SECTION 237216 - HEAT PIPE AIR-TO-AIR ENERGY RECOVERY UNITS

Revise this Section by deleting and inserting text to meet Project-specific requirements.

Verify that Section titles referenced in this Section are correct for this Project's Specifications; Section titles may have changed.

This Section may include provisions for LEED 2009, LEED v4, ASHRAE 189.1, IgCC, and Green Globes. Note that some sustainable design requirements are either mandatory or optional requirements that may be inserted in the Section Text using the hypertext links. Other requirements that are associated with sustainable design, and may be considered "best practice" or retained even if a sustainable design standard is not a project requirement, are discussed in the Evaluations.

1. GENERAL
	* + 1. RELATED DOCUMENTS

Retain or delete this article in all Sections of Project Manual.

* + - * 1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
			1. SUMMARY
				1. Section includes heat-pipe heat exchangers.
			2. SUBMITTALS
				1. Submittals for this section are subject to the re-evaluation fee identified in Article 4 of the General Conditions.
				2. Manufacturer's installation instructions shall be provided along with product data.
				3. Submittals shall be provided in the order in which they are specified and tabbed (for combined submittals).
				4. Product Data: For each type of product. Include rated capacities, operating characteristics, furnished specialties, and accessories.
				5. Shop Drawings: For air-to-air energy recovery equipment.

Include plans, elevations, sections, and [**mounting**] [**attachment**] details.

Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

Include diagrams for power, signal, and control wiring.

Retain "Coordination Drawings" paragraph below for situations where limited space necessitates maximum utilization for efficient installation of different components or if coordination is required for installation of products and materials by separate installers. Coordinate paragraph with other Sections specifying products listed below. Preparation of coordination drawings requires the participation of each trade involved in installations within the limited space.

* + - * 1. Coordination Drawings: Floor plans, elevations, and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

Mechanical-room layout and relationships between components and adjacent structural and mechanical elements.

Support location, type, and weight.

Field measurements.

Retain "Seismic Qualification Data" paragraph below if required by seismic criteria applicable to Project. Coordinate with Section 230548 "Vibration and Seismic Controls for HVAC." See ASCE/SEI 7 for certification requirements for equipment and components.

* + - * 1. Seismic Qualification Data: Certificates, for air-to-air energy recovery equipment, accessories, and components, from manufacturer.

Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.

Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

Retain "Field quality-control reports" paragraph below if Contractor is responsible for field quality-control testing and inspecting.

* + - * 1. Field quality-control reports.
				2. Sample Warranty: For special warranty.
			1. CLOSEOUT SUBMITTALS
				1. Operation and Maintenance Data: For air-to-air energy recovery equipment to include in maintenance manuals.
			2. COORDINATION
				1. Coordinate sizes and locations of concrete bases with actual equipment provided.
			3. DELIVERY, STORAGE, AND HANDLING
				1. Deliver and store products in a clean, dry place.
				2. Comply with manufacturer's written rigging and installation instructions for unloading and moving to final installed location.
				3. Handle products carefully to prevent damage, breakage, denting, and scoring. Do not install damaged products.
				4. Protect products from weather, dirt, dust, water, construction debris, and physical damage.

Retain factory-applied coverings on equipment to protect finishes during construction and remove just prior to operating unit.

Cover unit openings before installation to prevent dirt and dust from entering inside of units. If required to remover coverings during unit installation, reapply coverings over openings after unit installation and remove just prior to operating unit.

Replace installed products damaged during construction.

* + - 1. WARRANTY

When warranties are required, verify with Director’s Representative's counsel that warranties stated in this article are not less than remedies available to Director’s Representative under prevailing local laws.

* + - * 1. Special Warranty: Manufacturer agrees to repair or replace components of air-to-air energy recovery equipment that fail in materials or workmanship within specified warranty period.

Verify available warranties and warranty periods for units and components with manufacturers listed in Part 2 articles.

Warranty Period for Heat Pipe Energy Recovery Equipment: [**Two**] <**Insert number**> years.

1. PRODUCTS

Manufacturers and products listed in SpecAgent and MasterWorks Paragraph Builder are neither recommended nor endorsed by the AIA or Deltek. Before inserting names, verify that manufacturers and products listed there comply with requirements retained or revised in descriptions and are both available and suitable for the intended applications. For definitions of terms and requirements for Contractor's product selection, see Section 016000 "Product Requirements."

* + - 1. PERFORMANCE REQUIREMENTS

Retain "Electrical Components, Devices, and Accessories" paragraph below if retaining tilt control in "Control" paragraph in "Heat-Pipe Heat Exchangers" Article.

* + - * 1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
				2. NPFA Compliance: Comply with NFPA 90A for design, fabrication, and installation of unit components.

"ASHRAE Compliance" paragraph below may be required to comply with Project requirements or authorities having jurisdiction. Sustainable design systems require compliance with requirements in ASHRAE 62.1, including requirements for controls, surfaces in contact with the airstream, particulate and gaseous filtration, humidification and dehumidification, drain pan construction and connection, finned-tube coil selection and cleaning, and equipment access. Verify, with manufacturers, the availability of units with components and features that comply with these requirements.

* + - * 1. ASHRAE Compliance:

Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."

Capacity ratings for air-to-air energy recovery equipment shall comply with ASHRAE 84, "Method of Testing Air-to-Air Heat/Energy Exchangers."

"ASHRAE/IES 90.1 Compliance" paragraph below may be required to comply with Project requirements or authorities having jurisdiction. Sustainable design may require minimum efficiency equal to requirements in ASHRAE/IES 90.1.

