

**Part 1 GENERAL**

**1.1 SCOPE OF WORK**

- .1 Complete air balance of the following systems as shown on the drawings. Refer to drawings for air and flow schematics summarizing each system:
  - .1 HRV-1,
  - .2 EF-1-4,
  - .3 Verification of any life-safety devices including fire-smoke dampers.

**1.2 GENERAL**

- .1 TAB means to test, adjust and balance to perform in accordance with requirements of Contract Documents and to do all other work as specified in this section.
- .2 TAB to be performed by balancing company who is a registered member of AABC and final TAB report shall bear seal and certification number of AABC registration.

**1.3 PURPOSE OF TAB**

- .1 Test to verify proper and safe operation, determine actual point of performance, evaluate qualitative and quantitative performance of equipment, systems and controls at design, average and low loads using actual or simulated loads.
- .2 Adjust and regulate equipment and systems so as to meet specified performance requirements and to achieve specified interaction with other related systems under normal and emergency loads and operating conditions.
- .3 Balance systems and equipment to regulate flow rates to match design conditions.

**1.4 CO-ORDINATION**

- .1 Schedule time required for TAB (including repairs, re-testing) into project construction and completion schedule so as to ensure completion before acceptance of project.
- .2 Do TAB of each system independently and subsequently, where interlocked with other systems, in unison with those systems.

**1.5 PRE-TAB REVIEW**

- .1 Review Contract Documents before project construction is started and confirm adequacy of provisions for TAB and all other aspects of design and installation pertinent to success of TAB.
- .2 Review specified standards and report to Contract Administrator all proposed procedures which vary from standard.

- .3 During construction, co-ordinate location and installation of all TAB devices, equipment, accessories, measurement ports and fittings.

## **1.6 START-UP**

- .1 Follow start-up procedures as recommended by equipment manufacturer unless specified otherwise.
- .2 Follow special start-up procedures specified elsewhere in Divisions 21 & 23.

## **1.7 OPERATION OF SYSTEMS DURING TAB**

- .1 Operate systems for length of time required for TAB and as required by Contract Administrator for verification of TAB reports.

## **1.8 START OF TAB**

- .1 Notify Contract Administrator 7 days prior to start of TAB.
- .2 Start TAB only when building is essentially completed including:
  - .1 Installation of ceilings, doors, windows, other construction affecting TAB.
  - .2 Application of weatherstripping, sealing, caulking.
  - .3 All pressure, leakage, other tests specified elsewhere in Divisions 21 & 23.
  - .4 All provisions for TAB installed and operational.
  - .5 Start-up, verification for proper, normal and safe operation of all mechanical and associated electrical and control systems affecting TAB including but not limited to:
    - .1 Proper thermal overload protection in place for electrical equipment.
    - .2 Air systems:
      - .1 Filters in place, clean.
      - .2 Duct systems clean.
      - .3 Ducts, air shafts, ceiling plenums are airtight to within specified tolerances.
      - .4 Correct fan rotation.
      - .5 Fire, smoke, volume control dampers installed and open.
      - .6 Coil fins combed, clean.
      - .7 Access doors, installed, closed.
      - .8 All outlets installed, volume control dampers open.

## **1.9 APPLICATION TOLERANCES**

- .1 Do TAB to following tolerances of design values:
- .2 HVAC systems: plus 5%, minus 5%.

**1.10 ACCURACY TOLERANCES**

- .1 Measured values to be accurate to within plus or minus 2% of actual values.

**1.11 INSTRUMENTS**

- .1 Calibrate in accordance with requirements of most stringent of referenced standard for either applicable system or HVAC system.
- .2 Calibrate within 3 months of TAB.

**1.12 SUBMITTALS**

- .1 Submit, prior to commencement of TAB:
- .2 Proposed methodology and procedures for performing TAB if different from referenced standard.

**1.13 TAB REPORT**

- .1 TAB report to show all results in S.I. units and to include:
  - .1 Project record drawings.
  - .2 System schematics.
  - .3 Date of TAB, date of report.
- .2 Submit one copy of TAB Report to Contract Administrator for verification and approval, in English in D-ring binders, complete with index tabs.
- .3 Incorporate review comments and submit 3 copies of final report.

**1.14 SETTINGS**

- .1 After TAB is completed to satisfaction of Contract Administrator, replace drive guards, close all access doors, lock all devices in set positions, ensure sensors are at required settings.
- .2 Permanently mark all setting to allow restoration at any time during life of facility. Markings not to be eradicated or covered in any way.

**1.15 COMPLETION OF TAB**

- .1 TAB to be considered complete only when final TAB Report received and approved by Contract Administrator.

**1.16 AIR SYSTEMS**

- .1 Standard TAB to be to most stringent of TAB standards of AABC or ASHRAE.

- .2 Do TAB of following systems, equipment, and components including all grilles, dampers and zone pressurization.
  - .1 HRV-1
  - .2 Fire & smoke dampers (location and operating verifications; if applicable).
- .3 Measurements: to include, but not limited to, the following as appropriate for systems, equipment, components, controls: air velocity, static pressure, flow rate, pressure drop (or loss), temperatures (dry bulb), duct cross-sectional area, RPM electrical power.
- .4 Locations of equipment measurements; to include, but not limited to, the following as appropriate:
  - .1 Outlet of each damper, grille, terminal unit and fan.
  - .2 At controllers, controlled device.
- .5 Locations of systems measurements to include, but not be limited to, following as appropriate: each main duct, main branch, sub-branch, run-out (or grille, register or diffuser).

**END OF SECTION**

**Part 1 GENERAL**

**1.1 SCOPE OF WORK**

- .1 Supply and installation of external duct insulation where shown on the drawings.
- .2 Supply and installation of external duct insulation on all ducts connected to the exterior of the building. The insulation shall extend 10 feet from the exterior wall or until the first modulating damper, whichever is longer.
- .3 Supply and installation of external duct insulation for all HRV supply ductwork.

