazard assessment.

.2 Results of safety and health risk or hazard analysis for site tasks and operation found in work plan.

.3 Submit Electronic copies of Contractor's authorized representative's work site health and safety inspection reports to Owner and 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 Owner will review Contractor's site-specific Health and Safety Plan and provide comments to Contractor within 5 days after receipt of plan. Revise plan as appropriate and resubmit plan to Owner within 4 days after receipt of comments from Owner.

.7 Owner review of Contractor's final Health and Safety plan should not be construed as approval and does not reduce the Contractor's overall responsibility for construction Health and Safety.

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

1.4 FILING OF NOTICE

.1 File Notice of Project with Territorial authorities prior to beginning of Work.

1.5 SAFETY ASSESSMENT

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

1.6 MEETINGS

.1 Schedule and administer Health and Safety meeting with Owner prior to commencement of Work.

1.7 REGULATORY REQUIREMENTS

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

1.8 PROJECT/SITE CONDITIONS

.1 N/A – currently no unforeseen conditions.

1.9 GENERAL REQUIREMENTS

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

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

1.10 RESPONSIBILITY

.1 Be responsible for health and safety of persons on site, safety of property on site and for protection of persons adjacent to site and environment to extent that they may be affected by conduct of Work.

1.11 COMPLIANCE REQUIREMENTS

.1 Comply with Safety Act, General Safety Regulations, R.R.N.W.T.

1.12 UNFORSEEN HAZARDS

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

1.13 HEALTH AND SAFETY CO-ORDINATOR

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

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

.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.

1.14 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 Territory having jurisdiction, and in consultation with Owner.

1.15 CORRECTION OF NON-COMPLIANCE

.1 Immediately address health and safety non-compliance issues identified by authority having jurisdiction or by Owner.

.2 Provide Owner with written report of action taken to correct non-compliance of health and safety issues identified.

.3 Owner may stop Work if non-compliance of health and safety regulations is not corrected.

1.16 WORK STOPPAGE

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

Part 2 Products

2.1 NOT USED

.1 Not used.

Part 3 Execution

3.1 NOT USED

.1 Not used.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 This Section references laws, bylaws, ordinances, rules, regulations, codes, orders of Authority Having Jurisdiction (AHJ), and other legally enforceable requirements applicable to the Work and that are or become enforced during performance of the Work.

1.2 RELATED REQUIREMENTS

.1 List other Sections that are referenced in this Section that contain specific information that the reader might expect to find in this Section but is specified elsewhere. Typically, this list does not include Division 00 or Division 01 Sections.

.1 23 05 93 – Testing, Adjusting and Balancing for HVAC

1.3 DEFINITIONS

.1 Reference Standards: Means consensus standards, trade association standards, guides, and other publications expressly referenced in the Contract Documents.

1.4 REFERENCE STANDARDS AND REFERENCE DOCUMENTS

.1 If specified referenced standards do not indicate an edition or version, the latest edition or revision issued by the publisher at the time of bid closing shall apply, except as follows:

.1 If a particular edition or revision date of a specified standard is referenced in an applicable code or other regulatory requirement, the edition or version in the regulatory reference shall apply.

.2 The specified reference standards establish minimum requirements. If Contract Documents indicate requirements that conflict with a reference standard, the more stringent requirements shall apply.

.3 If multiple reference standards are specified and the standards establish different requirements, the most stringent requirement shall apply.

.4 In case of discrepancy or uncertainties, refer to Consultant for interpretation or clarification.

1.5 CODES

.1 Building Code: Perform Work in accordance with the National Building Code of Canada (NBC) including amendments up to the time of bid closing and other codes of provincial or local application.

.2 Fire Code: Perform Work in accordance with the National Fire Code of Canada (NFC) 2020 including amendments up to the time of bid closing and other codes of provincial or local application.

.3 If there is a conflict or discrepancy between codes, the most stringent requirements shall apply.

.4 Specific design and performance requirements listed in Specifications and indicated on Drawings may exceed minimum requirements established by referenced Codes; these requirements will govern over the minimum requirements listed in the referenced Codes.

1.6 FEES

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

.1 Regulatory requirements and fees in force at the time of bid closing, and

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

Part 2 Products

2.1 PERMIT REQUIREMENTS

.1 Development Permit: Owner has applied for, obtained, and paid for development permit.

.2 Building Permit:

.1 Contractor shall apply for, obtain and pay for building permit on behalf of Owner, and other permits required for Work and its various parts.

.2 Contractor shall display building permit and other permits in a conspicuous location at the Place of the Work.

.3 Occupancy Permits:

.1 Contractor shall apply for, obtain, and pay for occupancy permits, including partial occupancy permits where required by AHJ.

.2 Contractor shall correct deficiencies in accordance with Consultant's instructions. If a deficiency is not corrected, the Owner reserves the right to make correction and charge Contractor for costs incurred.

.3 Contractor shall turn occupancy permits over to Owner.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 DEFINITIONS

.1 Mock-up: A full-size physical example that demonstrates materials, finishes, interrelationship of materials and assemblies, aesthetic effects, and execution. A mock-up may demonstrate coordination of multiple Subcontractors' work. A mock-up establishes a standard by which the Work will be judged. Mock-ups are not samples.

.2 Quality Assurance: Procedures for preventing defects and deficiencies before and during execution of the Work.

.3 Quality Audit: Systematic and independent examination to determine whether <linkref rid="https://en.wikipedia.org/wiki/Quality_system" xmlns="NMS">quality requirements</linkref> have been fulfilled as planned. A quality audit will examine processes, products and services to determine if they have been implemented effectively to achieve their specified objective.

1.2 REFERENCE STANDARDS

.1 ASTM International (ASTM):

.1 ASTM E329-[20]<linkref rid="https://compass.astm.org/EDIT/html_annot.cgi?E329+20" xmlns="NMS">Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection</linkref>

1.3 SECTION INCLUDES

.1 This Section describes administrative and procedural requirements for proactive Contractor activities to assure the quality of construction before and during execution of the Work.

1.4 ADMINISTRATIVE REQUIREMENTS

.1 Contractor is responsible for self-performed testing and inspections and submittal of test reports to Consultant and Owner.

1.5 Owner will employ and pay for quality audit services performed through third-party observation and testing to validate the Contractor's performance of the Work.

1.6 Contractor to provide a Quality Management System that establishes a standardized approach to managing quality of materials and workmanship during the execution of Work,

1.7 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Submit a detailed testing and inspections schedule to Consultant in accordance with the Contractor's Quality Management System.

.3 Submit certificates for products. Process, and system for verification approval by Consultant.

.4 Submit formal testing and inspections reports per ASTM E329 as indicated in technical specification Sections to Consultant and Owner in accordance with contractual agreement.

.5 Submit one digital copy and one hardcopy of each quality assurance inspection and test report to Owner and Consultant, except where a technical specification Section indicates otherwise.

.6 Submit mill test certificates as required in technical specification Sections [and as indicated on Drawings].

1.8 QUALIFICATIONS

.1 Manufacturers' Qualifications:

.1 specializes in manufacturing the products specified in the technical Section of the Project's construction specification.

.2 minimum 3 years documented experience with a record of successful performance

.2 Suppliers' Qualifications:

.1 authorized to distribute manufacturer's products

.2 has capacity to supply required products without delaying the Project

.3 Fabricators' Qualifications:

.1 experienced in producing products required for this Project

.2 successful record of in-service performance

.3 sufficient production capacity to fabricate required products without delaying the Project

.4 Installer Qualifications:

.1 firm or individual experienced in design and installation, application, and erection of materials to the extent required for this Project

.2 successful record of in-service performance

.5 Testing and Inspecting Agency Qualifications:

.1 accredited organizations by the Standards Council of Canada for testing and inspection

.2 capable of reliably performing testing of building products and inspections of construction activities in accordance with ASTM E329.

.6 Licensed Professionals Qualifications:

.1 individual registered or licensed to practice their respective design profession as defined by the statutory requirements of the professional registration laws of the state or jurisdiction in which the project is to be constructed.

1.9 CERTIFICATIONS

.1 Ensure that certification of products, processes, and systems includes physical and examination testing as specified in ASTM E329 to confirm compliance with Specifications requirements.

1.10 COORDINATION

.1 Coordinate and schedule tests and inspections with accredited inspection agencies as indicated in Contract Documents.

.2 Coordinate Quality Management System with Owner and Consultant for reporting, scheduling access and incidental labour required by Quality Auditor's reports if required.

.3 Obtain Consultant approval before proceeding with tests and inspections, and additional tests and inspections as may be reasonably requested by Consultant and Owner.

.4 Coordinate testing and inspections schedule with SubContractor, testing agencies, and other affected parties.

1.11 Mock-ups

.1 Mock-ups can be used as a reference for assessing quality of workmanship and site-applied finishes as requested in the project's Contract Documents.

.2 Obtain Consultant's acceptance of mock-ups installation before beginning to install those portions of the Work represented by the mock-up.

.3 Assemble mock-ups at the Place of the Work in locations acceptable to Consultant, or where location is indicated in the technical specification Section.

.4 Schedule mock-ups ready for Consultant 's review and in orderly sequence, to avoid delays in Work.

.1 Failure to prepare mock-ups in ample time is not considered sufficient reason to request an extension of Contract Time. Claims for extension of Contract Time by reason of such default will not be considered.

.5 Construct mock-ups using materials, finishes, colours, and methods proposed for the completed Work. Mock-ups to demonstrate proposed workmanship and range of aesthetic appearance.

.6 Where a mock-up represents or affects multiple specification Sections, coordinate activities of these Subcontractors to ensure mock-ups are complete.

.7 Modify or replace mock-ups when unacceptable to Consultant.

.8 Maintain acceptable mock-ups in an undisturbed condition as a standard for judging the completed Work.

.9 Mock-ups may remain as part of Work, unless indicated otherwise in a technical specification Section.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 RELATED SECTION

.1 Section 23 09 33 – Testing, Adjusting and Balancing for HVAC

1.2 SUMMARY

.1 This Section describes administrative and procedural requirements for reactive activities to verify that completed Work conforms to Contract Documents requirements.

.2 Having inspection and testing agencies by Contractor or Owner does not relieve the Contractor of their responsibility to perform Work in accordance with Contract Documents.

1.3 ADMINISTRATIVE REQUIREMENTS

.1 Allow and coordinate access to Work on site, with inspection and testing agencies.

.2 Retain and pay for inspection and testing that are designated for Contractor's own quality control plan, and when testing and inspection are required by AHJ.

.3 Give advanced notice to Owner and Consultant and to each inspection/testing agency for inspection and testing required by Contract Documents or by AHJ.

.4 In advance of each test, notify appropriate agency Owner and Consultant in the order that attendance arrangements can be made.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Submit schedule of testing and inspection activities to Owner and Consultant, applicable Subcontractors, testing agencies, and other affected parties. Include the following:

- .1 List each testing and inspection agency
- .2 Identify types of tests and inspections for each agency, and cross reference to applicable specification Section number-title in Contract Documents
- .3 Description of test and inspection
- .4 Identify applicable reference standard
- .5 Identify test and inspection method
- .6 Indicate number of each test and inspection required

.3 Submit one digital copy of each quality assurance inspection and test report to Consultant and Owner, except where a technical specification Section indicates otherwise.

.4 Submit reports for inspection and testing required by Contract Documents or by AHJ and performed by Contractor-retained inspection and testing agencies within ten days after inspection or test is completed, except where a technical specification Section indicates a different time period.

.5 Submit one digital copy of each quality control inspection and test report to the Consultant, except where a technical specification Section indicates otherwise.

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

1.5 SITE QUALITY CONTROL PROCEDURES

.1 Provide labour, Construction Equipment, and temporary facilities to obtain and handle test samples and materials on site. Arrange for sufficient space to store and cure test samples.

.2 Deliver samples and materials required for testing, as requested in technical specification Sections. Submit with reasonable promptness and in an orderly sequence to avoid delays in Work.

1.6 TESTING AND INSPECTION SERVICES

.1 Owner will retain and pay for independent inspection and testing agencies to inspect, test, or perform other quality control reviews of parts of the work, except where indicated otherwise.

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

.3 Correct defects and deficiencies when they are revealed during inspection or testing as advised by consultant at no change to Contract Price or Contract Time. Pay costs for retesting and re-inspection. Appointed agency will request additional inspections or tests to ensure full degree of defects or deficiencies are revealed and corrected.

.4 Quality control testing and inspection reports to include the following:

.1 Project name and number
.2 Testing/Inspection agency's name, address, telephone number, and website
.3 Date of issuing report
.4 Dates and locations of tests, inspections, or samples
.5 Description of the Work and test and inspection method
.6 Numbers and titles of associated specification Sections
.7 Test and inspection data and interpretation of test results (e.g., pass or fail)
.8 Ambient conditions at time of test, inspection, or sampling
.9 Recommendations on re-testing and re-inspecting, if applicable

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

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

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Submit proof of anchor and fastener load carrying capacity for a work result, when requested.

.3 Submit written request before cutting or altering to existing conditions which may affect the following:

- .1 structural integrity of existing elements: Submit structural details and calculations performed by a professional structural engineer registered or licensed in Northwest Territories, Canada. Include evidence of unsatisfactory structural integrity of the elements according to Consultant.
- .2 integrity of weather-exposed and moisture-resistant elements
- .3 efficiency, maintenance, safety, or accessibility of operational elements
- .4 visual qualities of sight-exposed elements.
- .5 Work of Owner

.4 Submit a request for cutting or altering which includes:

- .1 identification of the Project; and
- .2 location and description of affected existing conditions including changes to structural elements, function of elements, and visual appearance of existing elements; and the location and identification of utilities that will be temporarily out of service during cutting and patching activities.

.5 Submit site plan drawings indicating relative location of various services and equipment upon the request of Owner and Consultant.

.6 Submit a work plan including:

- .1 a statement why cutting or altering is unavoidable and describe alternatives to cutting and patching if available;
- .2 a description of proposed work and proposed Products;
- .3 the effect of cutting or altering on work by Owner or other contractors;
- .4 written acknowledgement by other contractors affected by cutting or altering, if applicable; and
- .5 proposed date(s) and time(s) work will be executed.

1.3 QUALIFICATIONS

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

Part 2 Products

2.1 MATERIALS

.1 Patching Materials: If possible, use the same materials found in the existing conditions, except in fire-resistance rated materials and assemblies.

.2 Materials Visible from the Floor Area: Use materials that visually match existing adjacent surfaces, and match existing functional performance.

Part 3 Execution

3.1 COMMON INSTALLATION/APPLICATION/ERECTION REQUIREMENTS

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

.2 Remove and replace defective and non-conforming Work.

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

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

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

.6 Provide openings in non-structural elements for penetrations of mechanical and electrical work.

.7 Conceal pipes, ducts and wiring in floor, wall, partition, and ceiling assemblies in finished areas, except where indicated otherwise.

.8 In addition to the manufacturer's recommendations for safety, access, accessibility, and maintenance, locate equipment, fixtures, and distribution systems where it shall provide minimal interference and shall maximize on usable space.

.1 Location of equipment, fixtures, and outlets indicated on Drawings and specifications are approximate.

.2 Notify Owner and Consultant of impending installation and obtain approval for actual locations.

3.2 CUTTING AND PATCHING

.1 Proceed with cutting and patching after the review and acceptance by the Owner and Consultant of all submittals listed in Article 1.03, Actions and Informational Submittals.

.2 Perform cutting, fitting, and patching [including excavation and fill,] to complete Work in accordance with related technical specification Sections.

.3 Use special techniques to avoid damaging existing conditions that will remain, and which will result in proper surfaces to receive patching and finishing.

.4 Employ original installer to perform cutting and patching for weather-exposed elements, moisture-resistant elements, and surfaces exposed to view.

.5 Cut rigid materials using masonry saw, core drill, or other tool recommended by the product manufacturer or applicable industry association. Pneumatic or impact tools are not allowed on masonry work without the approval the Owner.

.6 Fit Work to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.

.7 Refinish surfaces to match adjacent finishes. Refinish continuous surfaces to nearest intersection (e.g., edges of partition). Provide entire surface with uniform finish, colour, and texture.

3.3 ADJUSTING

.1 Remove and replace patching that is visually unsatisfactory to Owner.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 Canadian Construction Documents Committee (CCDC)

.1 CCDC 2, Stipulated Price Contract.

1.2 PROJECT CLEANLINESS

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

.2 Remove waste materials from site at daily regularly scheduled times or dispose of as directed by Owner. Do not burn waste materials on site.

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

.4 On-site containers are not required. Please use local waste facilities for disposal as indicated by Owner.

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

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

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

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

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

1.3 FINAL CLEANING

.1 Refer to CCDC 2, GC 3.14.

.2 When Work is Substantially Performed remove surplus products, tools, construction machinery and equipment not required for performance of remaining Work.

.3 Remove waste products and debris other than that caused by others, and leave Work clean and suitable for occupancy.

.4 Prior to final review remove surplus products, tools, construction machinery and equipment.

.5 Remove waste products and debris related to the renovation that caused by Owner or other Contractors.

.6 Remove waste materials from site at regularly scheduled times or dispose of as directed by Owner. Do not burn waste materials on site.

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

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

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

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

.11 Wax, seal, shampoo or prepare floor finishes, as recommended by manufacturer if required.

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

.13 Clean roofs, downspouts, and drainage systems, if applicable in regards to the renovation.

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

1.4 WASTE MANAGEMENT AND DISPOSAL

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

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 This Section includes requirements for management of construction waste and disposal, which forms the Contractor 's commitment to reduce and divert waste materials from landfill and includes the following:

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

1.2 RELATED REQUIREMENTS

1.3 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 building materials, packaging, trash, debris, and rubble resulting from construction, repair and demolition operations.

.3 Hazardous: Exhibiting the characteristics of hazardous substances including properties such as ignitability, corrosiveness, toxicity, or reactivity.

.4 Non-hazardous: Exhibiting none of the characteristics of hazardous substances, including properties such as ignitability, corrosiveness, toxicity, or reactivity.

.5 Non-toxic: Not poisonous to humans either immediately or 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 remanufactured into a new product for reuse by others.

.7 Recycle: To remove a waste material from the Project site to another site for remanufacture 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 particleboard, fiberboard, 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.

1.4 REFERENCE STANDARDS

.1 ASTM International (ASTM)

.1 ASTM E1609 01, Standard Guide for Development and Implementation of a Pollution Prevention Program

1.5 ADMINISTRATIVE REQUIREMENTS

.1 Coordination: Coordinate waste management requirements with all Divisions of the Work for the Project and ensure that requirements of the Construction Waste Management Plan are followed.

.2 Preconstruction Meeting: Arrange a pre-construction meeting in accordance with Section 01 31 19 - Project Meetings before starting any Work of the Contract attended by the Owner, Contractor, affected Subcontractor 's and Departmental Representative, Consultant to discuss the Contractor 's Construction Waste Management Plan and to develop mutual understanding of the requirements for a consistent policy towards waste reduction and recycling.

1.6 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Action Submittals: Provide the following submittals before starting any work of this Section:

1.7 PROJECT CLOSEOUT SUBMITTALS

.1 Record Documentation Diversion Documentation: Submit as constructed information in accordance with Section Section 01 78 00 - Closeout Submittals as follows:

1.8 QUALITY ASSURANCE

.1 Resources for Development of Construction Waste Management Report (CWM Report): The following sources may be useful in developing the Draft Construction Waste Management Plan:

.1 Recycling Haulers and Markets: Investigate local haulers and markets for recyclable materials, and incorporate into CWM Plan.

.2 Waste-to-Energy Systems: Investigate local waste-to-energy incentives where systems for diverting materials from landfill for reuse or recycling are not available.

1.9 DELIVERY, STORAGE, AND HANDLING

.1 Storage Requirements: Implement a recycling/reuse program that includes separate collection of waste materials as appropriate to the Project waste and the available recycling and reuse programs in the Project area.

.2 Handling Requirements: Clean materials that are contaminated before placing in collection containers and ensure that waste destined for landfill does not get mixed in with recycled materials:

.1 Deliver materials free of dirt, adhesives, solvents, petroleum contamination, and other substances deleterious to recycling process.

.2 Arrange for collection by or delivery to the appropriate recycling or reuse facility.

.3 Hazardous Waste and Hazardous Materials: Handle in accordance with applicable regulations.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 (CWM PLAN) IMPLEMENTATION

.1 Manager: Contractor is responsible for designating an on site party or parties responsible for instructing workers and overseeing and documenting results of the CWM Plan for the Project.

.2 Distribution: Distribute copies of the CWM Plan to the job site foreman, each], the Owner, the Consultant and other site personnel as required to maintain CWM Plan.

.3 Instruction: Provide on-site instruction of appropriate separation, handling, and recycling, salvage, reuse, composting and return methods being used for the Project to Subcontractor 's at appropriate stages of the Project.

.4 Separation Facilities: Lay out and label a specific area to facilitate separation of materials for potential recycling, salvage, reuse, composting and return:

.1 Recycling and waste bin areas are to be kept neat and clean and clearly marked in order to avoid contamination of materials.

.2 Hazardous wastes shall be separated, stored, and disposed of in accordance with local regulations.

3.2 SUBCONTRACTOR'S RESPONSIBILITY

.1 Subcontractor's shall cooperate fully with the Contractor to implement the CWM Plan.

.2 Failure to cooperate may result in the Owner not achieving their environmental goals, and may result in penalties being assessed by the Contractor to the responsible Subcontractor's.

3.3 SAMPLE CONSTRUCTION WASTE MANAGEMENT FORMS

.1 Sample waste tracking form below can be used by the Contractor to establish their own forms for recording management of construction waste:

SAMPLE WASTE MANAGEMENT FORM

Material Stream	Diverted Waste by Report Date	Total	Units				
	Sept			Oct	Nov	Dec	
Material Streams Contributing to Credit	Plastic	1.25	2.5	10	5	18.75	m^3
	Carpet	2.5	2.5	2.5	0	7.5	m^3
	Paper/Cardboard	5	2.5	2.5	5	15	m^3
	Clean Wood	0	25	0	1.25	26.25	m^3
	Metal	1.25	2.5	5.5	7	16.25	m^3
	Gypsum Board	2.5	2.5	4	5	14	m^3
	Brick/Concrete	10.5	2.5	5.5	8.75	27.25	m^3
	Asphalt Shingles	10	0	0	0	10	m^3
Total Diverted Waste	135	m^3					
Material Streams not Contributing to Credit	Landfill	10.75	7.5	15	10	43.25	m^3
	Screen Fines (ADC)	5	1.25	0	2.5	8.75	m^3
	150 mm Minus (ADC	1.25	1.25	5	5.5	13	m^3
Total Landfill/ADC Waste	65	m^3					
Total Waste	200	m^3					
Percent Diverted	67.5	%					

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

1.2 ADMINISTRATIVE REQUIREMENTS

.1 Pre-warranty Meeting:

.1 Convene meeting one week before Contract completion with contractor's representative, Owner and Consultant Section 01 31 19 - Project Meetings to:

.1 Verify Project requirements.

