

## **1. GENERAL**

### **1.1 Intent**

- .1 Provide complete, fully tested and operational mechanical systems to meet the requirements described herein and in complete accordance with current edition of all applicable codes and ordinances.
- .2 Contract Documents and Drawings of this Division are diagrammatic and approximately to scale unless detailed otherwise. They establish scope, material and installation quality and are not detailed installation instructions.
- .3 Follow Manufacturers' recommended installation details and procedures for equipment, supplemented by requirements of Contract Documents.
- .4 Install equipment generally in locations and routes shown. Run piping and ductwork parallel to building lines so as to minimize interference with other services and free space. Remove and replace improperly installed piping, ductwork, and equipment to satisfaction of the Contract Administrator at no extra cost.
- .5 Install equipment to provide access and ease of maintenance.
- .6 Connect to equipment specified in other Sections and to equipment supplied and installed by other Contractors. Uncrate equipment, move in place and install complete; start-up and test.
- .7 Install control valves, control dampers, thermal wells, and other devices on piping and ducts, furnished by the Controls Subcontractor.
- .8 Furnish a written guarantee stating that all Work executed in this Contract will be free from defective workmanship and materials for a period of one (1) year from the date of Substantial Performance. The Contractor shall, at his own expense, repair and replace any Work which fails or becomes defective during the term of the guarantee/warranty, providing such Work is not due to improper usage. The period of guarantee specified shall not in any way supplant any other guarantees of a longer period but shall be binding on Work not otherwise covered.
- .9 If the equipment is used during construction, the guarantee or guarantee period shall not be shortened or altered.
- .10 'Provide' shall mean 'supply and install'.

### **1.2 Related Requirements**

- .1 Division 10 – Specialties.
- .2 Division 21 – Mechanical General Requirements.
- .3 Division 22 – Plumbing.
- .4 Division 23 – Heating, Ventilating and Air Conditioning (HVAC).

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**1.3 Action and Informational Submittals**

- .1 Submittals: in accordance with City of Winnipeg Construction Master Specification Division 2 CW-1110 Revision 1.
- .2 Shop drawings; submit contractor reviewed drawings stamped, dated and signed by the general contractor to indicate acceptance, and stamped by a professional engineer registered or licensed in Manitoba, Canada where indicated in these specifications.
- .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.
- .5 Closeout Submittals:
  - .1 Provide operation and maintenance data for incorporation into manual specified in City of Winnipeg Construction Master Specification Division 2 CW-1110 Revision 1.
  - .2 Operation and maintenance manual approved by, and final copies deposited with, Contract Administrator 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:

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- .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 2 copies of draft Operation and Maintenance Manual to Contract Administrator for approval. Submission of individual data will not be accepted unless directed by Contract Administrator.
    - .2 Make changes as required and re-submit as directed by Contract Administrator.
  - .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 Contract Administrator 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 HVAC, finalize production of as-built drawings.
    - .2 Identify each drawing in lower right hand corner in letters at least 12 mm high as follows: - "AS BUILT DRAWINGS: THIS DRAWING HAS BEEN REVISED TO SHOW MECHANICAL SYSTEMS AS INSTALLED" (Signature of Contractor) (Date).
    - .3 Submit to Contract Administrator for approval and make corrections as directed.

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- .4 Perform testing, adjusting and balancing for HVAC 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.

#### **1.4 Coordination of Work**

- .1 Cooperate and coordinate with other Contractors and Subcontractors on the project.
- .2 Make reference to electrical, mechanical, process, controls, structural and architectural drawings when setting out work. Consult with respective Divisions in setting out locations for ductwork, equipment, and piping, so that conflicts are avoided and symmetrical even spacing is maintained. Jointly work out all conflicts on Work Site before fabricating or installing any materials or equipment.
- .3 Coordinate installation with Division 16 Contractor.
- .4 Where dimensional details are required, work with the applicable architectural and structural drawings.
- .5 Full-size and detailed drawings shall take precedence over scale measurements from Drawings. Drawings shall take precedence over Specifications.
- .6 Any areas indicated as space for future materials or equipment shall be left clear.

