SECTION 23 72 15 - PACKAGED ENERGY RECOVERY UNITS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The following Specification Section apply this specification section:

1. Bidding Requirements, Contract Forms and Conditions of the Contract.
2. Division 1 - General Requirements.

1.2 SUMMARY

A. This section includes Energy Recovery Units and accessories. Refer to the contract drawings for unit configurations and required components.

1.3 SUBMITTALS

A. Submit product technical data for each unit to include the following information:

1. Certified fan performance curves with system operating conditions indicated.
2. Certified fan sound power ratings.
3. Certified coil performance ratings with system operating conditions indicated.
4. Motor ratings and electrical characteristics plus motor and fan accessories
5. Filters with performance characteristics,

B. Exceptions: Shop drawing submittals are required to include a listing of any and all exceptions to the requirements indicated in this specification and on the drawings. If no exceptions are taken the lead sheet of the submittal shall indicate this. Submittals that do not have this information will be returned without review.

C. Provide manufacturer’s shop drawings detailing dimensions, operating weight, required clearances, all components, and location and size of each field connection.

D. Provide wiring diagrams detailing wiring for power and controls and differentiating between manufacturer-installed wiring and field-installed wiring.

E. Provide Operation and Maintenance data for all units.

F. Provide warranty information.

1.4 QUALITY ASSURANCE

A. All units shall be factory assembled, internally wired, and 100% run tested to check operation, fan/blower rotation and control sequence before leaving the factory. Wiring internal to the unit shall be numbered for simplified identification. Units shall be ETL listed and labeled, classified in accordance with ANSI-UL 1995.

B. Source Limitations: Obtain all energy recovery units through one source from a single manufacturer, regularly engaged in production of energy recovery units.

C. Units shall be ETL listed and bear the ETL label.

D. Electrical components shall be UL listed.

E. Fans shall be tested in an AMCA equivalent laboratory.

F. Housing insulation shall comply with NFPA 90A.

G. Coils shall be tested in accordance to AHRI 410.

H. Energy recovery exchangers shall be tested in accordance to AHRI 1060, "Rating Air to Air Energy Recovery Equipment" standards.

I. Filters shall be tested in accordance to ASHRAE 52.2.

1.5 COORDINATION

A. Where applicable coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.

1.6 WARRANTY

A. The energy recovery unit(s) shall be warranted to be free from defects in material and workmanship for a period of one year from the date of Substantial Completion.

1.7 EXTRA MATERIALS

A. In addition to the equipment and materials furnished with the energy recovery units, furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

B. Filters: Two sets of each type of filter specified for each unit installed.

C. Fan Belts: One set of belts for each belt-driven fan in each energy recovery unit.

PART 2 - PRODUCTS

2.1 MANUACTURERS

A. Subject to compliance with requirements, provide Packaged Energy Recovery Units manufactured by Annexair. Subject to review, equipment meeting the full requirements of the specifications and project installation limitations (i.e. physical size and weight) and manufactured by one of the following will be considered by alternate bid:

1. Trane.
2. Aaon.

B. Manufactures other the basis of design manufacturer shall carefully review the contract drawings, prior to bidding to verify the equipment will meet all requirements, including installation clearances, electrical power,

and structural support. Any change in cost required for alternate bid manufacturers shall be included in the alternate bid price.

2.2 UNT HOUSING CONSTRUCTION

A. The unit housing shall be comprised of 2" Thermo-Composite and foam panel construction on the interior and exterior, or an all-aluminum 4" foam thermal break construction.

B. The unit housing shall be constructed from a frame, base and panel assembly. Unit shall be completely factory assembled and shipped in one piece as shown on drawings.

C. Base structure shall be fully welded G-90, painted exterior, and have integral lifting lugs which can be removed once the unit is installed.

D. The frame shall consist of anodized extruded aluminum profiles which incorporates a thermally broken construction; welded together for reinforcement and insulated for superior thermal performance.

E. All panels and access doors shall be double wall construction with R14 foam insulation for every 2" of construction. Insulation shall contain any CFCs or HCFCs in its construction.

