

Part 1 General

1.1 GENERAL

- .1 Following Appendix of Manufacturers lists manufacturers of equipment and materials acceptable to Contract Administrator, subject to individual clauses under the various sub-sections of Mechanical Work Specifications. See item 'Materials' under this section of specification.
- .2 Product noted in individual specification clauses is an item that meets specification in all respects regarding performance, quality of material and workmanship, and is acceptable to Contract Administrator without qualification. Equipment proposed from other manufacturers listed as 'Approved Manufacturers or approved equal in accordance with B7 and alternates shall meet same standards.
- .3 Contractor to submit within forty-eight hours of notification from Contract Administrator, one (1) copy of fully and properly completed Appendix of Manufacturers listing thereon names of manufacturers of products which shall be used to execute work of Contract. If list is not submitted within 48 hours, Contractor must use product named in each individual clause.
- .4 Submit shop drawings for all items marked with asterisk(*).
- .5 Request for equal shall be in accordance with B7.

**1.2 EQUIPMENT OR MATERIAL & APPROVED MANUFACTURERS OR
APPROVED EQUAL IN ACCORDANCE WITH B7**

- .1 ELECTRIC MOTORS
 - .1 G.E.; Siemens; Tamper; Reliance; Leland; Lincoln; U.S. Electric; Century; Baldor; WEG; Toshiba
- .2 AIR DISTRIBUTION
 - .1 Heat recovery units* Tempeff
*** HRU Request for equal must be accompanied by a full shop drawing***

END OF SECTION

Part 1 General

1.1 GENERAL

- .1 All drawings and all sections of the specifications shall apply to and form an integral part of this section.

1.2 WORK INCLUDED

- .1 Labour, materials, plant, tools, equipment and services necessary and reasonably incidental to completion of air conditioning and/or ventilation work.

1.3 RELATED WORK SPECIFIED ELSEWHERE

- .1 Section 21 05 10 Acceptable Materials & Equipment

Part 2 Products

2.1 HEAT RECOVERY UNITS (TEMPEFF)

- .1 Refer to HRU Schedule and Specification below for reference.
- .2 General Description
 - .1 Configuration: Fabricate as detailed on Drawings.
 - .2 Performance: As detailed in schedules.
- .3 Unit Construction
 - .1 Fabricate unit with galvanized steel panels secured with mechanical fasteners. All access doors shall be sealed with permanently applied bulb-type gasket.
 - .1 Panels and access doors shall be constructed as a 2-inch (50-mm) nominal thick; with injected polyurethane foam insulation. R value shall be 6.5 per inch of wall thickness. The outer panel shall be constructed of 24 gauge G90 galvanized steel. The inner liner shall be constructed of G90 galvanized steel. Module to module assembly shall be accomplished with self adhering foam gaskets. Manufacturer shall supply test data demonstrating less than L/240 deflection for an unsupported under 30" W.C pressure. Units that cannot demonstrate this deflection are unacceptable.
 - .2 Access Doors shall be flush mounted to cabinetry, with minimum of two hinges, locking latch and full size handle assembly.
 - .3 All outdoor units will have an 18 gauge roof and gutters. The gutters will cover the entire perimeter of the unit.
 - .4 Control cabinet shall be sealed from the air flow and have self-contained ventilation and heating (external enclosure with hood, dampers with actuators, temperature controls, transformer, cooler, heater and etc.).
- .4 Supply / Return Fans
 - .1 Provide direct-drive airfoil plenum supply & return fans. Fan assemblies including fan, motor and sheaves shall be dynamically balanced by the manufacturer on all three planes and at all bearing supports. Manufacturer must ensure maximum fan RPM is below the first critical speed.
 - .2 Bearings shall be self-aligning, grease lubricated, ball or roller bearings with extended copper lubrication lines to access side of unit. Grease fittings shall be