.2 Review manufacturer's installation instructions and warranty requirements.

.2 Consultant to establish communication procedures for:

.1 Notifying construction warranty defects.

.2 Determine priorities for type of defects.

.3 Determine reasonable response time.

.3 Contact information for bonded and licensed company for warranty work action: provide name, telephone number and address of company authorized for construction warranty work action.

.4 Ensure contact is located within local service area of warranted construction, is continuously available, and is responsive to inquiries for warranty work action.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Two weeks before Substantial Performance of the Work, submit to the Owner and Consultant, 4 final copies of operating and maintenance manuals in English.

.3 Provide spare parts, maintenance materials and special tools of same quality and manufacture as products provided in Work.

.4 Provide evidence, if requested, for type, source and quality of products supplied.

1.4 FORMAT

.1 Organize data as instructional manual.

.2 Binders: Vinyl, hard covered, 3 'D' ring, loose leaf 219 x 279 mm with spine and face pockets.

.3 When multiple binders are used correlate data into related consistent groupings.

.1 Identify contents of each binder on spine.

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

.5 Arrange content by systems, process flow, 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.

.1 Bind in with text; fold larger drawings to size of text pages.

.9 Provide 1:1 scaled CAD files in dwg format on [CD].

1.5 CONTENTS - PROJECT RECORD DOCUMENTS

.1 Table of Contents for Each Volume: provide title of project;

.1 Date of submission; names.

.2 Addresses, and telephone numbers of Consultant and Owner with name of responsible parties.

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

.2 For each product or system:

.1 List names, addresses and telephone numbers of subcontractors and suppliers, including local source of supplies and replacement parts.

.3 Product Data: mark each sheet to identify specific products and component parts, and data applicable to installation; delete inapplicable information.

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

.5 Typewritten Text: As required to supplement product data.

.1 Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions specified in Section 01 45 00 - Quality Control.

.6 Training: Refer to Section 01 79 00 - Demonstration and Training.

1.6 AS-BUILT DOCUMENTS AND SAMPLES

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

.1 Contract Drawings.

.2 Specifications.

.3 Addenda.

.4 Change Orders and other modifications to Contract.

.5 Reviewed shop drawings, product data, and samples.

.6 Site test records.

.7 Inspection certificates.

.8 Manufacturer's certificates.

.2 Store record documents and samples in site office apart from documents used for construction.

.1 Provide files, racks, and secure storage.

.3 Label record documents and file in accordance with Section number listings in List of Contents of this Project Manual.

.1 Label each document "PROJECT RECORD" in neat, large, printed letters.

.4 Maintain record documents in clean, dry and legible condition.

.1 Do not use record documents for construction purposes.

.5 Keep record documents and samples available for inspection by [Departmental Representative] [DCC Representative] [Consultant].

1.7 RECORDING INFORMATION ON PROJECT RECORD DOCUMENTS

.1 Record information on set of blue line opaque drawings, and in copy of Project Manual, provided by Owner Consultant.

.2 Use felt tip marking pens, maintaining separate colours for each major system, for recording information.

.3 Record information concurrently with construction progress.

.1 Do not conceal Work until required information is recorded.

.4 Contract Drawings and shop drawings: mark each item to record actual construction, including:

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

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

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

.4 Site changes of dimension and detail.

.5 Changes made by change orders.

.6 Details not on original Contract Drawings.

.7 Referenced Standards to related shop drawings and modifications.

.5 Specifications: mark each item to record actual construction, including:

.1 Manufacturer, trade name, and catalogue number of each product actually installed, particularly optional items and substitute items.

.2 Changes made by Addenda and change orders.

.6 Other Documents: Maintain [manufacturer's certifications,] [inspection certifications,] [site test records,] required by individual specifications Sections.

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

1.8 FINAL SURVEY

.1 Submit final site survey certificate in accordance with Section [01 71 00 - Examination and Preparation], certifying that elevations and locations of completed Work are in conformance, or non-conformance with Contract Documents.

1.9 EQUIPMENT AND SYSTEMS

.1 For each item of equipment and each system include description of unit or system, and component parts.

.1 Give function, normal operation characteristics and limiting conditions.

.2 Include performance curves, with engineering data and tests, and complete nomenclature and commercial number of replaceable parts.

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

.3 Include installed colour coded wiring diagrams.

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

.1 Include regulation, control, stopping, shut-down, and emergency instructions.

.2 Include summer, winter, and any special operating instructions.

.5 Maintenance Requirements: include routine procedures and guide for trouble-shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.

.6 Provide servicing and lubrication schedule, and list of lubricants required.

.7 Include manufacturer's printed operation and maintenance instructions.

.8 Include sequence of operation by controls manufacturer.

.9 Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.

.10 Provide installed control diagrams by controls manufacturer.

.11 Provide [Contractor's] [Design-Builder's] coordination drawings, with installed colour coded piping diagrams.

.12 Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.

.13 Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.

.14 Include test and balancing reports as specified in Section 01 45 00 - Quality Control and Section 01 91 13 - General Commissioning Requirements.

1.10 MATERIALS AND FINISHES

.1 Building products, applied materials, and finishes: Include product data, with catalogue number, size, composition, and colour and texture designations.

.1 Provide information for re-ordering custom manufactured products.

.2 Instructions for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.

.3 Moisture-protection and weather-exposed products: Include manufacturer's recommendations for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.

.4 Additional requirements: As specified in individual specifications Sections.

1.11 MAINTENANCE MATERIALS

.1 Spare Parts:

.1 Provide spare parts, in quantities specified in individual specification Sections.

.2 Provide items of same manufacture and quality as items in Work.

.3 Deliver to [site] [location as directed]; place and store.

.4 Receive and catalogue items.

.1 Submit inventory listing to Owner and Consultant.

.2 Include approved listings in Maintenance Manual.

.5 Obtain receipt for delivered products and submit before final payment.

.2 Extra Stock Materials:

.1 Provide maintenance and extra materials, in quantities specified in individual specification Sections.

.2 Provide items of same manufacture and quality as items in Work.

.3 Deliver to site; place and store.

.4 Receive and catalogue items.

.1 Submit inventory listing to Owner and Consultant.

.2 Include approved listings in Maintenance Manual.

.5 Obtain receipt for delivered products and submit before to final payment.

.3 Special Tools:

.1 Provide special tools, in quantities specified in individual specification Section.

.2 Provide items with tags identifying their associated function and equipment.

.3 Deliver to site; place and store.

.4 Receive and catalogue items.

.1 Submit inventory listing to Owner and Consultant.

.2 Include approved listings in Maintenance Manual.

1.12 DELIVERY, STORAGE, AND HANDLING

.1 Store spare parts, maintenance materials, and special tools in manner to prevent damage or deterioration.

.2 Store in original and undamaged condition with manufacturer's seal and labels intact.

.3 Store components subject to damage from weather in weatherproof enclosures.

.4 Store paints and freezable materials in a heated and ventilated room.

1.13 Remove and replace damaged products at own expense and for review by Owner and Consultant.

1.14 WARRANTIES AND BONDS

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

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

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

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

.5 Submit, warranty information made available during construction phase, to Owner and Consultant for approval before each monthly pay estimate.

.6 Assemble approved information in binder, submit upon acceptance of work and organize binder as follows:

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

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

.3 Obtain warranties and bonds, executed in duplicate by Subcontractors, suppliers, and manufacturers, within [ten] days after completion of applicable item of work.

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

.5 Co-execute submittals when required.

.6 Retain warranties and bonds until time specified for submittal.

.7 Except for items put into use with Owner's permission, leave date of beginning of time of warranty until Date of Substantial Performance is determined.

.8 Conduct joint 9 month warranty inspection, measured from time of acceptance, by Consultant and Owner.

.9 Include information contained in warranty management plan as follows:

.1 Roles and responsibilities of personnel associated with warranty process, including points of contact and telephone numbers within the organizations of Contractors, Subcontractors, manufacturers, or suppliers involved.

.2 Listing and status of delivery of Certificates of Warranty for extended warranty items, to include commissioned systems.

.3 Provide list for each warranted equipment, item, feature of construction or system indicating:

.1 Name of item.

.2 Model and serial numbers.

.3 Location where installed.

.4 Name and phone numbers of manufacturers or suppliers.

.5 Names, addresses and telephone numbers of sources of spare parts.

.6 Warranties and terms of warranty: include one-year overall warranty of construction. Indicate items that have extended warranties and show separate warranty expiration dates.

.7 Cross-reference to warranty certificates as applicable.

.8 Starting point and duration of warranty period.

.9 Summary of maintenance procedures required to continue warranty in force.

.10 Cross-Reference to specific pertinent Operation and Maintenance manuals.

.11 Organization, names and phone numbers of persons to call for warranty service.

.12 Typical response time and repair time expected for various warranted equipment.

.4 Contractor's plans for attendance at 9 month post-construction warranty inspections.

.5 Procedure and status of tagging of equipment covered by extended warranties.

.6 Post copies of instructions near selected pieces of equipment where operation is critical for warranty and/or safety reasons.

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

.11 Written verification to follow oral instructions.

.1 Failure to respond will be cause for the Owner to proceed with action against Contractor.

1.15 WARRANTY TAGS

.1 Tag, at time of installation, each warranted item. Provide durable, oil- and water-resistant tag approved Owner.

.2 Attach tags with copper wire and spray with waterproof silicone coating.

.3 Leave date of acceptance until project is accepted for occupancy.

.4 Indicate the following information on tag:

.1 Type of product/material.

.2 Model number.

.3 Serial number.

.4 Contract number.

.5 Warranty period.

.6 Inspector's signature.

.7 Construction Contractor.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 ADMINISTRATIVE REQUIREMENTS

.1 Demonstrate scheduled operation and maintenance of equipment and systems to Owner's personnel one week before date of final inspection.

.2 Owner: Provide list of personnel to receive instructions and coordinate their attendance at agreed-upon times.

.3 Preparation:

- .1 Verify conditions for demonstration and instructions comply with requirements.
- .2 Verify designated personnel are present.
- .3 Ensure testing, adjusting, and balancing has been performed in accordance with Section 01 91 13 - General Commissioning Requirements and equipment and systems are fully operational.

.4 Demonstration and Instructions:

- .1 Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, and maintenance of each item of equipment at scheduled times, at the equipment designated location.
- .2 Instruct personnel in phases of operation and maintenance using operation and maintenance manuals as basis of instruction.
- .3 Review contents of manual in detail to explain aspects of operation and maintenance.
- .4 Prepare and insert additional data in operations and maintenance manuals when needed during instructions.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Submit schedule of time and date for demonstration of each item of equipment and each system two weeks before designated dates, for Owner and Consultant's approval.

.3 Submit reports within one week after completion of demonstration, that demonstration and instructions have been satisfactorily completed.

.4 Give time and date of each demonstration, with list of persons present.

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

1.3 QUALITY ASSURANCE

.1 When specified in individual Sections requiring manufacturer to provide authorized representative to demonstrate operation of equipment and systems:

- .1 Instruct Owner's personnel.
- .2 Submit written report that demonstration and instructions have been completed.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 National Air Duct Cleaners Association (NADCA)

.1 ACR Standard,: Assessment, Cleaning and Restoration of HVAC Systems.

.2 North American Insulation Manufacturers Association (NAIMA)

.1 NAIMA 05, Cleaning Fibrous Glass Insulated Duct Systems - Recommended Practices.

1.2 DEFINITIONS

.1 HVAC System: complete air duct system from outside air intake louvers to furthest air supply terminal unit and including:

.1 Rigid supply and return ductwork;
.2 Flexible ductwork;
.3 Mixing plenum boxes;
.4 Return air plenums including ceiling plenums;
.5 Cooling and heating coils and compartments;
.6 Condensate drain pans, eliminator blades and humidifiers;
.7 Fans, fan blades and fan housing;
.8 Filter housing and frames;
.9 Acoustically insulated duct linings;
.10 Diffusers, registers and terminal units;
.11 Dampers and controls;

1.3 ADMINISTRATIVE REQUIREMENTS

.1 Site Evaluation: conduct site visit 2 weeks before start of work to establish specific co-ordinated video survey and cleaning plan to establish specific co-ordinated video survey and cleaning plan determining how areas of facility and HVAC systems will be protected during cleaning operations.

.1 Organize and lay out plan for video survey and identify camera and cleaning apparatus insertion points.

.2 Ensure plan identifies sequence and schedule of survey and cleaning operations for each individual HVAC system and for complete facility.

.1 Take account of elbows, bends, turning vanes, dampers, transitions, take-offs.

.3 Departmental Representative to review video survey and cleaning plan 1 week minimum prior to start of work.

.1 Proceed with survey and cleaning work only after receiving written approval from Departmental Representative.

.2 Scheduling: Hours of Operation:

.1 Coordinate all work with Departmental Representative:

.2 Work may not be carried out during statutory holidays.

.3 Hours of operation are subject to change with 12 hours notice.

.3 Project Co-ordination: assign Project Co-ordinator to oversee air duct cleaning processes.

.1 Provide Departmental Representative with contact information of Project Co-ordinator including: name, telephone number, cell phone number

.4 Security: Departmental Representative will provide security escort at times requested on Contractor's submitted work schedule.

.1 Cancellation of security escort requires 72 hours minimum written notice.

.2 Failure to cancel security escort requirements 72 hours minimum before scheduled event will result in Contractor paying for security costs.

.5 Damaged or broken equipment and components found during initial testing and inspection will be repaired or replaced by Departmental Representative.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Submit video survey and cleaning plan developed during site evaluation.

.1 Ensure plan includes sequence of operation, identification of camera and cleaning apparatus insertion points and schedule for work.

.3 Product Data:

.1 Submit manufacturer's printed product literature and data sheets for antimicrobial agents and include product characteristics, performance criteria and limitations.

.2 Provide two copies of WHMIS SDS in accordance with Section 01 35 29.06- Health and Safety Requirements for antimicrobial agents or coatings.

.4 Testing Laboratory Services: submit name and address of laboratory engaged for work of this Section.

.1 Submit laboratory analysis report of particulate collection indicating:

.1 Location of collection;

.2 Particulate grade;

.3 Particulate size;

.4 Percentage concentration of individual particulates in each sample.

.5 Submit verification of delivery of hazardous or toxic waste materials to contaminated waste facility, as described in PART 3 - CLEANING - Waste Management.

1.5 CLOSEOUT SUBMITTALS

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

.2 Post Cleaning Inspection Report: submit digital copies of Final Inspection Report, including data collected, observations and recommendations as well as following information:

.1 Name and address of facility;

.2 Name and address of HVAC cleaning contractor;

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

.4 Identification scheme for location points in systems that were inspected with accompanying notes describing methods of inspection or tests used;

.5 Identification of points where samples were collected and type of analysis used for each collection;

.6 Identification of each sample collected;

.7 Comments complete with photographs of each sampling location and other observed system features;

.8 Identify systems tested, observations, actions taken and recommendations for future maintenance.

.3 Record post cleaning video survey: submit survey USB Drive media, and include on video survey following:

.1 Areas tested for particulate analysis or microbial growth evaluation;

.2 Areas of special interest and location;

.3 Special internal features;

.4 Problems such as broken or damaged controls or components;

.5 Ensure system tested, locations, observations, actions taken and recommendations are clearly identified in English on video using text or voice over.

.4 Submit verification of delivery of hazardous or toxic waste materials to contaminated waste facility.

1.6 QUALITY ASSURANCE

.1 Contractor: Verification of 5 years minimum experience in work similar to or exceeding work of this Section.

.2 Project Co-ordinator: Verification of 5 years minimum experience in work similar to or exceeding work of this Section.

Part 2 Products

2.1 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 1.27mm minimum sheet steel with gasketted seal.

.1 Ensure access door is 25 mm greater in every dimension than access opening.

.2 Access door size 200 mm x 200 mm minimum.

.3 Secure access doors with sheet metal screws on 75 mm centres minimum. Ensure 3 screws per side minimum.

.3 Access Doors and Panels Acoustic Lining:

.1 Install acoustic lining to match existing.

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

.3 Water-based duct sealer for repairing cut acoustic lining.

2.2 SYSTEM FILTERS

.1 Supply and install new filters for each HVAC System cleaned.

2.3 AIR DUCT CLEANING EQUIPMENT

.1 Manually propelled full contact brushes:

.1 Ensure brushes are specifically manufactured and shaped to fit individual ducts, equipment and components of HVAC system.

.1 Ensure brushes are sized to fit various duct sizes in HVAC system.

.2 Ensure brushes make scrubbing motion and full contact with HVAC system interior surfaces to be cleaned.

.2 Brushes: manually propelled with integrally-mounted motor and nylon bristles.

.1 Ensure motor has capacity to continue to push brush after bristles are distorted.

.2 Replace worn and ineffective brushes when required.

2.4 MULTI-FUNCTIONAL ROBOTIC CLEANING SYSTEM

.1 Self-propelled emote controlled, wheeled drive equipped with: camera, halogen lights: reciprocating brushes, air supply nozzle, vacuum and spraying system attachment.

.1 Ensure brushes are specifically manufactured and shaped to fit individual ducts, equipment and components of HVAC system.

.2 Ensure brushes make scrubbing motion and full contact with HVAC system interior surfaces.

.3 Replace worn and ineffective brushes when required.

.2 Camera: fully rotational remote control focus and dustproof video with 480 lines of resolution, capable of storing 4 hours of recorded media.

.1 Camera Light: 2 x 20 watt Halogen with dimmer

2.5 HEPA FILTER EVACUATION FAN

.1 Evacuation Fan: includes fan, HEPA filter, flexible hose and motor capable of maintaining debris and particulates airborne in airstream until they reach evacuation fan and maintaining system under negative pressure.

.1 Ensure HEPA filters are clean and maintain evacuation fan and HEPA filter to run efficiently.

2.6 HEPA VACUUM UNIT

.1 Vacuum Unit: includes vacuum fan, integral HEPA filter, suction hose and vacuum head, capable of maintaining HVAC System debris and particulates airborne in air stream until they reach vacuum unit and maintaining system under negative pressure.

.1 Ensure HEPA filters are clean and maintain vacuum unit and HEPA filter to run efficiently.

Part 3 Execution

3.1 PREPARATION

.1 Shutdown lab HVAC system.

.2 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;

.3 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.

.4 Installation of Access Doors and Panels: install access doors and panels for equipment where required to facilitate system inspection and cleaning.

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

.1 Heating and cooling coils;

.2 Fan units;

.3 Filters;

.4 Dampers;

.5 Sensors;

.5 Installation of Access Doors in Ductwork: install access doors in ductwork where required to facilitate system inspection and cleaning.

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

.1 Inspect flexible ductwork only by disconnecting from main duct and inspecting from open end.

.6 When acoustically lined duct is cut for access, repair cut edges of acoustic lining using self-adhesive fibre glass tape and water based 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.

.7 Remove and reinstall ceiling tiles to gain access to HVAC system as required.

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

3.2 EXAMINATION / PRE-CLEANING INSPECTION

.1 Verification of Conditions:

.1 Make visual inspection of interior of HVAC system using remote controlled robotic camera.

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

.2 Evaluation and Assessment:

.1 Identify location and type of internal components.

.2 Identify extent of potential problems.

.3 If toxic or hazardous materials or deposits are suspected after initial inspection immediately stop work and inform Departmental Representative.

.1 Do not proceed further with inspection operations until written approval from Departmental Representative.

3.3 DUCT CLEANING

.1 Ductwork systems to be cleaned:

.1 AH-1 supply and return air system from mechanical room to lab.

.2 Do duct cleaning in accordance with NADCA ACR Standard.

.3 Isolate and clean sections in zones to ensure that dirt deposits and debris from zone being cleaned does not pass through another zones which has already been cleaned.

.1 Isolate zone of duct using closed-cell polyurethane foam before cleaning.

.4 Ensure vacuum units and evacuation fans are securely in place before starting cleaning operation of isolated section of HVAC air duct system.

.5 Install HEPA filter evacuation fan at one end of zone section and insert full contact brushes at other end.

.6 Clean HVAC supply air duct system and components where particulate sample collected from surfaces is greater than 75 mg of particulate per 0.01 square metres.

.7 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 square metres.

.8 Energize brushes to travel from insertion point to HEPA filter evacuation fan.

.1 Pass brushes through sections as often as necessary to achieve required cleanliness.

.2 Change brush sizes as required to ensure positive contact with duct and component interiors.

.3 Clean corners and pockets where dirt and debris can accumulate.

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

.10 Clean diffusers, registers, intake hoods.

.11 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.

.12 Advise Departmental Representative 72 hours minimum before deactivation of fire alarm and smoke detectors duct cleaning operations.

.1 Departmental Representative will pay for costs of deactivation of fire alarm and smoke detector system.

3.4 ACOUSTICALLY LINED DUCTWORK CLEANING

.1 Clean glass fibre acoustically insulated ducts to NAIMA recommended practices.

.1 Use specifically designed robotic apparatus that has been demonstrated not to damage acoustic glass fibre lining.

.2 Monitor cleaning process progress by onboard camera.

3.5 COMPONENTS AND EQUIPMENT CLEANING

.1 Brush and vacuum coils, humidifiers, air handling unit enclosures,

.2 When cleaning equipment and components by brushing and vacuuming is inappropriate or insufficient, dismantle and remove equipment or component and move to area designated by Departmental Representative for cleaning.

.1 Pressure wash with water and cleaning solution until required cleanliness is achieved.

.2 Clean equipment and components in place only if there is no hazard to adjacent materials.

.3 Proceed to next section in cleaning sequence only after written approval from Departmental Representative.

.4 Compressed air and manual cleaning is acceptable only for cleaning individual components and small areas as follows and only after written approval from Representative:

.1 Fan blades;

.2 Dampers;

.3 Turning vanes;

.4 Controls;

.5 Sensor bulbs;

.6 Fire alarms;

.7 Smoke detectors;

3.6 FIELD QUALITY CONTROL/FINAL INSPECTIONS

.1 Post Cleaning Inspection: carry out final inspection using robotic camera and other visual inspection methods after final cleaning has been completed.

- .1 Carry out video survey as directed by Departmental Representative.
- .2 Include in final survey areas inspected by Departmental Representative prior to cleaning.
- .3 Identify on HVAC system record drawings access points used for inspection and cleaning.
- .4 Re-collect and analyse particulates collected at same locations where original samples were collected before cleaning.
- .5 Reset components including dampers and sensors, which have been disturbed during cleaning operations.

3.7 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.