**1.2 REFERENCES**

ASTM	C411-82(1992)	Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation
CGSB	51-GP-52MA-89	Vapour Barrier Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation

\*\*\* All Codes and Standards are to the latest editions

**1.3 DEFINITIONS**

- .1 For purposes of this section:
  - .1 “CONCEALED” – insulated mechanical services and equipment tin suspended ceilings and non-accessible chases and furred-in spaces.
  - .2 “EXPOSED” – will mean “not concealed” as defined herein.
  - .3 Insulation systems – insulation material, fasteners, jackets, etc.

**Part 2 PRODUCTS**

**2.1 GENERAL**

- .1 Components of insulation system to have maximum flame spread rating of 25 and maximum smoke developed rating of 50 in accordance with CAN/ULC-S102.
- .2 Materials to be tested in accordance with ASTM C411.

**2.2 D-2 MINERAL FIBRE BLANKET WITH VAPOUR BARRIER -40 TO +600 C**

- .1 Application: on exterior of ductwork where shown on the drawings.
- .2 Material:
  - .1 CAN/CGSB-51.11, CAN/CGSB-51.5M; Type II, (FSKfacing), inorganic glass fibre blanket, 1 lb/ft<sup>3</sup>.
  - .2 Acceptable material: Knauf Duct Wrap (or approved equal in accordance with B7).

- .3 Thickness:
  - .1 Fresh air intakes: 2 in.
  - .2 Exhaust ducts where noted: 1 ½ in.
  - .3 Supply air ducts: 1 ½ in.

## 2.3 ACCESSORIES

- .1 Vapour retarder lap adhesive:
  - .1 Water based, fire retardant type, compatible with insulation.
- .2 Indoor Vapour Retarder Finish:
  - .1 Vinyl emulsion type acrylic, compatible with insulation.
- .3 Tape: self-adhesive, aluminum, 3-inch-wide minimum.

## Part 3 EXECUTION

### 3.1 APPLICATION

- .1 Apply insulation after required tests have been completed and approved by Contract Administrator.
- .2 Surfaces shall be clean and dry during application of insulation and finishes.
- .3 Apply insulation materials, accessories and finishes in accordance with manufacturer's recommendations and as specified.
- .4 Vapour barriers and insulation to be unbroken over full length of duct or surface, without penetration for hangers, standing duct seams and without interruption at sleeves and supports.
- .5 Insulate strap hangers 4 in. beyond insulated duct.
- .6 Use stand-offs for duct mounted control accessories.
- .7 Apply 1.0 mm thick galvanized sheet metal corners (nosings) in traffic areas to ductwork in mechanical rooms.

### 3.2 INSTALLATION

- .1 General:
  - .1 Install in accordance with ANSI/NFPA 90A and ANSI/NFPA 90B.
  - .2 Adhere and seal vapour barrier using vapour seal adhesives.
  - .3 Stagger longitudinal and horizontal joints on multi layered insulation.
- .2 Mechanical fastenings:

- .1        On rectangular ducts, use 50% coverage of insulating cement and weld pins at not more than 8 in. centers, but not less than 2 rows per side and bottom.

**END OF SECTION**

**Part 1 GENERAL**

**1.1 SCOPE OF WORK**

- .1 Supply and installation of supply air, relief air, outside air and return air ductwork related to the HRV-1 system and gravitational air intakes.
- .2 Supply and installation of labour and materials for duct insulation where noted on the drawings.

**1.2 CODES AND STANDARDS**

- .1 SMACNA HVAC Duct Construction Standards, Metal and Flexible, 1985.
- .2 SMACNA HVAC Duct Leakage Test Manual, 1985.
- .3 ASTM A52M-87, Specification for General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process.
- .4 ANSI/NFPA 90A-1989, Installation of Air Conditioning and Ventilating Systems.
- .5 NBCC, National Building Code of Canada, Part 6.

**1.3 CERTIFICATION OF RATINGS**

- .1 Catalogue or published ratings shall be those obtained from tests carried out by manufacturer or independent testing agency signifying adherence to codes and standards.

**Part 2 PRODUCTS**

**2.1 SEAL CLASSIFICATION**

- .1 Classification as follows:

	Maximum Pressure <u>Pa</u>	SMACNA Seal <u>Class</u>
All:	500	A

- .2 Class A: longitudinal seams, transverse joints, duct wall penetrations and connections made airtight with sealant and tape.

**2.2 SEALANT**

- .1 Sealant; oil resistant, polymer type fame resistant duct sealant. Temperature range of minus 30° C to plus 93° C.

- .2 Acceptable material: Ductmate Proseal/Fibreseal (or approved equal in accordance with B7).

## 2.3 FITTINGS

- .1 Fabrication: to SMACNA.
- .2 Radiused elbows:
  - .1 Rectangular: standard radius or short radius with single thickness turning vanes Standard (1.5 times width of duct).
  - .2 Round: smooth radius (1.5 times diameter).
- .3 Mitred elbows, rectangular:
  - .1 To 400 mm: with single thickness turning vanes.
  - .2 Over 400 mm: with double thickness turning vanes.
- .4 Branches:
  - .1 Rectangular main and branch: with radius on branch 1.5 times width of duct 45° entry on branch.
  - .2 Round main and branch: enter main duct to 45° with conical connection.
  - .3 Provide volume control damper in branch duct near connection to main duct.
  - .4 Main duct branches: with splitter damper.
- .5 Transitions:
  - .1 Diverging: 20o maximum included angle.
  - .2 Converging: 30o maximum included angle.
- .6 Offsets:
  - .1 Full radiused elbows.
- .7 Obstruction deflectors: maintain full cross-sectional area.

## 2.4 FIRE STOPPING

- .1 Fire stopping material and installation must not distort duct.

## 2.5 DUCT LEAKAGE

- .1 In accordance with SMACNA HVAC air duct leakage Test Manual.