- attached to the fan base assembly near access door. Contractor shall mount copper lube lines in the field.
- .3 Fan and motor shall be mounted internally on a steel base. Provide access to motor, drive, and bearings through hinged access door. Fan and motor assembly shall be mounted on 1" deflection spring vibration type isolators inside cabinetry.
- .5 Electrical
- .1 The air handler(s) shall bear an ETL listing label for the entire assembly. Units with only components bearing third party safety listing are unacceptable.
 - .2 All controls shall be located on the side of the unit for ease of servicing. Controls located on the top or the bottom of the unit are not acceptable.
 - .3 Wiring Termination: Provide terminal lugs to match branch circuit conductor quantities, sizes, and Materials indicated. All wires shall be number tagged and cross-referenced to the wiring diagram for ease of troubleshooting.
 - .4 Controls must include Self Diagnostics with fault error and PLC error code. On board fault detection and diagnostics that sense and alerts when the damper is not operating correctly.
 - .5 Fan motors shall be 1800 rpm, totally enclosed fan-cooled (TEFC) type. Motors shall be premium efficiency, and inverter duty rated. Electrical characteristics shall be as shown in schedule.
 - .6 Provide and mount ABB variable speed drives in heated enclosure for each fan.
 - .7 Air handler manufacturer shall provide and mount a damper hand-off-auto (HOA) switch.
 - .8 Unit shall be supplied with single point power connection complete.
- .6 Indirect Fired Gas Heat Exchanger
- .1 Provide indirect gas-fired furnace models listed by Intertek Testing Services (ITS / ETL), a Nationally Recognized Testing Laboratory (NRTL), to the current edition of ANSI Z83.8 / CSA 2.6 Standard for Gas-Fired Duct Furnaces for installation on the positive pressure side of the circulating air blower only and provide a minimum combustion efficiency of 80%.
 - .2 Duct Furnaces shall be listed for either outdoor installation (or) for indoor installation in accordance with Category I and Category III venting systems without need for additional power venting.
 - .3 Duct Furnaces shall be listed for either outdoor installation (or) for indoor installation in accordance with Category I and Category III venting systems without need for additional power venting.
 - .4 Gas-fired furnace provided shall have a tubular heat exchanger constructed of Type 409 Stainless Steel .044 Min. Wall thickness produced to ASTM A268. Heat exchanger tubes shall be mechanically secured to vestibule panels and design shall be suitable to withstand 3.0" w.c. total external static pressure.
 - .5 Duct Furnaces shall be Listed for application downstream of refrigeration and cooling systems and shall provide means for removal of condensate that occurs in the heat exchanger tubes during cooling operation. Heat exchanger tubes shall have (integral formed dimpled restrictors; formed turbulators) to provide for an unobstructed drainage path and tubes shall be formed to provide a positive pitch to promote condensate drainage. Drainage shall be configured so that burners are not exposed to condensate.
 - .6 The Duct Furnace shall include:
 - .1 A 20 gauge galvanized steel cabinet
 - .2 1 inch thick, minimum 1 ½ lb./ft.3 density thermal insulation for exterior cabinets

- .3 Patented in shot gas burners, with integral carryovers, capable of operation at 5:1 turndown with modulating controls
- .4 An induced-draft combustion air blower to provide for positive venting of flue gases
- .5 Provision for attachment of a vent system to exhaust flue gases to outdoors.
- .6 Combustion air pressure switch to prove air supply for combustion
- .7 Direct spark ignition of the gas burners with remote flame sensor to prove carryover across all burners
- .8 Listed Combination Gas Valve incorporating redundant (two) electric safety shut-off valves, manual shut-off, and gas regulator which regulates gas pressure to burner supply manifold.
- .9 A 1/8" NPT tapped test gauge connection in the gas manifold for measuring gas pressure
- .10 A union fitting downstream of gas control to facilitate installation and service
- .11 An automatic reset type high limit switch to limit maximum outlet air temp to less than 250 °F
- .12 Manual reset flame rollout switch(es).
- .13 A Class II step down transformer to provide 24 VAC control voltage at selected supply voltage
- .14 60 inch flue extension shall be included with gas heat exchanger section.
- .7 Duct Furnace shall incorporate a Direct Spark Ignition control module that is design certified by a NRTL to ANSI Z21.20 and CAN/CSA-C22.2. The control shall provide:
 - .1 100% safety shut-off
 - .2 A minimum 15 second pre-purge to provide a minimum of four (4) air changes
 - .3 A maximum 0.8 second flame failure response time
 - .4 Two additional ignition retrials preceded by an inter-purge period
 - .5 A minimum 30 second post-purge
 - .6 An automatic reset after one hour should a lockout occur
 - .7 A LED indicator light to provide a flash code to identify operating condition of control
 - .8 An Alarm capable contact
- .8 All electrical components shall be listed or recognized by a NRTL (ETL, UL, CSA, etc.).
- .9 Duct Furnace and burners provided are listed for use on Natural or Propane gases as specified at the time of order.
- .10 Ratings listed in Submittal Tables are for installations between 0 and 2000 feet (0 to 610m). For installations above 2000 feet, unit must be de-rated in accordance with National Standards.
- .11 The fully assembled Duct Furnace shall be factory fire tested prior to shipment.
- .12 Duct Furnace shall be accompanied by wiring diagrams for the control system supplied and printed instructions for proper installation, start-up, operation and maintenance.
- .13 Burner and components are warranted for one year from date of installation or 18 months from date of manufacture. Heat exchanger is warranted for ten (10) years on a pro-rated basis. See Heatco Standard Warranty for full details.
- .14 Initial on sight start-up must be completed by qualified installation and service agency. A Start-up data sheet is provided for recording operating data and the