F. Unit casing will have no exterior condensation at interior AHU temperatures down to 42.5 degrees F. while unit exterior conditions are maintained at 95 F dry bulb / 85 F wet bulb. The air handling unit manufacturer shall submit a copy of the test report demonstrating the general construction of the unit housing thermal performance. The test shall include placing the housing panels in a climate chamber and exposing the unit to the conditions mentioned previously.

G. The panels shall be tested in accordance with SMACNA and ASHRAE 111 to have a deflection of no more than L/1150 at 10" (Exceeding AHRI casing deflection rating class CD1) and 1% leakage rate at 8" pressure and meet AHRI 1350 Casing Air Leakage rating Class 6.

H. Fire resistance of the panel will be in compliance with UL 94 rated at 5VA; and a flame spread / smoke development in compliance with UL 723 ASTM E84 Class 1 rating.

I. All roof and side wall seams shall be positively sealed to prevent water and air leakage. The OA compartment shall have 1.25" PVC drains extended to exterior of unit (outdoor units only).

J. Floor duct openings shall be covered with 1" fiberglass safety walk on gratings.

K. Access doors shall be provided to all major components to facilitate quick and easy access. Access doors will be made from the same material as the unit casing and shall incorporate thermal break construction. Fan access door(s) shall have Allegis type handles, with one handle interlinking multiple latches and threaded insert fastening handles for all remaining doors. If access doors do not open against unit operating pressure, provide safety latches that allow access doors to partially open after first handle movement and fully open after second handle movement.

L. Unit shall have the entire exterior finished with a PVDF coating designed for UV resistance. Panels shall be painted in the manufacture’s standard color white gray RAL 9002. Panels shall pass ASTM B117 3000-hour salt fog resistance test and ASTM D4585 3000 hour moisture condensation resistance test.

M. Outdoor units shall have a rain gutter above each access door and a watertight roof shall be provided with a white TPO UV reflective membrane.

N. The air handler unit casing shall be provided with a lifetime warranty against corrosion under normal use.

O. Weather Hoods: The outdoor intake weather hood shall be completely constructed in aluminum for superior corrosion resistance. The hood shall ship loose for field installation by the installing contractor. The outdoor air hood shall be designed with a 4” extruded aluminum louver, bird screen and a plenum enclosure with drain holes. The louver blades shall be drainable type with a maximum 45-degree angle and curved with integral rain baffle. The louver design shall not allow more than 0.03 oz./ft2 water penetration when tested in accordance to AMCA 500. The pressure drop of the complete hood assembly shall not exceed 0.05” w.c. at a maximum 500 fpm face velocity.

P. Exhaust Air Louver: The exhaust air outlet louvers shall be 2” extruded aluminum, with non- restricting blade design and bird screen.

2.3 SUPPLY AND EXHAUST FANS

A. Provide centrifugal plenum type fans. Fans shall incorporate a wheel; heavy gauge reinforced steel inlet plate with removable spun inlet cone, structural steel frame, and shaft and bearings in the AMCA Arrangement 3 configuration to form a heavy-duty integral unit. All fan wheels shall be tapered spun wheel cones or shrouds providing stable flow and high rigidity. The wheels shall be non-overloading type. The blades shall be securely welded, die-formed backward curved (16” and smaller) or airfoil (18” and larger) type. Fan wheels shall be statically and dynamically balanced. Fan shafts shall be sized for first critical speed of at least 1.25 times the maximum speed for the class. Fan wheel bearings shall be heavy duty, grease lubricated, anti-friction ball or roller, self-aligning, pillow block type and selected for minimum average bearing life (AFBMA L-50) in excess of 200,000 hours at the maximum class RPM. Fan ratings shall be based on tests made in accordance with AMCA Standard 210 and shall bear the AMCA Seal.

B. Fan motors shall be standard NEMA frame, high efficiency, with 1.15 service factor and open drip-proof enclosures. Belt drives shall be designed for a minimum 1.4 service factor. Drives shall be fixed pitch. Rotating fan and drive parts shall be enclosed by protective guards.

C. Fan assemblies shall have adjustable motor bases, motors and V-belt drives mounted with the assembly mounted on 1 inch deflection spring isolators with flexible connections between fan and fan wall.