3.8 CLEANING

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

.2 Waste Management: separate waste materials in accordance with Section 01 74 19- Waste Management and Disposal.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Division 26

1.2 REFERENCE STANDARDS

.1 Mechanical Contractors Association of Canada (MCAC):

.1 Shop Drawing Submittal Title Sheet

1.3 ADMINISTRATIVE REQUIREMENTS

.1 Coordination:

.1 Coordinate with Section 26 05 00 - Common Work Results for Electrical for electrical connections for mechanical equipment.

.2 Pre-installation meetings: Conduct a site meeting in accordance with Section 01 31 19 - Project Meetings and attended by the Departmental Representative and Consultant and appropriate Subcontractors to:

.1 Verify project requirements.

.2 Review delivery, storage, and handling requirements.

.3 Review installation and substrate conditions.

.4 Coordinate with other Subcontractors.

.5 Review manufacturer's instructions and warranty requirements.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

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

.1 Submit the following with product data and shop drawings:

.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's certification of current model production; and

.5 certification of compliance to applicable codes.

.2 Shop drawings:

.1 Show location of each component, dimensioned plans, large scale details, mounting arrangements, operating and maintenance clearances, and attachment details.

.2 Show locations and sizes of framing, blocking, or backing required for wall mounting, including concealed items specified in other sections.

.3 In addition to transmittal letter specified in Section 01 33 00 - Submittal Procedures, use the MCAC Shop Drawing Submittal Title Sheet. Identify section and paragraph number.

.4 Integrated coordinated shop drawings with the measurement of equipment to meet the requirement. All equipment that needs regular maintenance and calibration shall be accessible. All interdependent equipment and material are to be provided in a coordinated submitted shop drawing to provide efficient installation.

.5 Coordinate shop drawings for all systems in the same area.

1.5 CLOSEOUT SUBMITTALS

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

.2 Operation and maintenance data:

.1 Include, in the operation and maintenance manual, manufacturer's operating and maintenance instructions and recommended cleaning materials and methods.

.2 Operation data to include:

.1 control schematics for systems including environmental controls;

.2 descriptions of systems and their controls;

.3 descriptions of operation of systems at various loads, together with reset schedules and seasonal variances;

.4 operation instruction for systems and components; and

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

.3 Maintenance data to include:

.1 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.

.5 Review:

.1 Submit draft operation and maintenance manual for review. Submission of individual data will not be accepted unless directed by the Departmental Representative and Consultant.

.2 Make changes as required and resubmit as directed by the Departmental Representative or 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.

.3 Record documentation:

.1 Site records:

.1 Provide one set of Mechanical Drawings. Provide sets of white prints as required for each phase of work.

.2 Transfer information weekly to as-built drawings, revising to show work as actually installed.

.2 As-built drawings:

.1 Finalize production of as-built drawings before start of testing, adjusting, and balancing for HVAC.

.2 Identify each drawing in lower right-hand corner in letters at least 13 mm high as follows: "AS BUILT DRAWINGS: THIS DRAWING HAS BEEN REVISED TO SHOW MECHANICAL SYSTEMS AS INSTALLED" (Signature of Contractor) (Date).

.3 Submit to the Consultant for review and make corrections as directed.

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

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

1.6 QUALITY ASSURANCE

.1 Qualifications:

.1 Installers and maintenance personnel: Trained and authorized by respective equipment manufacturers.

1.7 DELIVERY, STORAGE, AND HANDLING

.1 Deliver, store, and handle materials in accordance with Section 01 61 00 - Common Product Requirements, and:

Part 2 Products

.1 Not used

Part 3 Execution

3.1 RESTORATION

.1 Repainting:

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

.2 Restore to as-new condition, finishes which have been damaged.

3.2 SYSTEM STARTUP

.1 Perform in accordance with:

.1 Section 01 91 13 - General Commissioning Requirements.

.2 Section 23 08 00 - Commissioning of HVAC.

.3 Section 26 08 00 - Commissioning of Electrical Systems.

3.3 CLEANING

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

.1 Clean interiors and exteriors of all systems.

.2 Vacuum interiors of ductwork and air handling units.

.3 Clean HVAC systems in accordance with Section 23 01 31 - Air Duct Cleaning for HVAC Systems.

.2 Waste management:

.1 Manage waste in accordance with Section 01 74 19 - Waste Management and Disposal and:

3.4 CLOSEOUT ACTIVITIES

.1 Provide demonstration and training, where identified in the technical sections, in accordance with Section 01 79 00 - Demonstration and Testing.

3.5 PROTECTION

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

END OF SECTION

PART 1 General

1.1 SUMMARY

.1 Section Includes:

.1 Selective demolition and removal of:

.1 heating, ventilation, and air conditioning systems; and

.2 controls and automation components.

1.2 RELATED REQUIREMENTS

.1 Division 02.

1.3 DEFINITIONS

.1 Demolish: Detach items from existing construction and dispose of off site.

.2 Remove: Deconstruct, or disassemble, and detach items from existing construction.

.3 Hazardous Materials: Products, mixtures, materials, or substances classified as physical hazards or health hazards in accordance with Schedule 2 of the Hazardous Products Act.

1.4 REFERENCE STANDARDS

.1 CSA Group (CSA):

.1 CSA Z783, Deconstruction of Buildings and Their Related Parts

.2 Department of Justice Canada:

.1 Hazardous Products Act

.3 Environment and Climate Change Canada (ECCC):

.1 Environmental Code of Practice for Elimination of Fluorocarbon Emissions from Refrigeration and Air Conditioning Systems

1.5 ADMINISTRATIVE REQUIREMENTS

.1 Coordination:

.1 Coordinate work of this Section with:

.1 Division 01, 02, and 26.

.2 Pre-Demolition Meetings: Conduct a site meeting attended by the Departmental Representative and related Subcontractors to:

.1 Verify project requirements, including existing construction conditions affected by work of this Section, scope of selective demolition work, demolition sequencing, and protection of in-place conditions.

.2 Scheduling:

.1 Maintain project schedule without compromising specified minimum material diversion rates.

.2 Notify the Departmental Representative and Consultant of unforeseen delays.

1.6 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Submit the following when requested by the Departmental Representative:

.1 Qualification statements: Information about companies and personnel indicating their experience and capabilities to perform demolition work; include lists of completed projects with project names and addresses, and names and addresses of consultants for work of similar complexity and extent.

.3 Submit copies of the following, when required by the authority having jurisdiction (AHJ):

.1 reviewed Shop Drawings;

.2 reviewed demolition procedures.

1.7 QUALITY ASSURANCE

.1 Licensed Professional Qualifications: In accordance with Section 01 43 00 – Quality Assurance.

1.8 SITE CONDITIONS

.1 Existing Conditions: Condition of materials identified as being salvaged or demolished are based on their observed condition at time of site examination before tendering.

.2 Hazardous materials are not expected to be encountered in the Work.

.3 Review the hazardous materials assessment in Appendix A.

PART 2 PRODUCTS

2.1 MATERIAL OWNERSHIP

.1 Coordinate material ownership with the Departmental Representative.

2.2 REPAIR MATERIALS

.1 Use repair materials identical to existing materials.

.1 If identical materials are unavailable or cannot be used for exposed surfaces, use materials that visually match existing adjacent surfaces as closely as possible.

.2 Use materials whose installed performance equals or surpasses that of existing materials.

.2 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.

.3 HVAC Repair Materials: Use 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 AHJ.

PART 3 EXECUTION

3.1 EXAMINATION

.1 Review existing conditions and coordinate with indicated requirements to determine extent of demolition required.

3.2 PREPARATION

.1 Protection of In-Place Conditions:

.1 Minimize noise, dust, vibration, and inconvenience to occupants in accordance with Section 01 14 00 – Work Restrictions. Provide temporary negative air pressure in demolition areas relative to adjacent occupied areas.

.2 Protect building systems, utilities, equipment, and other items to remain.

.3 Maintain access to egress, walkways, corridors, exits, and other adjacent occupied or partially-occupied facilities, unless approved, in writing, by the AHJ.

.1 Submit copy of written approval from the AHJ.

3.3 DEMOLITION REQUIREMENTS

.1 Demolish or remove select HVAC items in accordance with CSA Z783.

.2 Disconnect and cap gas supply and electrical services in accordance with requirements of the AHJ.

.3 Disconnect and remove electrical items from existing construction including removal of conduit, junction boxes, cabling and wiring from electrical component to panel. Do not damage adjacent assemblies designated to remain.

.4 Do not disrupt active or energized utilities without approval of the Departmental Representative.

.5 Use methods to minimize dust, such as wetting dust-producing materials.

.6 Leave Work in safe and stable condition at end of each Working Day.

.7 Dispose of demolished items off site. Comply with hauling and disposal regulations of AHJ.

3.4 DEMOLITION

.1 Demolish items as indicated on Drawings.

3.5 REMOVE AND REINSTALL

.1 Remove items as indicated on Drawings.

.2 Examine removed items. Confirm Departmental Representative and Consultant's acceptance for reinstallation if removed items appear in poor condition.

.3 Temporarily store, protect, and prepare removed items for re-use.

.4 Reinstall removed items as indicated on the Drawings.

3.6 REPAIRS AND RESTORATION

.1 Promptly repair damage to adjacent construction caused by work of this Section. Patch existing surfaces to make suitable for new materials.

.2 Restore exposed finishes on patched surfaces. Extend restoration to adjoining construction to eliminate evidence of patching and refinishing.

3.7 CLEANING

.1 Waste Management:

.1 Manage waste in accordance with Section 01 74 19 – Waste Management and Disposal and:

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 Electrical motors, drives, and guards for mechanical equipment and systems.

1.2 RELATED REQUIREMENTS

.1 Division 26

1.3 REFERENCE STANDARDS

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

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

.2 CSA Group (CSA):

.1 CSA C390:10, Test methods, marking requirements, and energy efficiency levels for three-phase induction motors

.3 National Electrical Manufacturers Association (NEMA):

.1 ANSI/NEMA MG 1, Motors and Generators

.2 NEMA MG 11, Energy Management Guide for Selection and Use of Single-Phase Motors

1.4 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, including product characteristics, performance criteria, wiring characteristics, and limitations.

.2 Submit a complete list of HVAC motors and identify their locations before beginning installation of motors.

.3 Shop Drawings: Submit drawings indicating work of other Subcontractors, and identify areas that might have congestion or conflicts.

.4 When requested, submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

1.5 CLOSEOUT SUBMITTALS

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

.2 Submit maintenance data for motors, drives, and guards and incorporate into operation and maintenance manual.

.3 Submit field test reports.

1.6 MAINTENANCE MATERIALS SUBMITTALS

.1 Supply one set of spare belts for each set installed in accordance with Section 01 78 00 - Closeout Submittals, unless otherwise indicated in other Division 23 Sections.

1.7 QUALITY ASSURANCE

.1 Where multiple motors are required for the same application, provide the same manufacturer's motor model for all identical conditions.

.2 Health and Safety Requirements: Comply with Section 01 35 29 - Health, Safety, and Emergency Response Procedures.

1.8 DELIVERY, STORAGE, AND HANDLING

.1 Packing, shipping, handling, and unloading: Perform in accordance with Section 01 61 00 - Common Product Requirements, and as follows:

.1 Protect motors from dust and corrosion.

.2 Packaging Waste Management and Disposal: Perform Waste Management Plan in accordance with Section 01 74 19 - Waste Management and Disposal.

Part 2 Products

2.1 MOTORS

.1 Provide motors for mechanical equipment as specified in other Sections.

.2 Motors: High efficiency, in accordance with ANSI/ASHRAE/IES 90.1.

.3 Motor Speed: single

.4 Motors: single speed, continuous duty, built-in overload protection, resilient mount, single phase, 120 V, unless otherwise specified or indicated on Drawings.

.5 Motor Enclosure: ODP or TEFC – suitable for installation indoors.

2.2 BELT DRIVES

.1 Fit reinforced belts in sheave matched to drive. Multiple belts to be matched sets.

.2 Use cast iron or steel sheaves secured to shafts with removable keys unless otherwise indicated.

.3 For motors under 7.5 kW: Standard adjustable pitch drive sheaves, having plus or minus 10% range. Use mid-position of range for specified motor rpm.

.4 Determine correct sheave size during commissioning

.5 Minimum drive rating: 1.5 times nameplate rating on motor. Keep overhung loads within manufacturer's design requirements on prime mover shafts.

.6 Provide motor slide rail adjustment plates to allow for centre line adjustment.

2.3 DRIVE GUARDS

.1 Provide guards for unprotected drives.

.2 Guards for belt drives:

.1 Expanded metal screen welded to steel frame

.2 Minimum 1.2-mm-thick sheet metal tops and bottoms

.3 38-mm diameter holes on both shaft centres for insertion of tachometer

.4 Removable for servicing

.3 Drive Guards: Designed to allow motor maintenance (lubrication and use of test instruments) with guards in place.

.4 Guard for flexible coupling:

.1 "U" shaped, minimum 1.6-mm-thick galvanized mild steel

.2 Fasten securely in place

.3 Removable for servicing

.5 Unprotected fan inlets or outlets:

.1 Wire or expanded metal screen, galvanized, 19-mm mesh

.2 Net free area of guard: not less than 80% of fan openings

.3 Fasten securely in place

.4 Removable for servicing

Part 3 Execution

3.1 INSTALLATION

.1 Install according to manufacturer's instructions and supplemented by the requirements of the Contract Documents.

.2 Locate motors with adequate access space to allow safe and unimpeded maintenance services.

.3 Install with minimum interference with other equipment and services.

.4 Install belt guards to allow movement of motors for adjusting belt tension.

.5 Fasten motors and equipment securely in place.

.6 Replace temporary motors with specified motors.

3.2 CLEANING

.1 Comply with Section 01 74 00 - Cleaning.

.2 Remove surplus materials, rubbish, tools, and equipment.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 23 05 53 – Identification for HVAC Piping and Equipment

.2 Section 23 08 16 - Cleaning and Start-up of HVAC Piping Systems

1.2 REFERENCE STANDARDS

.1 American Society of Mechanical Engineers (ASME):

.1 ASME B16 Series, Standards for Valves, Flanges, Fittings, and Gaskets

.2 CSA Group (CSA):

.1 CSA B51, Boiler, pressure vessel, and pressure piping code

.3 Underwriters' Laboratories Inc. (UL):

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

.2 UL 2762, Standard for Sustainability for Adhesives

1.3 ADMINISTRATIVE REQUIREMENTS

.1 Pre-Installation Meetings: Conduct a site meeting in accordance with Section 01 31 19 – Project Meetings and attended by the Departmental Representative, and related Subcontractors to:

.1 Verify project requirements.

.2 Review delivery, storage, and handling requirements.

.3 Review installation and substrate conditions.

.4 Coordinate with other Subcontractors.

.5 Review manufacturer's instructions and warranty requirements.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data: Product literature and data sheets for process cooling equipment, including product characteristics, performance criteria, WHMIS SDSs and limitations.

.3 Shop Drawings:

.1 Diagrams of site installation for pipes, valves, and accessories, with refrigerant flows, pipe sizes, pressure drops in equipment, and suction lines.

.2 Required clearances for operation and maintenance.

.4 Manufacturer’s Instructions:

.1 Special delivery, storage, and handling requirements.

.2 Installation and assembly instructions.

.3 Recommended sequencing.

.4 Cleaning procedures.

1.5 DELIVERY, STORAGE, AND HANDLING

.1 Deliver, store, and handle materials in accordance with Section 01 61 00 - Common Product Requirements, and:

Part 2 PRODUCTS

2.1 PIPE MATERIAL

.1 Heating Glycol Piping: Type L Hard Copper to ASTM-88

.2 Domestic Cold Water: Type L Hard Copper to ASTM-88

.3 Condensate Piping: Type L Hard Copper to ASTM-88

2.2 VALVES, FITTINGS, AND JOINTS

.1 Material: Copper: Brazed, phos copper alloy.

.2 Isolation Valves: Ball NPS 2 and under

.1 Body and cap: cast high tensile bronze to ASTM B62

.2 Pressure rating: 4134 kPa

.3 Connections: screwed ends to ANSI B1.20.1

.4 Stem: tamperproof ball drive.

.5 Stemp packing nut: external to body.

.6 Ball and seat: replaceable chrom plated brass ball and Teflon seats.

.7 Stem seal: TFE with external packing nut.

.8 Operator: removable lever handle

.3 Control Valves

.1 Two-way Pressure Independent 24V control valve

.2 Brass body

Part 3 EXECUTION

3.1 CONNECTIONS TO EQUIPMENT

.1 Use valves and either unions or flanges for isolation and ease of maintenance and assembly.

.2 Use double swing joints when equipment mounted on vibration isolation and when piping subject to movement.

3.2 CLEARANCES

.1 Provide clearance around systems, equipment, and components for observation of operation, inspection, servicing, maintenance, and as recommended by the manufacturer.

.2 Provide space for disassembly, removal of equipment, and components without interrupting operation of other system, equipment, and components.

3.3 INSTALLATION

.1 Install concealed valves, expansion joints, controls, dampers, and equipment requiring access in locations freely accessible.

.2 Install screwed fittings jointed with polytetrafluoroethylene (PTFE) tape.

.3 Protect openings to prevent entry of debris.

.4 Isolate equipment and allow removal without interrupting operation of other equipment or systems.

.5 Saddle type branch fittings may be used on mains if branch line is no larger than half size of main.

.1 Hole saw, or drill, and ream main to maintain full inside diameter of branch line before welding saddle.

.6 Install exposed piping, equipment, rectangular cleanouts, and similar items parallel or perpendicular to building lines.

.7 Install concealed pipework to minimize furring space, maximize headroom, and conserve space.

.8 Install piping with grade in direction of flow for positive drainage and venting.

.9 Provide individual thermal insulation of each pipe.

.10 Group piping wherever possible.

.11 Ream pipes, remove scale, and other foreign material before assembly.

.12 Use eccentric reducers at pipe size changes to ensure positive drainage and venting.

.13 Install piping to allow thermal expansion.

.14 Drains:

.1 Install drain valve at low points in piping systems, at equipment, and at section isolating valves.

.2 Each drain valve’s discharge pipe to be routed separately to above floor drain.

.3 Discharge to be visible.

.15 Air Vents:

.1 manual air vents at high points.

.2 Install isolating valve at each automatic air valve.

.3 Install drain piping to approved location and terminate where discharge is visible.

.16 Dielectric Couplings:

.1 Install dielectric couplings to suit pressure rating of system where dissimilar metals are joined.

.2 NPS 2 and under: Use isolating unions or bronze valves.

.3 Over NPS 2: Use isolating flanges.

.17 Valves:

.1 Install in accessible locations.

.2 Remove interior parts before soldering.

.3 Install with stems above horizontal position.

.4 Valves accessible for maintenance without removing adjacent piping.

.5 Install globe valves in bypass around control valves.

.6 Use ball valves at branch take-offs for isolating purposes.

3.4 SYSTEM STARTUP

.1 Flush system in accordance with Section 23 08 16 - Cleaning and Start-up of HVAC Piping Systems.

3.5 CLEANING

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

.1 Clean interior of piping systems in accordance with applicable mechanical sections.

.2 Waste Management:

.1 Manage waste in accordance with Section 01 74 19 – Waste Management and Disposal and:

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 American Society of Mechanical Engineers (ASME):

.1 ASME B31.1, Power Piping

.2 ASTM International (ASTM):

.1 ASTM A125, Standard Specification for Steel Springs, Helical, Heat-Treated

.2 ASTM A307, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength

.3 ASTM A563, Standard Specification for Carbon and Alloy Steel Nuts

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

.1 MSS SP58, Pipe Hangers and Supports - Materials, Design and Manufacture

.2 MSS SP69, Pipe Hangers and Supports - Selection and Application

.3 MSS SP89, Pipe Hangers and Supports - Fabrication and Installation Practices

.4 National Research Council Canada (NRC):

.1 National Plumbing Code of Canada 2020 (NPC)

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 Northwest Territories, 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.

.6 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.3 DELIVERY, STORAGE, AND HANDLING

.1 Deliver, store, and handle materials in accordance with Section 01 61 00 - Common Product Requirements.

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 Performance Requirements:

.1 Design supports, platforms, catwalks, hangers to withstand seismic events as per the National Building Code of Canada.

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

.1 Finishes:

.1 Pipe hangers and supports: galvanized after manufacture.

.2 Use electro-plating galvanizing process.

.3 Ensure steel hangers in contact with copper piping are epoxy coated.

.2 Hanger rods: threaded rod material to MSS SP58:

.1 Ensure that hanger rods are subject to tensile loading only.

.2 Provide linkages where lateral or axial movement of pipework is anticipated.

.3 Do not use 22 mm mm rod.

.3 Pipe attachments: material to MSS SP58:

.1 Attachments for steel piping: carbon steel galvanized.

.2 Attachments for copper piping: copper plated black steel.

.3 Use insulation shields for hot pipework.

.4 Adjustable clevis: material to MSS SP69 UL listed, clevis bolt with nipple spacer and vertical adjustment nuts above and below clevis.

.1 Ensure "U" has hole in bottom for rivetting to insulation shields.

.5 Yoke style pipe roll: carbon steel yoke, rod and nuts with cast iron roll, to MSS SP69

.6 U-bolts: carbon steel to MSS SP69 with 2 nuts at each end to ASTM A563

.1 Finishes for steel pipework: galvanized.

.2 Finishes for copper, glass, brass or aluminum pipework: galvanized.

.7 Pipe rollers: cast iron roll and roll stand with carbon steel rod to MSS SP69

2.4 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 site 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.

2.5 EQUIPMENT ANCHOR BOLTS AND TEMPLATES

.1 Provide templates to ensure accurate location of anchor bolts.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

.1 Install in accordance with:

.1 Manufacturer's instructions and recommendations.

.2 Spring Hangars:

.1 Provide spring hangers for ceiling suspended exhaust and supply fans.

.3 Clamps on riser piping:

.1 Support independent of connected horizontal pipework using riser clamps and riser clamp lugs welded to riser.

.2 Bolt-tightening torques to industry standards.

.3 Steel pipes: install below coupling or shear lugs welded to pipe.

.4 Cast iron pipes: install below joint.

.4 Provide supplementary structural steelwork where structural bearings do not exist or where concrete inserts are not in correct locations.

.5 Use approved constant support type hangers where:

.1 Vertical movement of pipework is 13 mm or more,

.2 Transfer of load to adjacent hangers or connected equipment is not permitted.

.6 Use variable support spring hangers where:

.1 Transfer of load to adjacent piping or to connected equipment is not critical.

.2 Variation in supporting effect does not exceed 25% of total load.

3.3 HANGER SPACING

.1 Plumbing piping: to National Plumbing Code of Canada (NPC) and authority having jurisdiction.

.2 Copper piping: up to NPS 1/2: every 1.5 m.