## 2.6 GALVANIZED STEEL

- .1 Lock forming quality: to ASTM A525M, Z90 zinc coating.
- .2 Thickness, fabrication and reinforcement: to SMACNA.
- .3 Joints: to SMACNA

## 2.7 HANGERS AND SUPPORTS

- .1 Strap hangers: of same material as duct but next sheet metal thickness heavier than duct. Maximum size duct supported by strap hanger: 20 in.
- .2 Hanger configuration: to SMACNA.
- .3 Hangers: galvanized steel angle with galvanized steel rods to SMACNA following table:

<u>Duct Size</u> (mm)	<u>Angle Size</u> (mm)	<u>Rod Size</u> (mm)
up to 750	25x25x3	6
751 to 1050	40x40x3	6

<u>Duct Size</u> (mm)	<u>Angle Size</u> (mm)	<u>Rod Size</u> (mm)
1051 to 1500	40x40x3	10
1501 to 2100	50x50x3	10
2101 to 2400	50x50x5	10
2401 and over	50x50x6	10

- .4 Upper hanger attachments:
  - .1 For steel joist: manufactured joist clamp or steel plate washer.
  - .2 For steel beams: manufactured beam clamps.
  - .3 For wood framing: 3 in. long, galvanized lag screws, fastened to structural framing.
  - .4 For concrete: manufactured concrete inserts.

## Part 3 EXECUTION

### 3.1 GENERAL

- .1 To SMACNA standards referenced.
- .2 Do not break continuity of insulation vapour barrier with hangers or rods.
- .3 Support risers in accordance with SMACNA as indicated/where applicable.
- .4 Install proprietary manufactured flanged duct joints in accordance with manufacturer's instructions.
- .5 Balancing dampers on all branch supply run-outs.

### 3.2 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 as follows:

<u>Duct Size</u> (mm)	<u>Spacing</u> (inch)
to 1500	3000
1501 and over	2500

**3.3            WATERTIGHT DUCT**

- .1        Provide watertight duct for:
- .1        Fresh air intakes.
  - .2        Exhaust air wall penetrations.
- .2        Form bottom of horizontal duct without longitudinal seams. Solder or weld joints of bottom and side sheets. Seal all other joints with duct sealer.
- .3        Slope horizontal branch ductwork down towards hoods served. Slope header ducts down toward risers.
- .4        Provide insulating blanket on duct exterior at outside air intakes.

**3.4            SEALING AND TAPING**

- .1        Apply sealant to outside of joint to manufacturer's recommendations.

**3.5            LEAKAGE TESTS**

- .1        In accordance with SMACNA HVAC Duct Leakage Test Manual.
- .2        Do leakage tests in sections.
- .3        Complete test before performance insulation or concealment work.

**END OF SECTION**

**Part 1 GENERAL**

**1.1 SUMMARY**

- .1 Section Includes:
  - .1 Materials and installation for duct accessories including flexible connections, access doors, vanes and collars.

**1.2 REFERENCES**

- .1 Health Canada/Workplace Hazardous Materials Information System (WHMIS).
  - .1 Material Safety Data Sheets (MSDS).
- .2 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA).
  - .1 SMACNA - HVAC Duct Construction Standards - Metal and Flexible, 95.

**1.3 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Submit manufacturer's printed product literature, specifications and data sheet. Indicate the following:
    - .1 Flexible connections.
    - .2 Duct access doors.
    - .3 Turning vanes.
    - .4 Instrument test ports.
  - .3 Test Reports: submit certified test reports from approved independent testing laboratories indicating compliance with specifications for specified performance characteristics and physical properties.
    - .1 Certification of ratings: catalogue or published ratings to be those obtained from tests carried out by manufacturer or independent testing agency signifying adherence to codes and standards.
  - .4 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
  - .5 Instructions: submit manufacturer's installation instructions.
  - .6 Manufacturer's Field Reports: manufacturer's field reports specified.
  - .7 Closeout submittals: submit maintenance and engineering data for incorporation into manual specified in Section 01 78 10 – Closeout Submittals.

## **1.4 QUALITY ASSURANCE**

- .1 Pre-Installation Meetings:
  - .1 Convene pre-installation meeting one week prior to beginning work of this Section and on-site installations.
    - .1 Verify project requirements.
    - .2 Review installation and substrate conditions.
    - .3 Co-ordination with other building subtrades.
    - .4 Review manufacturer's installation instructions and warranty requirements.

## **1.5 DELIVERY, STORAGE AND HANDLING**

- .1 Separate waste materials for reuse and recycling.
- .2 Remove from Site and dispose of packaging materials at appropriate recycling facilities.
- .3 Collect and separate for disposal paper, plastic, polystyrene, and corrugated cardboard packaging material in appropriate on-site bins for recycling.

## **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<sup>3</sup>.

### **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.
  - .2 301 to 450 mm: four sash locks complete with safety chain.
  - .3 451 to 1000 mm: piano hinge and minimum two sash locks.
  - .4 Doors over 1000 mm: piano hinge and two handles operable from both sides.
  - .5 Hold open devices.
  - .6 300 x 300 mm glass viewing panels.

#### **2.4 TURNING VANES**

- .1 Factory or shop fabricated single thickness, to recommendations of SMACNA and as indicated.

#### **2.5 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.

#### **2.6 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 MANUFACTURER'S INSTRUCTIONS**

- .1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and data sheet.

#### **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: 100mm.

- .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 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 Contract Administrator.
        - .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 FIELD QUALITY CONTROL

- .1 Manufacturer's Field Services:



- .1 Have manufacturer of products, supplied under this Section, review Work involved in the handling, installation/application, protection and cleaning, of its products and submit written reports, in acceptable format, to verify compliance of Work with Contract.
- .2 Manufacturer's Field Services: provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.
- .3 Schedule site visits, to review Work, at stages listed:
  - .1 After delivery and storage of products, and when preparatory Work, or other Work, on which the Work of this Section depends, is complete but before installation begins.
  - .2 Twice during progress of Work at 25% and 60% complete.
  - .3 Upon completion of the Work, after cleaning is carried out.
- .4 Obtain reports, within 3 days of review, and submit, immediately, to Contract Administrator.

### 3.4 **CLEANING**

- .1 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 PROJECT SCOPE**

- .1 Supply and installation of balancing dampers as shown on drawings.

**1.2 REFERENCES**

- .1 SMACNA HVAC Duct Construction Standards, Metal and Flexible, 1985.

**Part 2 PRODUCTS**

**2.1 GENERAL**

- .1 Manufacture to SMACNA standards.