2.4 ENERGY RECOVERY WHEELS

A. The enthalpy wheel shall recover both sensible and latent heat. The wheel shall bear the AHRI 1060 certified label.

B. The matrix shall be a minimum of 8" thick to achieve optimal performance and be constructed from a corrugated aluminum alloy. The corrugation shall be uniform to obtain minimum pressure drops through the wheel.

C. The wheel media shall be specifically treated and coated with Silica gel desiccant to assist and enhance latent heat transfer.

D. A heavy-duty wheel hub will contain the bearings in a closed compartment for wheel sizes up to 96" diameter. These shall be maintenance free while larger sizes require periodic lubrication. In addition, segmented wheel shall be provided on diameter sizes above 85".

E. The wheel seal shall made from a dual band ultra-high molecular weight polyethylene and be self-lubricating, wear resistant, and air tight against prolonged use. Seals shall be full contact compression type, on both sides of the wheel to ensure minimal leakage. Specially designed stainless-steel clips are used to position the seal across the face of the wheel.

F. Drive system shall be operated by a fractional horsepower motor. pulley and V-belt. Belts shall be made of multi-link high-tech urethane/polyester composite. An access panel shall be provided for maintenance on the drive system. A double purge sector shall be factory installed to reduce cross contamination to under 0.04%. Frost control prevention shall be provided by the unit manufacturer and accounted for if outdoor air temperatures are below 10 degrees F. at equal airflows and return relative humidity below 30%. Frost control shall be accomplished by a variable speed drive and controlling the leaving air condition of the exhaust air.

G. Media cleaning shall be accomplished with any of the following methods: compressed air, low pressure steam, hot water, or light detergent without degrading the latent recovery.

H. The wheel cassette shall be made of corrosion resistance Thermo Composite panels with aluminum frame.

2.5 SUPPLY AND EXHAUST FANS

A. Fans shall be direct drive radial centrifugal fans with free running impeller. Fans shall be compact, optimized and construction made of galvanized sheet steel with backward curved, high efficiency impeller, protected by an epoxy powder coating.

B. To reduce vibration, the impeller shall be balanced with hub to an admissible vibration severity of less than 2.8 mm/s in conformity with DIN ISO 14694 and proof shall be supplied for each individual impeller. Tests shall be made according to DIN ISO 1940 Part 1, quality of balancing G2.5/6.3.

C. The single inlet shall be mounted onto constant speed direct drive motor, equipped with an air flow optimized inlet cone from galvanized sheet steel.

D. Fans shall be completely certified as per ISO 5801 and in accordance to AMCA standards.

E. Fans will require to be operated by a variable speed drive per fan bank.

F. The fan housing and motor assembly shall be isolated from the unit cabinetry with a minimum 95% efficient 1" deflection spring isolators.

G. Fans shall have flexible canvas to reduce vibration transmission.

H. Fan Motors: The fan motors shall meet NEMA standard dimensions and comply with the Energy policy Act of 1997. Motors shall have premium efficiencies with low noise and vibration output. Motors shall be certified and built in accordance to ISO 9001 quality control system. Motors shall have ODP enclosure with Premium efficiency performance. A shaft grounding brush kit will be provided to prevent electrical damage to motor bearings by safely channeling harmful shaft currents to ground.

2.6 VARIABLE SPEED DRIVE

A. VFDs will be used to set or regulate the fan speed and airflow for these units. The VFD shall have PID function.

B. The VFDs will be installed with integral brake transistor, overload protection, and adjustable pulse-width modulation (PWM).

C. The VFD shall use Insulated Gate Bipolar Transistor (IGBT) technology to convert three phase input power to coded PWM output and have 4-20mA analog output terminals that are fully programmable for variable flow applications.

D. The VFD shall be equipped with a keypad with status indicators, easy access functions, and monitoring functions during motor operation.

E. In the event of a momentary power failure or fault the VFD shall read the inverter speed and direction of a coasting motor and shall automatically restart the motor smoothly.

F. VFDs shall be installed with contactors, relays, and all specified accessories.

G. VFDs will be installed without by-pass.

2.7 HYDRONIC HEATING AND CHILLED WATER COILS

A. All coils shall be rated and certified in accordance with AHRI standard 410. Coils shall be factory installed in the unit.