.3 Flexible joint roll groove pipe: in accordance with table below for steel, but not less than one hanger at joints. Table listings for straight runs without concentrated loads and where full linear movement is not required.

.4 Within 300 mm of each elbow.

Maximum Pipe Size: NPS	Maximum Spacing Steel	Maximum Spacing Copper
up to 1-1/4	2.4 m	1.8 m
1-1/2	3.0 m	2.4 m
2	3.0 m	2.4 m
2-1/2	3.7 m	3.0 m

Maximum Pipe Size: NPS	Maximum Spacing Steel	Maximum Spacing Copper
3	3.7 m	3.0 m
3-1/2	3.7 m	3.3 m
4	3.7 m	3.6 m
5	4.3 m	
6	4.3 m	
8	4.3 m	
10	4.9 m	
12	4.9 m	

.5 Pipework greater than NPS 12: to MSS SP69

3.4 HANGER INSTALLATION

.1 Install hanger so that rod is vertical under operating conditions.

.2 Adjust hangers to equalize load.

.3 Support from structural members. Where structural bearing does not exist or inserts are not in suitable locations, provide supplementary structural steel members.

3.5 HORIZONTAL MOVEMENT

.1 Angularity of rod hanger resulting from horizontal movement of pipework from cold to hot position not to exceed 4 degrees from vertical.

.2 Where horizontal pipe movement is less than 13 mm, offset pipe hanger and support so that rod hanger is vertical in the hot position.

3.6 FINAL ADJUSTMENT

.1 Adjust hangers and supports:

.1 Ensure that rod is vertical under operating conditions.

.2 Equalize loads.

.2 Adjustable clevis:

.1 Tighten hanger load nut securely to ensure proper hanger performance.

.2 Tighten upper nut after adjustment.

.3 C-clamps:

.1 Follow manufacturer's recommended written instructions and torque values when tightening C-clamps to bottom flange of beam.

.4 Beam clamps:

.1 Hammer jaw firmly against underside of beam.

3.7 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.

.3 Schedule site visits, to review Work, as directed in PART 1 - QUALITY ASSURANCE.

3.8 CLEANING

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

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 Vibration isolation materials and components, seismic control measures and their installation.

1.2 REFERENCE STANDARDS

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

.1 Safety Data Sheets (SDS)

.2 National Research Council Canada (NRC)

.1 National Building Code of Canada (NBC).

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 - Submittal Procedures. Include product characteristics, performance criteria, and limitations.

.1 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Safety Data Sheets (SDS) in accordance with Section 01 33 00 - Submittal Procedures.

.2 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.

.1 Shop drawings: Submit drawings stamped and signed by professional engineer registered or licensed in the Northwest Territories, Canada.

.2 Provide shop drawings complete with performance and product data.

.3 Provide detailed drawings of seismic control measures for equipment and piping.

.3 Quality assurance submittals: submit following in accordance with Section 01 33 00 - Submittal Procedures.

.1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.2 Instructions: submit manufacturer's installation instructions.

.3 Manufacturer's Field Reports: manufacturer's field reports specified.

1.4 QUALITY ASSURANCE

.1 Health and Safety:

.1 Do construction occupational health and safety in accordance with Section 01 35 29 - Health, Safety, and Emergency Response Procedures.

1.5 DELIVERY, STORAGE, AND HANDLING

.1 Packing, shipping, handling and unloading:

.1 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.2 Waste Management and Disposal:

.1 Waste Management and Disposal: separate waste in accordance with Section 01 74 19 - Waste Management and Disposal.

Part 2 PRODUCTS

1.6 GENERAL

.1 Seismic restraint system products to meet the requirements of seismic engineer design documentation.

1.7 EQUIPMENT SPRING HANGERS

.1 Refer to Section 23 05 29 – Hangers and Supports for HVAC.

1.8 HORIZONTAL THRUST RESTRAINT

.1 Spring and elastomeric element housed in box frame; assembly complete with rods and angle brackets for equipment and ductwork attachment; provision for adjustment to limit maximum start and stop movement to 9 mm.

.2 Arrange restraints symmetrically on either side of unit and attach at centerline of thrust.

1.9 SEISMIC CONTROL MEASURES

.1 General:

.1 Seismic control systems to work in every direction.

.2 Fasteners and attachment points to resist same maximum load as seismic restraint.

.3 Drilled or power driven anchors and fasteners not permitted.

.4 No equipment, equipment supports or mounts to fail before failure of structure.

.5 Supports of cast iron or threaded pipe not permitted.

.6 Seismic control measures not to interfere with integrity of fire stopping or fire separations.

.2 Static equipment:

.1 Anchor equipment to equipment supports. Anchor equipment supports to structure.

.2 Suspended equipment:

.1 Use one or more of following methods:

.1 Install tight to structure.

.2 Cross brace in every direction.

.3 Brace back to structure.

.4 Cable restraint system.

.3 Seismic restraints:

.1 Cushioning action gentle and steady.

.2 Never reach metal-like stiffness.

.3 Vibration isolated equipment:

.1 Seismic control measures not to jeopardize noise and vibration isolation systems. Provide 6 to 9 mm clearance during normal operation of equipment and systems between seismic restraint and equipment.

.2 Incorporate seismic restraints into vibration isolation system to resist complete isolator unloading.

.3 As indicated.

.4 Piping systems:

.1 Piping systems: hangers longer than 305 mm; brace at each hanger.

.2 Compatible with requirements for anchoring and guiding of piping systems.

.5 Bracing methods:

.1 Approved by Consultant.

.2 Structural angles or channels.

.3 Cable restraint system incorporating grommets, shackles and other hardware to ensure alignment of restraints and to avoid bending of cables at connection points. Incorporate neoprene into cable connections to reduce shock loads.

Part 3 Execution

1.10 DELEGATED DESIGN

.1 Contractor to retain services of a seismic Engineer licensed to practice in the Northwest Territories.

.2 Seismic Engineer to provide signed and sealed seismic restraint system design drawings and information for all systems in project scope to Consultant for review.

.3 Seismic Engineer to complete field reviews and provide Letter of Assurance for seismic restraint systems.

1.11 MANUFACTURER'S INSTRUCTIONS

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

1.12 INSTALLATION

.1 Seismic control measures to meet requirements of NBC.

.2 Install vibration isolation equipment in accordance with manufacturers instructions and adjust mountings to level equipment.

.3 Ensure piping, ducting and electrical connections to isolated equipment do not reduce system flexibility and that piping, conduit and ducting passage through walls and floors do not transmit vibrations.

.4 Unless indicated otherwise, support piping connected to isolated equipment with spring mounts or spring hangers with 25 mm minimum static deflection as follows:

.1 Up to NPS4: first 3 points of support. NPS5 to NPS8: first 4 points of support. NPS10 and Over: first 6 points of support.

.2 First point of support: static deflection of twice deflection of isolated equipment, but not more than 50 mm.

.5 Where isolation is bolted to floor use vibration isolation rubber washers.

.6 Block and shim level bases so that ductwork and piping connections can be made to rigid system at operating level, before isolator adjustment is made. Ensure that there is no physical contact between isolated equipment and building structure.

1.13 FIELD QUALITY CONTROL

.1 Manufacturer's Field Services:

.1 Arrange with manufacturer's representative to review work of this Section and submit written reports to verify compliance with Contract Documents.

.2 Manufacturer's Field Services: consisting of product use recommendations and periodic site visits to review installation, scheduled as follows:

.1 After delivery and storage of Products.

.2 After preparatory work is complete but before installation commences.

.3 Once during the installation, at 50% completion stages.

.4 Upon completion of installation.

.3 Submit manufacturer's reports Consultant within 3 days of manufacturer representative's review.

.4 Make adjustments and corrections in accordance with written report.

.2 Inspection and Certification:

.1 Seismic Engineer to complete field reviews and provide Letter of Assurance for seismic restraint systems.

1.14 CLEANING

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

.2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 Materials and requirements for the identification of piping systems, duct work, valves and controllers, including the installation and location of identification systems.

1.2 RELATED REQUIREMENTS

.1 Division 01

.2 Division 02

.3 Division 26

1.3 REFERENCE STANDARDS

.1 Canadian General Standards Board (CGSB):

.1 CAN/CGSB-1.60, Interior Alkyd Gloss Enamel

.2 CAN/CGSB-24.3, Identification of Piping Systems

1.4 ACTION AND INFORMATIONAL SUBMITTALS

.1 Product Data:

.2 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.

.3 Product data to include paint colour chips, other products specified in this Section.

.4 Samples:

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

.2 Samples to include nameplates, labels, tags, lists of proposed legends.

1.5 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 01 35 29 - Health, Safety, and Emergency Response Procedures.

1.6 DELIVERY, STORAGE, AND HANDLING

.1 Packing, shipping, handling and unloading:

.1 Deliver, store and handle in accordance with Section 01 61 00 - Common Product Requirements.

.2 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.2 Waste Management and Disposal:

.1 Waste Management and Disposal: separate waste materials in accordance with Section 01 74 19 - Waste Management and Disposal.

.2 Do not dispose of unused 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 MANUFACTURER'S EQUIPMENT NAMEPLATES

.1 Metal or plastic laminate nameplate mechanically fastened to each piece of equipment by manufacturer.

.2 Lettering and numbers raised or recessed.

.3 Information to include, as appropriate:

.1 Equipment: manufacturer's name, model, size, serial number, capacity.

.2 Motor: voltage, Hz, phase, power factor, duty, frame size.

2.2 SYSTEM NAMEPLATES

.1 Colours:

.1 Hazardous: red letters, white background.

.2 Elsewhere: black letters, white background (except where required otherwise by applicable codes).

.2 Construction:

.1 3 mm thick laminated plastic, matte finish, with square corners, letters accurately aligned and machine engraved into core.

.3 Sizes:

.1 Conform to following table:

Size # mm	Sizes (mm)	No. of Lines	Height of Letters (mm)
1	10 x 50	1	3
2	13 x 75	1	5
3	13 x 75	2	3
4	20 x 100	1	8
5	20 x 100	2	5
6	20 x 200	1	8

Size # mm	Sizes (mm)	No. of Lines	Height of Letters (mm)
7	25 x 125	1	12
8	25 x 125	2	8
9	35 x 200	1	20

.2 Use maximum of 25 letters/numbers per line.

.4 Locations:

.1 Terminal cabinets, control panels: use size #5.

.2 Equipment in Mechanical Rooms: use size #9.

2.3 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 Departmental Representative.

2.4 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 marker tags.

.2 Other pipes: pressure sensitive vinyl with protective overcoating, waterproof contact adhesive undercoating, 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 Departmental Representative or 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
Glycol heating supply	Yellow	GLS
Glycol heating return	Yellow	GLR
Domestic cold water supply	Green	DCW
Sanitary	Green	SAN

2.5 IDENTIFICATION DUCTWORK SYSTEMS

.1 50 mm high stencilled letters and directional arrows 150 mm long x 50 mm high.

.2 Colours: back, or coordinated with base colour to ensure strong contrast.

.3 Identification Legend:

.1 SA – Supply Air

.2 RA – Return Air

.3 EA – Exhaust Air

2.6 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.

2.7 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.

2.8 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 INSTALLATION

.1 Perform work in accordance with CAN/CGSB-24.3 except as specified otherwise

.2 Provide ULC and/or CSA registration plates as required by respective agency

3.3 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.

3.4 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.

3.5 VALVES, CONTROLLERS

.1 Valves and operating controllers, except at plumbing fixtures, radiation, or where in plain sight of equipment they serve: Secure tags with non-ferrous chains or closed "S" hooks.

.2 Install one copy of flow diagrams, valve schedules mounted in frame behind non-glare glass where directed by Departmental Representative Consultant. Provide one copy (reduced in size if required) in each operating and maintenance manual.

.3 Number valves in each system consecutively.

3.6 CLEANING

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

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Testing, adjusting, and balancing of HVAC equipment to achieve specified performance requirements.

1.2 RELATED REQUIREMENTS

.1 Section 23 08 00 – Commissioning of HVAC

1.3 REFERENCE STANDARDS

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

.1 ANSI/ASHRAE Standard 111, Measurement, Testing, Adjusting, and Balancing of Building HVAC Systems

.2 Associated Air Balance Council (AABC):

.1 ANSI/AABC National Standards for Total System Balance.

.3 National Environmental Balancing Bureau (NEBB):

.1 NEBB Procedural Standard for Testing, Adjusting, and Balancing of Environmental Systems.

.4 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA):

.1 SMACNA 1780 - HVAC Systems - Testing, Adjusting and Balancing

.5 MD 15128-2013: Laboratory Fume Hoods

.1 Velocity and Flow Test in Chapter 6: Fume Hood Performance and Testing Requirements.

1.4 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.

1.5 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 Preliminary Report: Submit for checking and approval by Consultant before submission of formal report. Include:

.1 Details of instruments used

.2 Details of procedures employed

.3 Calculations procedures

.4 Summaries

.5 Testing and Balancing Report:

.1 Format in accordance with ANSI/ASHRAE 111 and show results in SI units.

.2 Include:

.1 Project record drawings

.2 System schematics

.3 Submit Digital copies of the report to Consultant, in English.

1.6 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.

.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

.1 Not used.

Part 3 EXECUTION

3.1 PREPARATION

.1 During construction, coordinate location and installation of measurement and balancing devices, equipment, accessories, measurement ports, and fittings.

.2 Calibrate instruments in accordance with requirements of most stringent of referenced standard for either applicable system or HVAC system.

.3 Calibrate instruments within three months of work. Submit certificate of calibration.

.4 Notify Departmental Representative seven days before start of work.

3.2 VERIFICATION OF CONDITIONS

.1 Verify that building is substantially complete, including:

.1 Installation of ceilings, doors, windows, and other construction affecting the Work.

.2 Application of weatherstripping, sealing, and sealants.

.3 Pressure, leakage, and other tests specified elsewhere in Division 23.

.4 Provisions for Work are installed and operational.

.2 Verify proper, normal, and safe operation of mechanical and associated electrical and control systems affecting Work including but not limited to:

.1 Proper thermal overload protection in place for electrical equipment.

.2 Air systems:

.1 Filters in place are clean.

.2 Duct systems are clean.

.3 Ducts, air shafts, and ceiling plenums are airtight to within specified tolerances.

.4 Correct fan rotation.

.5 Fire, smoke, and volume control dampers are installed and open.

.6 Coil fins are combed and clean.

.7 Access doors are installed and closed.

.8 Outlets are installed and volume control dampers are open.

.3 Liquid systems:

.1 Flushed, filled, and vented.

.2 Correct pump rotation.

.3 Strainers are in place and baskets are clean.

.4 Isolating and balancing valves are installed and open.

.5 Calibrated balancing valves are installed at factory settings.

.6 Chemical treatment systems are complete and operational.

3.3 SYSTEM START-UP

.1 Follow start-up procedures as recommended by equipment manufacturer unless specified otherwise.

.2 Follow special start-up procedures specified in equipment Sections.

3.4 ADJUSTING

.1 Operate systems as required to perform the work and as required by Departmental Representative or Consultant for verification of reports.

.2 Test to verify proper and safe operation, to determine actual point of performance, and to evaluate qualitative and quantitative performance of equipment, systems and controls at design, average and low loads using actual or simulated loads.

.3 Adjust and regulate equipment and systems to meet specified performance requirements and sequence of operations and to achieve specified interaction with other related systems under normal operating conditions.

.4 Balance systems and equipment to regulate flow rates to match load requirements over full operating ranges.

3.5 AIR SYSTEMS

.1 Test and balance air systems to ANSI/ASHRAE 111.

.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).

3.6 FUME HOOD SYSTEMS

.1 In coordination with the air balancing systems and commissioning requirement, Section 23 08 00, conduct testing on fume hood FH-1 in accordance with MD15128-2013 at a minimum include:

.1 Cross drafts tests

.2 Velocity and flow tests

.3 Visualization Tests

.2 Submit all draft test reports to Consultant for Review prior to final.

3.7 HEATING GLYCOL SYSTEMS

.1 Test and balance systems to ANSI/ASHRAE 111.

.2 Take measurements as appropriate for application, including but not limited to fluid flow rate, pressure drop (or loss), temperatures, and pump RPM, electrical power, voltage, noise, and vibration.

.3 Document locations of equipment measurements in report, including:

.1 HC-1.

3.8 TOLERANCES

.1 Laboratory Exhaust systems: +10%, -0% of design.

.2 Other HVAC systems: +/-5% of design.

.3 Hydronic systems: +/-5% of design.

.4 Accuracy: +/-2% of actual values.

3.9 SITE QUALITY CONTROL

.1 Reported results may be subject to verification by Departmental Representative. Verify number and location of results as directed by Departmental Representative or 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.

3.10 CLOSEOUT ACTIVITIES

.1 After work is completed to satisfaction of Departmental Representative and 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.

3.11 MAINTENANCE

.1 Measure NC levels in occupied zone of following areas: #15 Lab and #12 Open Office Area.

.2 Participate in systems checks twice during Warranty Period - #1 approximately three months after acceptance and #2 within one month of termination of Warranty Period.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes: Materials and methods for pressure testing ducts, forming part of a supply, return, or exhaust ductwork system directly or indirectly connected to air handling equipment.

1.2 RELATED REQUIREMENTS

.1 Section 23 05 93 - Testing, Adjusting and Balancing for HVAC

1.3 REFERENCE STANDARDS

.1 Sheet Metal and Air Conditioning Contractor's National Association (SMACNA):

.1 ANSI/SMACNA 016, HVAC Air Duct Leakage Test Manual

1.4 ADMINISTRATIVE REQUIREMENTS

.1 Sequencing:

.1 Test ducts before installation of insulation or other forms of concealment.

1.5 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Submit details of test instruments to be used at least three weeks before anticipated start date.

.3 Certificates: Submit instrument calibration certificates no more than 28 days before start of tests.

.4 Test Reports: Submit certified test reports from approved independent testing laboratories indicating compliance with specifications for specified performance characteristics and physical properties. Include pressure test information and results as follows:

.1 Submit proposed report form and test report format for approval to Consultant. Do not start tests until approval received in writing from Departmental Representative and Consultant.

.2 Prepare report of results and submit within 24 hours of completion of tests. Include:

.1 Schematic of entire system.

.2 Schematic of section under test showing test site.

.3 Required and achieved static pressures.

.4 Orifice differential pressure at test sites.

.5 Permissible and actual leakage flow rate (L/s) for test sites.

.6 Witnessed certification of results.

.3 Include test reports in final testing and balancing report specified in Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.

.4 Submit manufacturers' site reports to Consultant.

1.6 QUALITY ASSURANCE

.1 Work of this Section shall be performed by the same agency as work in Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.

.2 Health and Safety: Comply with Section 01 35 29 - Health, Safety, and Emergency Response Procedures.

Part 2 PRODUCTS

2.1 TEST INSTRUMENTS

.1 Test apparatus to include:

.1 Fan capable of producing required static pressure.

.2 Duct section with calibrated orifice plate mounted and accurately located pressure taps.

.3 Flow measuring instrument compatible with the orifice plate.

.4 Calibration curves for orifice plates used.

.5 Flexible duct for connecting to ductwork under test.

.6 Smoke bombs for visual inspections.

.2 Test Apparatus Accuracy: Within +/-3% of flow rate and pressure.

.3 Calibration: Calibrate instruments at minimum interval of six months and submit certificates of calibration.

Part 3 EXECUTION

3.1 TOLERANCES

.1 System leakage tolerances specified are stated as percentage of total flow rate handled by the system. Pro-rate specified system leakage tolerances.

.2 Leakage Rates: Leakage shall not exceed specified leakage rates.

.1 Small duct systems up to 250 Pa: Leakage +/-2%.

.3 Evaluation of test results to use surface area of duct and pressure in duct as basic parameters.

3.2 TESTING

.1 Test when ambient temperature will not affect effectiveness of seals and gaskets.

.2 Test flexible connections to VAV boxes.

.3 Test lengths of ducts consistent with test equipment capacity.

.4 Test fittings, branch ducts, tap-ins.

.5 Repair leaks and repeat tests until specified pressures are attained.

.6 Base partial system leakage calculations on ANSI/SMACNA 016.

.7 Seal leaks that can be heard or felt, regardless of their contribution to total leakage. Retest after seals have cured.

3.3 SITE QUALITY CONTROL

.1 Manufacturers' Site Services:

.1 HVAC equipment manufacturers shall review work involved in the handling, installation/application, protection, and cleaning of its products and submit written reports, in acceptable format, to verify compliance of Work with specified requirements.

.2 Manufacturers' Site Services: Manufacturer shall offer product use recommendations and make periodic site visits for inspection to verify that product installation complies with manufacturers' instructions.

.3 Schedule site visits to review work, at stages listed:

.1 After delivery and storage of products, and when preparatory work, or other work, on which the work of this Section depends, is complete but before installation begins.

.2 Upon completion of the work, after cleaning is carried out.

.4 Performance Verification: Departmental Representative to witness tests and verify reported results.

3.4 CLEANING

.1 Comply with Section 01 74 00 - Cleaning.

.2 Upon completion of work, remove surplus materials, rubbish, tools, and equipment.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 Thermal insulation for ductwork and ductwork accessories.

1.2 RELATED REQUIREMENTS

.1 Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment

1.3 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.

1.4 REFERENCE STANDARDS

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

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

.2 ASTM International (ASTM):

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

.2 ASTM C449, Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement

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

.4 ASTM C612, Standard Specification for Mineral Fiber Block and Board Thermal Insulation

.5 ASTM C921, Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation

.6 ASTM C1423, Standard Guide for Selecting Jacketing Materials for Thermal Insulation

.7 ASTM C1729, Standard Specification for Aluminum Jacketing for Insulation

.8 ASTM C1767M, Standard Specification for Stainless Steel Jacketing for Insulation

.3 Green Seal Environmental Standards (GS):

.1 GS-36-, Green Seal® Standard for Adhesives for Commercial Use

.4 ULC Standards (ULC):

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

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

1.5 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's product literature and datasheets for duct insulation, and include product characteristics, performance criteria, physical size, finishes, and limitations.

.3 Shop Drawings: Submit drawings.

.4 Samples:

.1 When requested, submit for approval: Complete assembly of each type of insulation system, insulation, coating, and adhesive proposed.

.2 Mount sample on 12-mm plywood board.

.3 Affix typewritten label beneath sample indicating service.

.5 Manufacturers' Instructions:

.1 Submit manufacturers’ duct insulation jointing recommendations and special handling criteria, installation sequence, and cleaning procedures.

1.6 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.

1.7 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, 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 19 - Waste Management 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.

.4 Type C-1: Rigid mineral fibre board to CAN/ULC S702.1, with factory applied vapour retarder jacket.

2.2 JACKETS

.1 Canvas jacketing: 220 g/m^2 cotton, plain weave, treated with dilute fire retardant lagging adhesive to ASTM C921.