**2.2 SPLITTER DAMPERS**

- .1 Of same material as duct but one sheet metal thickness heavier, with appropriate stiffening.
- .2 Single thickness construction.
- .3 Control rod with locking device and position indicator.
- .4 Rod configuration to prevent end from entering duct.
- .5 Pivot: piano hinge.
- .6 Folded leading edge.

**2.3 SINGLE BLADE DAMPERS**

- .1 Of same material as duct, but one sheet metal thickness heavier. V-groove stiffened.
- .2 Size and configuration to recommendations of SMACNA, except maximum height 150 mm.
- .3 Locking quadrant with shaft extension to accommodate insulation thickness.
- .4 Inside and outside bronze end bearings.
- .5 Channel frame of same material as adjacent duct, complete with angle stop.

**Part 3 EXECUTION**

**3.1 INSTALLATION**

- .1 Install where indicated and on all outlet/return branches as applicable.
- .2 On main supply duct trunks requiring balancing dampers (where noted on drawings) provide necessary transitions with multi-blade balancing damper.
- .3 Install in accordance with recommendations of SMACNA and in accordance with manufacturer's instructions.
- .4 For supply, return and exhaust system, locate balancing dampers in each branch duct.
- .5 All dampers to be vibration free.

**END OF SECTION**

**Part 1 GENERAL**

**1.1 SUMMARY**

- .1 Section Includes:
  - .1 Operating dampers for mechanical forced air ventilation and air conditioning systems.

**1.2 REFERENCES**

- .1 American Society for Testing and Materials International (ASTM)
  - .1 ASTM A 653/A 653M-04a, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by Hot-Dip Process.
- .2 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
  - .1 Material Safety Data Sheets (MSDS).

**1.3 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Product Data:
  - .1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 21 05 01. Include product characteristics, performance criteria, and limitations.
    - .1 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS)
  - .2 Indicate the following:
    - .1 Performance data.
- .2 Quality assurance submittals: submit following in accordance with Section 21 05 01.
  - .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.
    - .1 Boeing Focal will make available 1 copy of systems supplier's installation instructions.
- .3 Closeout Submittals
  - .1 Provide maintenance data for incorporation into manual specified in Section 21 05 01.

**1.4 DELIVERY, STORAGE, AND HANDLING**

- .1 Packing, shipping, handling and unloading:
  - .1 Deliver, store and handle in accordance with Section 21 05 01.
  - .2 Deliver, store and handle materials in accordance with manufacturer's written instructions.

**Part 2 PRODUCTS**

**2.1 LOW LEAKAGE AIR-FOIL CONTROL DAMPER- MD-1-6**

- .1 Parallel blade flanged to duct type.
- .2 Extruded aluminum frame and air foil blades, complete with extruded EPDM blade seals and extruded silicone frame seals.
- .3 Maintenance-free bearings.
- .4 Linkage: plated steel tie rods, brass pivots and plated steel brackets, complete with plated steel control rod.
- .5 Performance:
  - .1 Leakage: in closed position less than 15.2 l/s/m<sup>2</sup> of rated air flow at 250 Pa differential static pressure across damper.
- .6 Approved Product: Tamco series 9000 (or approved equal in accordance with B7).
  - .1 Damper to come complete with Belimo actuator, with position indicator, integral prove open limit switch, power to open spring close. Voltage to be confirmed by electrical.

**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 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.
- .5 Ensure dampers are observable and accessible.

**3.3 FIELD QUALITY CONTROL**

- .1 Verification requirements include:
  - .1 Materials and resources.
  - .2 Storage and collection of recyclables.
  - .3 Construction waste management.
  - .4 Resource reuse.

- .5 Recycled content.
- .6 Local/regional materials.
- .7 Low-emitting materials.

**3.4 CLEANING**

- .1 Proceed in accordance with Section 21 05 01.
- .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 SCOPE OF WORK**

- .1 Supply, installation and commissioning of fire and smoke dampers shall be in strict accordance with applicable codes, regulations and Authorities Having Jurisdiction.
- .2 Refer to Mechanical Drawings to determine all fire separations. Provide dampers at all duct penetrations. Ensure no exits are penetrated by ducts. Check for fire rated enclosures around combustion air, drier exhaust and ducts through exits. Review all dampers and separations with the Contract Administrator early in the project.
- .3 Complete installation, testing and submit damper report with all tests successful; before substantial completion/occupancy.

**1.2 SHOP DRAWINGS**

- .1 Submit shop drawings in accordance with Sections 21 05 01.
- .2 Indicate:
  - .1 Dimensions, internal and external construction details, recommended method of installation.

**1.3 MAINTENANCE DATA**

- .1 Provide maintenance data for incorporation into manual specified in Sections 21 05 01.

**Part 2 PRODUCTS**

**2.1 FIRE DAMPER**

- .1 Fire dampers shall meet all N.B.C. requirements for orientation whether static or dynamic and be constructed in accordance with NFPA Standard No. 90A. Fire dampers and fusible links shall be tested and approved by ULC or another nationally recognized testing agency acceptable to the Authority Having Jurisdiction and bear the appropriate label.
- .2 Fire dampers shall be of interlocking blade design. Use fire dampers with blades in the air stream for velocities 8 m/s (1000 fpm) and lower where aspect ratio is 2:1 or less. Use low resistance type fire dampers with blades out of the air stream for velocities above 8 m/s (1000 fpm) and aspect ratios greater than 2:1.

- .3 Generally, use fusible links at 70°C (160 °F) on exhaust and recirculation ducts, 105°C (220 °F) on supply ducts and kitchen exhaust ducts. Revise, with Contract Administrator approval, as required to meet the needs of special locations. Fusible links shall be readily removable by hand to facilitate testing. All dampers to be factory tested for proper operation.

## **2.2 FIRE STOP FLAPS**

- .1 Fire smoke flaps: ULC listed and labelled and fire tested in accordance with CAN4-S112.2.
- .2 Construct of minimum 1.5 mm thick sheet steel with 1.6 mm thick non-asbestos ULC listed insulation and corrosion-resistant pins and hinges.
- .3 Flaps held open with fusible link conforming to ULC-S505 and close at 74 degrees C.