#### **1.5 Permits**

- .1 All Work shall comply with provincial, municipal bylaws and the authority(ies) having jurisdiction.
- .2 Obtain all permits and pay all fees applicable to the Work.
- .3 Contractor shall arrange for inspections of the Work by the authorities having jurisdiction and shall provide certificates indicating Final Approval.

#### **1.6 Quality Assurance**

- .1 Quality Assurance: in accordance with referenced standards and codes.
- .2 Health and Safety Requirements: do construction occupational health and safety in accordance with Manitoba Workplace Safety and Health Regulations.
- .3 All work shall be performed by qualified tradesmen with valid Provincial Trade Qualification Certificates. Spot checks will be made by the Contract Administrator.
- .4 Work which does not conform to standards accepted by the Contract Administrator may be rejected by the Contract Administrator. The Contractor shall correct rejected work to the accepted standard at no cost to the Contract Administrator.

#### **1.7 Bid Price Breakdown**

- .1 Submit a bid price breakdown within thirty (30) days of Bid closing and before first progress claim, in a format agreed to with the Contract Administrator.

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- .2 As a minimum, include the following in the Bid price breakdown:
- .1 Equipment (fans, air handling units, fire extinguishers): materials, labour.
  - .2 Plumbing and natural gas: equipment, materials, labour.
  - .3 Insulation (piping and ductwork): materials, labour.
  - .4 Sheet Metal: equipment, materials, labour.
  - .5 Controls: equipment, materials, labour.

### 1.8 Progress Claims

- .1 Submit a Progress Summary and a Detailed Price Breakdown with each Progress Claim. The Summary and Breakdown shall include all Change Orders issued.
- .2 Progress claims shall not be processed past 95% of the overall Mechanical Contract until the final commissioning has been completed. This will allow for sufficient deficiency holdbacks for problems identified during commissioning.

### 1.9 Examination of Work Site

- .1 Before submitting Bid, visit and examine the Work Site and note all characteristics and features affecting the work. No allowances will be made for any difficulties encountered or any expenses incurred because of any conditions of the Work Site or item existing thereon, which is visible or known to exist at the time of Bid.

### 1.10 Metric Conversion

- .1 All units in this division are expressed in SI units.
- .2 Equivalent Nominal Diameters of Pipes - Metric and Imperial:
  - .1 Where pipes are specified with metric dimensions and Imperial sized pipes are available, provide equivalent nominal Imperial sized pipe as indicated in the table, and provide at no extra cost adapters to ensure compatible connections to all metric sized fittings, equipment and piping.
  - .2 When CSA approved SI Metric pipes are provided, the Contractor shall provide at no extra cost adapters to ensure compatible connections between the SI Metric pipes and all new and existing pipes, fittings, and equipment.

mm (in. NPS)	mm (in. NPS)	mm (in. NPS)
3 (1/8)	65 (2½)	450 (18)
6 (1/4)	75 (3)	500 (20)
10 (3/8)	100 (4)	600 (24)
15 (1/2)	125 (5)	750 (30)
20 (3/4)	150 (6)	
25 (1)	200 (8)	
30 (1¼)	250 (10)	
40 (1½)	300 (12)	

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mm (in. NPS)	mm (in. NPS)	mm (in. NPS)
50 (2)	375 (15)	

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.3 Metric Duct Sizes:

- .1 The Metric duct sizes are expressed as 25 mm = 1 inch.

**1.11 Alternate Materials and Equipment**

- .1 Request for approval of substitutes must be done in accordance with B8.

**1.12 Drawings and Specifications**

- .1 Drawings and specifications are complementary each to the other, and what is called for by one shall be binding as if called for by both.
- .2 Should any discrepancy appear between drawings and/or specifications which leaves the Contractor in any doubt as to the true intent and meaning of the plans and specifications, contact the Contract Administrator in accordance with B5 Enquiries.

**1.13 Shop Drawings**

- .1 Submit Shop Drawings for all products supplied by this Division as per Section E4 - Shop Drawings.
- .2 Installed materials and equipment shall meet specified requirements regardless of whether or not shop drawings are reviewed by the Contract Administrator.
- .3 Do not order equipment or material until the Contract Administrator has reviewed and returned shop drawings.
- .4 Retain one (1) copy of Shop Drawings on Work Site for review.

