

Part 1 General

1.1 RELATED GENERAL PROVISION

- .1 This section covers items common to all sections of Division 23 and is intended only to supplement the requirements of Division 1.

1.2 DESCRIPTION OF WORK

- .1 Work under this division covers all labour, materials and equipment required for installing and placing in operation the mechanical systems as specified herein and as shown on the drawings.

1.3 RESPONSIBILITY FOR TRIAL USAGE

- .1 Obtain written permission from Departmental Representative to start and test permanent equipment and equipment and systems prior to acceptance by Owner.
- .2 Comply with the requirements of Departmental Representative in connection with the use of these systems and equipment.
- .3 Such use of permanent equipment and systems shall in no way prejudice the period of guarantee of all equipment and systems which shall commence upon the acceptance of the building by the Owner as substantially complete.
- .4 Owner may use equipment and systems for test purposes prior to acceptance. Supply labour, materials and instruments required for testing.
- .5 Such tests shall not be construed as evidence of acceptance of any part of the contract and it is agreed and understood that no claim for damage will be made for any injury or breakage to any part or parts of the tested equipment due to the aforementioned tests.

1.4 EXAMINATION OF SITE AND DRAWINGS

- .1 Examine the site and local conditions affecting the work of this contract prior to submitting tender.
- .2 Examine the mechanical drawings and determine that the work under this contract can be carried out without changes to the building as it is shown on these drawings.
- .3 Before commencing any work, examine the work of other trades and report at once any defects or interference affecting the work of this division.
- .4 Notes on the drawings are intended to form a part of this specification.
- .5 The mechanical drawings do not show all structural details of the building. Any information involving accurate dimensions of the building shall be taken from the figured dimensions on the architectural drawings or by measurements taken on site.

- .6 The contractor shall make, without additional charge, any necessary changes to accommodate structural conditions as built or existing.
- .7 As work progresses and before installing fixtures, fittings, or equipment which may interfere with the interior treatment or use of the building, consult with the Departmental Representative on the exact location of such equipment.
- .8 The drawings indicate the general location and route of pipes, ducts, etc. Where required piping, etc., are not shown, or shown diagrammatically, they shall be installed to conserve head room and space.
- .9 The plans do not necessarily show all valves, unions, etc. The Contractor shall not avail himself to these obvious omissions but shall install the work complete in essential details that it will function properly and so that repairs or removal of equipment can easily be accomplished.
- .10 The drawings are intended to serve as a guide to the Contractor. The number, location and distribution of electrical services must be located on site.
- .11 Bidders finding discrepancies in, or omissions from the drawings, specifications, or other documents, or having any doubts as to the intent or meaning of any part thereof, shall immediately notify the Departmental Representative who will send written instructions or explanations to all bidders. Neither the Consultant, the Departmental Representative or the Owner will be responsible for oral instructions.

1.5 COOPERATION OF CONTRACTORS

- .1 Coordinate the mechanical work with the work of other trades to facilitate the progress of the work as a whole.
- .2 Any change in the work or schedule caused by failure to coordinate trades shall not be considered as a claim for extra compensation.

1.6 CHANGES AND EXTRAS

- .1 No change to the drawings and specifications will be accepted, if not authorized in writing by the Departmental Representative.
- .2 All work carried out which does not conform to the plans and specifications shall be corrected at the Contractor's expense.
- .3 The Owner reserves the right to change quantity, quality, or any kind of work or equipment described on the drawings or in the specifications without affecting the validity of the contract.
- .4 Monetary adjustments required by such changes shall be accepted in writing by the Departmental Representative before alterations are proceeded with by the Contractor.

1.7 LAWS AND ORDINANCES

- .1 All work performed under this division shall comply with the requirements of the authorities having jurisdiction, including, but not limited to, the following: Provincial Department of Labour, Provincial Department of Environment, Provincial Fire Marshall, Provincial Board of Insurance Underwriters, Provincial Department of Health, Plumbing Inspector, Building Inspector, National Building Code of Canada, Local and Municipal By-Laws and Canadian Standards Association.

1.8 GUARANTEE

- .1 All mechanical work and equipment shall be guaranteed to work satisfactorily for a period of one year from the date of acceptance of substantial completion of the contract, provided any failure is not due to neglect or improper use by the Owner.
- .2 Any certificate given, payment made, partial or entire use of the equipment by the Owner, shall not be construed as acceptance of defective work or improper materials.
- .3 This general guarantee shall not act as a waiver of any specified guarantee for any greater length of time.

1.9 SUBMITTALS

- .1 Submittals: in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Shop drawings; submit drawings stamped and signed by professional engineer registered or licensed in Province of New Brunswick, Canada.
- .3 Shop drawings to show:
 - .1 Mounting arrangements.
 - .2 Operating and maintenance clearances.
- .4 Shop drawings and product data accompanied by:
 - .1 Detailed drawings of bases, supports, and anchor bolts.
 - .2 Acoustical sound power data, where applicable.
 - .3 Points of operation on performance curves.
 - .4 Manufacturer to certify current model production.
 - .5 Certification of compliance to applicable codes.
 - .6 Acoustical sound power data, where applicable.
 - .7 Equipment control schematics and available control points, where applicable.
- .5 Closeout Submittals:
 - .1 Provide operation and maintenance data for incorporation into manual.
 - .2 Operation and maintenance manual approved by, and final copies deposited with, Departmental Representative before final inspection.
 - .3 Operation data to include:
 - .1 Control schematics for systems including environmental controls.

- .2 Description of systems and their controls.
- .3 Description of operation of systems at various loads together with reset schedules and seasonal variances.
- .4 Operation instruction for systems and component.
- .5 Description of actions to be taken in event of equipment failure.
- .6 Valves schedule and flow diagram.
- .7 Colour coding chart.
- .4 Maintenance data to include:
 - .1 Servicing, maintenance, operation and trouble-shooting instructions for each item of equipment.
 - .2 Data to include schedules of tasks, frequency, tools required and task time.
- .5 Performance data to include:
 - .1 Equipment manufacturer's performance datasheets with point of operation as left after commissioning is complete.
 - .2 Equipment performance verification test results.
 - .3 Special performance data as specified.
 - .4 Testing, adjusting and balancing reports as specified in Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.
- .6 Approvals:
 - .1 Submit 3 copies of draft Operation and Maintenance Manual to Departmental Representative for approval. Submission of individual data will not be accepted unless directed by Departmental Representative.
 - .2 Make changes as required and re-submit as directed by Departmental Representative.
- .7 Additional data:
 - .1 Prepare and insert into operation and maintenance manual additional data when need for it becomes apparent during specified demonstrations and instructions.
- .8 Site records:
 - .1 Departmental Representative will provide 1 set of reproducible mechanical drawings. Provide sets of white prints as required for each phase of work. Mark changes as work progresses and as changes occur. Include changes to existing mechanical systems, control systems and low voltage control wiring.
 - .2 Transfer information weekly to reproducibles, revising reproducibles to show work as actually installed.
 - .3 Use different colour waterproof ink for each service.
 - .4 Make available for reference purposes and inspection.
- .9 As-built drawings:
 - .1 Prior to start of Testing, Adjusting and Balancing for plumbing, finalize production of as-built drawings.
 - .2 Identify each drawing in lower right hand corner in letters at least 12 mm high as follows: - "AS BUILT DRAWINGS: THIS DRAWING HAS

BEEN REVISED TO SHOW MECHANICAL SYSTEMS AS
INSTALLED" (Signature of Contractor) (Date).

- .3 Submit to Departmental Representative for approval and make corrections as directed.
- .4 Perform testing, adjusting and balancing for plumbing using as-built drawings.
- .5 Submit completed reproducible as-built drawings with Operating and Maintenance Manuals.
- .10 Submit copies of as-built drawings for inclusion in final TAB report.

1.10 PERMITS AND TAXES

- .1 This Contractor shall apply for and pay all necessary municipal permits. All Provincial and Municipal taxes shall be included in the tendered amount. He shall arrange for all inspections of work by these authorities.
- .2 All materials and labour required to conform to any or all of the regulations imposed by the authorities having jurisdiction over the contract shall be included by the Contractor in his tender. There shall be no additional charges to the Owner.