B. Primary surface shall be round seamless (5/8" O.D.) copper tube with 0.018" plain wall thickness staggered in the direction of airflow. Secondary surface shall consist of a minimum 0.006" rippled aluminum plate fins for higher capacity and structural strength. Fins shall have full drawn collars to provide a continuous surface cover over the entire tube for maximum heat transfer. 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.

C. Coils shall be circuited for counter-flow heat transfer to provide maximum mean effective temperature difference for maximum heat transfer rates.

D. Headers shall have intruded tube holes to provide a large brazing surface for maximum strength and inherent flexibility.

E. Casing shall be constructed of continuous galvanized steel.

F. Coils shall be submerged in water and tested with a minimum of 315 psi air pressure. Maximum finned coil height shall be 60" and shall not exceed 500 FPM face velocity.

G. Drain pan shall be provided on cooling coils. Cooling coils shall sit on stainless steel support rails, which shall stand a minimum of (2) two inches above the highest point of the floor drain pan. Stacked coils shall be provided for larger airflows and intermediate drain pans shall be provided for each coil bank. Drain pans shall be 316 stainless steel with 1.25" MPT stainless steel drain connections on one side only. Pan shall be sloped in three planes.

2.8 FILTERS

A. Pre-Filters: Pre-filters shall be factory installed. The pre-filters shall be MERV 8. Each filter consists of 100% synthetic media that does not support microbial growth. Filters shall have a high wet strength beverage board with a cross member design that increases filter rigidity and prevents breaching. Frame shall be recyclable. MERV 11 model High-Capacity Series 1100 filters are classified to UL 900 and tested in accordance with the ASHRAE test 52.2. Filter shall have a low initial pressure drop that shall not exceed 0.28" w.g. in 2" at 500 fpm air flow, and 0.22" in 4" at 500 fpm air flow. Filters shall have a recommended final resistance of 1.0" w.g. Filters shall be placed in a completely sealed, galvanized holding frame with quick release latches for easy replacement.

B. MERV 13 Filters: Filters shall be factory installed where shown on the drawings. Each filter consists of 100% synthetic media that does not support microbial growth. Frame shall be a heavy duty, high strength, moisture resistant paperboard with cross member design that increases filter rigidity and prevents

breaching. Frame shall be recyclable. Filter shall have a low initial pressure drop that shall not exceed 0.36" w.g. in 2" at 500 fpm air flow, and 0.23" in 4" at 500 fpm air flow. Filters shall have a recommended final resistance of 1.0" w.g. Filters shall be rated to withstand a continuous operating temperature up to 150°F. Filters shall be placed in a completely sealed, galvanized holding frame with quick release latches for easy replacement.

2.9 DAMPERS

A. Dampers shall be low leak type (Leakage Class 1A at 1 in. w.g.) static pressure differential). Blades are maximum 6" deep extruded aluminum air-foil profiles. All blades are symmetrically pivoted.

B. Blade seals are extruded EPDM. Frame seals are extruded silicone. Seals are secured in an integral slot within the aluminum extrusions. Blade and frame seals are mechanically fastened to prevent shrinkage and movement over the life of the damper.

C. Dampers shall be opposed blade type and installed in the compartments (as shown on the drawings) with linkage rod for actuators, unless otherwise noted.

D. Actuators shall be 24V factory installed; two-position or modulating.

E. All actuators shall have spring return mechanism and auxiliary switches. Dampers will be installed in the failed close positions unless otherwise noted.

2.10 AIR FLOW MONITORING

A. Airflow measuring stations shall be provided. Airflow measuring stations shall be tested per AMCA Standard 611 and licensed to bear the AMCA Ratings Seal for airflow measurement performance. Integral control damper blades shall be provided as galvanized steel and housed in a galvanized steel frame. Leakage rate shall not exceed 4 CFM/square foot at one inch water gauge complying with ASHRAE 90.1 maximum damper leakage. The airflow measurement station shall measure up to 100 percent of the total outside air and/or return air. The airflow measurement station shall be capable of measuring down to 300 fpm. The airflow measuring device shall adjust for temperature variations. Output shall be provided from the station as a 2-10 VDC signal. Signal shall be proportional to air velocity. The accuracy of the measuring station shall be no greater than +/- 5 percent.