**1.14 Installation of Equipment**

- .1 Install all equipment in accordance with the manufacturer's installation instructions.
- .2 Unions and flanges shall be provided in piping or ductwork to permit easy removal of equipment.
- .3 Maintain permanent access to equipment for maintenance.

**1.15 Electrical Motors**

- .1 Supply mechanical equipment complete with electrical motors.
- .2 Provide motors designed, manufactured, and tested in accordance with the latest edition of the following codes and standards: NEMA, EEMAC, CSA, CEC Part 1, IEEE and ANSI. All motors to be CSA labelled. All motors to be approved for use in the designated area classification by the Provincial Electrical Protection Branch.
- .3 All motors intended for use with a variable speed drive (VFD) shall be inverter duty rated. Variable speed drive shall be matched to motor. Coordinate with Electrical.

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- .4 Two speed motors shall have separate winding for each speed.
  - .5 Unless specified otherwise, provide motors designed for full voltage starting, EEMAC Design B. Motors driving high torque or high inertia loads may be EEMAC Design C or D.
  - .6 Provide motors rated for continuous duty with 1.15 service factor unless specified otherwise in the driven equipment specifications. Provide all motors with thermal overload protection.
  - .7 Motors less than 0.37 kW shall be 120 V, 60 Hz, 1 phase. Motors 0.37 kW and larger shall be 3 phase at the indicated voltage.
  - .8 All motors shall be 1800 rpm except where indicated.
  - .9 Provide motors with grease or oil lubricated anti-friction type ball or roller bearings.
  - .10 Provide motors designed with Class B insulation; Class F insulation for totally enclosed motors.
  - .11 Refer to electrical specifications Division 26, for voltage, frequency, and phase data. This shall take precedence over any reference in Division 23.
  - .12 Where motor power is stated in watts or kilowatts, nominal motor horsepower multiplied by 746 or 0.746 respectively, has been used as the conversion factor.

#### **1.16 Miscellaneous Metals**

- .1 Provide all necessary miscellaneous metals to hang or support materials, equipment and provide access for work under this contract.
- .2 All miscellaneous metals shall be corrosion resistant primer coated.
- .3 Miscellaneous metals shall include but are not limited to:
  - .1 Hangers for equipment, piping and ductwork.
  - .2 Support for equipment.
  - .3 Access platforms and catwalks.

#### **1.17 Painting and Identification**

- .1 Coordinate colour coding of piping and equipment with work of Divisions 09.
- .2 Colour code mechanical equipment, piping and exposed ductwork. Refer to colour coding schedule below.
- .3 Legend and direction of flow arrows shall consist of adhesive backed labels, yellow colour, with minimum 20 mm high black lettering equal to Brady System B-500, vinyl cloth labels for non-insulated surfaces; and Brady B 946 for insulated surfaces.
- .4 Identify piping with labels, colour bands, and flow arrows. Provide identification at 3 m maximum intervals, before and after pipes pass through walls, at all sides of tees, behind access doors and in equipment rooms as required.

- .5 Apply colour bands at both ends of the label with primary colour bands used to secure both ends of individual labels. Refer to colour schedule at end of this section.
- .6 Provide 3 mm thick, 20 mm diameter white lamacoid with black engraved numbers, secured to valve stem with key chain. Provide neat, typewritten directories, giving valve number, services and location. Frame one copy under glass for wall mounting as directed, second copy to be forwarded to City. Include copies in O&M Manuals.
- .7 Provide 3 mm thick, 20 mm diameter white lamacoid with black engraved lettering secured to equipment. Use a maximum of 25 letters/numbers per line. For terminal cabinets, control panels, etc. use size # 5. For equipment in Mechanical Rooms use size # 9. For equipment elsewhere size as appropriate. Conform to following table.

Size #	Sizes (mm)	No. of Lines	Height of Letters (mm)
1	10 x 50	1	3
2	13 x 75	1	5
3	13 x 75	2	3
4	20 x 100	1	8
5	20 x 100	2	5
6	20 x 200	1	8
7	25 x 125	1	12
8	25 x 125	2	8
9	35 x 200	1	20

- .8 Tag automatic controls, instruments and relays and match/key to control shop drawing identification numbers. Tag all equipment and control panels.
- .9 Identify electric starting switches, thermostats controlling motors, remote push button stations, and controls equipment supplied under this division with lamacoid plates having 5 mm minimum letter size. Identification to state equipment controlled.
- .10 Identify the usage of duct access panels with self-adhesive Brady stick-on coloured labels. Apply labels conforming to the following schedule.