1.11 STAGING

- .1 This contractor shall supply all staging and equipment necessary for the installation of his work.

1.12 LABOUR AND WORKMANSHIP

- .1 All tradesmen employed by this Contractor for this work shall be properly licensed journeymen and apprentices qualified to do work in each particular trade. The Departmental Representative shall have the right to examine each man's credentials and order any unqualified personnel away from the project.
- .2 This Contractor shall be completely responsible for the proper execution of the work as outlined in the plans and specifications. This Contractor shall assume responsibility for workmanship and material defects whether or not they are discovered by the Departmental Representative.

1.13 DEFICIENCY LISTS

- .1 The Departmental Representative will notify this Contractor at various intervals of defective workmanship or installation deficiencies, etc. This Contractor shall not request revised or updated lists without first submitting a current detailed, item by item report on the status of all deficiencies as reported to the Contractor on a previous listing.
- .2 When the Contractor notifies the Departmental Representative that the contract is ready for final inspection, a comprehensive deficiency listing will be prepared. If such list exceeds twenty (20) items, the contract shall not be considered ready for final inspection and the Departmental Representative need to furnish the Contractor with such listing.

1.14 METRIC DESIGNATION OF NOMINAL PIPE SIZES

- .1 For the purposes of this contract only, pipes and tubes shown in this specification and on accompanying drawing(s) have been given metric nominal sizes in accordance with the following table:

ins.	mm	ins.	mm	ins.	mm	ins.	mm
1/4	6	2-1/2	65	15	375	36	900
5/16	8	3	75	16	400	39	975
3/8	10	3-1/2	90	18	450	40	1000
1/2	12	4	100	20	500	44	1100
5/8	16	5	125	21	525	48	1200
3/4	20	6	150	22	550	52	1300
7/8	22	7	175	pl.	560	56	1400
1	25	8	200	24	600	60	1500
1-1/8	28	9	225	pl.	630	64	1600
1-1/4	32	10	250	26	650	72	1800
1 3/8	35	11	275	27	675	then by multiples of 200 mm to 4000 mm	
1-1/2	40	pl.	280	28	700		
1-5/8	41	12	300	pl.	710		
1-3/4	44	pl.	315	30	750		
1-7/8	47	14	350	32	800		
2	50	pl.	355	33	825		

PL. – listed in CGSB.41 – Plastic Series.

- .2 It should be understood by all concerned that there is no intended physical change in the sizes of pipes, tubes, fittings, valves and screw threads. They are simply given a metric nominal designation.
- .3 Pipe thread sizes will be designated as they have been in the past: e.g. 2" NPT means a two inch tapered pipe thread, to ANSI B2.1, pipe threads, specification.

1.15 METRIC SYMBOLS

- .1 All metric symbols used in this specification and on the accompanying drawings are those used in National Standard of Canada, CAN3-Z234.1-79, Canadian Metric Practice Guide.

1.16 METRIC DESIGNATION OF SHEET METAL GAUGES

- .1 For the purpose of this contract only, sheet metal gauges shown on this specification and on the accompanying drawing(s) are given in millimeter thicknesses in accordance with the following table of gauge equivalents:

Nominal Thickness in mm	Hot or Cold Rolled Steel	Stainless Steel	Galvanized Steel	Aluminum
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0.4	28	28	30	26
0.5	26	26	28	24
0.6	24	24	26	22
0.8	22	22	22 to 24	20
1	20	20	20	18
1.2	18	18	18	16
1.5	16	16	16	14
2	14	14	14	12
2.5	12			10
3		12	12	
3.5	10	10		8
4	8			6
4.5		8		

Metric Sheet Metal Products:

The above noted table indicates the metric nomenclature which replaces the gauge numbers of those metal sheets commonly used in construction.

1.17 MAINTENANCE

- .1 Furnish spare parts in accordance as follows:
 - .1 One set of packing for each pump.
 - .2 One casing joint gasket for each size pump.
 - .3 One head gasket set for each heat exchanger.
 - .4 One glass for each gauge glass.
 - .5 One filter cartridge or set of filter media for each filter or filter bank in addition to final operating set.
 - .6 Two spare cylinders for each humidifier
 - .7 One complete set of spare filters for each filter banks, including filters in manufactured units.
 - .8 One set of belts for each belt drives.
- .2 Provide one set of special tools required to service equipment as recommended by manufacturers.
- .3 Furnish one commercial quality grease gun, grease and adapters to suit different types of grease and grease fittings.

Part 2 Products

2.1 MATERIALS

- .1 All materials used in this project must be purchased directly through jobbers, manufacturers' agent, wholesalers and suppliers having an established office in the Maritime provinces and purchased through Maritime representatives. By submitting a tender, this contractor acknowledges his responsibility.

2.2 STANDARD OF ACCEPTANCE

- .1 Means that item named and specified by catalogue number forms part of specification regarding performance, quality of materials and workmanship.
- .2 Tender price shall be based upon materials as specified. Manufacturer's products that are not named in the specifications must receive approval from the Departmental Representative prior to the tender closing date.
- .3 All designs are based on units numbered in schedules on drawings or stated as being "basis of design" in the spec. If approved equal is chosen, contractor shall be responsible for any and all modifications required to make unit fit, including but not limited to mechanical, electrical, architectural and structural modifications.

2.3 MOTORS

- .1 Provide motors for mechanical equipment as specified.
- .2 If delivery of specified motor will delay delivery or installation of any equipment, install motor approved by Departmental Representative for temporary use. Final acceptance of equipment will not occur until specified motor is installed.
- .3 Motors under 1/2 HP: speed as indicated, continuous duty, built-in overload protection, resilient mount, single phase, 115 V, unless otherwise specified or indicated.
- .4 Motors 1/2 HP and larger: EEMAC Class B, high efficiency squirrel cage induction, speed as indicated, continuous duty, drip proof, ball bearing, maximum temperature rise 40°C. Power supply wattage and phases as indicated on drawings.
- .5 Motors 2 HP and larger for Variable Frequency Drive application:
 - .1 Inverter duty, with internal or external maintenance-free Shaft Grounding Bearing Protection Ring.

2.4 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 specified.
- .3 For motors under 10 HP: standard adjustable pitch drive sheaves, having plus or minus 10% range. Use mid-position of range for specified r/min.
- .4 For motors 10 HP and over: sheave with split tapered bushing and keyway having fixed pitch unless specifically required for item concerned. Provide sheave of correct size to suit balancing.
- .5 Minimum drive rating: 1.5 times nameplate rating on motor. Keep overhung loads within manufacturer's design requirements on prime mover shafts.
- .6 Motor slide rail adjustment plates to allow for centre line adjustment.

2.5 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 dia holes on both shaft centres for insertion of tachometer.
 - .4 Removable for servicing.
- .3 Provide means to permit lubrication and use of test instruments with guards in place.
- .4 Install belt guards to allow movement of motors for adjusting belt tension.
- .5 Guard for flexible coupling:
 - .1 "U" shaped, minimum 1.6 mm thick galvanized mild steel.
 - .2 Securely fasten in place.
 - .3 Removable for servicing.
- .6 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 Securely fasten in place.
 - .4 Removable for servicing.

2.6 EQUIPMENT SUPPORTS

- .1 Equipment supports supplied by equipment manufacturer: specified elsewhere in Division 23.
- .2 Mount base mounted equipment on chamfered edge housekeeping pads, minimum of 100 mm high and 50 mm larger than equipment dimensions all around.
- .3 Supply anchor bolts and templates for installation by other division.

2.7 FIRESTOPPING

- .1 All penetrations through all fire separations (Wall and floor penetrations) are to be fire stopped.
- .2 All firestopping by general contractor with the exception of mechanical firestopping as specified elsewhere in Division 23.
- .3 Mechanical contractors to coordinate number, size and locations of openings with general contractor.

2.8 SPECIAL TOOLS AND SPARE PARTS

- .1 Provide one set of special tools required to service equipment as recommended by manufacturers.
- .2 Identify spare parts containers as to contents and replacement parts number.