2.11 AIR TEMPERATURE CONTROL PACKAGE

A. The unit shall be delivered with factory installed control system. Field installed control package by the ATC will not be acceptable.

B. The control system shall consist of a microprocessor with 8-lines and 22-charater built-in LCD display, allowing for full monitoring of all the unit equipment. Six push buttons allow for menu navigation and settings modification as required. Remote access ports also allow for potential program upgrade, operation log download and unit monitoring.

C. Provide Communication Interface Card: The microprocessor shall be capable of communicating with Bacnet MS/TP RS-485.

2.12 ROOF CURB

A. Furnish a pre-fabricated roof curb shall be provided and shipped knocked down. The roof curb will be fabricated of 16-gauge galvanized steel with 4” flanges, minimum 24” high with a factory installed 2” x 3” wood nailer strip.

2.13 ELECTRICAL

A. The power and control center shall be integral to the unit housing and rated equivalent to NEMA 4X.

B. Panels that are externally mounted to the unit shall not be accepted, regardless of the NEMA rating they may have.

C. Each panel should have a separate access door with an approved locking device.

D. All electrical components contained in the panel shall be UL/CSA certified and labeled. The unit shall be complete with VFDs, fuses, relays, phase protection, terminals for main ON/OFF and step-down transformer. All components shall be factory wired for single point power connection by the manufacturer of the unit. A non-fused safety disconnect switch shall be factory installed for ON/OFF servicing. Refer to wiring diagrams for field power connections.

E. An electrical pipe chase for power and control feeding shall be provided next to the control panel.

F. The Short Circuit Current Rating (SCCR) is 5 KA (208/460 V) rms symmetrical, as noted on schedule.

G. GFI (120 V/1), lights, and switches shall be factory installed and wired to a common junction box, powered by unit transformer.

PART 3 - EXECUTION

3.1 ON-SITE STORAGE

A. If equipment is to be stored for a period of time prior to installation, the installing contractor shall remove all stretch or shrink wrap from units upon receipt to prevent unit corrosion and shall either place the units in a controlled indoor environment or shall cover the units with canvas tarps and place them in an area not subject to rain and/or snow.

3.2 EXAMINATION

A. Examine areas and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of the work. Examine casing insulation materials and filter media before air-to-air energy recovery equipment installation. Reject insulation materials and filter media that are wet, moisture damaged, or mold damaged.

B. Examine roughing-in for electrical services to verify actual locations of connections before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 INSTALLATION

A. Install units per manufacture's installation instructions. Install units with required clearances.

B. Roof curb: provide a roof curb for all roof mounted units. Install the roof mounted unit(s) on the roof curb immediately after the curb is installed. If immediate installation is not performed provide temporary watertight covering, for all curb openings, consisting of minimum ¾" exterior grade plywood and watertight rubber or plastic cover.

C. Where applicable pipe drains from units and drain pans to nearest to the roof area.

D. Install all electrical devices and controls furnished with energy recovery units that are required but not factory mounted. Provide all required control wiring to field-mounted electrical devices that are supplied with the energy recovery units.

E. At the direction of the Owner's Representative the contractor shall remove and dispose of filters from the respective units and install a new filter obtained from the Extra Materials required in Part 1 of this specification. If additional filter installation is not required, forward filters to the owner as extra stock, at the completion of the project.

3.4 CONNECTIONS

A. When applicable, comply with requirements for piping specified in Division 23 Section "Hydronic Piping." Drawings indicate general arrangement of piping, fittings, and specialties. Install piping within the unit casing and allow the proper service and maintenance. Connect piping to units mounted on vibration isolators with flexible connectors. Where applicable, connect cooling condensate drain pans with air seal trap at connection to drain pan and install cleanouts at changes in pipe direction.

B. Comply with requirements for ductwork specified in Division 23 Section "Metal Ducts."

3.5 STARTUP AND TRAINING

A. The energy recovery unit manufacturer shall provide a factory trained representative, employed by the manufacture, to perform the start-up procedures as outlined in the Start-Up, Operation and Maintenance manual provided by the manufacturer.

B. Provide training on the operation and maintenance of the energy recovery units.

END OF SECTION 23 72 15