## **Part 3 EXECUTION**

### **3.1 INSTALLATION**

- .1 Install all dampers in strict accordance with their listings and the manufacturer's recommendations. Install dampers only in positions for which they have been listed.
- .2 Meet with TAB Contractor early in the project to review all locations and ensure complete testing and report.
- .3 Provide convenient access to all fusible links, damper operators and linkages to facilitate testing and maintenance.
- .4 Identify all dampers clearly and accurately on the as-built drawings.

**END OF SECTION**

**Part 1 GENERAL**

**1.1 SCOPE OF WORK**

- .1 Supply, installation and commissioning of exhaust fans EF-1, EF-2, EF-3, EF-4 and stratification fans SF 1-4.

**1.2 REFERENCES**

- .1 AMCA 99-1986, Standards Handbook.
- .2 ANSI/AMCA 210-1985, Laboratory Methods of Testing Fans for Rating.

**1.3 SHOP DRAWINGS AND PRODUCT DATA**

- .1 Submit shop drawings and product data in accordance with Section 21 05 01.
- .2 Provide fan curves and sound rating data, showing point of operation and efficiency.
- .3 Indicate following: motors, wheels, bearings, hoe accessories.

**1.4 OPERATION AND MAINTENANCE DATA**

- .1 Provide operation and maintenance data for incorporation into manual specified in Section 21 05 01.
- .2 Furnish list of individual manufacturer's recommended spare parts for equipment such as bearings and seals, and addresses of suppliers, together with list of specialized tools necessary for adjusting, repairing or replacing, for placement into operating manual.

**1.5 MAINTENANCE MATERIALS**

- .1 Provide the following spare parts:
  - .1 Matched set of belts for each fan.

**1.6 MANUFACTURED ITEMS**

- .1 Catalogued or published ratings shall be those obtained from tests carried out by manufacturer or those ordered by him from independent testing agency signifying adherence to codes and standards in force.

**Part 2 PRODUCTS**

**2.1 FANS – GENERAL**

- .1 Fans: statically and dynamically balanced, constructed in conformity with AMCA 99.
- .2 Sound ratings: comply with AMCA (Air Moving and Conditioning Association) 301, tested to AMCA 300.
- .3 Performance ratings: based on tests performed in accordance with ANSI/AMCA 210, and ANSI/ASHRAE 51.
- .4 Accessories and hardware:

- .1 Matched sets of V-belts.
- .2 Replacement of fan sheaves required for final air balance.
- .5 Factory primed before assembly in colour standard to manufacturer.
- .6 Bearing lubrication systems plus extension lubrication tubes where bearings are not easily accessible.
- .7 3-phase motors, high efficiency type, industrial design, 1750 rpm unless noted otherwise.

## 2.2 CIVIL MAINTENANCE SHOP EXHAUST FAN, EF-1

- .1 General:
  - .1 Belt drive,
  - .2 Sidewall mounted propeller,
  - .3 Welded steel blades and hubs,
  - .4 Motors to be permanently lubricated, heavy ball bearing type to match with the fan load and furnished at the specific voltage and phase,
  - .5 Belts, pulleys, and keys oversized for a minimum of 150% of driven horsepower,
  - .6 Motor pulley shall be adjustable for final system balancing,
  - .7 Backdraft dampers and damper guard,
  - .8 Weatherhood with 90° turndown angle complete with birdscreen,
  - .9 Wall housing constructed of galvanized steel with heavy gauge mounting flanges and pre-punched mounting holes, and
  - .10 OSHA motor side guard.
- .2 Approved product:
  - .1 Greenheck SBE (or approved equal in accordance with B7).
- .3 Exhaust fan performance:
  - .1 Flow (l/s) 1,360
  - .2 ESP (pa) 93

## 2.3 WASH BAY EXHUAST FANS, EF-2

- .1 General:
  - .1 Belt drive,
  - .2 Sidewall mounted propeller,
  - .3 Welded steel blades and hubs,
  - .4 Motors to be permanently lubricated, heavy ball bearing type to match with the fan load and furnished at the specific voltage and phase,
  - .5 Belts, pulleys, and keys oversized for a minimum of 150% of driven horsepower,
  - .6 Motor pulley shall be adjustable for final system balancing,
  - .7 Backdraft dampers and damper guard,
  - .8 Weatherhood with 90° turndown angle complete with birdscreen,
  - .9 Wall housing constructed of galvanized steel with heavy gauge mounting flanges and pre-punched mounting holes, and
  - .10 OSHA motor side guard.
- .2 Approved product:
  - .1 Greenheck SBE (or approved equal in accordance to B7).

- .3 Exhaust fan performance:
  - .1 Flow (l/s) 192
  - .2 ESP (pa) 93

**2.4 AQUEDUCT STORAGE EXHAUST FANS, EF-3**

- .1 General:
  - .1 Belt drive,
  - .2 Sidewall mounted propeller,
  - .3 Welded steel blades and hubs,
  - .4 Motors to be permanently lubricated, heavy ball bearing type to match with the fan load and furnished at the specific voltage and phase,
  - .5 Belts, pulleys, and keys oversized for a minimum of 150% of driven horsepower,
  - .6 Motor pulley shall be adjustable for final system balancing,
  - .7 Backdraft dampers and damper guard,
  - .8 Weatherhood with 90° turndown angle complete with birdscreen,
  - .9 Wall housing constructed of galvanized steel with heavy gauge mounting flanges and pre-punched mounting holes, and
  - .10 OSHA motor side guard.
- .2 Approved product:
  - .1 Greenheck SBE (or approved equal in accordance with B7).
- .3 Exhaust fan performance:
  - .1 Flow (l/s) 1,614
  - .2 ESP (125 pa) 93

**2.5 INLINE CABINET EXHAUST FAN, EF-4**

- .1 General:
  - .1 Belt drive,
  - .2 Backward inclined centrifugal inline fan,
  - .3 Non-overloading, backward inclined centrifugal wheel,
  - .4 Motors to be permanently lubricated, heavy ball bearing type to match with the fan load and furnished at the specific voltage and phase,
  - .5 Belts, pulleys, and keys oversized for a minimum of 150% of driven horsepower,
  - .6 Motor pulley shall be adjustable for final system balancing,
  - .7 Backdraft damper,
  - .8 Rectangular hooded wall cap.
- .2 Approved product:
  - .1 Greenheck BSQ (or approved equal in accordance with B7).
- .3 Exhaust fan performance:
  - .1 Flow (l/s) 120
  - .2 SP (pa) 25

**2.6 STRATIFICATION FANS, SF-1 to SF-4**

- .1 General: Industrial ceiling fan, thermally protected PSC type variable speed motor with permanently lubricated bearings, painted steel blades, reversible operation, ganged speed control.
- .2 Acceptable Product: CANARM CP56 complete with CANARM CN5041 MC-3 speed controls (or approved equal in accordance with B7).