.2 Lagging adhesive: Compatible with insulation.

.3 Aluminum jacketing: To ASTM C1729, with moisture barrier.

.1 Thickness: 0.50-mm sheet.

.2 Finish: Smooth.

.3 Jacket banding and mechanical seals: 19-mm-wide, 0.5-mm-thick stainless steel.

.4 Outer Surface Treatment and Emittance:

.1 Type I (bare surface)

.2 Type II (painted with pigmented paint)

.3 Type IV (PVF film coated surface)

.4 Type V (painted with a PVdF based paint system)

.5 Grade 1 (alloy T-304/T-304L)

.6 Grade 2 (alloy T-316/T-316L)

.5 Moisture Retarder:

.1 Class A (polyfilm, minimum 3 mil thick)

.2 Class C (polykraft)

.3 Class E (no moisture retarder)

.6 Jacket banding and mechanical seals: 19-mm-wide, 0.5-mm-thick stainless steel.

.7 Jacketing elbows: Factory fabricated, same material as straight jacketing, 2-piece, smooth finish, Class A

2.3 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 Insulating Cement: Hydraulic setting on mineral wool, to ASTM C449.

.4 Outdoor Vapour Retarder Finishes:

.1 Vinyl emulsion type acrylic, compatible with insulation.

.2 Reinforcing Fabric: Fibrous glass, untreated 305 g/m^2.

.5 Tape: Self-adhesive, aluminum, reinforced, 75-mm-wide minimum.

.6 Contact Adhesive: Quick-setting

.7 Canvas Adhesive: Washable.

.8 Tie wire: 1.5-mm stainless steel.

.9 Banding: 19-mm-wide, 0.5-mm-thick stainless steel.

.10 Facing: 25 mm galvanized steel hexagonal wire mesh stitched on one face of insulation with expanded metal lath on other face one face of insulation.

.11 Fasteners: 4 mm diameter pins with 35-mm-square clips, length to suit thickness of insulation.

Part 3 Execution

3.1 PREPARATION

.1 Verify that pressure testing of ductwork systems is complete, witnessed, and certified.

.2 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 Use two layers of insulation with staggered joints when required nominal thickness exceeds 75 mm.

.4 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.

.5 Apply high compressive strength insulation where insulation may be compressed by weight of ductwork.

.6 Fasteners: Install at 300-mm on centre in horizontal and vertical directions, minimum two rows each side.

.7 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 DUCTWORK INSULATION SCHEDULE

.1 Insulation Types and Thicknesses: Conform to following table:

	Type	Clad	Thickness (mm)
Outdoor air ducts from building envelope to heating coil	C-1	Canvas	50
Exhaust ductwork inside building to 3m from building envelope	C-1	Canvas	50
Exhaust ductwork exterior	C-1	Aluminum	100

3.5 CLEANING

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

.2 Waste Management: Perform in accordance with Section 01 74 19 - Waste Management and Disposal.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 This section specifies the Contractor's responsibilities related to commissioning (Cx) of heating, ventilation and air-conditioning (HVAC) systems and their contribution to the overall Cx work specified in Division 01.

.2 Construction Team: Contractor is responsible for performing tests and verification activities specified in Division 23 and submitting reports to Consultant

.1 Subcontractors: HVAC Subcontractors and third-party inspection/testing agencies participate in Cx activities in coordination with site quality control requirements for work they are providing.

.2 Manufacturers: Manufacturers assist verification activities and report on installation, performance and operation of the products/systems they supplied, as specified in Division 23.

.3 Contractor coordinates the work of Subcontractors, inspection/testing agencies with the commissioning requirements of this section.

.3 CxA: The CxA may assign a Cx specialist with expertise in building mechanical systems and controls, to undertake its Cx responsibilities related to this section.

.4 O&M Representative: The Departmental Representative may designate an additional representative to participate in the commissioning process and facilitate the transfer of HVAC systems to the facility's O&M staff.

.5 The requirements of this section do not replace testing requirements specified in Division 23, or reporting activities to demonstrate compliance with building code requirements to the authorities having jurisdiction (AHJ).

1.2 RELATED REQUIREMENTS

.1 Section 23 05 93 – Testing, Adjusting and Balancing for HVAC

1.3 DEFINITIONS

.1 Construction Team: Term used in this section to designate inclusively the Contractor, Subcontractors, manufacturers, suppliers, and other support disciplines that are responsible for construction/installation of the Work.

.2 Commissioning Forms: Forms used to document the inspections, tests, and verification activities performed during the commissioning process, as specified in Section 01 91 13 – General Commissioning Requirements.

.3 Commissioning Plan: Document developed under the responsibility of the commissioning authority/agent to specify the Project's commissioning requirements, as specified in Section 01 91 13 – General Commissioning Requirements.

.4 Commissioning Team: Project members that participate in the development, refinement and execution of the Commissioning Plan, as specified in Section 01 91 13 – General Commissioning Requirements.

1.4 REFERENCE STANDARDS

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

.1 ASHRAE Guideline 1.2, Technical Requirements for the Commissioning Process for Existing HVAC&R Systems and Assemblies

.2 CSA Group (CSA):

.1 CSA Z320, Building commissioning

.2 CSA Z5000, Building commissioning for energy using systems

1.5 ADMINISTRATIVE REQUIREMENTS

.1 Construction Team – Cx Representative: Designate a person from the Construction Team to review and coordinate Cx activities specified in this section.

.2 Coordination: Coordinate the responsibilities of the Construction Team in the Cx process with the responsibilities of other participants that form part of the Cx Team.

.1 Coordinate the participation of HVAC Subcontractors, inspection/testing agencies and manufacturers in reviewing the Cx Plan, submittals, and in assisting testing and demonstration activities related to their work.

.2 Coordinate Cx activities with execution of the Work during the course of construction to allow Cx participants and the AHJ to fulfill their responsibilities for witnessing tests and reviewing installation before concealment of work.

.3 Review interfaces with other work to ensure submittals and installation requirements are coordinated with other trades, including:

.1 Drainage requirements of HVAC equipment and connection of water make-up to HVAC systems specified in Division 22.

.2 Metering equipment and control devices requiring to be installed on HVAC systems.

.3 Electrical distribution serving HVAC equipment, including disconnects and starters, as specified in Division 26.

.3 Notification: Notify the Departmental Representative and Consultant of activities associated with the Cx process in accordance with Section 01 91 13 – General Commissioning Requirements.

.4 Cx Conferences: Arrange Cx meetings attended by Departmental Representative and Consultant, CxA, Contractor and HVAC Subcontractors in accordance with Section 01 91 13 – General Commissioning Requirements and as follows:

.1 Before starting work: Review mock-up requirements and factory testing of systems, components, or equipment.

.2 Coordination of integrated systems: Review and coordinate interfaces of HVAC equipment and control devices to ensure they connect with systems provided and specified in Division 25.

.3 During execution of Work but before start of Cx activities: Refine the Cx Plan, Cx documentation, and Cx schedule.

.5 Sequencing: Perform Cx activities in accordance with the Cx process described in CSA Z320, maintaining the systematic approach to completing and obtaining acceptance for each phase of Cx, in particular with regards to static verification, start-up, and functional performance testing (FPT).

.1 FPT: Perform operational and performance testing by phases, starting with individual components and equipment, testing of sub-systems, and then proceeding to FPT of overall systems.

.2 Integrated Systems: Perform Cx of integrated systems once the FPT for each individual system forming part of the integrated system is completed.

.3 Demonstration and training activities may form part of certain Cx activities, as agreed by Departmental Representative.

1.6 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 HVAC Cx Schedule:

.1 Submit proposed schedule before start of Cx conferences indicating key activities critical to the Cx process including:

.1 Inspection of HVAC systems.

.2 Testing, flushing, and cleaning of HVAC piping and ductwork.

.3 Testing, adjusting, and balancing (TAB) activities in coordination with Section 23 05 93 – Testing, Adjusting and Balancing for HVAC.

.4 Cx phases: Static verification, start-up, FPT, systems orientation, O&M manuals submissions, training sessions.

.5 Integrated testing activities.

.6 Review activities to be completed by other participants.

.2 Review the proposed schedule through the course of the Work and notify the Departmental Representative and Consultant of modifications required.

.3 Cx Forms: Contractor to review and complete forms for documenting static verification and start-up activities

.1 Approved Cx Forms: CxA reviews and approves the final format to use through the Cx process.

.1 Review the forms proposed by CxA and submit comments with proposed adjustments.

.2 Contractor may submit its own preferred format for review by the CxA. This may include manufacturer provided checklists.

.2 Submit completed static verification and start-up checklists within 48 hours of completion of verification of equipment or system.

.4 Testing Equipment: Submit a list of proposed testing equipment for performing HVAC Cx activities and related tests in accordance with Section 01 91 13 – General Commissioning Requirements.

.5 Site Quality Control Submittals: Submit manufacturers' written certificates and reports demonstrating compliance of Work, as specified in Division 23.

.6 Training Program: Submit proposed training program and materials in accordance with Section 01 91 13 – General Commissioning Requirements.

1.7 CLOSEOUT SUBMITTALS

.1 Submit O&M data and as-built information in accordance with Section 01 78 00 – Closeout Submittals.

.2 Site Modifications: Record changes to installations, system configuration or controls that were made during the Cx process to meet the required performance of HVAC equipment and systems.

1.8 QUALITY ASSURANCE

.1 Qualifications:

.1 Construction Team – Cx Representative:

.1 To be acceptable to Departmental Representative with the following qualifications:

.1 Technical personnel with a minimum of 5 years of documented experience in construction, testing, and Cx of HVAC systems.

.2 Site supervisor or project manager within the construction team, with direct responsibilities for supervising the execution of work specified in Division 23.

Part 2 Products

2.1 NOT USED

.1 Not used.

Part 3 Execution

3.1 EQUIPMENT

.1 Furnish special tools or equipment required for:

.1 Verifying or adjusting equipment/system components.

.2 Accessing equipment, enclosures, or control cabinets.

.3 Interfacing with equipment controls or system integrated diagnostics.

.2 Furnish instruments and equipment required to perform testing and validate performance of HVAC systems through the Cx process or as specified in Division 23.

3.2 STATIC VERIFICATION

.1 Perform static verification of components, equipment, and systems in accordance with Section 01 91 13 – General Commissioning Requirements and complete the approved Cx Forms in coordination with performing the following activities:

.1 Verify installation and connection of equipment, sub-systems, and systems.

.2 Confirm proper location of valves, sensors, dampers and control components in accordance with design and O&M requirements.

.3 Confirm accessibility to HVAC equipment and components for inspection and O&M activities.

.4 Conduct hydrostatic pressure testing of HVAC piping and report results.

.5 Conduct pressure testing and leakage tests of HVAC ductwork and report results.

.6 Record equipment and systems information including: manufacturer, model number, serial number, and rated capacities.

.7 Confirm completion of labelling and identification of piping, valves, dampers, ductwork, equipment, and control components.

.8 Confirm completion and documentation of equipment prestart-up tests, including manufacturer's factory tests.

.9 Confirm adequate protection of HVAC systems during construction.

.10 Confirm that thermal insulation of HVAC systems and equipment is completed in accordance with design requirements.

.11 Confirm seismic and vibration controls for HVAC equipment/systems are installed in accordance with design details and manufacturer's recommendations.

3.3 START-UP

.1 Perform start-up of equipment and systems in accordance with Section 01 91 13 – General Commissioning Requirements and complete the approved Cx Forms in coordination with performing the following activities:

.1 Flushing and cleaning of HVAC piping.

.2 Cleaning of HVAC ductwork.

.3 Contractor/manufacturer start-up of equipment.

.4 Electrical start-up of equipment including site electrical tests and verification of overloads and motor rotation.

.5 Confirm equipment electrical wiring diagrams are provided within the unit's electrical or controls enclosure.

.6 Start-up of chemical water treatment systems.

.7 Visual and mechanical inspections following equipment start-up.

.8 Verify proper staging control of multi-stage equipment and modulation of equipment supplied with variable control.

.9 Verify operation of safety controls and interlocks.

.10 Complete inspections required by the AHJ.

.11 Setup and adjustment of system and expansion tank pressures on hydronic networks.

.12 Setup and adjustment of glycol feed systems.

.13 Verify temperature performance of hydronic and ventilation systems.

.14 Verify refrigerant charges.

.2 Site Quality Control: Departmental Representative and the AHJ will witness start-up activities for selected equipment. Notify the Departmental Representative and Consultant and the AHJ of start-up activities in accordance with Section 01 91 13 – General Commissioning Requirements.

3.4 FUNCTIONAL PERFORMANCE TESTING

.1 Perform FPT on HVAC equipment and systems in accordance with Section 01 91 13 – General Commissioning Requirements and as directed by the Departmental Representative.

.2 Operate equipment as directed by Departmental Representative to demonstrate and validate that equipment, sub-systems, and systems function and perform in accordance with design requirements.

.3 FPT activities include:

.1 Verify proper operation of HVAC systems and equipment in the following modes of operation:

.1 Systems operation on normal power.

.2 Verify operation of safety cut-outs, alarms, and interlocks.

.3 Confirm alarms are generated and transmitted effectively to the intended notification system (for example, pilot light, control panel, building automation system (BAS), or remote surveillance system).

.4 Confirm capacities of heating systems at design conditions at near winter design condition.

.5 Optimize operation of systems involved in energy control strategies such as peak shaving and load shifting.

.6 Verify that the proper schedules were configured for each HVAC equipment and system and confirm that they are disabled or set back when not required.

.7 Confirm that airflow quantities in ventilation systems meet design and special requirements, specifically with regards to indoor air quality, building/space pressurization and energy optimization.

.8 Verify TAB results in coordination with Section 23 05 93 – Testing, Adjusting and Balancing for HVAC.

.9 Confirm that simultaneous heating and cooling is not occurring at an equipment or system level.

.10 Optimize operating sequences, control parameters, and setpoints for HVAC systems with an emphasis on energy management, including the following:

.1 Ventilation and hydronic free cooling strategies.

.2 Setpoints for controlling pressures and temperatures in ventilation and hydronic systems.

.3 Setpoint optimization in ventilation systems:

.1 Supply air temperature reset strategies.

3.5 FUME HOOD SYSTEMS

.1 Testing on fume hood FH-1 in accordance with MD15128-2013. Include all final reports, approvals, safety reviews, and results in commissioning and closeout documents for distribution to Consultant, Building Owner, and DFO. Refer to Section 23 05 93.

3.6 SITE QUALITY CONTROL

.1 Manufacturer’s Site Services: Obtain written certificates and reports from manufacturer verifying compliance of Work and submit Manufacturer’s Site Reports as described in ACTION AND INFORMATIONAL SUBMITTALS in this section.

.1 Provide manufacturer's site services to complete start-up activities and assist in FTP as specified in Division 23.

3.7 CLOSEOUT ACTIVITIES

.1 Corrections: Provide equipment, materials, and labour as required to correct installation or equipment deficiencies identified through the Cx process.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 26 05 00 - Common Work Results for Electrical

1.2 REFERENCE STANDARDS

.1 American Society of Heating, Refrigeration and Air Conditioning Engineers / Illuminating Engineering Society (ASHRAE/IES):

.1 ASHRAE Guideline 13, Specifying Building Automation Systems

.2 CSA Group (CSA):

.1 CSA C22.2 No. 24, Temperature-indicating and -regulating equipment

.2 CSA C22.2 No. 94.2: Enclosures for electrical equipment, environmental considerations

1.3 ADMINISTRATIVE REQUIREMENTS

.1 Coordination:

.1 Coordinate with Section 26 05 00 - Common Work Results for Electrical.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data: Product literature and data sheets for HVAC control systems, including product characteristics, performance criteria, physical sizes, finishes, and limitations.

.3 Shop Drawings:

.1 Signed and sealed by a qualified professional in accordance with Section 01 43 00 - Quality Assurance.

.2 Installation layouts and details of the components and equipment and room layout and the design of the control system.

.4 Manufacturer's instructions:

.1 Special delivery, storage, and handling requirements.

.2 Installation instructions.

.3 Recommended sequencing.

.4 Cleaning procedures.

1.5 CLOSEOUT SUBMITTALS

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

.2 Operation and maintenance data:

.1 Include, in the operation and maintenance manual, manufacturer’s maintenance and operating instructions and recommended cleaning materials and methods.

Part 2 Products

2.1 PERFORMANCE/DESIGN CRITERIA

.1 Provide electric and electronic control systems that comply with CSA C22.2 No. 24.

.2 Provide motors and controllers with the required pieces of equipment with electric wiring and connection.

.3 Provide also variable air volume and mixing boxes with valves, dampers, controllers and required accessories for automatic function of airflow as specified by manufacturer.

.4 Products requiring electrical connection: Listed and certified by a certification body accredited by the Standards Council of Canada or acceptable to authority having jurisdiction as suitable for purpose specified.

.5 Controls: Easily programmable, with simple electronic set-up.

.6 Displays: Digital, backlit.

.1 Internally illuminated thermostats:

.1 background illumination level of 50 to 100 lx;

.2 operating controls that are luminance (colour) contrasted with their background.

.2 Install controls as specified by electrical requirement in Division 26, design layouts, and with available access for maintenance and replacement in accordance with ASHRAE Guideline 13.

2.2 LOW-VOLTAGE DUCT TEMPERATURE SENSORS

.1 Low-voltage wall thermostats:

.1 For use on 24 V circuit at 1.5 A capacity.

.2 Temperature setting range: 10°C to 25°C.

.3 With air proving switch.

2.3 FLOW CONTROL VALVES

.1 Provide flow control valves for modulating the flange as required in alignment with the coil for effective control.

.2 Provide valve position indicators to show its positions as required for proper function.

.3 These valves can be used for hydronic or steam with the selection of the material for valves as required by each fluid or operation.

2.4 POWER OPERATED DAMPERS

.1 Provide power operated dampers that control air passing through ducts by adjusting its position and regulating air flow. These dampers can be operated by pneumatic or electric switches that are operated by electric motor to adjust damper’s blade.

Part 3 Execution

3.1 SEQUENCE OF OPERATIONS

.1 #15 Lab General Occupied Ventilation

.1 The #15 Lab ventilation systems are to operate in general occupied mode in the case that the existing wall switch in the lab is initiated.

.2 Ventilation systems are to operate continuously until the switch is deactivated, for a minimum 30 minutes of operation, or until the fan switch on FH-1 is initiated, overriding the controls to operate in Fume Hood Ventilation Mode.

.3 Existing EX-EF-1 is to operate at constant volume.

.4 The motorized damper serving AH-1 is to modulate to the set damper position 2 for 115 L/s supply air. Following which, AH-1 is to initiate and operate at constant volume.

.5 HC-1 control valve is to modulate to maintain a discharge air temperature of 20C based on duct mounted temperature sensor.

.6 EF-3 is not to operate.

.2 #15 Lab Fume Hood Ventilation

.1 The #15 Lab ventilation systems are to operate to the #15 Lab Fume Hood Ventilation sequence of operations in the case that the fan switch on the owner supplied FH-1 is initiated.

.2 Ventilation systems are to operate continuously until the fan switch on FH-1 is deactivated or for a minimum 30 minutes of operation.

.3 Existing EX-EF-1 is not to operate. If the system was previously operating in General Occupied Mode, EX-EF-1 is to shut down.

.4 The motorized damper serving AH-1 is to modulate to the set damper position 3 for 315 L/s. Following which, AH-1 is to initiate and operate at constant volume.

.5 HC-1 control valve is to modulate to maintain a discharge air temperature of 20C based on duct mounted temperature sensor.

.6 The motorized damper, serving EF-3 is to open, following which, EF-3 is to initiate and operate at constant volume.

.3 Unoccupied Mode

.1 When neither condition associated with the #15 Lab General Occupied Ventilation or Fume Hood ventilation Systems are operating, the system is to be in unoccupied mode.

.2 Existing EX-EF-1 is not to operate.

.3 New EF-3 is not to operate.

.4 Exhaust motorized damper is to be closed.

.4 New AH-1 is not to operate.

.1 Outdoor air motorized damper is to be closed.

3.2 EXAMINATION

.1 Verification of conditions:

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

3.3 INSTALLATION

.1 Install work of this section in accordance with manufacturer's instructions and reviewed Shop Drawings.

.2 Install thermostats at heights in accordance with CSA B651, with centre of thermostat maximum 1200 mm above finished floor.

.3 Verify the sequence of operations of mechanical controls is provided and is aligned with the design and integration and commissioning plan in accordance with ASHRAE Guideline 13.

.4 Execute and optimize HVAC equipment setpoints and control settings in accordance with the designer’s approach and ASHRAE Guideline 13.

3.4 CLEANING

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

.2 Waste management:

.1 Manage waste in accordance with Section 01 74 19 - Waste Management and Disposal

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 A480/A480M, Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet and Strip.

.2 ASTM A635/A635M, 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.

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

.3 Green Seal Environmental Standards (GS)

.1 GS-36, Standard for Adhesives for Commercial Use.

.4 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)

.1 SMACNA HVAC Duct Construction Standards - Metal and Flexible.

.2 SMACNA HVAC Air Duct Leakage Test Manual.

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 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 manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials indoors in a 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.

Part 2 Products

2.1 SEAL CLASSIFICATION

.1 Classification as follows:

Maximum Pressure Pa	SMACNA Seal Class
250	C
125	C

.2 Seal classification:

.1 Class A: not used

.2 Class B: not used

.3 Class C: transverse joints and connections made air tight with tape, gaskets, sealant.

2.2 SEALANT

.1 Sustainability Characteristics:

.2 Sealant: oil resistant, polymer type flame resistant duct sealant. Temperature range of minus 45 degrees C to plus 93 degrees C.

2.3 TAPE

.1 Tape: polyvinyl treated, open weave fiberglass tape, 50 mm wide.

2.4 FITTINGS

.1 Fabrication: to SMACNA.

.2 Radiused elbows:

.1 Rectangular: centreline radius: 1.5 times width of duct.

.2 Round: smooth radius for Fume Hood Exhaust, five piece otherwise, centreline radius: 1.5 times diameter.

.3 Branches:

.1 Rectangular main and branch: with radius on branch 1.5 times width of duct.

.2 Round main and branch: enter main duct at 45 degrees.

.3 Provide volume control damper in branch duct near connection to main duct.

.4 Main duct branches: with splitter damper.

.4 Transitions:

.1 Diverging: 20 degrees maximum included angle.

.2 Converging: 30 degrees maximum included angle.

2.5 GALVANIZED STEEL

.1 Lock forming quality: to ASTM A653/A653M, Z90 zinc coating.

.2 Thickness, fabrication and reinforcement: to SMACNA.