2.9 ACCESS DOORS

- .1 Supply access doors to concealed mechanical equipment for operating, inspecting, adjusting and servicing.
- .2 Flush mounted 600 x 600 mm for body entry and 300 x 300 mm for hand entry unless otherwise noted. Doors to open 180°, have rounded safety corners, concealed hinges, screwdriver latches and anchor straps.
- .3 Material:
 - .1 Special areas such as tiled or marble surfaces: use stainless steel with brushed satin or polished finish as directed by Departmental Representative.
 - .2 Remaining areas: use prime coated steel.
- .4 Installation:
 - .1 Locate so that concealed items are accessible.
 - .2 Locate so that hand or body entry (as applicable) is achieved.
 - .3 Installation is specified in applicable sections.

Part 3 Execution

3.1 INSTALLATION

- .1 Unions or flanges: provide for ease of maintenance and disassembly.
- .2 Space for servicing, disassembly and removal of equipment and components: provide as recommended by manufacturer or as indicated.
- .3 Equipment drains: pipe to floor drains.
- .4 Install equipment, rectangular cleanouts and similar items parallel to or perpendicular to building lines.
- .5 Provide accessible means for lubricating equipment including permanent lubricated bearings.
- .6 A minimum clearance of 2.2 m shall be maintained unless otherwise stated or impossible to achieve. Where headroom will be less than 2.0 m from the finished floor, pipe or duct runs shall be approved by the Departmental Representative.

3.2 PROTECTION

- .1 Protect equipment and systems openings from dirt, dust, and other foreign materials with materials appropriate to system.
- .2 protect all equipment, piping, fixtures, ductwork, etc. throughout the construction period and assume responsibility for the same.

3.3 CUTTING AND PATCHING

- .1 Cutting and patching shall be the responsibility of the general contractor. Mechanical contractor to coordinate location of openings for mechanical equipment with general contractor.
- .2 In new installations, painting of patches shall be by general contractor.
- .3 If, however, cutting and patching is required to fix a defect and/or omission which is the responsibility of the Mechanical contractor, all cutting and patching costs required to fix this defect and/or omission shall be carried by the Mechanical contractor.

3.4 CONCEALMENT

- .1 Unless otherwise shown or specified, all ducts and piping shall be run concealed in ceilings, walls, partitions, etc. Heating risers and water piping shall not be concealed in exterior walls without adequate thermal protection.

3.5 REMOVAL OF EQUIPMENT

- .1 All equipment designated in later sections of this specification or on drawings as being turned over to Building Owners shall be placed in room as determined by Owners. This Contractor shall take every reasonable precaution to ensure that such equipment is kept in good condition.

3.6 ELECTRICAL

- .1 Electrical work to conform to Division 26 including the following:
 - .1 Supplier and installer responsibility is indicated on electrical drawings and related mechanical responsibility is indicated on mechanical drawings.
 - .2 Control wiring and conduit is specified in Division 26 except for conduit, wiring and connections below 50 V which are related to control systems specified in Division 25. Refer to Division 26 for quality of materials and workmanship.

3.7 PREPARATION FOR FIRESTOPPING

- .1 Firestopping material and installation within annular space between pipes, ducts, insulation and adjacent fire separation.
- .2 Uninsulated unheated pipes not subject to movement: no special preparation.
- .3 Uninsulated heated pipes subject to movement: wrap with non-combustible smooth material to permit pipe to move without damaging firestopping material.

- .4 Insulated pipes and ducts: ensure integrity of insulation and vapour barrier at fire separation.

3.8 PAINTING

- .1 Apply at least one coat of corrosion resistant primer paint to ferrous supports and site fabricated work.
- .2 Prime and touch up marred finished paintwork to match original.
- .3 Restore to new condition, finishes which have been damaged too extensively to be merely primed and touched up.

3.9 CLEANING

- .1 Clean interior and exterior of all systems including strainers. Vacuum interior of ductwork and air handling units.
- .2 In preparation for final acceptance, clean and refurbish all equipment and leave in operating condition including replacement of all filters in all air and piping systems.

3.10 EXISTING SYSTEMS

- .1 Connections into existing systems to be made at time approved by Departmental Representative. Request written approval of time when connections can be made.
- .2 Be responsible for damage to existing plant by this work.

3.11 COMMISSIONING

- .1 All contractors shall be available for commissioning process described in section 25 01 11 – EMCS: Start-up, Verification and Commissioning.
- .2 All bugs relating to mechanical equipment shall be fixed during commissioning process so that commissioning can be completed in a timely fashion. All deficiencies shall be fixed at no extra cost.
- .3 Contractor shall perform any and all test on their own equipment as required by manufacturer and as described in equipment's relevant section in order to ensure that their equipment is functioning properly prior to EMCS commissioning.
- .4 Further to standard commissioning requirements, ventilation contractor and TAB contractor shall be represented and shall participate during the Acceptance Testing as prescribed in Chapter 8 of NFPA 92A-2011 – Standard for Smoke-Control System Utilizing Barriers and pressure Differences. Any deficiencies found during these tests shall be repaired immediately and at no extra cost.

3.12 DEMONSTRATION AND OPERATING AND MAINTENANCE INSTRUCTIONS

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

- .2 Supply tools, equipment and personnel to demonstrate and instruct operating and maintenance personnel in operating, controlling, adjusting, trouble-shooting and servicing of all systems and equipment during regular work hours, prior to acceptance.
- .3 Use operation and maintenance manual, as-built drawings, and audio visual aids as required as part of instruction materials.
- .4 Instruction duration time requirements as specified in appropriate sections.
- .5 Departmental Representative will record these demonstrations on video tape as required for future reference.
- .6 Where specified elsewhere in Division 23, manufacturers to provide demonstrations and instructions.

END OF SECTION

Part 1 General

1.1 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.

1.2 QUALIFICATIONS OF TAB PERSONNEL

- .1 Submit names of personnel to perform TAB to Departmental Representative within 90 days of award of contract.
- .2 Provide documentation confirming qualifications, successful experience.
- .3 TAB: performed in accordance with the requirements of standard under which TAB Firm's qualifications are approved:
 - .1 Associated Air Balance Council, (AABC) National Standards for Total System Balance, MN-1-2002.
 - .2 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA), HVAC TAB HVAC Systems - Testing, Adjusting and Balancing-2002.
- .4 Recommendations and suggested practices contained in the TAB Standard: mandatory.
- .5 Use TAB Standard provisions, including checklists, and report forms to satisfy Contract requirements.
- .6 Use TAB Standard for TAB, including qualifications for TAB Firm and Specialist and calibration of TAB instruments.
- .7 Where instrument manufacturer calibration recommendations are more stringent than those listed in TAB Standard, use manufacturer's recommendations.
- .8 TAB Standard quality assurance provisions such as performance guarantees form part of this contract.
 - .1 For systems or system components not covered in TAB Standard, use TAB procedures developed by TAB Specialist.
 - .2 Where new procedures, and requirements, are applicable to Contract requirements have been published or adopted by body responsible for TAB Standard used (AABC), requirements and recommendations contained in these procedures and requirements are mandatory.

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 all other related systems under all normal and emergency loads and operating conditions.
- .3 Balance systems and equipment to regulate flow rates to match load requirements over full operating ranges.

1.4 EXCEPTIONS

- .1 TAB of systems and equipment regulated by codes, standards to be to satisfaction of authority having jurisdiction.

1.5 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.

1.6 PRE-TAB REVIEW

- .1 Review contract documents before project construction is started and confirm in writing to Departmental Representative 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 Departmental Representative in writing 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.

1.7 START-UP

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

1.8 OPERATION OF SYSTEMS DURING TAB

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

1.9 START OF TAB

- .1 Notify Departmental Representative 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 weather-stripping, sealing, caulking.
- .3 All pressure, leakage, other tests specified elsewhere Division 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.

1.10 APPLICATION TOLERANCES

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

1.11 ACCURACY TOLERANCES

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

1.12 INSTRUMENTS

- .1 Prior to TAB, submit to Departmental Representative list of instruments to be used together with serial numbers.
- .2 Calibrate in accordance with requirements of most stringent of referenced standard for either applicable system or HVAC system.
- .3 Calibrate within 3 months of TAB. Provide certificate of calibration to Departmental Representative.