**Part 3 EXECUTION**

**3.1 FAN INSTALLATION**

- .1 Install fans as indicated, according to manufacturer's instructions.
- .2 Provide sheaves and belts required for final air balance.
- .3 Bearings and extension tubes to be easily accessible.
- .4 Grade fan housings to drain to exterior.
- .5 Provide fabricated steel support structure for fans where not supplied with fan unit.

**END OF SECTION**

**Part 1 GENERAL**

**1.1 SCOPE OF WORK**

- .1 Supply and installation of grilles, registers and diffusers as shown on drawings.

**1.2 PRODUCT DATA**

- .1 Submit product data in accordance with Section 21 05 01.
- .2 Indicate the following:
  - .1 Capacity.
  - .2 Throw and terminal velocity.
  - .3 Noise criteria.
  - .4 Pressure drop.
  - .5 Neck velocity.

**1.3 MAINTENANCE DATA**

- .1 Provide maintenance data for incorporation into manual specified in Section 21 05 01.

**1.4 MANUFACTURED ITEMS**

- .1 Grilles, registers and diffusers of same generic type to be product of one manufacturer.

**1.5 CERTIFICATION OF RATING**

- .1 Catalogued or published ratings shall be those obtained from tests carried out by manufacturer or those ordered by him from independent testing agency signifying adherence to codes and standards.

**Part 2 PRODUCTS**

**2.1 GENERAL**

- .1 To meet capacity, pressure drop, terminal velocity, throw, noise level, neck velocity.
- .2 Frames:
  - .1 Full perimeter gaskets.
  - .2 Plaster frames where set into plaster or gypsum board at all locations and as specified.
  - .3 Concealed fasteners.
  - .4 Concealed operators.
  - .5 Colour: standard.
- .3 Refer to drawings for grille and diffuser sizes.

- .4 Acceptable product: Price, Nailor (or approved equal in accordance with B7).

**Part 3 EXECUTION**

**3.1 INSTALLATION**

- .1 Install in accordance with manufacturer's instructions.
- .2 Install with stainless steel screws in countersunk holes where fastenings are visible.
- .3 Reinforce and brace air vents, intakes, goosenecks and louvers as indicated.
- .4 Anchor securely into opening. Seal with caulking all around to ensure weather tightness.

**END OF SECTION**

**Part 1 GENERAL**

**1.1 PRODUCT DATA**

- .1 Submit product data in accordance with Section 21 05 01 – Mechanical General Provisions.

**1.2 REFERENCES**

- .1 American National Standards Institute (ANSI)/National Fire Protection Association (NFPA)
  - .1 ANSI/NFPA 96-04, Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations.
  - .2 American Society for Testing and Materials International (ASTM)
    - .1 ASTM E 90-04, Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
  - .3 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
    - .1 Material Safety Data Sheets (MSDS).
  - .4 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)
  - .5 Society of Automotive Engineers (SAE)

**1.3 SYSTEM DESCRIPTION**

- .1 Performance Requirements:
  - .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.

**Part 2 PRODUCTS**

**2.1 GOOSENECK HOODS**

- .1 Thickness: To ASHRAE and SMACNA.
- .2 Fabrication: To ASHRAE and SMACNA.
- .3 Joints: To ASHRAE and SMACNA and or proprietary manufactured duct joint. Proprietary manufactured flanged duct joint shall be considered to be a class A seal.
- .4 Supports: As indicated.
- .5 Complete with integral birdscreen of 2.7 mm diameter stainless steel wire. Use 19 mm mesh on intake.

**Part 3                      EXECUTION**

**3.1                      INSTALLATION**

- .1                      In accordance with manufacturers and SMACNA recommendations.
- .2                      Reinforce and brace air vents, intakes and goosenecks as indicated.
- .3                      Anchor securely into opening. Seal with caulking all around to ensure weather tightness.

**END OF SECTION**

**Part 1 GENERAL**

**1.1 SCOPE OF WORK**

- .1 Supply and installation of duct heaters and ancillaries where shown or indicated on the drawings.

**1.2 REFERENCES**

- .1 Canadian Standards Association, CSA C22.2 No. 46, Electric Duct Heaters.

**1.3 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Make submittals in accordance with 23 05 01.
- .2 Submit product data and include:
  - .1 Element support details.
  - .2 Heater: total kW rating, voltage, phase.
  - .3 Number of stages.
  - .4 Rating of stage: rating, voltage, phase.
  - .5 Heater element watt/density and maximum sheath temperature.
  - .6 Maximum discharge temperature.
  - .7 Physical size.
  - .8 Unit support.
  - .9 Performance limitations.
  - .10 Clearance from combustible materials.
  - .11 Internal components wiring diagrams.
  - .12 Minimum operating airflow.
  - .13 Pressure drop operating airflow.

**1.4 MAINTENANCE**

- .1 Extra Materials:
  - .1 Provide maintenance materials in accordance with Section. 21 05 01

**Part 2 PRODUCTS**

**2.1 GENERAL**

- .1 Comply with ASHRAE 84.