.3 Joints: to SMACNA

2.6 HANGERS AND SUPPORTS

.1 Hangers and Supports: in accordance with Section 23 05 29- Hangers and Supports for HVAC Piping and Equipment.

.1 Strap hangers: of same material as duct

.1 Maximum size duct supported by strap hanger: 500.

.2 Hanger configuration: to SMACNA

.3 Hangers: galvanized steel angle with galvanized steel rods to SMACNA and the following:

Duct Size (mm)	Angle Size (mm)	Rod Size (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

.4 Upper hanger attachments:

.1 For concrete: manufactured concrete inserts.

.2 For steel joist: manufactured joist clamp.

.3 For steel beams: manufactured beam clamps:

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 Departmental Representative.

.2 Inform Departmental Representative and 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 Departmental Representative.

3.2 GENERAL

.1 Do work in accordance with SMACNA.

.2 Do not break continuity of insulation vapour barrier with hangers or rods.

.3 Support risers in accordance with SMACNA and 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 where required.

3.3 HANGERS

.1 Strap hangers: install in accordance with SMACNA.

.2 Angle hangers: complete with locking nuts and washers.

.3 Hanger spacing: in accordance with SMACNA and as follows:

Duct Size	Spacing
(mm)	(mm)
to 1500	3000
1501 and over	2500

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 LEAKAGE TESTS

.1 Refer to Section 23 05 94- Pressure Testing of Ducted Air Systems.

.2 In accordance with SMACNA HVAC Duct Leakage Test Manual.

3.6 CLEANING

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

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 - Cleaning.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

1.2 REFERENCE STANDARDS

.1 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)

.1 SMACNA -HVAC Duct Construction Standards -Metal and Flexible.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for air duct accessories and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Indicate:

.1 Flexible connections.

.2 Duct access doors.

.3 Turning vanes.

.4 Instrument test ports.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.2 Storage and Handling Requirements:

.1 Store materials indoors and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect air duct accessories from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 PRODUCTS

2.1 GENERAL

.1 Manufacture in accordance with SMACNA - HVAC Duct Construction Standards.

2.2 FLEXIBLE CONNECTIONS

.1 Frame: galvanized sheet metal frame with fabric clenched by means of double locked seams.

.2 Material:

.1 Fire resistant, self extinguishing, neoprene coated glass fabric, temperature rated at minus 40 degrees C to plus 90 degrees C, density of 1.3 kg/m^2.

2.3 ACCESS DOORS IN DUCTS

.1 Non-Insulated Ducts: sandwich construction of same material as duct, one sheet metal thickness heavier, minimum 0.6 mm thick complete with sheet metal angle frame.

.2 Insulated Ducts: sandwich construction of same material as duct, one sheet metal thickness heavier, minimum 0.6 mm thick complete with sheet metal angle frame and 25 mm thick rigid glass fibre insulation.

.3 Gaskets: neoprene.

.4 Hardware:

.1 Up to 300 x 300 mm: two sash locks complete with safety chain.

2.4 INSTRUMENT TEST

.1 1.6 mm thick steel zinc plated after manufacture.

.2 Cam lock handles with neoprene expansion plug and handle chain.

.3 28 mm minimum inside diameter. Length to suit insulation thickness.

.4 Neoprene mounting gasket.

2.5 SPIN-IN COLLARS

.1 Conical galvanized sheet metal spin-in collars with lockable butterfly damper.

.2 Sheet metal thickness to co-responding round duct standards.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for air duct accessories installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Departmental Representative.

.2 Inform Departmental Representative and 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 Departmental Representative.

3.2 INSTALLATION

.1 Flexible Connections:

.1 Install in following locations:

.1 Inlets and outlets to supply air units and fans.

.2 Inlets and outlets of exhaust and return air fans.

.3 As indicated.

.2 Length of connection: 50 to 100 mm.

.3 Minimum distance between metal parts when system in operation: 75 mm.

.4 Install in accordance with recommendations of SMACNA

.5 When fan is running:

.1 Ducting on sides of flexible connection to be in alignment.

.2 Ensure slack material in flexible connection.

.2 Access Doors and Viewing Panels:

.1 Size:

.1 300x300 mm for servicing entry.

.2 Locations:

.1 Fire and smoke dampers.

.2 Control dampers.

.3 Devices requiring maintenance.

.4 Required by code.

.5 Reheat coils.

.6 Elsewhere as indicated.

.3 Instrument Test Ports:

.1 General:

.1 Install in accordance with recommendations of SMACNA and in accordance with manufacturer's instructions

.2 Locate to permit easy manipulation of instruments.

.3 Install insulation port extensions as required.

.4 Locations:

.1 For traverse readings:

.1 Ducted inlets to roof and wall exhausters.

.2 Inlets and outlets of other fan systems.

.3 Main and sub-main ducts.

.4 And as indicated.

.2 For temperature readings:

.1 At outside air intakes.

.2 In mixed air applications in locations as approved by Consultant.

.3 At inlet and outlet of coils.

.4 Downstream of junctions of two converging air streams of different temperatures.

.5 And as indicated.

.4 Turning Vanes:

.1 Install in accordance with recommendations of SMACNA and as indicated

3.3 CLEANING

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

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 - Cleaning.

.3 Waste Management: separate waste materials in accordance with Section 01 74 19 - Waste Management and Disposal.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 23 33 00 - Air Duct Accessories

1.2 REFERENCE STANDARDS

.1 ASTM International (ASTM)

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

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

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

1.4 CLOSEOUT SUBMITTALS

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

.2 Operation and Maintenance Data: submit operation and maintenance data for dampers for incorporation into manual.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials indoors and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect dampers from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 MULTI-LEAF DAMPERS

.1 Opposed blade type.

.2 Extruded aluminum, interlocking blades, complete with extruded vinyl seals, spring stainless steel side seals, extruded aluminum frame.

.3 Pressure fit self-lubricated bronze bearings.

.4 Linkage: plated steel tie rods, brass pivots and plated steel brackets, complete with plated steel control rod.

.5 Performance:

.1 Rated for operation at -45°C or colder.

.2 Leakage: in closed position less than 2% of rated air flow at 25 Pa differential across damper.

.3 Pressure drop: at full open position less than 25 Pa differential across damper at system maximum operating velocity.

.6 Insulated aluminum dampers:

.1 Frames: thermally broken blades and frame, insulated with extruded polystyrene foam with RSI 0.88.

.2 Blades: constructed from aluminum extrusions with internal hollows insulated with polyurethane or polystyrene foam, RSI 0.88.

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 damper installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Departmental Representative.

.2 Inform Departmental Representative and 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 Departmental Representative.

3.2 INSTALLATION

.1 Install where indicated.

.2 Install in accordance with recommendations of SMACNA and manufacturer's instructions

.3 Seal multiple damper modules with silicon sealant.

.4 Install access door adjacent to each damper. See Section 23 33 00 - Air Duct Accessories.

.5 Ensure dampers are observable and accessible.

3.3 CLEANING

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

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 - Cleaning.

.3 Waste Management: separate waste materials in accordance with Section 01 74 19 - Waste Management and Disposal.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 23 05 13 - Common Motor Requirements for HVAC Equipment

.2 Section 23 05 48 - Vibration and Seismic Controls for HVAC Piping and Equipment

.3 Section 23 33 00 - Air Duct Accessories

1.2 REFERENCE STANDARDS

.1 American National Standards Institute/Air Movement and Control Association (ANSI/AMCA):

.1 ANSI/AMCA Standard 99, Standards Handbook

.2 ANSI/ASHRAE 51 (ANSI/AMCA 210), Laboratory Methods of Testing Fans for Aerodynamic Performance Rating

.3 ANSI/AMCA Standard 300, Reverberant Room Method for Sound Testing of Fans

.4 ANSI/AMCA Standard 301, Methods for Calculating Fan Sound Ratings from Laboratory Test Data

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

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

.3 Shop Drawings:

.1 Provide:

.1 Fan performance curves showing point of operation, W and efficiency.

.2 Sound rating data at point of operation.

.2 Indicate:

.1 Motors, sheaves, bearings, shaft details,

.2 Minimum performance achievable as appropriate.

1.4 MAINTENANCE MATERIAL SUBMITTALS

.1 Spare Parts:

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

.1 Supply:

.1 Matched sets of belts.

.2 Supply list of individual manufacturer's recommended spare parts for equipment, include:

.1 Bearings and seals.

.2 Addresses of suppliers.

.3 List of specialized tools necessary for adjusting, repairing or replacing.

1.5 DELIVERY, STORAGE, AND HANDLING

.1 Deliver, store, and handle materials in accordance with Section 01 61 00 - Common Product Requirements.

.2 Storage and Handling Requirements:

.1 Store materials indoors in dry location and in accordance with manufacturer's recommendations in clean, well-ventilated area.

.2 Store and protect HVAC fans from nicks, scratches, and blemishes.

.3 Packaging Waste Management: remove as specified in Construction Waste Management Plan in accordance with Section 01 74 19 - Waste Management and Disposal.

Part 2 Products

2.1 PERFORMANCE CRITERIA

.1 Catalogued or published ratings for manufactured items: obtained from tests carried out by manufacturer or those ordered by manufacturer from independent testing agency signifying adherence to codes and standards in force.

.1 Capacity: flow rate, External static pressure, W, efficiency, revolutions per minute, power, model, size, sound power data and as indicated on schedule.

.2 Fans: statically and dynamically balanced, constructed in conformity with ANSI/AMCA Standard 99.

.3 Sound ratings: comply with ANSI/AMCA Standard 301, tested to ANSI/AMCA Standard 300.

.4 Performance ratings: based on tests performed in accordance with ANSI/AMCA Standard 210.

2.2 FANS GENERAL

.1 Motors:

.1 In accordance with Section 23 05 13 - Common Motors Requirements for HVAC Equipment supplemented as specified herein.

.2 Motor Speed: single

.2 Accessories and hardware: matched sets of V-belt drives, adjustable motor bases, belt guards, coupling guards fan as specified in Section 23 05 13 - Common Motor Requirements for HVAC Equipment.

.3 Factory primed before assembly in colour standard to manufacturer.

.4 Scroll casing drains: as indicated.

.5 Bearing lubrication systems plus extension lubrication tubes where bearings are not easily accessible.

.6 Vibration isolation: to Section 23 05 48 - Vibration and Seismic Controls for HVAC Piping and Equipment.

.7 Flexible connections: to Section 23 33 00 - Air Duct Accessories.

2.3 CENTRIFUGAL FANS

.1 Fan wheels:

.1 Welded steel construction.

.2 Spark Resistance Rating – Type B

.3 Maximum operating speed of centrifugal fans not more than 50% of first critical speed.

.4 backward inclined blades, as indicated.

.2 Bearings: heavy duty grease lubricated ball or roller self aligning type with oil retaining dust excluding seals and a certified minimum rated life of 80 000 hours.

.3 Shaft seals on laboratory fume hood exhaust fans:

.1 Single disc seals.

.4 Housings:

.1 Volute with inlet cones: fabricated steel for wheels 300 mm or greater, steel, for smaller wheels, braced, and with welded supports.

.2 For horizontally and vertically split housings provide flanges on each section for bolting together, with gaskets of non-oxidizing non-flammable material.

.3 Provide bolted airtight access doors with handles.

2.4 CABINET FANS - GENERAL PURPOSE

.1 Fan characteristics and construction: as centrifugal fans.

.2 Cabinet hung single or multiple wheel with DWDI centrifugal fans in factory fabricated casing complete with vibration isolators and seismic control measures, motor, direct drive inside casing.

Part 3 EXECUTION

3.1 EXAMINATION

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

.1 Visually inspect substrate in presence of Departmental Representative.

.2 Inform Departmental Representative and Consultant of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied.

3.2 FAN INSTALLATION

.1 Install fans as indicated, complete with resilient mountings specified in Section 23 05 48 - Vibration and Seismic Controls for HVAC Piping and Equipment, flexible electrical leads and flexible connections in accordance with Section 23 33 00 - Air Duct Accessories.

.2 Provide sheaves and belts required for final air balance.

.3 Bearings and extension tubes to be easily accessible.

.4 Access doors and access panels to be easily accessible.

3.3 ANCHOR BOLTS AND TEMPLATES

.1 Size anchor bolts to withstand seismic acceleration and velocity forces as specified in Section 23 05 48 - Vibration and Seismic Controls for HVAC Piping and Equipment.

3.4 SITE QUALITY CONTROL

.1 Refer to Section 01 91 13 - General Commissioning Requirements for commissioning requirements.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Division 23

1.2 REFERENCE STANDARDS

.1 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA):

.1 ANSI/SMACNA 006, HVAC Duct Construction Standards – Metal and Flexible

1.3 ADMINISTRATIVE REQUIREMENTS

.1 Coordination:

.1 Coordinate installation of exterior intakes and exhausts

1.4 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer’s instructions, product literature, and data sheets for intakes. Indicate product characteristics, performance criteria, physical size, finishes, and limitations.

.2 Show anchorage details, elevations, sections, and specific details for each louvre. Include a list of all louvres and their locations in the Project using the identification numbers on the Drawings.

.3 Indicate the following:

.1 Pressure drop

.2 Face area

.3 Free area

1.5 DELIVERY, STORAGE, AND HANDLING

.1 Delivery and Acceptance Requirements: Deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.2 Storage and Handling Requirements:

.1 Store materials indoors, in a clean, dry, well-ventilated location, and in accordance with manufacturer’s recommendations.

.2 Store and protect material from nicks, scratches, and blemishes.

.3 Develop Construction Waste Management Plan related to Work of this Section and in accordance with Section 01 74 19 - Waste Management and Disposal.

.4 Packaging Waste Management: Remove packaging materials as specified in Construction Waste Management Plan in accordance with Section 01 74 19 - Waste Management and Disposal.

Part 2 Products

2.1 RAIN CAPS

.1 Thickness of Metal: To SMACNA.

.2 Fabrication: To ANSI/SMACNA 006, chapter 5.

.3 Joints: To SMACNA.

.4 Supports: To SMACNA.

.5 Screens: Integral mesh screens made of a minimum 1.3 mm diameter Aluminum wire with 19 mm mesh aperture.

2.2 GOOSENECK HOODS

.1 Thickness of Metal: To SMACNA.

.2 Fabrication: To ANSI/SMACNA 006, chapter 5.

.3 Joints: To SMACNA.

.4 Supports: To SMACNA.

.5 Screens: Integral mesh screens made of a minimum 1.3 mm diameter Aluminum wire with 19 mm mesh aperture.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: Verify that conditions of substrates previously installed are acceptable for louvres, intakes, and vents installation in accordance with manufacturer’s instructions.

.1 Inform Departmental Representative and Consultant of unacceptable conditions immediately upon discovery.

.2 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLATION

.1 Perform in accordance with manufacturer's and SMACNA recommendations.

.2 Reinforce and brace as indicated.

.3 Anchor securely into opening. Seal with sealant to ensure weather tightness.

.4 Install screens where indicated. Where screen joints are unavoidable, overlap edges and ends by a minimum of 25 mm.

3.3 CLEANING

.1 Progress and Final Cleaning: Clean in accordance with Section 01 74 00 - Cleaning.

.2 Waste Management: Separate waste materials in accordance with Section 01 74 19 - Waste Management and Disposal.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 CSA Group

.1 CSA C22.1, Canadian Electrical Code, Part 1, Safety Standard for Electrical Installations.

.2 CAN3-C235, Preferred Voltage Levels for AC Systems, 0 to 50,000 V.

.2 Institute of Electrical and Electronics (IEEE)/National Electrical Safety Code Product Line (NESC)

.1 IEEE SP1122, The Authoritative Dictionary of IEEE Standards Terms, 7th Edition.

1.2 DEFINITIONS

.1 Electrical and electronic terms: unless otherwise specified or indicated, terms used in these specifications, and on drawings, are those defined by IEEE SP1122.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for equipment as identified in the electrical specifications.

.3 Shop drawings:

.1 Submit drawings stamped and signed by professional engineer registered or licensed in NWT, Canada.

.2 Indicate on drawings clearances for operation, maintenance, and replacement of operating equipment devices.

.3 Submit full size drawings to authority having jurisdiction

.4 If changes are required, notify Consultant and Departmental Representative of these changes before they are made.

.4 Certificates:

.1 Provide CSA certified equipment.

.2 Permits and fees: in accordance with General Conditions of contract.

.3 Submit certificate of acceptance from authority having jurisdiction upon completion of Work to Departmental Representative and Consultant.

1.4 CLOSEOUT SUBMITTALS

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

.2 Operation and Maintenance Data: submit operation and maintenance data for:

.1 Provide for each system and principal item of equipment as specified in technical sections for use by operation and maintenance personnel.

.2 Operating instructions to include following:

.1 Wiring diagrams, control diagrams, and control sequence for each principal system and item of equipment.

.2 Start up, proper adjustment, operating, lubrication, and shutdown procedures.

.3 Safety precautions.

.4 Procedures to be followed in event of equipment failure.

.5 Other items of instruction as recommended by manufacturer of each system or item of equipment.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section with manufacturer's written instructions and 01 61 00- Common Product Requirements.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials in dry location indoors and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect materials from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 DESIGN REQUIREMENTS

.1 Operating voltages: to CAN3-C235.

.2 Motors, control and distribution devices and equipment to operate satisfactorily at 60 Hz within normal operating limits established by above standard.

.1 Equipment to operate in extreme operating conditions established in above standard without damage to equipment.

2.2 MATERIALS AND EQUIPMENT

.1 Provide material and equipment in accordance with Section 01 61 00- Common Product Requirements.

.2 Materials and equipment to be CSA certified. Where CSA certified materials and equipment are not available, obtain special approval from the authority having jurisdiction before delivery to site and submit such approval as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.

2.3 ELECTRIC MOTORS, EQUIPMENT AND CONTROLS

.1 Verify installation and co-ordination responsibilities related to motors, equipment and controls, as indicated.

.2 Control wiring and conduit: Connections below 50 V which are related to control systems as shown on mechanical drawings and specified in mechanical sections.

2.4 WIRING TERMINATIONS

.1 Ensure lugs, terminals, screws used for termination of wiring are suitable for either copper or aluminum conductors.

2.5 EQUIPMENT IDENTIFICATION

.1 Identify electrical equipment with labels or nameplates as follows:

.1 Nameplates: lamicoid mm black face, white core, lettering accurately aligned and engraved into core.

.2 Sizes as follows:

NAMEPLATE SIZES			
Size 1	10 x 50 mm	1 line	3 mm high letters
Size 2	12 x 70 mm	1 line	5 mm high letters
Size 3	12 x 70 mm	2 lines	3 mm high letters
Size 4	20 x 90 mm	1 line	8 mm high letters
Size 5	20 x 90 mm	2 lines	5 mm high letters
Size 6	25 x 100 mm	1 line	12 mm high letters
Size 7	25 x 100 mm	2 lines	6 mm high letters

.2 Labels: embossed plastic labels with 6 mm high letters unless specified otherwise.

.3 Wording on nameplates and labels to be approved by Consultant prior to manufacture.

.4 Allow for minimum of twenty-five (25) letters per label and nameplate.

.5 Nameplates for terminal cabinets and junction boxes to indicate system and/or voltage characteristics.

.6 Identify equipment with Size 3 labels engraved "ASSET INVENTORY NO. ____".

.7 Disconnects, starters and contactors: indicate equipment being controlled and voltage.

.8 Terminal cabinets and pull boxes: indicate system and voltage.

2.6 WIRING IDENTIFICATION

.1 Identify wiring with permanent indelible identifying markings, coloured plastic tapes, on both ends of phase conductors of feeders and branch circuit wiring.

.2 Maintain phase sequence and colour coding throughout.

.3 Colour coding: to CSA C22.1.

.4 Use colour coded wires in communication cables, matched throughout system.

2.7 CONDUIT AND CABLE IDENTIFICATION

.1 Colour code conduits, boxes and metallic sheathed cables.

.2 Code with plastic tape or paint at points where conduit or cable enters wall, ceiling, or floor, and at 15 m intervals.

.3 Colours: 25 mm wide prime colour and 20 mm wide auxiliary colour.

Type	Prime	Auxiliary
up to 250 V	Yellow	

2.8 FINISHES

.1 Shop finish metal enclosure surfaces by application of rust resistant primer inside and outside, and at least two coats of finish enamel.

.1 Paint indoor distribution enclosures light gray

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 Consultant.

.1 Inform Consultant and Departmental Representative of unacceptable conditions immediately upon discovery.

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

3.2 INSTALLATION

.1 Do complete installation in accordance with CSA C22.1 except where specified otherwise.

3.3 NAMEPLATES AND LABELS

.1 Ensure manufacturer's nameplates, CSA labels and identification nameplates are visible and legible after equipment is installed.

3.4 CONDUIT AND CABLE INSTALLATION

.1 If plastic sleeves are used in fire rated walls or floors, remove before conduit installation.

.2 Install cables, conduits and fittings embedded or plastered over, close to building structure so furring can be kept to minimum.

3.5 CO-ORDINATION OF PROTECTIVE DEVICES

.1 Ensure circuit protective devices such as overcurrent trips, relays and fuses are installed to required values and settings.

3.6 FIELD QUALITY CONTROL

.1 Conduct following tests in accordance with Section 01 45 00- Quality Control.

.1 Circuits originating from branch distribution panels.

.2 Motors, heaters and associated control equipment including sequenced operation of systems where applicable.

.2 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 This Section includes requirements for selective demolition and removal of electrical components including removal of conduit, junction boxes, and panels to source (home run removal) and incidentals required to complete work described in this Section ready for new construction.

1.2 RELATED REQUIREMENTS

.1 Section 02 41 13– Selective Site Demolition

.2 Section 02 41 16– Structure Demolition

.3 Section 02 41 19.13– Selective Building Demolition

.4 Section 02 41 19.16– Selective Interior Demolition

.5 Section 02 41 00.08– Demolition - Minor Works

.6 Section 02 42 00– Removal and Salvage of Construction Materials

.7 Section 02 81 00– Transportation and disposal of hazardous materials

.8 Section 02 82 00.02– Asbestos abatement - intermediate precautions

.9 Section 02 84 00– Polychlorinated Biphenyl Remediation

1.3 REFERENCE STANDARDS

.1 CSA Group (CSA)

.1 CSA S350 M1980 (R2003), Code of Practice for Safety in Demolition of Structures

1.4 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 Departmental Representative 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 Federal Hazardous Products Act (RSC 1985) including latest amendments.

1.5 ACTION AND INFORMATIONAL SUBMITTALS

.1 Action Submittals: Provide in accordance with Section 01 33 00– Submittal Procedures before starting work of this Section:

.1 Construction Waste Management Plan (CWM Plan): Submit plan addressing opportunities for reduction, reuse, or recycling of materials prepared in accordance with Section 01 74 19– Construction Waste Management and Disposal.