1.13 SUBMITTALS

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

1.14 PRELIMINARY TAB REPORT

- .1 Submit for checking and approval of Departmental Representative, prior to submission of formal TAB report, sample of rough TAB sheets. Include:

- .1 Details of instruments used.
- .2 Details of TAB procedures employed.
- .3 Calculations procedures.
- .4 Summaries.

1.15 TAB REPORT

- .1 TAB report to show all results in SI units and to include:
 - .1 Project record drawings.
 - .2 System schematics.
- .2 Submit 6 copies of TAB Report to Departmental Representative for verification and approval, in English in D-ring binders, complete with index tabs.

1.16 VERIFICATION

- .1 All reported results subject to verification by Departmental Representative.
- .2 Provide manpower and instrumentation to verify up to 30% of all reported results.
- .3 Number and location of verified results to be at discretion of Departmental Representative.
- .4 Bear costs to repeat TAB as required to satisfaction of Departmental Representative.

1.17 SETTINGS

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

1.18 COMPLETION OF TAB

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

1.19 AIR SYSTEMS

- .1 Standard: TAB to be to most stringent of this section or TAB standards of SMACNA.
- .2 Do TAB of all systems, equipment, components, controls specified in Division 23 including, but not limited to the following systems, equipment, components, controls:
 - .1 HRV-1
- .3 Qualifications: personnel performing TAB to be qualified to standards of AABC or NEBB.

- .4 Quality assurance: Perform TAB under direction of supervisor qualified to standards of AABC.
- .5 Measurements: to include, but not limited to, following as appropriate for systems, equipment, components, controls: 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, vibration.
- .6 Locations of equipment measurements: To include, but not be limited to, following as appropriate:
 - .1 Inlet and outlet of each damper, filter, coil, humidifier, fan, other equipment causing changes in conditions.
 - .2 At each controller, controlled device.
- .7 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).
- .8 Adjustment: Adjust airflows to match airflows shown on drawings.
 - .1 Adjustments to include, but not limited to:
 - .1 All balancing dampers shown on drawings.
 - .2 All fan rotation speeds.

Part 2 Products (not applicable)

Part 3 Execution (not applicable)

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 Canadian General Standards Board (CGSB)
 - .1 CGSB 51-GP-52Ma-89, Vapour Barrier, Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation.
- .2 Underwriters Laboratories of Canada (ULC)
 - .1 CAN/ULC-S102-03, Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.
 - .2 CAN/ULC-S701-05, Standard for Thermal Insulation, Polystyrene, Boards and Pipe Covering.
- .3 American Society for Testing and Materials (ASTM).
 - .1 ASTM B209M-07, Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric).
 - .2 ASTM C335-05ae1, Standard Test Method for Steady State Heat Transfer Properties of Pipe Insulation.
 - .3 ASTM C411-05, Standard Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation.
 - .4 ASTM C449/C449M-00, Standard Specification for Mineral Fiber-Hydraulic-Setting Thermal Insulating and Finishing Cement.
 - .5 ASTM C547-07e1, Standard Specification for Mineral Fiber Pipe Insulation.
 - .6 ASTM C553-02e1, Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.
 - .7 ASTM C612-04e1, Standard Specification for Mineral Fiber Block and Board Thermal Insulation.
 - .8 ASTM C795-03, Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.
 - .9 ASTM C921-03a, Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.
- .4 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)
 - .1 ASHRAE Standard 90.1-2004.
- .5 Manufacturer's Trade Associations.
 - .1 Thermal Insulation Association of Canada (TIAC): National Insulation Standards (2005).

1.2 SHOP DRAWINGS AND PRODUCT DATA

- .1 Submit shop drawings and product data in accordance with Section 23 05 00 – Common work Results for HVAC.

1.3 QUALIFICATIONS

- .1 Installer to be specialist in performing work of this section, and have at least 3 years successful experience in this size and type of project, qualified to standards of TIAC.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.
- .2 Protect from weather and construction traffic.
- .3 Protect against damage from any source.
- .4 Store at temperatures and conditions required by manufacturer.

1.5 DEFINITIONS

- .1 For purposes of this section:
 - .1 "CONCEALED" - insulated mechanical services and equipment in 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, and other accessories.
- .2 TIAC Codes:
 - .1 CRD: Code Round Ductwork,
 - .2 CRF: Code Rectangular Finish.

Part 2 Products

2.1 PRIOR APPROVAL OF PRODUCTS

- .1 Manufacturers products that are not named in the specifications must receive approval from Departmental Representative prior to the tender closing date.

2.2 FIRE AND SMOKE RATING

- .1 In accordance with CAN/ULC S102:
 - .1 Maximum flame spread rating: 25.
 - .2 Maximum smoke developed rating: 50.

2.3 INSULATION

- .1 Mineral fibre as specified herein includes glass fibre, rock wool, slag wool.
- .2 Thermal conductivity ("k" factor) not to exceed specified values at 24°C mean temperature when tested in accordance with ASTM C 335.

- .3 TIAC Code C-1: Rigid mineral fibre board to ASTM C612, with or without factory applied vapour retarder jacket to CGSB 51-GP-52Ma (as scheduled in PART 3 of this Section).

2.4 JACKETS

- .1 Canvas:
 - .1 220 gm/m2 cotton, plain weave, treated with dilute fire retardant lagging adhesive to ASTM C 921.

2.5 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 Insulating Cement: hydraulic setting on mineral wool, to ASTM C 449.
- .4 ULC Listed Canvas Jacket:
 - .1 220 gm/m2 cotton, plain weave.
- .5 Outdoor Vapour Retarder Mastic:
 - .1 Vinyl emulsion type acrylic, compatible with insulation.
 - .2 Reinforcing fabric: Fibrous glass, untreated 305 g/m2.
- .6 Tape: self-adhesive, aluminium, reinforced, 50 mm wide minimum.
- .7 Contact adhesive: quick-setting
- .8 Canvas adhesive: washable.
- .9 Tie wire: 1.5 mm stainless steel.
- .10 Banding: 19 mm wide, 0.5 mm thick stainless steel.
- .11 Facing: 25 mm galvanized steel hexagonal wire mesh stitched on one face of insulation.
- .12 Fasteners: 4 mm diameter pins with 35 mm diameter square clips, length to suit thickness of insulation.

Part 3 Execution

3.1 APPLICATION

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

3.2 PRE-INSTALLATION REQUIREMENTS

- .1 Pressure testing of ductwork systems to be complete, witnessed and certified.
- .2 Surfaces to be clean, dry, free from foreign material.

3.3 INSTALLATION

- .1 Install in accordance with TIAC National Standards.
- .2 Apply materials in accordance with manufacturers instructions and this specification.
- .3 Use two layers with staggered joints when required nominal thickness exceeds 75 mm.
- .4 Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes.
 - .1 Hangers, supports to be outside vapour retarder jacket.
- .5 Apply high compressive strength insulation where insulation may be compressed by weight of ductwork.
- .6 Fasteners: At 300 mm oc. in horizontal and vertical directions, minimum two rows each side.

3.4 DUCTWORK INSULATION SCHEDULE

- .1 Insulation types and thickness: Conform to following table:

	TIAC Code	Vapour Retarder	Thickness mm
Supply, return and exhaust ducts exposed in space being served			none
Outside air ducts and plenums To motorized damper upstream of HRV	C-1	yes	25
Exhaust air ducts and plenums From motorized damper Downstream of HRV	C-1	no	25

- .2 Exposed round ducts 600 mm and larger, smaller sizes where subject to abuse:
 - .1 Use TIAC code C-1 insulation, scored to suit diameter of duct.
- .3 Finishes definition:
 - .1 CRF/1 - For indoor ductwork:
 - .1 Rigid insulation with an integral vapour retarder. Continuous metal corner bead to all corners. Adhere vapour retarder tape over all joints and breaks in vapour retarder, and at all corners.