**2.2 DUCT HEATERS**

- .1 Duct heaters: steel tubular flange type.
- .2 Frame:

- .1 Corrosion-resistant and made of galvanized steel of suitable gauge as required by CSA.
- .3 Elements:
  - .1 Tubular steel element.
  - .2 Heaters shall be CSA approved for zero clearance in horizontal ducts.
- .4 Safety and Built in Controls:
  - .1 Heaters shall be equipped with fail-safe automatic reset disc thermal cut-out.
  - .2 Cut-outs shall de-energize the heater in case of accidental over-heating.
  - .3 Load fuses shall be supplied as recommended by NEC (National Electrical Code).
  - .4 All duct heaters shall be complete with the following built-in controls: magnetic contactors as required, control transformer, proportional electronic controller and air flow sensor as standard components.
  - .5 Prior to shipment, heaters shall withstand tests as required by CSA.
  - .6 All internal wiring shall terminate on clearly identified terminal blocks.
- .5 Controls:
  - .1 All duct heaters shall be complete with the following built-in controls:
    - .1 High limit cut-outs, magnetic contactors as required, control transformer and air flow sensor as standard components.
    - .2 Additional options include:
      - .1 SCR proportional controller,
      - .2 Pilot lights to indicate staging, power supply on, overheating, no air flow, heating on.
  - .2 Low voltage space thermostats to be provided by Contractor and installed by others.
- .6 Schedule:

TAG	TYPE	QTY	DUCT DIM'S (WIDTH X HEIGHT)	kW	VOLTS/ PHASES	STAGES	AIR FLOW (L/S)	ΔT (°C)	OPTIONS
HC-1	ST	1	500mm x 200mm	6	575/3	FULL SCR	315	12	SCR controller, electrical to provide disconnect switch, pilot lights
HC-2	ST	1	450mm x 200mm	7	575/3	FULL SCR	234	19.5	SCR controller, electrical to provide disconnect

									switch, pilot lights
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- .7 Approved Product:
  - .1 Thermolec (or approved equal in accordance with B7).

**Part 3 EXECUTION**

**3.1 MANUFACTURER'S INSTRUCTIONS**

- .1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

**3.2 INSTALLATION**

- .1 Install in accordance with manufacturers recommendations.
- .2 Make power and control connections to CSA C22.2 No.46.

**3.3 CLEANING**

- .1 Proceed in accordance with Section 21 05 01.
- .2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

**3.4 FIELD QUALITY CONTROL**

- .1 Provide test report and include copy with Operations and Maintenance Manuals.

**END OF SECTION**

**Part 1 GENERAL**

**1.1 SUMMARY**

- .1 Section Includes:
  - .1 Materials, components and installation for heat reclaim devices.

**1.2 REFERENCES**

- .1 American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE)
- .2 ASHRAE 84-1991, Method of Testing Air-to-Air Heat Exchangers (ANSI approved).
- .3 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
  - .1 Material Safety Data Sheets (MSDS).

**1.3 SUBMITTALS**

- .1 Product Data:
  - .1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 21 05 01. Include product characteristics, performance criteria, and limitations.
    - .1 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS).
- .2 Shop Drawings:
  - .1 Submit shop drawings in accordance with Section 21 05 01.
    - .1 Shop drawings: submit drawings stamped and signed by professional engineer registered or licensed in Province of Manitoba, Canada.
- .3 Quality assurance submittals:
  - .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.
    - .1 Departmental Representative will make available 1 copy of systems supplier's installation instructions.
- .4 Closeout Submittals:
  - .1 Provide operation and maintenance data for incorporation into manual specified in Section 21 05 01.
- .5 Certificates:
  - .1 Catalogued or published ratings: obtained from tests carried out by manufacturer or those ordered from independent testing agency signifying adherence to codes and standards in force.
  - .2 Provide confirmation of testing.

**1.4 DELIVERY, STORAGE, AND HANDLING**

- .1 Packing, shipping, handling and unloading:
  - .1 Deliver, store and handle in accordance with manufacturer's written instructions.

**1.5 MAINTENANCE**

- .1 Extra Materials:
  - .1 Provide maintenance materials in accordance with Section. 21 05 01

**Part 2 PRODUCTS**

**2.1 GENERAL**

- .1 Comply with ASHRAE 84.

**2.2 AIR TO AIR HEAT RECOVERY VENTILATOR, ERV-1**

- .1 Performance: as indicated on equipment schedules.
- .2 Unit Construction:
  - .1 Extruded aluminum channel posts and galvanized panels secured with mechanical fasteners. Unit shall be capable of having all wall panels removed simultaneously without affecting the structural integrity of the unit. All access doors shall be sealed with permanently applied bulb-type gasket.
  - .2 Panels and access doors shall be constructed as a 2-inch nominal thick; thermally broken double wall assembly with 4 lb/ft<sup>3</sup> mineral wool insulation. The outer panel shall be constructed of galvanized 18-gauge steel. The inner liner shall be constructed of 22 gauge galvanized steel
- .3 Fans:
  - .1 Provide direct-drive airfoil plenum fans. Fan assemblies including fan, motor and sheaves shall be dynamically balanced by the manufacture on all three planes and at all bearing supports. Manufacture must ensure maximum fan RPM is below the first critical speed.
  - .2 Bearings shall be self-aligning grease lubricated, ball or roller bearings.
  - .3 Fan and motor shall be mounted internally on a steel base. Provide access to motor, drive, and bearings through hinged access door. Fan and motor assembly shall be mounted on spring vibration type isolators inside cabinetry.
- .4 Bearings and Drives:
  - .1 Bearings to be heavy duty pillow block type, self-aligning, greases lubricated, ball or roller bearings.
  - .2 Shafts shall be solid, hot rolled steel, ground and polished, keyed to shaft, and protectively coated with lubricating oil. Hollow shafts are unacceptable.
  - .3 Direct drive complete with variable frequency drive.
- .5 Electrical:

- .1 Components shall be CSA, UL or CE listed as applicable.
- .2 Fan motors shall be 1800 RPM TEFC
- .6 Filters:
  - .1 Filter media shall be UL 900 listed.
  - .2 V-bank arrangement with 2-inch, throw-away panel filters.
- .7 Energy Recovery:
  - .1 Unit shall be 90% efficient (+/- 5%) in winter and up to 80% in summer. It shall also provide up to 70% latent recovery. Unit shall accomplish this without the need of a defrost cycle. Cores shall be comprised of corrugated high grade aluminum.
  - .2 Switchover damper section shall be comprised of multi section low leakage dampers operated by electric damper motors complete with DC braking. Each damper shall control one of four airways, upper-horizontal, lower-horizontal, forward-vertical and rear-vertical. Dampers shall be capable of orienting to close of outside air to the building without needing external shut off dampers. Units employing single blade dampers must include external shut-off dampers. Dampers shall also be capable of orienting to allow 100% recirculation of air without using heat recovery device for off peak or unoccupied heating modes. Damper blades, rods and axles shall be galvanized.
  - .3 Recovery cycles shall be controlled by internal programmed thermostats measuring both supply and exhaust air, and optimizing performance of both heat recovery and fee cooling modes.
- .8 Acceptable Manufacturer: Tempeff RGSP (or approved equal in accordance with B7).