.2 Landfill Records: Indicate receipt and acceptance of selective demolition waste and hazardous wastes by a landfill facility licensed to accept hazardous wastes.

1.6 ADMINISTRATIVE REQUIREMENTS

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

.2 Scheduling: Account for Owner’s continued occupancy requirements during selective demolition and schedule staged occupancy and worksite.

1.7 QUALITY ASSURANCE

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

.1 Federal Workers’ Compensation Service

.2 Territorial Workers’ Compensation Boards/Commissions

.3 Territorial Occupational Health and Safety Standards and Programs

.4 Government of Canada, Labour Program: Workplace Safety

1.8 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: It is not expected that Hazardous Substances will be encountered in Work; immediately notify Departmental Representative and Consultant if materials suspected of containing hazardous substances are encountered and perform following activities:

.1 Refer to Section 01 41 00– Regulatory Requirements for directives associated with specific material types.

.2 Hazardous substances will be as defined in Hazardous Products Act.

.3 Stop work in area of suspected hazardous substances.

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

.5 Hazardous substances will be removed by Departmental Representative under a separate contract or as a change to Work.

.6 Proceed only after written instructions have been received from Departmental Representative.

1.9 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.

.1 Leave main electrical distribution panel in place; panel can be used for temporary construction power for this and subsequent contracts in accordance with Section 01 50 00– Temporary Facilities; coordinate temporary power connections with .

Part 2 Products

2.1 MATERIALS

.1 Electrical Repair Materials: Use only new materials, CSA or ULC labelled as appropriate and matching components remaining after work associated with components identified for removal or demolition are completed.

.2 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; Departmental Representative 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 Departmental Representative 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 will remain in operation.

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

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

.2 Notify Departmental Representative and 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 Coordinate requirements of this Section with information contained as follows:

.1 Disconnect electrical circuits and panel feeders; maintain electrical service and main distribution panel as is, ready for subsequent Work.

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

.1 Remove 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 Disconnect panel feeders back to main distribution panel and re label respective circuit breaker as “SPARE”.

.4 Place weatherproof blank cover plates on exterior outlet boxes remaining after demolition and removal activities.

.5 Remove existing conduits, boxes, cabling and wiring associated with removed electrical devices and equipment.

.6 Grind off conduits and make flush with surface of concrete where conduits are cast into concrete; seal open ends of conduit with silicone sealant and leave in place.

.7 Seal open ends of conduit with silicone sealant and leave in place where they are inaccessible or cannot be removed without damaging adjacent construction.

3.4 CLOSEOUT ACTIVITIES

.1 Demolition Waste Disposal: Arrange for legal disposal and remove demolished materials to accredited provincial landfill site or alternative disposal site (recycle centre).

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 CSA Group (CSA)

- .1 CAN/CSA-C22.2 No.18, Outlet Boxes, Conduit Boxes and Fittings.
- .2 CAN/CSA-C22.2 No.65, Wire Connectors (Tri-National Standard with UL 486A-486B and NMX-J-543-ANCE-03).

.2 Electrical and Electronic Manufacturers' Association of Canada (EEMAC)

- .1 EEMAC 1Y-2, Bushing Stud Connectors and Aluminum Adapters (1200 Ampere Maximum Rating).

.3 National Electrical Manufacturers Association (NEMA)

Part 2 Products

2.1 MATERIALS

.1 Pressure type wire connectors to: CAN/CSA-C22.2 No.65, with current carrying parts of copper sized to fit copper conductors as required.

.2 Fixture type splicing connectors to: CAN/CSA-C22.2 No.65, with current carrying parts of copper sized to fit copper conductors 10 AWG or less.

.3 Bushing stud connectors: to NEMA to consist of:

- .1 Connector body and stud clamp for copper conductors.
- .2 Clamp for copper conductors.
- .3 Stud clamp bolts for copper conductors.
- .4 Bolts for copper bar and conductors.
- .5 Sized for conductors as required.

.4 Clamps or connectors for armoured cable, as required to: CAN/CSA-C22.2 No.18.

Part 3 Execution

3.1 INSTALLATION

.1 Remove insulation carefully from ends of conductor cables and:

- .1 Install mechanical pressure type connectors and tighten screws with appropriate compression tool recommended by manufacturer. Installation shall meet secureness tests in accordance with CAN/CSA-C22.2 No.65.
- .2 Install fixture type connectors and tighten to CAN/CSA-C22.2 No.65. Replace insulating cap.
- .3 Install bushing stud connectors in accordance with NEMA.

END OF SECTION

Part 1 Products

1.1 BUILDING WIRES

.1 Conductors: stranded for 10 AWG and larger. Minimum size: 12 AWG.

.2 Copper conductors: size as indicated, with 1000 V insulation of cross-linked thermosetting polyethylene material rated RWU90 XLPE, Jacketted.

.3 Neutral supported cable: 3 phase insulated conductors of Copper and one neutral conductor of Copper steel reinforced, size as indicated. Type: NS90 Insulation: Type NSF-2 flame retardant rated 600 V.

1.2 ARMOURED CABLES

.1 Conductors: insulated, copper, size as indicated.

.2 Type: AC90.

.3 Armour: interlocking type fabricated from galvanized steel strip.

.4 Type: flame retardant, ACWU90 jacket over thermoplastic armour and compliant to applicable Building Code classification for this project.

.5 Connectors: anti short connectors.

1.3 CONTROL CABLES

.1 Type: LVT: 2 soft annealed copper conductors, sized as indicated:

.1 Insulation: thermoplastic.

.2 Sheath: thermoplastic jacket, and armour of closely wound aluminum wire.

.2 Type: low energy 300 V control cable: stranded annealed copper conductors sized as indicated LVT: 2 soft annealed copper conductors, sized as indicated:

.1 Insulation: polyethylene.

.2 Shielding: wireover conductor group.

.3 Overall covering: polyethylene jackets PVC jackets.

.3 Type: 600 V conductors, sizes as indicated: ACM alloy

.1 Insulation: PVC ethylene-propylene rubber insulation type, polyethylene RW90 (x-link), cross-linked polyethylene type.

.2 Shielding: over each pair of conductors.

.3 Overall covering: with sheath of interlocked armour.

Part 2 Execution

2.1 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00- Common Work Results for Electrical.

.2 Perform tests before energizing electrical system.

2.2 GENERAL CABLE INSTALLATION

.1 Terminate cables in accordance with Section 26 05 20- Wire and Box Connectors - (0-1000 V).

.2 Cable Colour Coding: to Section 26 05 00- Common Work Results for Electrical.

.3 Lace or clip groups of feeder cables at distribution centres, pull boxes, and termination points.

.4 Wiring in walls: typically drop or loop vertically from above to better facilitate future renovations. Generally wiring from below and horizontal wiring in walls to be avoided unless indicated.

.5 Provide numbered wire collars for control wiring. Numbers to correspond to control shop drawing legend. Obtain wiring diagram for control wiring.

2.3 INSTALLATION OF BUILDING WIRES

.1 Install wiring as follows:

.1 In conduit systems in accordance with Section 26 05 34- Conduits, Conduit Fastenings and Conduit Fittings.

2.4 INSTALLATION OF ARMOURED CABLES

.1 Group cables wherever possible on channels.

2.5 INSTALLATION OF CONTROL CABLES

.1 Install control cables in conduit.

.2 Ground control cable shield.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 CSA Group

.1 CSA C22.1, Canadian Electrical Code, Part 1 (24th Edition), Safety Standard for Electrical Installations.

.2 CSA C22.2 No.41, Grounding and Bonding Equipment (Tri-National Standard, with NMX-J-590ANCE and UL 467).

.3 CSA C22.2 No.65, Wire connectors (Tri-National Standard, with UL 486A-486B NMX-J-543-ANCE).

Part 2 Products

2.1 CONNECTORS AND TERMINATIONS

.1 Copper compression connectors to CSA C22.2 No.65 as required sized for conductors.

.2 Contact aid for aluminum cables where applicable.

.3 2, 3, or 4 way joint boxes dry location type in accordance with Section 26 05 33- Raceway and Boxes for Electrical Systems.

.4 2, 3, or 4 way junction boxes with respective pothead for 2, 3, or 4 conductor cables for polyethylene cable copper with sheath, and overall jacket in accordance with Section 26 05 33- Raceway and Boxes for Electrical Systems.

Part 3 Execution

3.1 INSTALLATION

.1 Install stress cones, terminations, and splices in accordance with manufacturer's instructions.

.2 Bond and ground as required to CSA C22.2 No.41.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 CSA Group (CSA)

.1 CSA C22.1, Canadian Electrical Code, Part 1, 20th Edition.

Part 2 Products

2.1 OUTLET AND CONDUIT BOXES GENERAL

.1 Size boxes in accordance with CSA C22.1.

.2 102 mm square or larger outlet boxes as required.

.3 Gang boxes where wiring devices are grouped.

.4 Blank cover plates for boxes without wiring devices.

.5 Combination boxes with barriers where outlets for more than one system are grouped.

2.2 CONDUIT BOXES

.1 Cast FS & FD aluminum boxes with factory-threaded hubs and mounting feet for surface wiring of devices.

2.3 FITTINGS - GENERAL

.1 Bushing and connectors with nylon insulated throats.

.2 Knock-out fillers to prevent entry of debris.

.3 Conduit outlet bodies for conduit up to 35 mm and pull boxes for larger conduits.

.4 Double locknuts and insulated bushings on sheet metal boxes.

Part 3 Execution

3.1 INSTALLATION

.1 Support boxes independently of connecting conduits.

.2 Fill boxes with paper, sponges or foam or similar approved material to prevent entry of debris during construction. Remove upon completion of work.

.3 Provide correct size of openings in boxes for conduit, mineral insulated and armoured cable connections. Do not install reducing washers.

.4 Vacuum clean interior of outlet boxes before installation of wiring devices.

.5 Identify systems for outlet boxes as required.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 CSA Group (CSA)

.1 CSA C22.2 No.40-M1989(R2009), Cutout, Junction and Pull Boxes.

Part 2 Products

2.1 JUNCTION BOXES POWER LEVEL

.1 Cast iron octagonal box painted with chromate primer and grey enamel with joints ground smooth and fitted with gasket, contacts mounted on porcelain supports to which conductors are fastened by soldered-on lugs, medium hard asphalt compound filled, suitable for 3 phase, 15 kV cable, 250 MCM maximum cable size, with stuffing box wiping sleeve entrance.

.2 Welded steel rectangular boxes, oil resistant gasketted steel plate lids fastened with silicon-bronze bolts, shot blasted and painted with chromate primer and grey enamel, cable heads medium hard asphalt compound filled cap nut sealed potheads with wiping sleeve entrances, air filled, disconnecting links insulated switch stick operated at no voltage rated 250A at 7500V, 4 way for wall mounting in maintenance holes.

Part 3 Execution

3.1 INSTALLATION

.1 Install distribution level steel boxes on walls of maintenance holes tunnels. Splice main cable in box and connect branch feeder. Fasten cover and fill with compound.

.1 Ground steel boxes as required.

.2 Install power level boxes as follows:

.1 Cast iron type: on trench floor, connect cable terminals to box contacts, fasten lid and fill with compound before trench is backfilled.

.2 Steel type: mount on wall of maintenance holes; connect cables to box terminals; install disconnect links, fasten lid securely check for air leaks.

.3 Ground power level boxes as required.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 CSA Group (CSA)

- .1 CAN/CSA C22.2 No. 18-98(R2003), Outlet Boxes, Conduit Boxes, Fittings and Associated Hardware, A National Standard of Canada.
- .2 CSA C22.2 No. 45-M1981(R2003), Rigid Metal Conduit.
- .3 CSA C22.2 No. 56, Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit.
- .4 CSA C22.2 No. 83-M1985(R2003, Electrical Metallic Tubing.
- .5 CSA C22.2 No. 211.2-M1984(R2003), Rigid PVC (Unplasticized) Conduit.
- .6 CAN/CSA C22.2 No. 227.3, Nonmetallic Mechanical Protection Tubing (NMPT), A National Standard of Canada (February 2006).

Part 2 Products

2.1 CABLES AND REELS

.1 Provide cables on reels or coils.

- .1 Mark or tag each cable and outside of each reel or coil, to indicate cable length, voltage rating, conductor size, and manufacturer's lot number and reel number.

.2 Each coil or reel of cable to contain only one continuous cable without splices.

.3 Identify cables for exclusively dc applications.

.4 Reel and mark shielded cables rated 2,001 volts and above.

2.2 CONDUITS

.1 Rigid metal conduit: to CSA C22.2 No. 45, galvanized steel threaded.

.2 Epoxy coated conduit: to CSA C22.2 No. 45, with zinc coating and corrosion resistant epoxy finish inside and outside.

.3 Electrical metallic tubing (EMT): to CSA C22.2 No. 83, with couplings.

.4 Flexible metal conduit: to CSA C22.2 No. 56, liquid-tight flexible metal.

2.3 CONDUIT FASTENINGS

.1 One hole steel straps to secure surface conduits 50 mm and smaller.

- .1 Two hole steel straps for conduits larger than 50 mm.

.2 Beam clamps to secure conduits to exposed steel work.

.3 Channel type supports for two or more conduits.

.4 Threaded rods, 6 mm diameter, to support suspended channels.

2.4 CONDUIT FITTINGS

.1 Fittings: to CAN/CSA C22.2 No. 18, manufactured for use with conduit specified. Coating: same as conduit.

.2 Ensure factory "ells" where 90 degrees bends for 25 mm and larger conduits.

.3 Watertight connectors and couplings for EMT.

.1 Set-screws are not acceptable.

2.5 EXPANSION FITTINGS FOR RIGID CONDUIT

.1 Weatherproof expansion fittings with internal bonding assembly suitable for 100 mm linear expansion.

.2 Watertight expansion fittings with integral bonding jumper suitable for linear expansion and 19 mm deflection.

.3 Weatherproof expansion fittings for linear expansion at entry to panel.

2.6 FISH CORD

.1 Polypropylene.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

.1 Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass.

.2 Conceal conduits except in unfinished areas and in mechanical and electrical service rooms.

.3 Use rigid galvanized steel threaded conduit except where specified otherwise.

.4 Use epoxy coated conduit in corrosive areas.

.5 Use electrical metallic tubing (EMT) except in cast concrete and above 2.4 m not subject to mechanical injury.

.6 Use flexible metal conduit for work in movable metal partitions and connection to motors in dry areas.

.7 Use liquid tight flexible metal conduit for connection to motors or vibrating equipment in damp, wet or corrosive locations.

.8 Minimum conduit size for power circuits: 19 mm.

.9 Bend conduit cold:

.1 Replace conduit if kinked or flattened more than 1/10th of its original diameter.

.10 Mechanically bend steel conduit over 19 mm diameter.

.11 Field threads on rigid conduit must be of sufficient length to draw conduits up tight.

.12 Install fish cord in empty conduits.

.13 Dry conduits out before installing wire.

3.3 SURFACE CONDUITS

.1 Run parallel or perpendicular to building lines.

.2 Locate conduits behind infrared or gas fired heaters with 1.5 m clearance.

.3 Run conduits in flanged portion of structural steel.

.4 Group conduits wherever possible on surface or suspended channels.

.5 Do not pass conduits through structural members except as indicated.

.6 Do not locate conduits less than 75 mm parallel to steam or hot water lines with minimum of 25 mm at crossovers.

3.4 CONCEALED CONDUITS

.1 Run parallel or perpendicular to building lines.

.2 Do not install horizontal runs in masonry walls.

.3 Do not install conduits in terrazzo or concrete toppings.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 CSA Group (CSA)

.1 CSA C22.2 No. 100-04, Motors and Generators.

.2 Electrical and Electronic Manufacturers' Association of Canada (EEMAC)

.1 EEMAC M1-7-1992, Standard for Motors and Generators.

Part 2 Products

2.1 FRACTIONAL HORSEPOWER MOTOR

.1 Non-hazardous locations: to EEMAC M1-7 and CSA C22.2 No. 100.

.2 Motor with inherent overheating protectors.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

.1 Install wiring, flexible connections and grounding.

.2 Check rotation before coupling to driven equipment.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 CSA Group (CSA)

.1 CSA C22.2 No.29-11 , Panelboards and Enclosed Panelboards.

Part 2 Products

2.1 PANELBOARDS

.1 Panelboards: Re-use existing panelboards, Schneider Square D NQOB Type.

2.2 BREAKERS

.1 Re-use existing breakers within panelboards except as indicated otherwise.

Part 3 Execution

3.1 INSTALLATION

.1 Disconnect existing mechanical loads from existing panelboards.

.2 Connect new mechanical loads to existing panelboards.

.3 Connect loads to circuits.

3.2 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by panelboards installation.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 CSA Group

.1 CAN/CSA-C22.2 No.4-04(R2009), Enclosed and Dead-Front Switches (Tri-National Standard, with ANCE NMX-J-162-2004 and UL 98).

.2 CSA C22.2 No.39, Fuseholder Assemblies.

Part 2 Products

2.1 DISCONNECT SWITCHES

.1 Fusible disconnect switch in CSA enclosure size.

.2 Provision for padlocking in on-off switch position by 3 locks.

.3 Mechanically interlocked door to prevent opening when handle in ON position.

.4 Fuses: size as indicated.

.5 Fuseholders: to CSA C22.2 No.39 relocatable and suitable without adaptors, for type and size of fuse indicated.

.6 Quick-make, quick-break action.

.7 ON-OFF switch position indication on switch enclosure cover.

Part 3 Execution

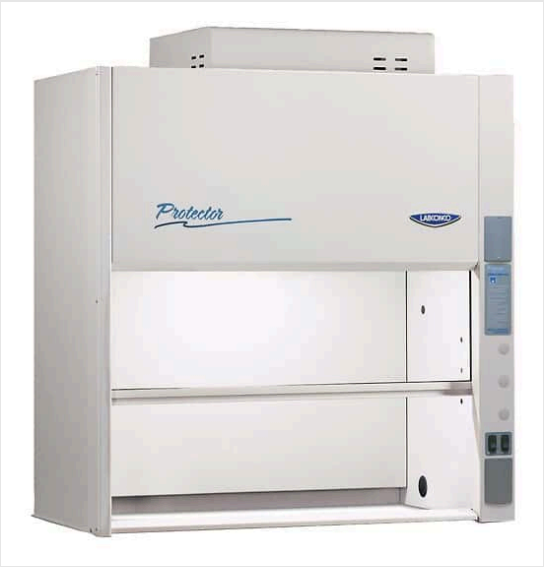
3.1 INSTALLATION

.1 Disconnect and reconnect to refurbished mechanical equipment.

END OF SECTION

Appendix A

Pre-purchased Equipment



Labconco 2247300 47" Basic Fume Hood, with standard blower; 115 VAC/60 Hz

Labconco | Mfr: 2247300 | Item: 3350310

(4.0) 1 Review Write a Review | Q&A

100% of respondents would recommend this to a friend

Perfect when you need a full-sized ventilated hood to handle small quantities of chemicals

- 1 year warranty ...

$12,263.02 CAD / EACH

Call for Availability

1

ADD TO CART

+ADD TO LIST

PRODUCT OPTIONS

Recommended Accessory

Labconco Work Surface, Flat Epoxy, 48"

$3,598.02 CAD / EACH

ADD TO CART

Product Description

Key Features

- 1 year warranty

More About this Item

Benefit from renowned Labconco design and quality—while staying within a limited budget. Basic™ hoods enable safe light-duty chemical handling for a broad range of applications. These hoods utilize by-pass airflow design to assure safe continuous ventilation regardless of sash height. All models incorporate advanced design features such as a removable curved air foil and an adjustable two-piece baffle to ensure optimal air routing. Applications should limit long-term exposure to harsh solvents and highly-corrosive vapors.

All fume hoods include a 3/16" (0.5 cm) thick tempered safety glass counterbalanced sash and a 10" (25.4 cm) diameter duct collar. Hoods are constructed of glacier white epoxy-coated 16 gauge steel and include a removable front panel and a 4" (10.2 cm) L x 41/2" (11.4 cm) W utility pass-through port with molded neoprene cover. Hoods do not include a cabinet or work surface—order in accessories.

Models are available with or without a built-in blower, and in standard or spark-proof configurations. Blowers can be mounted any of three ways—within the hood, above the hood, or on the roof of your building.

The 115 VAC models are shipped fully assembled; 220 VAC models require assembly. Cord and plug are not included.

Specifications

Hood Width (in)	47
Blower Type	Standard
Blower (hp)	1/3
Lights	Incandescent

Switches	2
Exterior Width (in)	47
Exterior Height (in)	53
Exterior Depth (in)	25
Interior Width (in)	41.25
Power (VAC)	115
Power (Hz)	60
Description	47" Basic Fume Hood, with standard blower; 115 VAC/60 Hz
Warranty	1 Year

Reviews

(4.0) 1 Review Write a Review

100% of respondents would recommend this to a friend

+

Q&A

8 Questions Answered

+

Appendix B

Hazardous Materials Assessment

Nanzu Demolition and Environmental Ltd.

October 22nd, 2025

To: Inuvialuit Regional Corporation
Attention: Johanna Mitchener

Nanzu Demolition and Environmental Ltd. (Nanzu), was contracted by the Inuvialuit Regional Corporation (IRC) to conduct an inspection for asbestos containing materials (ACM), lead, and mould, at the DFO (Department of Fisheries and Oceans) Building located at 8 Arctic Road in Inuvik, NT. Inspection for other possible hazardous materials were included in the inspection. All samples were sent to Enviroworks Laboratories in Edmonton, Alberta, and accredited Laboratory.

Asbestos Containing Materials

During inspection of the building, no asbestos insulation, ACM pipe wrap, or ACM floor tiles were observed within the mechanical room of the building, or anywhere else on site. Samples of suspected ACM were collected from drywall in the office wall, as well as ceiling tile in the mechanical room. Both samples contained no detectable ACM (see attached laboratory results page, sample ID 25101437-001, and 25101437-002).

Lead-Based Paint

A sample was taken of the painted surface in the mechanical room. Laboratory analysis indicated that the total lead in the paint was less than 23.5 mg/kg (see attached laboratory results page, sample ID 25101443-001). This level is well within the threshold for lead levels in the NT. And therefore, considered to be at non-hazardous levels. If this material requires abatement, it can be safely disposed of at the Inuvik landfill.

Mould

Nanzu carried out testing on suspected mould on surfaces within this building. All samples revealed no fungal growth. Each observed surface is deemed to be mould-free (see attached laboratory results page, sample ID 25101438-001, 25101438-002, and 25101438-003).

PCBs

During inspection, no PCB containing light ballasts were observed.

Ozone depleting substances

Any unit containing a refrigerator or freezer is suspected of containing CFCs, an ozone depleting substance. This does not pose a risk to the environment unless the units are damaged such that CFCs are released.