- .2 Apply treated fabric jacket over insulation using fabric adhesive and finish with one coat of fabric coating.
- .4 Finishes: to match existing.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 American Society of Mechanical Engineers (ASME).
 - .1 ASME B16.1-10, Cast Iron Pipe Flanges and Flanged Fittings.
 - .2 ASME B16.3-06, Malleable Iron Threaded Fittings.
 - .3 ANSI/ASME B16.4-98, Gray-Iron Threaded Fittings.
 - .4 ASME B16.5-09, Pipe Flanges and Flanged Fittings.
 - .5 ASME B16.9-07, Factory-Made Wrought Buttwelding Fittings.
 - .6 ANSI/ASME B16.15-1985(2004), Cast Bronze Threaded Fittings.
 - .7 ANSI/ASME B16.18-2001, Cast Copper Alloy, Solder Joint Pressure Fittings.
 - .8 ANSI/ASME B16.22-2001, Wrought Copper and Copper-Alloy Solder Joint Pressure Fittings.
 - .9 ASME B18.2.1-10, Square and Hex Bolts and Screws (Inch Series).
 - .10 ASME B18.2.2-10, Square and Hex Nuts (Inch Series).
- .2 American Society for Testing and Materials International, (ASTM).
 - .1 ASTM A47/A47M-99(2009), Standard Specification for Ferritic Malleable Iron Castings.
 - .2 ASTM A53/A53M-10, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc Coated Welded and Seamless.
 - .3 ASTM A536-84(2009), Standard Specification for Ductile Iron Castings.
 - .4 ASTM B32-04, Standard Specification for Solder Metal.
 - .5 ASTM B61-08, Standard Specification for Steam or Valve Bronze Castings.
 - .6 ASTM B62-09, Standard Specification for Composition Bronze or Ounce Metal Castings.
 - .7 ASTM B88M-03, Standard Specification for Seamless Copper Water Tube [Metric].
 - .8 ASTM E202-10, Standard Test Method for Analysis of Ethylene Glycols and Propylene Glycols.
- .3 American Water Works Association (AWWA).
 - .1 ANSI/AWWA C111/A21.11-06, Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
- .4 American National Standards Institute (ANSI)/American Welding Society (AWS)
 - .1 ANSI/AWS A5.8/A5.8M-04, Specification Filler Metals for Brazing and Bronze Welding.
- .5 Canadian Standards Association (CSA International).
 - .1 CSA B242-05(R2011), Groove and Shoulder Type Mechanical Pipe Couplings.
 - .2 CAN/CSA W48-06, Filler Metals and Allied Materials for Metal Arc Welding.

- .6 Manufacturer's Standardization of the Valve and Fittings Industry (MSS).
 - .1 MSS-SP-67-02a, Butterfly Valves.
 - .2 MSS-SP-70-06, Cast Iron Gate Valves, Flanged and Threaded Ends.
 - .3 MSS-SP-71-05, Cast Iron Swing Check Valves Flanged and Threaded Ends.
 - .4 MSS-SP-80-08, Bronze Gate, Globe, Angle and Check Valves.
 - .5 MSS-SP-85-02, Cast Iron Globe and Angle Valves, Flanged and Threaded Ends.

1.2 SHOP DRAWINGS AND PRODUCT DATA

- .1 Submit shop drawings and product data in accordance with Section 23 05 00 – Common Work Results for HVAC.

1.3 MAINTENANCE

- .1 Extra Materials:
 - .1 Furnish following spare parts:
 - .1 Valve seats: one for every ten valves, each size. Minimum one.
 - .2 Discs: one for every ten valves, each size. Minimum one.
 - .3 Stem packing: one for every ten valves, each size. Minimum one.
 - .4 Valve handles: two of each size.
 - .5 Gaskets for flanges: one for every ten flanges.

Part 2 Products

2.1 PRIOR APPROVAL OF PRODUCTS

- .1 Manufacturers products that are not named in the specifications must receive approval from Departmental Representative prior to the tender closing date.
- .2 Schedule found on drawings shall be considered as being integral part of these specifications. Model number in schedule is the basis of design. Any model number not found in schedules shall only be considered as equal if it meets quality and performance of numbered item.
- .3 Any and all extra work that may result from an approved equal that is of different dimensions or requirements than the basis of design shall be the responsibility of this contractor.

2.2 PIPE

- .1 Steel pipe: to ASTM A53/A53M, Grade B, as follows:
 - .1 Up to 150 mm, Schedule 40.
 - .2 200 mm and over, Schedule 30.
 - .3 300 mm and over, 10 mm wall thickness.

2.3 PIPE JOINTS

- .1 Steel:
 - .1 50 mm and under: screwed fittings with Teflon tape .
 - .2 65 mm and over: welding fittings and flanges.
 - .3 Flanges: plain or raised face, slip-on or weld neck.
 - .4 Orifice flanges: slip-on raised face, 2100 kPa.
 - .5 Flange gaskets: to ANSI/AWWA C111/A21.11.
 - .6 Pipe thread: taper.
 - .7 Bolts and nuts: to ANSI B18.2.1 and ANSI/ASME B18.2.2.

2.4 FITTINGS

- .1 Steel:
 - .1 Screwed fittings: malleable iron, to ANSI/ASME B16.3, Class 150.
 - .2 Pipe flanges and flanged fittings:
 - .1 Cast iron: to ANSI/ASME B16.1, Class 125.
 - .2 Steel: to ANSI/ASME B16.5.
 - .3 Butt-welding fittings: steel, to ANSI/ASME B16.9.
 - .4 Unions: malleable iron, to ASTM A47M and ANSI/ASME B16.3.

2.5 VALVES (METAL PIPES)

- .1 Connections:
 - .1 50mm and smaller: screwed ends.
 - .2 65mm and larger: Flanged ends.
- .2 Ball valves:
 - .1 50mm and under, screwed:
 - .1 Class 150, brass body, chrome plated brass ball, PTFE Teflon adjustable packing, full port, brass gland and PTFE Teflon seat, steel lever handle.
 - .2 Insulated pipes: Install with lever extension.
 - .3 Acceptable material: Jenkins 201J, Crane F9202, Kitz #58, MA Stewart B-1F, Toyo 5041, NCI T-FP-600, Bonomi 171N or approved equal.
- .3 Butterfly valves:
 - .1 65mm and over:
 - .2 Wafer-type, To MSS SP-67, Class 200.
 - .3 Cast iron body, Aluminum Bronze disc, stainless steel stem, EPDM liner.
 - .4 Operator:
 - .1 Under 200mm: lever handle
 - .2 200mm and over: gear operated
 - .5 Acceptable material: NCI WC-2000, Kitz 5122E, Demco NE-I, Jenkins 200 series, Crane Fig. 42 or approved equal.

- .4 Balancing valves:
 - .1 50mm and under:
 - .1 Brass body, Y pattern, equal percentage globe valve, threaded connections
 - .2 Multi-turn, 360° adjustment with micrometer type indicators located on the valve handwheel. Handwheel shall have hidden memory feature.
 - .3 Built-in venturi with two metering ports for flow measurements.
 - .4 Acceptable materials: Armstrong CBV, Danfoss STV, TA Hydronics STAD, Oventropp PN 16, Victaulic TA787 or approved equal.
 - .2 65mm and over:
 - .1 Cast Iron body, Y pattern, equal percentage globe valve, flanged connections
 - .2 Multi-turn, 360° adjustment with micrometer type indicators located on the valve handwheel. Handwheel shall have hidden memory feature.
 - .3 Built-in venturi with two metering ports for flow measurements.
 - .4 Acceptable materials: Armstrong CBV, Danfoss STV, Oventropp PN 16 or approved equal.
- .5 Drain valves:
 - .1 On all pipe sizes, 20mm dia. valve, ball-type, screwed:
 - .1 Class 150, brass body, chrome plated brass ball, PTFE Teflon adjustable packing, full port, brass gland and PTFE Teflon seat, steel lever handle, with 20mm hose connection, cap and chain.
 - .2 Acceptable material: NCI T-FP-600-HC, Dahl 50430, Crane 9211-HC, Toyo Fig. 5046A or approved equal.
- .6 Swing check valves:
 - .1 50mm and under:
 - .1 To MSS SP-80, Class 125, 860 kPa, bronze body, Y-pattern bronze swing disc, screw in cap, regrindable seat.
 - .2 Acceptable material: Kitz No. 22, NCI T-413, Toyo Red & White fig. 236, Jenkins 4037J, Crane Fig. 37 or approved equal.
 - .2 65mm and over:
 - .1 To MSS SP-71, Class 125, 860 kPa, cast iron body, flat flange faces, renewable seat, bronze disc, bolted cap.
 - .2 Acceptable material: Kitz No. 78, NCI F-918-B, Toyo Red & White fig. 435E, Jenkins 587J, Crane Fig. 373 or approved equal.
- .7 Lift check valves (for vertical installation):
 - .1 50mm and under:
 - .1 Bronze body, to MSS SP-80.
 - .2 Acceptable material: NCI T-480, Kitz no. 36, Crane Fig. 29 or approved equal.
 - .2 65mm and over:

- .1 Cast iron body, silent type, flanged end, spring actuated in-line lift, class 125.
 - .2 Acceptable material: NCI F-910 or approved equal.
- .8 Gate valves:
 - .1 65mm and over:
 - .1 Rising stem: to MSS SP-70, Class 125, 860 kPa, flat flange faces, cast-iron body, OS&Y bronze trim.
 - .2 Acceptable material: Kitz No. 72, Nibco F-617-O, Toyo Red & White fig. 243 or approved equal.

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 GENERAL PIPING INSTALLATION

- .1 Install piping as described herein.
- .2 Connect to equipment in accordance with manufacturer's instruction unless otherwise indicated.
- .3 Assemble piping using fittings manufactured to ANSI standards.

3.3 VALVE INSTALLATION

- .1 Install ball or butterfly valves at branch take-offs and to isolate each piece of equipment, and as indicated.
- .2 Install balancing valves for balancing and as indicated.

3.4 BALANCING VALVES

- .1 Install flow measuring stations and flow balancing valves as indicated.
- .2 Remove or lock handwheel after installation and TAB is complete.
- .3 Tape joints in prefabricated insulation on valves installed in chilled water mains.

3.5 CONTROL VALVES

- .1 Electronic control valves shall be supplied by division 25 and installed by division 23.

3.6 TESTING

- .1 Test system in accordance with Section 23 05 00 – Common Work Results for HVAC.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 Canadian Standards Association (CSA).
 - .1 CSA B51-03, Boiler, Pressure Vessel, and Pressure Piping Code.
- .2 ASTM International Inc.
 - .1 ASTM A47/A47M-99(2004), Standard Specification for Ferritic Malleable Iron Castings.
 - .2 ASTM A278/A278M-01(2006), Standard Specification for Gray Iron Castings for Pressure-Containing Parts for Temperatures up to 650 degrees F (350 degrees C).
 - .3 ASTM A516/A516M-06, Standard Specification for Pressure Vessel Plates, Carbon Steel, for Moderate - and Lower - Temperature Service.
 - .4 ASTM A536-84(2004), Standard Specification for Ductile Iron Castings.
 - .5 ASTM B62-02, Standard Specification for Composition Bronze or Ounce Metal Castings.
- .3 American Society of Mechanical Engineers (ASME).
 - .1 ANSI/ASME, Boiler and Pressure Vessels Code (BPVC).

1.2 SHOP DRAWINGS AND PRODUCT DATA

- .1 Submit shop drawings and product data in accordance with Section 23 05 00 – Common work Results for HVAC.

1.3 OPERATION AND MAINTENANCE DATA

- .1 Submit operation and maintenance data in accordance with Section 23 05 00 – Common Work Results for HVAC.

Part 2 Products

2.1 PRIOR APPROVAL OF PRODUCTS

- .1 Manufacturers products that are not named in the specifications must receive approval from Departmental Representative prior to the tender closing date.
- .2 Schedule found on drawings shall be considered as being integral part of these specifications. Model number in schedule is the basis of design. Any model number not found in schedules shall only be considered as equal if it meets quality and performance of numbered item.
- .3 Any and all extra work that may result from an approved equal that is of different dimensions or requirements than the basis of design shall be the responsibility of this contractor.

2.2 GENERAL REQUIREMENTS

- .1 All Seals, O-rings, Gaskets and other sealing materials shall be of a material compatible with system fluid.

2.3 SMALL CAPACITY AUTOMATIC AIR VENT

- .1 Standard float vent: brass body and 12mm x 20mm threaded connection and rated at 1034 kPa system working pressure.
- .2 Float: solid material suitable for 115°C working temperature.
- .3 Acceptable Materials: TACO Hy-Vent, Armstrong AV, Bell & Gossett 87, FloFab AA or approved equal.
- .4 Equipments requiring a 1/8" NPT vent shall be equipped with a hydroscopic cellulose disc vent, with manual internal ball check.
 - .1 Acceptable Materials: TACO 417 Coin Vent or approved equal.

2.4 PIPE LINE STRAINER

- .1 12mm to 50mm: bronze body to ASTM B62, screwed connections.
 - .1 Screen: stainless steel with 1.19 mm perforations.
 - .2 Working pressure: 860 kPa.
 - .3 Acceptable materials: Watts 777, FloFab 460-BTY or approved equal.
- .2 65mm to 300mm: cast iron body to ASTM A126 Cl.B, flanged connections.
 - .1 Blow-down connection with plug.
 - .2 Screen: stainless steel with 3.125 mm perforations.
 - .3 Working pressure: 860 kPa.
 - .4 Acceptable materials: Watts 77F-DI-125, FloFab 460-YF, Apollo 125YF or approved equal.

Part 3 Execution

3.1 APPLICATION

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

3.2 GENERAL

- .1 Run drain lines and blow off connections to terminate above nearest drain.
- .2 Maintain proper clearance to permit service and maintenance.
- .3 Should deviations beyond allowable clearances arise, request and follow Departmental Representative's directive.

- .4 Check shop drawings for conformance of all tapings for ancillaries and for equipment operating weights.

3.3 STRAINERS

- .1 Install in horizontal or down flow lines.
- .2 Ensure clearance for removal of basket.
- .3 Install ahead of each pump.
- .4 Install ahead of each automatic control valve and as indicated.

3.4 AIR VENTS

- .1 Install at high points of systems.
- .2 Install ball valve on inlet side of automatic air vents.
- .3 Use High Capacity Vents in mechanical room and piping 150mmØ and larger.
- .4 Run discharge of high capacity vents to nearest drain with soft copper or PEX tubing.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE).
- .2 American Society for Testing and Materials International, (ASTM).
 - .1 ASTM A480/A480M-03c, Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet and Strip.
 - .2 ASTM A635/A635M-02, Standard Specification for Steel, Sheet and Strip, Heavy-Thickness Coils, Carbon, Hot Rolled.
 - .3 ASTM A653/A653M-03, Standard Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process.
- .3 Department of Justice Canada (Jus).
 - .1 Canadian Environmental Protection Act (CEPA), 1999, c. 33 .
- .4 Health Canada/Workplace Hazardous Materials Information System (WHMIS).
 - .1 Material Safety Data Sheets (MSDS).
- .5 National Fire Protection Association (NFPA).
 - .1 NFPA 90A-12, Standard for the Installation of Air-Conditioning and Ventilating Systems.
 - .2 NFPA 90B-12, Standard for the Installation of Warm Air Heating and Air-Conditioning Systems.
 - .3 NFPA 96-11, Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations.
- .6 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA).
 - .1 SMACNA HVAC Duct Construction Standards - Metal and Flexible, 2005.
 - .2 SMACNA HVAC Air Duct Leakage Test Manual, 2012.
 - .3 IAQ Guideline for Occupied Buildings Under Construction, 2007.
 - .4 SMACNA Duct Cleanliness for New Construction - 2000
- .7 Transport Canada (TC).
 - .1 Transportation of Dangerous Goods Act (TDGA), 1992, c. 34.

1.2 SHOP DRAWINGS AND PRODUCT DATA

- .1 Submit shop drawings and product data in accordance with Section 23 05 00 – Common work Results for HVAC.
- .2 Product Data: submit WHMIS MSDS - Material Safety Data Sheets in accordance with Section 23 05 00 – Common Work Results for HVAC for the following:
 - .1 Sealants.