final heater adjustments. The indicated portion of the Start-up data sheet must be returned to Heatco to validate factory warranty.

- .7 Particulate Filters
 - .1 Filter section with filter racks and guides with hinged and latching access doors for side loading and removal of filters.
 - .2 Filter media shall be UL 900 listed, Class I or Class II.
 - .3 Flat arrangement with 2", 50mm deep MERV 10 panel filters.
- .8 Bypass Damper
 - .1 Unit shall include a supply air bypass damper for additional fresh air. The damper shall be TAMCO 9000 damper with modulating actuator.
- .9 Energy Recovery
 - .1 Dual Core™ Energy Recovery
 - .1 Unit shall be equipped with Dual Core™ energy recovery technology. The unit shall be 90% efficient (sensible +5%) at equal airflow in winter and up to 80% sensible in summer. It shall also provide up to 70% latent recovery. Unit shall accomplish this recovery without a defrost cycle that will reduce the effectiveness of the device. Devices employing defrost cycles that bypass the energy recovery device, or reduce the effectiveness are not acceptable. Energy recovery device shall not require frost protection in applications down to -40 degrees.
 - .2 Energy Cores shall be Generation 3, comprised of precisely corrugated 0.7mm (0.0276") thick 1100 Series aluminum. Thinner aluminum is unacceptable to prevent deformation should cleaning be required to maintain indoor air quality. Spacing between plates shall be minimum 9 mm (0.35") to assure that frost growth will not restrict airflow or reduce performance. Heat exchangers shall be a minimum of 995 mm (39") long to assure minimum 60 second dwell time. Time between switchovers shall be minimum 60 seconds. Must be able to meet scheduled supply air temperature and efficiency switching at a minimum 60 seconds Technologies employing shorter heat exchangers are not acceptable due to high cross leakage, and excessive cycling. Maximum allowable face velocity across heat exchangers shall be 500 fpm. Heat exchanger face velocities exceeding 500 fpm are not acceptable.
 - .3 Heat exchangers shall be sectioned for a maximum section weight of 30 kg (66 lbs) so that the heat exchangers can be easily removed for cleaning to maintain indoor air quality. Sections weighing more are not acceptable. Heat exchanger that require special equipment to remove for cleaning (cranes, hoist etc.) are not acceptable. Heat exchangers shall be durable enough to handle high pressure power washing without deformation.
 - .4 Unit Cross-leakage shall be maximum 1-3% as defined and tested in accordance with ASHRAE 84 Test Methods. Cross leakage exceed this amount is unacceptable. Manufacturer shall produce testing data reflecting this performance in accordance with ASHRAE 84 test method. Testing must use the tracer gas method prescribed by ASHRAE 84.
 - .5 Switchover damper section shall be comprised of multi section low leakage dampers operated by fast acting electric actuators. Pneumatic actuators are not acceptable. 800 CFM-7,000 CFM shall have damper switching times of 0.75 seconds. 7000 CFM-20,798 CFM shall have damper switching times of 1.25 seconds. Dampers that do not switch