Mercury

Thermostats were noted in each unit of the building. Each thermostat is suspected of containing mercury. This does not pose a risk to occupants unless the thermostats are damaged such that mercury is released into the unit.

Chemicals

Other than regular cleaning products, no hazardous chemicals were observed to be stored on site.

Results and Discussion

Other than any mercury containing thermostats and CFC-containing items such as refrigerators and freezers, this building is deemed to be hazard-free. Any planned demolition of this building will require the removal of CFC-containing items, as well as mercury-containing items.

Closing

Thank you for using Nanzu on this project. If you have any questions or concerns, please feel free to contact us.

Bradley Firth

President
Nanzu Demolition and Environmental Ltd.
867-678-0103
bradfirth@hotmail.com

Laboratory Results – Asbestos

eurofins | Enviro-Works

18949 111 Avenue NW
Edmonton, Alberta, T5S 2X4
Ph: 780-457-4652
Email: info@enviro-works.com
Web: www.enviro-works.com

Certificate of Analysis

Client: Nanzu
35 Amherst Crescent
St. Albert, Alberta T8N 2P7

Date Submitted: 14-Oct-25
Date Completed: 14-Oct-25

Lab ID : 25101437
COC No. 149239
Project: DFO (IRC)
Contact: Robert

Bulk Asbestos Fiber Analysis by Polarized Light Microscopy (PLM) NIOSH 9002

Sample No.	Date Sampled	Client Sample Description	Sample Type	Asbestos Type and Content	Non-Asbestos Constituents
25101437-001	10/14/2025	DFO Office Wall	Sheet with Drywall, Brown/Grey	None Detected	Cellulose Other
No Compound Provided					
25101437-002	10/14/2025	DFO Mechanical Room	Ceiling Tile, Beige	None Detected	Cellulose Glass Fibers/ Mineral Wool Other Perlite

* = Trace amounts detected; Below replicable detection limit

Eurofins Enviro-Works Inc. is accredited by CALA to ISO/IEC 17025. For scope of accreditation visit www.enviro-works.com. Samples will be stored for 60 days after they are submitted. This analytical report reflects only the results of the materials tested. Eurofins Enviro-Works Inc. is not responsible for the procedures used during sample collection. Eurofins Enviro-Works Inc. is not responsible for any consultation, interpretation or course of action taken with respect to these results. Please be aware that TEM is recommended for any cementitious material, and/or vermiculite matrix that are determined after analysis to be non-detected, as trace amounts of asbestos may be below the resolution of a PLM. Eurofins Enviro-Works Inc. privacy policy includes the limitation of access or discussion of these results to include only the client listed in the report.

ilac-MRA CALA Testing Accreditation No. A3166

Approved By:

Ann-Marie Kalman,
B.Sc.
Lab Manager

Laboratory Results – Lead

eurofins | Enviro-Works

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web: www.enviro-works.com

Certificate of Analysis

Client: Nanzu
35 Amherst Crescent
St. Albert, Alberta T8N 2P7

Date Submitted: 10/14/2025
Date Completed: 10/17/2025

Lab ID: 25101443
COC No. 149239
Project: DFO (IRC)
Contact Robert
Analyst: tadolph

Method: ASTM E1645-21 (prep) and ASTM E3193-23 (analysis) - Lead Paint by FAAS

Sample ID	Date Sampled	Description	Lead (mg/kg)	Qualifier
25101443-001	10/14/2025	DFO Mechanical Room	< 23.5	

Eurofins Enviro-Works Inc. is a proficient member of the AIHA ELPAT quality control program. Samples will be stored for 60 days after they are submitted. Eurofins Enviro-Works Inc. is not responsible for the procedures used during sample collection. Eurofins Enviro-Works Inc. is not responsible for any consultation, interpretation or course of action taken with respect to these results. Eurofins Enviro-Works Inc. privacy policy includes the limitation of access or discussion of these results to include only the client listed in the report.

ilac-MRA CALA Testing Accreditation No. A3166

Approved By:

Ann-Marie Kalman,
B.Sc.
Lab Manager

Laboratory Results – Mould

eurofins | Enviro-Works

18949 111 Avenue NW
Edmonton, Alberta T5S 2X4
Phone: 780-457-4652
email: info@enviro-works.com
web: www.enviro-works.com

Certificate of Analysis

Client: Nanzu
35 Amherst Crescent
St. Albert, Alberta T8N 2P7
Date Submitted: 10/14/2025
Date Completed: 10/15/2025

EWI Log No.: 25101438
COC No.: 149239
Project: DFO (IRC)
Contact: Robert
Analyst: akalman

Method: ASTM D7658-17 (Modified) Fungal Tape Lift

Sample ID	Date Sampled	Sample Description	Genus Identification	Relative Spore Concentration	Qualifier
25101438-001	10/14/2025	Smith ABT 1	No Fungal Growth	N/A	
Tape stuck together. Re-sampling suggested					
25101438-002	10/14/2025	Smith ABT 2	No Fungal Growth	N/A	
Tape stuck together. Re-sampling suggested					
25101438-003	10/14/2025	Smith ABT 3	No Fungal Growth	N/A	
Tape stuck together. Re-sampling suggested					

Spore Concentrations are reported subjectively by the analyst as an indication of colony viability. This observation is not a quantification of the fungal colony.

Relative Spore Concentration Guideline
Loaded = >80% of FOV
Many = 31% to 79% of FOV
Few = <30% of FOV

Eurofins Enviro-Works Inc. is a proficient member of the AIHA EMPAT quality control program. Samples will be stored for 60 days after they are submitted. Eurofins Enviro-Works Inc. is not responsible for the procedures used during sample collection. Eurofins Enviro-Works Inc. is not responsible for any consultation, interpretation or course of action taken with respect to these results. Eurofins Enviro-Works Inc. privacy policy includes the limitation of access or discussion of these results to include only the client listed in the report.

ilac-MRA CALA Testing Accreditation No. A3166

Approved By:

Ann-Marie Kalman,
B.Sc.
Lab Manager

Appendix C

Commissioning Forms

APPENDIX C

ON-SITE TEST FORMS

C.1 Commissioning Checklist

Laboratory Fume Hoods		Page 1
Project:	Project No:	Date:
Room:	Type:	Overall sizes:
Fume Hood No. on Contract Dwgs:		
Mfr:	Mfr Serial No.:	MMS Identifier:

Installation:

- ☐ Minimum disturbance of smooth air flow into fume hood by passing traffic
- ☐ No obstructions to air flow into hood
- ☐ Freedom of movement for fume hood user
- ☐ All labels firmly attached
- ☐ User instructions complete and in place
- ☐ Electronic sketch of the room, showing the location of the hood, windows and doors, all major furniture, air supply and return, etc.

Bypass (if provided)**:**

- ☐ Operates as designed

Work Surface:

- ☐ Work surface recessed to contain spills

Baffles:

- ☐ Factory settings
- ☐ Unalterable by fume hood user
- ☐ Position of baffles recorded and dimensioned (mm)

Bottom Airfoil:

- ☐ Height fixed (usually 25 mm)

Sash:

- ☐ Freedom of movement
- ☐ Locations of stop set to limit maximum operating position (manual override for set-up)

Counterbalance Mechanism:

- ☐ Sash moveable from one end
- ☐ Sash remains fixed (i.e., no creep)

Services:

- ☐ Corrosion-resistant finish as required
- ☐ Electrical:
  - ☐ Receptacle—correct power
  - ☐ Connected to emergency power (if required)
- ☐ Mechanical:
  - ☐ Correct gases from each outlet
  - ☐ Outlets properly identified
  - ☐ Correct pressure at outlet
  - ☐ Isolating controls easily accessible
  - ☐ Correct identification on each outlet

C.1 Commissioning Checklist (cont'd)

Laboratory Fume Hoods	Page 2
Fire Extinguishing System (if installed): ☐ Tested and operational	
Scrubber System (if installed): ☐ Correct neutralizing agent and concentration for contaminant ☐ Fluid pressure developed by pump sufficient for good atomization ☐ Atomizing sprays operating properly ☐ Spray system drainage operates correctly and is accessible for cleaning ☐ Reservoir drainage and recharging facilities easily accessible ☐ Control system verified ☐ Pump connected to emergency power (if required) ☐ Scrubber efficiency tested and verified	
Light Fixture: ☐ Lens sealed ☐ Light level verified	
Controls: ☐ Control sequences and alarm systems verified ☐ Visual, audible annunciator for power to fume hood system, adequate air flow for fume hood operation ☐ Visual and audible alarm for low air flow, audible alarms with muting switches ☐ Vapour warning system (if required) ☐ Connected to emergency power ☐ Written instructions available	
Fume Hood Exhaust Air Systems: ☐ Exhaust air flow rate confirmed by TAB ☐ Minimum air flow when sash closed verified at 150 to 375 air changes per hour (see *ANSI Z9.5*) ☐ Exhaust systems connected to emergency power (if required)	
Tests Completed: ☐ AM—As-manufactured ☐ AI—As-installed (i.e., after installation) ☐ Integrated systems tests ☐ Certificates provided	
Training ☐ Familiarization during installation ☐ Classroom ☐ Hands-on ☐ Log books prepared and in place	
Installation verified by:	Date:
Supervisor:	Date:

C.2 Performance Verification (PV) Report Forms—Hood and Systems

Agency Name
Building Name:
Laboratory:
Date:

Hood Information

Hood ID:	Hood Type:
Manufacturer:	Hood Model:
Serial:	Size:

Hood Design Features

Sash: ☐ Vertical ☐ Combination ☐ Horizontal ☐ None	Number of Sashes/Panels: _____ Panel Widths _____	Baffle: ☐ Adjustable ☐ None ☐ Fixed
Number of Slots:	Interior Depth:	Internal Construction:
Services:		
General Comments:		

C.2 Performance Verification (PV) Report Forms—Hood and Systems (cont'd)

System Information

System ID:		
Exhaust Type: ☐ VAV ☐ CAV ☐ Other	Exhaust Configuration: ☐ Single Hood—Single Fan ☐ Single Hood—Multiple Fan ☐ Multiple Hood—Single Fan	☐ Multiple Hood—Multiple Fan ☐ No Exhaust
Hood Duct Diameter:		Monitor:
Duct Material:		Monitor Type:
Filtration:		Alarm:
Filtration Type:		Damper:
VAV Control Type:		VAV Manufacturer:

C.3 Forms for Test Results—CAV

Agency Name:
Building Name:
Laboratory:
Date:

C.3 Forms for Test Results—CAV (cont'd)

Test Conditions

Sash Opening Description:				
Normal Operating Position Dimensions:	Width: _____ mm	Height: _____ mm	Area: _____ m^2	Total Area: _____ m^2
Baffle Opening:				
Apparatus in Hood:	☐ Yes ☐ No			
Monitor:	Type:		Reading:	
Additional Test Comments:				

C.3.1 Cross Draft Test Results

Horizontal Draft	Left	Centre	Right
Peak m/s			
Average m/s			
Vertical Draft	**Left**	**Centre**	**Right**
Peak m/s			
Average m/s			
Perpendicular Draft	**Left**	**Centre**	**Right**
Peak m/s			
Average m/s			

C.3 Forms for Test Results—CAV (cont'd)

C.3.2 Face Velocity Tests

Face Velocity Traverse Results, Sash at Design Opening

	Col 1	Col 2	Col 3	Col 4	Col 5	Col 6	Col 7	Col 8
Row 1								
Row 2								
Row 3								
	Ave. Velocity: ___ m/s		Max. Velocity: ___ m/s		Min. Velocity: ___ m/s		Exhaust Flow: ___ l/s	

Face Velocity Traverse Results, Bypass Effectiveness (Sash at 150 mm)

	Col 1	Col 2	Col 3	Col 4	Col 5	Col 6	Col 7	Col 8
Row 1								
Row 2								
Row 3								
	Ave. Velocity: ___ m/s		Max. Velocity: ___ m/s		Min. Velocity: ___ m/s		Exhaust Flow: ___ l/s	

C.3.3 Airflow Visualization

	Diffuser Location #1:	Diffuser Location #2:	Diffuser Location #3:
Observations:			
Time to evacuate smoke (sec.):			
Performance Evaluation:	High Pass: ☐ Yes ☐ No Low Pass: ☐ Yes ☐ No Low Fail: ☐ Yes ☐ No High Fail: ☐ Yes ☐ No		
Comments:			

C.3 Forms for Test Results—CAV (cont'd)

C.3.4 Tracer Gas Test Results

Sash at Normal Operating Position: (____ mm H x ____ mm W)

Ejector and Mannequin Position	Left	Centre	Right
Average ppm			
Peak ppm			

Peripheral Scan

Peak Reading, ppm, design sash position:

Sash Movement Effect (sash moving from closed to normal operating position)

	Cycle 1	Cycle 2	Cycle 3
45 second Rolling average			

C.3.5 Fume Hood Monitor, Alarm and Sensors

Calibration: All sensors reporting to BAS calibrated	☐ Yes	☐ No
Monitor Display: To at least 2 decimal points	☐ Yes	☐ No
Monitor Accuracy: Display is within +/– 5% of actual value	☐ Yes	☐ No
Alarm Enunciation: Occurs when beyond +/– 10% of design flow set point	☐ Yes	☐ No
Alarm Response: Enunciation delay (maximum 10 seconds)	_____ seconds	

C.5 Statement of Conformance

Statement of conformance for Laboratory Fume Hood Testing

We _____ certify that our company/agency conforms to the qualification requirements stated in *Section 6.2 of MD 15128-2013: Laboratory Fume Hoods*.

In particular, the following criteria have been met:

Qualification Criteria		
Minimum of 3 years of experience in the verification of fume hoods	☐ Met	☐ Not Met
Attended the *HVAC Systems and Laboratory Design* course (by U.S. Eagleson Institute or equivalent)	☐ Met	☐ Not Met
Attended *ASHRAE 110: Testing Workshop* training by U.S. Eagleson Institute, or *Fume Hood Testing Seminar for Certified Professionals* by National Environmental Balancing Bureau (NEBB), or equivalent	☐ Met	☐ Not Met
Fully cognizant of contents in *MD 15128: Laboratory Fume Hoods*	☐ Met	☐ Not Met

Contact Information
Company/Agency Name:
Contact Name:
Address:
Telephone Number:
E-Mail Address:

Please provide details on the following page.

I certify that all of the above statements are correct:

(Date and Place) (Signature of the Authorized Party)

C.5 Statement of Conformance (cont'd)

Details of How the Qualifications Are Met

Qualification Criteria	Explanation/Examples
Minimum of 3 years of experience in the verification of fume hoods *Examples of 3 projects for which verification of fume hoods was required:*	Project name (1): Project date and place: Number of hoods tested: Contact/reference name: Project name (2): Project date and place: Number of hoods tested: Contact/reference name: Project name (3): Project date and place: Number of hoods tested: Contact/reference name:
HVAC Systems and Laboratory Design course (by U.S. Eagleson Institute or equivalent)	Name of the Training Institution: Name of the Training Course: Date course taken: Name of the attendee: Copy of the certificate attached: ☐ Yes ☐ No
ASHRAE 110: Testing Workshop training (by U.S. Eagleson Institute or *Fume Hood Testing Seminar for Certified Professionals* by National Environmental Balancing Bureau (NEBB), or equivalent	Name of the Training Institution: Name of the Training Course: Date course taken: Name of the attendee: Copy of the certificate attached: ☐ Yes ☐ No

Appendix D

Sample Commissioning Forms

Owner: Department of Fisheries and Oceans	**Existing Exhaust Fan**
Project: DFO Fume Hood Replacement	**Fan** **Mechanical**

Location: Lab Ceiling
System:

Spec Section:
Sub-Category:

EQUIPMENT TAG

EX_EF-1

TECHNICAL DATA

DATE / CHECKED BY: _____

	SPECIFIED	SHOP DRAWING	INSTALLED	VERIFIED CONTR/COM.
Function	Lab Exhaust Fan	.....	.....	/
Air Flow (L/s)	140	.....	.....	/
Static Pressure	125	.....	.....	/
Fan RPM	.....	.....	.....	/
Manufacturer	Penn	.....	.....	/
Model No.	Zephr Z9RA	.....	.....	/
Type	Inline	.....	.....	/
Interlocks	FH-1 and Wall Switch	.....	.....	/
Serial No.	.....	.....	.....	/
Class	.....	.....	.....	/
Power (kW)	.....	.....	.....	/
Electrical (V/Ph/Hz)	120 / 1 / 60	.....	.....	/
Permanent Labels affixed & Legible	.....	.....	.....	/

STATIC CHECKS

DATE / CHECKED BY:

Fan Housing	.....	Vibration Isolation	.....
Bearing Type	.....	Flex Connections	.....
Alignment	.....	Fan Rotation	.....
Local Disconnect	.....	Belt Guard	.....
Control	.....	Maintenance Access	.....
Backdraft Damper	.....	Access	.....

OPERATION CHECKS

DATE / CHECKED BY: _____

Motor Amps	.....	Air Volume (L/s)	.....
Fan RPM	.....	Fan Static Inlet/Outlet	.....

Interlocks	.....	Noise & Vibration	.....

Contractor Signature:		Commissioning Agent Signature:	

Printed: January 22, 2026

Project No.

CS NO.

Owner: Department of Fisheries and Oceans	**Lab Supply Fan**
Project: **DFO Fume Hood Replacement**	**Fan** **Mechanical**

Mechanical
Location: Room
System:

Spec Section:
Sub-Category:

EQUIPMENT TAG **AH-1**

TECHNICAL DATA

DATE / CHECKED BY: _____

	SPECIFIED	SHOP DRAWING	INSTALLED	VERIFIED CONTR/COM.
Function	Lab Supply Fan	.....	.....	/
Air Flow (L/s)	315	.....	.....	/
Static Pressure	150	.....	.....	/
Fan RPM	.....	.....	.....	/
Manufacturer	Greenheck	.....	.....	/
Model No.	CSP-A700-VG	.....	.....	/
Type	Inline	.....	.....	/
Interlocks	FH-1 and Wall Switch	.....	.....	/
Serial No.	.....	.....	.....	/
Class	.....	.....	.....	/
Power (kW)	0.157	.....	.....	/
Electrical (V/Ph/Hz)	120 / 1 / 60	.....	.....	/
Permanent Labels affixed & Legible	.....	.....	.....	/

STATIC CHECKS

DATE / CHECKED BY: _____

Fan Housing	.....	Vibration Isolation	.....
Bearing Type	.....	Flex Connections	.....
Alignment	.....	Fan Rotation	.....
Local Disconnect	.....	Belt Guard	.....
Control	.....	Maintenance Access	.....
Motorized Damper	.....	Access	.....

OPERATION CHECKS

DATE / CHECKED BY: _____

Motor Amps	.....	Air Volume (L/s)	.....
Fan RPM	.....	Fan Static Inlet/Outlet	.....

Interlocks	.....	Noise & Vibration	.....

Contractor Signature:		Commissioning Agent Signature:	

Printed: January 22, 2026

Project No.

CS NO.

Owner: Department of Fisheries and Oceans	**Fume Hood Exhaust Fan**
Project: DFO Fume Hood Replacement	**Fan** **Mechanical**

Location: Lab Ceiling
System:

Spec Section:
Sub-Category:

EQUIPMENT TAG **EF-3**

TECHNICAL DATA

DATE / CHECKED BY: _____

	SPECIFIED	SHOP DRAWING	INSTALLED	VERIFIED CONTR/COM.
Function	Fumehood Exhaust Fan	.....	.....	/
Air Flow (L/s)	340	.....	.....	/
Static Pressure	150	.....	.....	/
Fan RPM	.....	.....	.....	/
Manufacturer	Twin City	.....	.....	/
Model No.	TFE	.....	.....	/
Type	Cetrifugal	.....	.....	/
Interlocks	FH-1	.....	.....	/
Serial No.	.....	.....	.....	/
Class	.....	.....	.....	/
Power (kW)	0.375	.....	.....	/
Electrical (V/Ph/Hz)	240 / 1 / 60	.....	.....	/
Permanent Labels affixed & Legible	.....	.....	.....	/

STATIC CHECKS

DATE / CHECKED BY:

Fan Housing	.....	Vibration Isolation	.....
Bearing Type	.....	Flex Connections	.....
Alignment	.....	Fan Rotation	.....
Local Disconnect	.....	Belt Guard	.....
Control	.....	Maintenance Access	.....
Motorized Damper	.....	Access	.....
Belt Size	.....	Belt Tension	.....

OPERATION CHECKS

DATE / CHECKED BY: _____

Motor Amps	.....	Air Volume (L/s)	.....

Fan RPM	.....	Fan Static Inlet/Outlet	.....
Interlocks	.....	Noise & Vibration	.....

Contractor Signature:		Commissioning Agent Signature:	

Printed: January 22, 2026

Project No.

CS NO.

Owner: Department of Fisheries and Oceans	**Heating Coil**
Project: DFO Fume Hood Replacement	**Coil** **Mechanical**

Mechanical
Location: Room
System:

Spec Section:
Sub-Category:

EQUIPMENT TAG **HC-1**

TECHNICAL DATA

DATE / CHECKED BY: _____

	SPECIFIED	SHOP DRAWING	INSTALLED	VERIFIED CONTR/COM.
Manufacturer	Heatcraft	.....	.....	/
Model No.	5WH0804A - 15 x 15	.....	.....	/
Fluid	50% Propylene Glycol	.....	.....	/
Heating Capacity (kW)	26	.....	.....	/
Coil Size (mm)	635 x 457 x 190	.....	.....	/
Rows	4	.....	.....	/
Air Flow (L/s)	315	.....	.....	/
Air Temp Entering	-45°C	.....	.....	/
Air Temp Leaving	20°C	.....	.....	/
Fluid Flow (L/s)	0.76 L/s	.....	.....	/
Fluid Temp Entering	71°C			
Fluid Temp Leaving	60°C	.....	.....	/
Permanent Labels affixed & Legible	.....	.....	.....	/

STATIC CHECKS

DATE / CHECKED BY:

Piping Complete	.....	Temp. Taps	.....
Air Vent	.....	Balancing Valve	.....
Drain Valve	.....	Coil Pump No.	.....
Control Valve Correct	.....	Flow Meter	.....
Isolation Valves	.....	Drain Pan Piping/Trap	.....
Coil Condition	.....	Service (Pull) Space	.....

OPERATION CHECKS

DATE / CHECKED BY: _____

Control Valve Failsafe	.....	Ent/Leave Fluid Temp.	.....

Control Valve Stroke	.....	Fluid Press. Drop	.....
Ent/Leave Air Temp	.....	Measured Flow	.....
Air Pressure Drop		Capacity	.....

Contractor Signature: _____

Commissioning Agent Signature: _____

Printed: January 22, 2026

Project No.

CS NO.