	<u>Colour</u>	<u>Letters</u>
Cleaning and service access	yellow	C.A.
Controls, including heat sensors	black	C.
Dampers (backdraft, balance & control)	blue	D.
Fire dampers	red	F.D.
Smoke dampers and detectors	red	S.D.

**Note:** Provide black lettering for yellow or white background, white for all other colours.

- .11 Mechanical Control Systems
  - .1 Conduit pull boxes, terminal boxes and junction boxes - GREY Covers - GREY with black 'C'.



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.2 Main and secondary control panels, factory finish acceptable - control Contractor to install company label to identify.

.12 Ductwork

.1 All ductwork to be identified as per legend on Drawings, complete with directional arrows.

**1.18 Temporary or Trial Usage**

.1 Temporary or trial usage by the Contract Administrator of mechanical equipment supplied under contract shall not represent acceptance.

.2 Repair or replace permanent equipment used temporarily.

.3 Repair or otherwise rectify damage caused by defective materials or workmanship during temporary or trial usage.

**1.19 Acceptable Manufacturers/Suppliers and Agencies**

.1 The following listed manufacturers are acceptable for their ability to meet the general design intent, quality and performance characteristics of the specified product. The list does not endorse the acceptability of all products available from the listed Manufacturers/Suppliers.

.2 It remains the responsibility of the Contractor to ensure the products supplied are equal to the specified products in every respect, operate as intended, and meet the performance specifications and physical dimensions of the specified product.

.3 The Contractor shall be fully responsible for any additional work or materials, to accommodate the use of equipment from the acceptable Manufacturers and Suppliers list.

.4 Submit within fourteen (14) days of contract award a copy of the list underlining the name of the manufacturer whose price was carried in the Bid. If no manufacturers names are submitted, it will be assumed that the price carried in the Bid was that of the specified manufacturer or where the specified product is generic, the first acceptable manufacturer listed for each item and equipment.

.5 List of Acceptable Manufacturers/Suppliers and Agencies:

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|----|--|---|
| .1 | Access Doors                                 | Maxam, Acudor, Milcor, Can.Aqua, Mifab, The Williams Brothers Corporation |
| .2 | Air Flow Measuring Air Monitor, Air Stations | Cambridge, Sentinel, Ebtron   |
| .3 | Air Terminals - Grilles Registers, Diffusers | E.H. Price, Titus, Anemostat, Nailor                                      |
| .4 | Balancing Agents                             | Accu-Air, Air Flo Management, Air-Tech Management Ltd, Center West Air    |
| .5 | Dampers – Balancing                          | Maxam, Ruskin   |
| .6 | Dampers – Control                            | Tamco, Ruskin   |

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.7	Fans - In-Line Centrifugal	Greenheck, Jenn Air, Ammerman, ILG, Cook, Penn, Twin-City, Carnes
.8	Filters	FARR, Cambridge, AAF, Flanders
.9	Flexible Connectors - Ducting	Duro-Dyne, Thermaflex, G.I. Industries Type IHP
.10	Gauges - Air	Magnehelic, Dwyer
.11	Hanger and Supports	Anvil International, E. Myatt & Co. Inc., Empire Tool & Mfg. Co. Inc., Unistrut, Tolco, Erico Canada, Taylor
.12	Insulation - Piping and Duct	Fibreglass Canada, Manson, Knauf Fibreglass, Plasti-Fab, Manville
.13	Louvers	Price/Airolite, Penn, Airstream, West Vent, Nailor, Ruskin, Ventex
.14	Vibration Isolation	Mason, Vibro Acoustic

#### **1.20 Maintenance**

- .1 Furnish spare parts in accordance with City of Winnipeg Construction Master Specification Division 2 as follows:
  - .1 One repair kit for backflow preventer.
  - .2 Bronze valves – 1 valve of each size.
  - .3 Valve handles: 2 of each size
  - .4 One set of spare belts for each belt-driven fan.
  - .5 One spare pressure sensor for MAU-U-20.
  - .6 One set of spare fuses for each fuse bank.
  - .7 One spare transformer for each size of control transformer.
  - .8 One filter cartridge or set of filter media for each filter or filter bank in addition to final operating set.
- .2 Provide one set of special tools required to service equipment as recommended by manufacturers and deliver with transmittal to the Contract Administrator.
- .3 Furnish one commercial quality grease gun, grease and adapters to suit different types of grease and grease fittings.