### **Part 3 EXECUTION**

#### **3.1 MANUFACTURER'S INSTRUCTIONS**

- .1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

#### **3.2 INSTALLATION**

- .1 Install in accordance with manufacturers recommendations.
- .2 Support independently of adjacent ductwork with flexible connections.

#### **3.3 CLEANING**

- .1 Proceed in accordance with Section 21 05 01.
- .2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

**3.4                      FIELD QUALITY CONTROL**

- .1                      Provide test report and include copy with Operations and Maintenance Manuals.

**END OF SECTION**

**Part 1 GENERAL**

**1.1 REFERENCES**

- .1 CSA International
  - .1 CSA C22.2 No.46-[M1988(R2006)], Electric Air-Heaters.
- .2 National Electrical Manufacturers Association (NEMA)
  - .1 NEMA 250-[08], Enclosures for Electrical Equipment (1000 V Maximum).

**1.2 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit in accordance with Section 01 00 20 - General Requirements.
- .2 Product Data:
  - .1 Submit manufacturer's instructions, printed product literature and data sheets for unit heaters and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Manufacturer's Instructions: provide to indicate special handling criteria, installation sequence, cleaning procedures.

**1.3 CLOSEOUT SUBMITTALS**

- .1 Submit in accordance with Section 21 05 01.
- .2 Operation and Maintenance Data: submit operation and maintenance data for unit heaters for incorporation into manual.

**1.4 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with Section 21 05 01 and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to the Site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
  - .1 Store materials in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Store and protect unit heaters from nicks, scratches, and blemishes.
  - .3 Replace defective or damaged materials with new.

**Part 2 PRODUCTS**

**2.1 UNIT HEATERS- UH -1-5**

- .1 Units shall be UL and C-UL listed for safe operation, construction, and performance. Units shall be listed for use in both the U.S. and Canada for commercial and industrial environment installations.
- .2 Casing
  - .1 18 and 20-gauge steel.
  - .2 Adjustable louvres to direct air flow.
  - .3 Epoxy/polyester powder paint.
- .3 Heating Element
  - .1 Durable tubular heating elements, stainless steel.
  - .2 Concentric disposition of heating elements.
- .4 Motor and Propeller Fan
  - .1 Motor mounted in cold compartment.
  - .2 Thermally-protected motor.
  - .3 Totally enclosed and factory-lubricated ball bearing motor.
  - .4 58 dBA fan.
  - .5 Fan delay to purge heater of residual heat.
- .5 Electrical
  - .1 Units shall have built-in contactors and control circuit transformers (where required) to provide single-source power connection.
  - .2 A wiring diagram and a grounding lug shall be included in each power junction box.
- .6 Controls
  - .1 Low voltage thermostat complete with insulating backplate to be provided by Contractor and installed by others.
- .7 Accessories
  - .1 Adjustable horizontal air deflectors
- .8 Performance
  - .1 Performance as indicated on equipment schedule.
- .9 Approved Products:
  - .1 Ouellet model OAS (or approved equal in accordance with B7).

**2.2 UNIT HEATER- UH 6**

- .1 Units shall be UL and C-UL listed for safe operation, construction, and performance. Units shall be listed for use in both the U.S. and Canada for commercial and industrial wet environment installations.

- .2 Casing
  - .1 16-gauge, stainless steel, moisture and corrosion resistant housing.
  - .2 Adjustable, stainless steel outlet louvres.
  - .3 Stainless steel rear grille to protect against accidental contact with the fan blade.
  - .4 Stainless steel swivel mounting bracket for wall or ceiling mounting.
- .3 Heating Element
  - .1 Sealed tubular heating element with stainless steel fins.
- .4 Motor and Propeller Fan
  - .1 Each unit shall have a single motor. The motor shall be totally enclosed, continuous-duty, with automatic resetting, thermal-overload protection. Propeller fan shall be directly connected to the motor shaft and be statically balanced. The motor shall be mounted to the unit with rubber vibration absorbing material.
- .5 Electrical
  - .1 Units shall have built-in contactors and control circuit transformers (where required) to provide single-source power connection.
  - .2 Electrical control components shall be safely enclosed in a NEMA 4X non-metallic electrical enclosure. A wiring diagram and a grounding lug shall be included in each power junction box.
- .6 Controls
  - .1 Low voltage thermostat, wet-area rated, to be provided by Contractor and installed by others.
- .7 Accessories
  - .1 Adjustable horizontal air deflectors
- .8 Performance
  - .1 Performance as indicated on equipment schedule.
- .9 Approved Product:
  - .1 Ouellet Model OWD (or approved equal in accordance with B7).

### **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 unit heaters installation in accordance with manufacturer's written instructions.
  - .1 Visually inspect substrate.
  - .2 Inform Contract Administrator of unacceptable conditions immediately upon discovery.
  - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Contract Administrator.

**3.2 INSTALLATION**

- .1 Suspend unit heaters from ceiling or mount on wall as indicated.
- .2 Install thermostats in suitable location within ceiling space close to unit heater.
- .3 Make power and control connections.

**3.3 FIELD QUALITY CONTROL**

- .1 Perform tests in accordance with Section 21 05 01 - General Provisions.
- .2 Test cut-out protection when air movement is obstructed.
- .3 Test fan delay switch to assure dissipation of heat after element shut down.
- .4 Test unit cut-off when fan motor overload protection has operated.
- .5 Ensure heaters and controls operate correctly.

**3.4 PROTECTION**

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

**END OF SECTION**