- .2 Tape.
- .3 Proprietary Joints.

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 PRIOR APPROVAL OF PRODUCTS

- .1 Manufacturers products that are not named in the specifications must receive approval from Departmental Representative prior to the tender closing date.

2.2 SEAL CLASSIFICATION

- .1 Classification as follows:

Maximum Pressure Pa	SMACNA Seal Class
To 500	A
500 to 2500	A

- .2 Seal classification:
 - .1 Class A: longitudinal seams, transverse joints, duct wall penetrations and connections made airtight with sealant and tape.
 - .2 Class B: longitudinal seams, transverse joints and connections made airtight with sealant and tape.
 - .3 Class C: transverse joints and connections made air tight with sealant and tape. Longitudinal seams unsealed.
 - .4 Unsealed seams and joints.

2.3 SEALANT

- .1 Sealant: oil resistant, polymer type flame resistant duct sealant. Temperature range of minus 30 degrees C to plus 93 degrees C.
- .2 For maximum pressure above 500 Pa, use high velocity duct sealing compound.

2.4 TAPE

- .1 Tape: polyvinyl treated, open weave fiberglass tape, 50 mm wide.

2.5 FIRE STOPPING

- .1 Retaining angles around duct, on both sides of fire separation in accordance with Section 23 05 00 – Common Work Results for HVAC.

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

2.6 LOW PRESSURE DUCTWORK TO 500 Pa

- .1 Galvanized Steel
 - .1 Lock forming quality: to ASTM A653/A653M, Z275 (G90) zinc coating.
 - .2 Thickness, fabrication and reinforcement: to SMACNA HVAC Duct Construction Standards Metal and Flexible.
 - .3 Joints: to SMACNA HVAC Duct Construction Standards Metal and Flexible or proprietary manufactured duct joint.
 - .1 Acceptable material: Ductmate or approved equal.
- .2 Fittings
 - .1 Fabrication: to SMACNA HVAC Duct Construction Standards Metal and Flexible.
 - .2 Radiused elbows.
 - .1 Rectangular: standard radius or short radius with single thickness turning vanes. Centreline radius: 1.5 times width of duct.
 - .2 Round: smooth radius or five piece (for 90 degrees) or three piece (for 45 degrees). Centreline radius: 1.5 times diameter unless noted otherwise.
 - .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 45 degrees entry on branch.
 - .2 Round main and branch: enter main duct at 45 degrees with conical connection.
 - .3 Provide volume control damper in branch duct near connection to main duct.
 - .4 Main duct branches: with splitter damper.
 - .5 Transitions:
 - .1 Diverging: 20 degrees maximum included angle.
 - .2 Converging: 30 degrees maximum included angle.
 - .6 Offsets:
 - .1 Short radiused elbows or as indicated.
 - .7 Obstruction deflectors: maintain full cross-sectional area.
 - .1 Maximum included angles: as for transitions.

2.7 HANGERS AND SUPPORTS

- .1 Strap hangers: of same material as duct but next sheet metal thickness heavier than duct.
 - .1 Maximum size duct supported by strap hanger: 500 mm.
- .2 Hanger configuration: to ASHRAE and SMACNA.

- .3 Hangers: black steel angle with black steel rods to following table:

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.
 - .4 Do not attach to lower cord of steel joist.

Part 3 Execution

3.1 GENERAL

- .1 Do work in accordance with NFPA 90A, NFPA 90B, ASHRAE and SMACNA.
- .2 Do not break continuity of insulation vapour barrier with hangers or rods.
 - .1 Insulate strap hangers 100 mm beyond insulated duct.
- .3 Support risers in accordance with ASHRAE and SMACNA.
- .4 Install breakaway joints in ductwork on sides of fire separation.
- .5 Install proprietary manufactured flanged duct joints in accordance with manufacturer's instructions.
- .6 Manufacture duct in lengths and diameter to accommodate installation of acoustic duct lining.

3.2 HANGERS

- .1 Strap hangers: install in accordance with SMACNA.
- .2 Angle hangers: complete with locking nuts and washers.
- .3 Upper attachments and rods as per section 23 05 29 – Hangers and Supports for HVAC Piping and Equipment.
- .4 Hanger spacing: as follows:

Duct Size	Spacing
(mm)	(mm)
to 1500	3000
1501 and over	2500

3.3 DUCT LEAKAGE TEST

- .1 In accordance with SMACNA HVAC Duct Leakage Test Manual.
- .2 Do leakage tests in sections.
- .3 Make trial leakage tests as instructed to demonstrate workmanship.
- .4 Do not install additional ductwork until trial test has been passed.
- .5 Test section minimum of 30 m long with not less than three branch takeoffs and two 90 degrees elbows.
- .6 Complete test before performance insulation or concealment Work.

3.4 SEALING AND TAPING

- .1 Apply sealant to outside of joint to manufacturer's recommendations.
- .2 Bed tape in sealant and recoat with minimum of one coat of sealant to manufacturers recommendations.

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 SUBMITTALS

.1 Submittals in accordance with Section 23 05 00 – Common Work Results for HVAC.

.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 23 05 00 – Common Work Results for HVAC.

Part 2 Products

2.1 GENERAL

- .1 Manufacture in accordance with SMACNA - HVAC Duct Construction Standards.

2.2 PRIOR APPROVAL OF PRODUCTS

- .1 Manufacturers products that are not named in the specifications must receive approval from Departmental Representative prior to the tender closing date.
- .2 Schedule found on drawings shall be considered as being integral part of these specifications. Model number in schedule is the basis of design. Any model number not found in schedules shall only be considered as equal if it meets quality and performance of numbered item.
- .3 Any and all extra work that may result from an approved equal that is of different dimensions or requirements than the basis of design shall be the responsibility of this contractor.

2.3 FLEXIBLE CONNECTIONS

- .1 Frame: galvanized sheet metal frame 1.5 mm thick 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/m².

2.4 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.
 - .2 301 to 450 mm: four sash locks.
 - .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.

2.5 TURNING VANES

- .1 Factory or shop fabricated double thickness without trailing edge, to recommendations of SMACNA and as indicated.

2.6 INSTRUMENT TEST PORTS

- .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.

2.7 DUCT-MOUNTED HYDRONIC HEATING COIL

- .1 Primary Surface: The primary surface shall be round seamless copper tube staggered in the direction of airflow.
- .2 Secondary surface: The secondary surface shall consist of rippled aluminum plate fins. Fins shall have full drawn collars to provide a continuous surface cover over the entire tube for maximum heat transfer. Bare copper tube shall not be visible between fins. Tubes shall be mechanically expanded into the fins to provide a continuous primary to secondary compression bond over the entire finned length for maximum heat transfer rates.
- .3 Casing: Casings shall be constructed of continuous galvanized steel with 9mm diameter bolt holes for mounting on 150mm centres. Coil side plates shall be of reinforced flange type for greater strength and ease of stacking coils in banks.
- .4 Coils: Coils shall have the connections located to permit installation as shown on drawings and have equal pressure drop through all circuits. Coils shall be circuited to provide the maximum mean effective temperature difference for maximum heat transfer rates. All coils over 1125mm fin length shall be furnished with four fin angles to properly position the coil core.
- .5 Water Coils: Headers on water coils shall be seamless copper tubing. The headers shall have intruded tube holes to provide large brazing surface for maximum strength and inherent flexibility. The complete coil core shall be tested with 2172 kPa air pressure under warm water and be suitable for operation at 1724 kPa working pressures. Individual tube test and core tests before installation of headers is not considered satisfactory. Hydrostatic tests alone will not be acceptable.
- .6 Capacities: As shown on schedules on drawings.
- .7 Acceptable material:
 - .1 Basis of design: Refer to schedule on drawings.
 - .2 Other acceptable Material: McQuay, Trane, Aerofin, Engineered Air, USA Coil and Air, Rosemex, or approved equal.