- within the specified times without objectionable noise are not acceptable. This switch over must limit any internal cross leakage below 3%. Test report must be provided showing that the damper configuration meets this requirement. Testing must use the tracer gas method prescribed by ASHRAE 84.
- .6 Single blade damper sections are not acceptable. Each damper shall control one of the four airways upper front, upper back and lower front, lower back. Dampers shall be capable of orienting to close off outside air to the building without needing external shut off dampers.
 - .7 Dampers shall also be capable of orienting to allow 100% recirculation of air without using heat recovery device for off peak or unoccupied heating modes. Units incapable of these operations without extra ductwork are not acceptable. Re-circ design must be capable of pre-warming both heat exchangers simultaneously for morning warm-up cycle. Strategies that only warm one heat exchanger is unacceptable.
 - .8 Damper seals shall be ½” heavy thickness EPDM bulb seal. Single blade seals are unacceptable due to high leakage and poor sealing.
 - .9 Damper bearings shall be heavy duty greaseable pillow block flange bearings. Bronze or plastic bearings are not acceptable due to high cycle requirements. Bearings shall have a minimum diameter:
 - .1 800 – 7000 CFM: ¾” Bearings, maximum of 4 shafts per unit
 - .2 7,000 – 20,798 CFM: 1” Bearings, maximum of 4 shafts per unit
 - .3 Damper shafts shall be large diameter shafts meeting:
 - .4 800 – 7,000 CFM ¾” Chromium Shafts, maximum of 4 shafts per unit
 - .5 7,000 – 20,798 CFM - 1” Chromium Shafts, maximum of 4 shafts per unit
 - .10 Technologies employing smaller diameter shafts, or more shafts per unit are unacceptable as that would be considered light duty, and insufficient to withstand the demanding nature of the application.
 - .11 Damper manufacturer must provide written documentation that the dampers are capable of a minimum duty cycle of 500,000 cycles annually. Damper Manufacturer shall provide a written warranty on damper manufactures letterhead confirming the warranty.
- .10 External Dampers
 - .1 External Damper Leakage: Leakage rate shall be less than two tenths of one percent leakage at 2 inches static pressure differential. Leakage rate tested in accordance with AMCA Standard 500.
 - .11 BMS Controls
 - .1 Unit shall come with its own controls wired to a terminal strip for connection to the BMS.
 - .12 Installation
 - .1 Install in accordance with manufacturer’s Installation & Maintenance instructions.
 - .13 Environmental Requirements
 - .1 Do not operate units for any purpose, temporary or permanent, until ductwork is clean, filters are in place, bearings lubricated, and fan has been test run under observation.
 - .14 Additional feature

- .1 Exterior casing: 24 gauge G90 galvanized steel
- .2 Interior casing: 24 gauge G90 galvanized steel
- .3 10HP WEG TEFP premium efficiency 4 pole 215T frame
- .4 10HP WEG TEFP premium efficiency 4 pole 215T frame
- .5 Supply air drive: ACH580-01-022A-6
- .6 Return air drive: ACH580-01-022A-6
- .7 1" seismic spring isolation
- .8 Supply air pre-filter: Dafco Merv 10 (2") 400 HC
- .9 Heatco HDB-HPP-300-900 indirect gas burner 15:1 burndown
- .10 Insulated bypass dampers with 2 position Belimo actuator
- .11 Single point power
- .12 Quick connect
- .13 Low limit
- .14 8" 10 gauge baseframe
- .15 Core defrost Dwyer DH3 Digihelic Differential Pressure sensor
- .16 External enclosure w/ hood
- .17 Enclosure dampers w/ actuators
- .18 Enclosure temperature controls
- .19 Enclosure transformer
- .20 Enclosure cooler
- .21 Enclosure heater
- .22 2" foam injected panels
- .23 All sections c/w hinged access doors and locking latches
- .24 Multi-damper switchover section c/w actuators
- .25 Stainless steel drain pans under heat exchanger(s) w/ 1" NPT connections
- .26 Galvanized heat exchanger frames
- .27 Galvanized damper blades, damper rods and axles
- .28 Removal bypass duct hood
- .15 The following DDC points are available from the manufacturer:
 - .1 Supply Fan Status and Command
 - .2 Exhaust Fan Status and Command
 - .3 Supply Fan Speed
 - .4 Exhaust Fan Speed
 - .5 Supply Air Temperature
 - .6 Exhaust Air Temperature
 - .7 Pre Heat Air Temperature (ie Temperature before Gas Heating Section)
 - .8 Supply Air Low Limit Status (ie Freeze Stat)
 - .9 Free Cooling Command
 - .10 Filter Differential Sensor
 - .11 Space Temperature
 - .12 Core Differential Sensor
 - .13 Bypass Opening On/Off
 - .14 Control Cabinet Temperature
- .16 Lead Time
 - .1 The units shall be manufactured and delivered within thirteen (13) weeks following approval of shop drawings.

Part 3 Execution

3.1 HEAT RECOVERY UNIT SEQUENCE

- .1 Comply with manufacturer's written recommendations or Specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

END OF SECTION