#### **1.21 Delivery, Storage, and Handling**

- .1 Deliver to Work Site in original factory packaging labeled with the Manufacturer's name and address.
- .2 Store materials indoors in a dry location. Store and protect materials from harmful weather conditions, temperature, and humidity conditions as recommended by the manufacturer.

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- .3 Materials and equipment installed shall be new, full weight and of quality specified.
  - .4 Each major component of equipment shall bear manufacturer's name, address, catalogue and serial number in a conspicuous place.
  - .5 Protect equipment and materials in storage on Work Site during and after installation until final acceptance. Leave factory covers in place. Take special precautions to prevent entry of foreign material into working parts of piping and duct systems.
  - .6 Protect equipment with polyethylene covers and crates.
  - .7 Seal all open-ended pipework, ductwork, or equipment to prevent the ingress of dust and debris as installed or at the end of each work day.
  - .8 At no cost to the contract, the Contractor shall repair and/or replace any installed equipment or material which is deemed to be damaged by the Contract Administrator to the Contract Administrator's satisfaction.
  - .9 Operate, drain and flush out unsealed bearings and refill with new change of oil, before final acceptance.
  - .10 Thoroughly clean piping, ducts and equipment of dirt, cuttings and other foreign substances.
  - .11 Protect bearings and shafts during installation. Grease shafts and sheaves to prevent corrosion. Supply and install necessary extended nipples for lubrication purposes.
  - .12 Where two or more products of the same type are required, products shall be of the same manufacturer.
  - .13 Make known in writing to the Contract Administrator ten (10) days prior to the Bid closing date any materials specified that are required to complete the work which are not currently available or will not be available for use as called for herein.

## **2. PRODUCTS**

### **2.1 Materials**

- .1 Materials and products in accordance with specifications in Divisions 22 and 23.

## **3. EXECUTION**

### **3.1 Painting Repairs and Restoration**

- .1 Do painting in accordance with Section 09 91 00.
- .2 Prime and touch up marred finished paintwork to match original.
- .3 Restore to new condition, finishes which have been damaged.

### **3.2 Cleaning**

- .1 Clean interior and exterior of all systems including strainers. Vacuum interior of ductwork and air handling units.

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### **3.3 Field Quality Control**

- .1 Site Tests: conduct following tests in accordance with Section 23 05 93 Testing, Adjusting and Balancing for HVAC and submit report as described therein in accordance with City of Winnipeg Construction Master Specification Division 2 CW-1110 Revision 1.
  - .1 Testing, Adjusting and Balancing of HVAC Systems.
  - .2 Pressure and leakage testing of the Control Room Superstructure.
- .2 Manufacturer's Field Services:
  - .1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports in accordance with City of Winnipeg Construction Master Specification Division 2 CW-1110 Revision 1.
  - .2 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, as directed by the Contract Administrator and the specific specification sections in Divisions 22 and 23.

### **3.4 Demonstration**

- .1 Contract Administrator will use equipment and systems for test purposes prior to acceptance. Supply labour, material, and instruments required for testing.
- .2 Trial usage to apply to following equipment and systems:
  - .1 Control Room Pressurization System.
  - .2 Wet Well Ventilation System.
  - .3 Generator fuel and ventilation systems.
- .3 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.
- .4 Use operation and maintenance manual, as-built drawings, and audio visual aids as part of instruction materials.
- .5 Instruction duration time requirements as specified in appropriate sections.
- .6 Contract Administrator will record these demonstrations on video tape for future reference.

### **3.5 Protection**

- .1 Protect equipment and systems openings from dirt, dust, and other foreign materials with materials appropriate to system.
- .2 Protect equipment and system components from physical damage, corrosion, and theft/vandalism.

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**END OF SECTION**