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 Inlets and outlets of modular of manufactured ventilation units (AHUs, ERVs, etc.), including fresh air and exhaust air connections.
 - .4 As indicated.
 - .2 Length of connection: 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:
 - .1 600 x 600 mm for person size entry.
 - .2 300 x 300 mm for servicing entry.
 - .3 100 x 100 mm for viewing.
 - .4 As indicated.
 - .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 Departmental Representative.
 - .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 any rectangular ductwork which does not meet the 1.5x turning radius requirement.
 - .2 Install in accordance with recommendations of SMACNA and as indicated.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

- .1 Balancing dampers for mechanical forced air ventilation and air conditioning systems.

1.2 REFERENCES

- .1 Sheet Metal and Air Conditioning National Association (SMACNA)
 - .1 SMACNA HVAC Duct Construction Standards, Metal and Flexible-2005.
- .2 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 23 05 00 – Common Work Results for HVAC. Include product characteristics, performance criteria, and limitations.

Part 2 Products

2.1 PRIOR APPROVAL OF PRODUCTS

- .1 Manufacturers products that are not named in the specifications must receive approval from Departmental Representative prior to the tender closing date.
- .2 Schedule found on drawings shall be considered as being integral part of these specifications. Model number in schedule is the basis of design. Any model number not found in schedules shall only be considered as equal if it meets quality and performance of numbered item.
- .3 Any and all extra work that may result from an approved equal that is of different dimensions or requirements than the basis of design shall be the responsibility of this contractor.

2.2 GENERAL

- .1 Manufacture to SMACNA standards.

2.3 SPLITTER DAMPERS

- .1 Fabricate from same material as duct but one sheet metal thickness heavier, with appropriate stiffening.

- .2 Double thickness construction.
- .3 Control rod with locking device and position indicator.
- .4 Rod configuration to prevent end from entering duct.
- .5 Pivot: piano hinge.
- .6 Folded leading edge.

2.4 SINGLE BLADE DAMPERS

- .1 Fabricate from same material as duct, but one sheet metal thickness heavier. V-groove stiffened.
- .2 Size and configuration to recommendations of SMACNA, except maximum height 100 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.

2.5 MULTI-BLADED DAMPERS

- .1 Factory manufactured of material compatible with duct.
- .2 Opposed blade: configuration, metal thickness and construction to recommendations of SMACNA.
- .3 Maximum blade height: 100 mm.
- .4 Bearings: pin in bronze bushings.
- .5 Linkage: shaft extension with locking quadrant.
- .6 Channel frame of same material as adjacent duct, complete with angle stop.

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 in accordance with manufacturer's instructions.
- .3 Locate balancing dampers in each branch duct, for supply, return and exhaust systems.
- .4 Runouts to registers and diffusers: install single blade damper located as close as possible to main ducts.
- .5 Dampers: vibration free.
- .6 Ensure damper operators are observable and accessible.

END OF SECTION

Part 1 General

1.1 SUMMARY

- .1 Section Includes:
 - .1 Supply, return and exhaust grilles and registers, diffusers and linear grilles, for commercial and residential use.

1.2 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.

1.3 SUBMITTALS

- .1 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 23 05 00 – Common Work Results for HVAC. Include product characteristics, performance criteria, and limitations.
 - .2 Indicate following:
 - .1 Capacity.
 - .2 Throw and terminal velocity.
 - .3 Noise criteria.
 - .4 Pressure drop.
 - .5 Neck velocity.
- .2 Quality assurance submittals: submit following in accordance with Section 23 05 00 – Common Work Results for HVAC.

1.4 MAINTENANCE

- .1 Extra Materials:
 - .1 Provide maintenance materials in accordance with Section 23 05 00 – Common Work Results for HVAC.
 - .2 Include:
 - .1 Keys for volume control adjustment.
 - .2 Keys for air flow pattern adjustment.

1.5 CERTIFICATION OF RATINGS

- .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 PRIOR APPROVAL OF PRODUCTS

- .1 Manufacturers products that are not named in the specifications must receive approval from Departmental Representative prior to the tender closing date.
- .2 Schedule found on drawings shall be considered as being integral part of these specifications. Model number in schedule is the basis of design. Any model number not found in schedules shall only be considered as equal if it meets quality and performance of numbered item.
- .3 Any and all extra work that may result from an approved equal that is of different dimensions or requirements than the basis of design shall be the responsibility of this contractor.

2.2 GENERAL

- .1 To meet capacity, pressure drop, terminal velocity, throw, noise level, neck velocity as indicated.
- .2 Frames:
 - .1 Full perimeter gaskets.
 - .2 Plaster frames where set into plaster or gypsum board.
 - .3 Concealed fasteners.
- .3 Concealed manual volume control damper operators.
- .4 Colour: standard unless stated otherwise.
- .5 Acceptable material:
 - .1 Basis of design: Refer to schedules on drawings.
 - .2 Other acceptable material: E.H. Price, Carnes, Nailor, Titus, Tuttle and Bailey, Metalaire or approved equal.

2.3 MANUFACTURED UNITS

- .1 Grilles, registers and diffusers of same generic type, products of one manufacturer.

2.4 SUPPLY GRILLES AND REGISTERS

- .1 Refer to schedule on drawings.

2.5 RETURN AND EXHAUST GRILLES AND REGISTERS

- .1 Refer to schedule on drawings.

2.6 DIFFUSERS

- .1 Refer to schedule on drawings.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

- .1 Install in accordance with manufacturers instructions.
- .2 Install with flat head stainless steel screws in countersunk holes where fastenings are visible.
- .3 Bolt grilles, registers and diffusers, in place, in gymnasium and similar game rooms.
- .4 Provide concealed safety chain on each grille, register and diffuser in gymnasium and similar game rooms and elsewhere as indicated.
- .5 Provide rigid elbow connection to all diffusers.

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)

- .1 ASHRAE 84-2008, Method of Testing Air-to-Air Heat Exchangers (ANSI approved).

.2 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 23 05 00 – Common Work Results for HVAC. Include product characteristics, performance criteria, and limitations.

.2 Shop Drawings:

- .1 Submit shop drawings in accordance with Section 23 05 00 – Common Work Results for HVAC.

.3 Quality assurance submittals: submit following in accordance with Section 23 05 00 – Common Work Results for HVAC.

.4 Closeout Submittals:

- .1 Provide operation and maintenance data for incorporation into manual specified in Section 23 05 00 – Common Work Results for HVAC.

.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 MAINTENANCE

.1 Extra Materials:

- .1 Provide maintenance materials in accordance with Section 23 05 00 – Common Work Results for HVAC.
- .2 Furnish 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.

Part 2 Products

2.1 GENERAL

- .1 Comply with ASHRAE 84.

2.2 PRIOR APPROVAL OF PRODUCTS

- .1 Manufacturers products that are not named in the specifications must receive approval from Departmental Representative prior to the tender closing date.
- .2 Schedule found on drawings shall be considered as being integral part of these specifications. Model number in schedule is the basis of design. Any model number not found in schedules shall only be considered as equal if it meets quality and performance of numbered item.
- .3 Any and all extra work that may result from an approved equal that is of different dimensions or requirements than the basis of design shall be the responsibility of this contractor.

2.3 AIR TO AIR FIXED PLATE EXCHANGER (HRV)

- .1 Unit shall include white, baked on, polyester pre-painted 20 gauge galvanized steel package. Cabinet shall withstand 10 years without chipping, peeling, brazing or spotting. Flat plate heat exchanger section shall be easily removable from the unit. Rugged polupropylene flat plate heat exchanger designed for general purpose or corrosive applications.
- .2 Heat transfer surfaces.
- .3 Cross contamination: not permitted.
- .4 Condensate drain: 50mm.
- .5 Main access panel shall be hinged and provide access to all components.
- .6 Performance characteristics: Refer to drawing schedule.
- .7 Acceptable material:
 - .1 Basis of design: Refer to schedules on drawings.
 - .2 Other acceptable material: Venmar CES, Nutech Lifebreath, Fantech, Nu-Air, Aëromatic or approved equal.

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 Install access doors in accordance with Section 23 33 00 - Air Duct Accessories for access to coils, dampers.
- .4 Pipe drain pans to closest floor or hub drain with minimum 300 mm P-trap, with minimum 50 mm difference in length between two legs of P-trap unless noted otherwise.

END OF SECTION