* + - * 1. ASHRAE/IES 90.1 Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."

Retain "Seismic Performance" paragraph below with "Seismic Qualification Data" paragraph in "Informational Submittals" Article for projects requiring seismic design. Delete paragraph if performance requirements are indicated on Drawings. Model building codes and ASCE/SEI 7 establish criteria for buildings subject to earthquake motions. Coordinate requirements with structural engineer.

* + - * 1. Seismic Performance: Air-to-air energy recovery equipment shall withstand the effects of earthquake motions determined according to [**ASCE/SEI 7**] <**Insert requirement**>.

Retain first subparagraph below to define the term "withstand" as it applies to this Project. Definition varies with type of building and occupancy and is critical to valid certification. Option is used for essential facilities where equipment must operate immediately after an earthquake.

The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified[**and the unit will be fully operational after the seismic event**]."

For life-safety components required to function after an earthquake (such as fire-sprinkler systems, components that contain hazardous content, and storage racks in structures open to the public), the Component Importance Factor is 1.5. For other components, the Component Importance Factor is 1.0 unless the structure is in Seismic Use Group III and component is necessary for continued operation of facility or failure of component could impair continued operation of facility, in which case the Component Importance Factor is 1.5.

Component Importance Factor: [**1.5**] [**1.0**].

See ASCE/SEI 7, Coefficients for Architectural Component Table and Seismic Coefficients for Mechanical and Electrical Components Table for requirements to be inserted in subparagraph below.

<**Insert requirements for Component Amplification Factor and Component Response Modification Factor**>.

* + - 1. CAPACITIES AND CHARACTERISTICS

If Project has more than one type or configuration of air-to-air energy recovery unit, delete this article and schedule air-to-air energy recovery units on Drawings.

* + - * 1. Exhaust Air:

Airflow: <**Insert number**> cfm.

Face Velocity: <**Insert number**> fpm.

Summer:

Entering-Air Temperature, Dry Bulb: <**Insert number**> deg F.

Entering-Air Temperature, Wet Bulb: <**Insert number**> deg F.

Leaving-Air Temperature, Dry Bulb: <**Insert number**> deg F.

Leaving-Air Temperature, Wet Bulb: <**Insert number**> deg F.

Winter:

Entering-Air Temperature, Dry Bulb: <**Insert number**> deg F.

Entering-Air Temperature, Wet Bulb: <**Insert number**> deg F.

Leaving-Air Temperature, Dry Bulb: <**Insert number**> deg F.

Leaving-Air Temperature, Wet Bulb: <**Insert number**> deg F.

Air Pressure Drop: <**Insert number**> inches wg.

* + - * 1. Supply Air:

Airflow: <**Insert number**> cfm.

Face Velocity: <**Insert number**> fpm.

Summer:

Entering-Air Temperature, Dry Bulb: <**Insert number**> deg F.

Entering-Air Temperature, Wet Bulb: <**Insert number**> deg F.

Leaving-Air Temperature, Dry Bulb: <**Insert number**> deg F.

Leaving-Air Temperature, Wet Bulb: <**Insert number**> deg F.

Winter:

Entering-Air Temperature, Dry Bulb: <**Insert number**> deg F.

Entering-Air Temperature, Wet Bulb: <**Insert number**> deg F.

Leaving-Air Temperature, Dry Bulb: <**Insert number**> deg F.

Leaving-Air Temperature, Wet Bulb: <**Insert number**> deg F.

Air Pressure Drop: <**Insert number**> inches wg.

* + - * 1. Tilt Motor:

Horsepower: <**Insert number**> hp.

Electrical Characteristics:

Volts: <**Insert number**> V.

Phase: <**Insert number**>.

Hertz: [**60**] <**Insert number**> Hz.

* + - * 1. Effectiveness: <**Insert percentage**>.
			1. HEAT-PIPE HEAT EXCHANGERS

* + - * 1. [Manufacturers:](http://www.specagent.com/Lookup?ulid=13332) Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

[Engineered Air](http://www.specagent.com/Lookup?uid=123457140003).

[Heat Pipe Technology, Inc](http://www.specagent.com/Lookup?uid=123457140005).

[Innergy Tech, Inc](http://www.specagent.com/Lookup?uid=123457140006).

Approved equivalent.

* + - * 1. Casing: [**Galvanized**] [**Stainless**]-steel flanged casing, with airtight [**single**] [**double**] partition between airstreams.
				2. Refrigerant: [**ASHRAE 34, Safety Group 1**] <**Insert refrigerant**>.

Not all manufacturers offer the same combination of tube diameter, tube material, and fin material. Consult manufacturers and insert desired tube diameter, tube material, and fin material.

* + - * 1. Tubes:

Tube Diameter: <**Insert dimension**> diameter.

Tube Material: [**Aluminum**] [**Copper**] <**Insert material**>.

Number of Tube Rows: As required to meet scheduled capacity conditions.

* + - * 1. Fins: <**Insert material**>.

Fin Spacing: As required to meet scheduled capacity conditions.

Not all manufacturers offer each option in "Fin and Tube Joint" subparagraph below; consult manufacturers.

Fin and Tube Joint: [**Mechanical bond**] [**Silver brazed**].

* + - * 1. Coating: [**None**] [**Flexible epoxy polymer e-coating**] [**Baked phenolic**] <**Insert coating**>; apply to supply and exhaust.

Retain one of two "Control" paragraphs below to require controls to be an integral part of air-to-air energy recovery equipment. Retain first for face-and-bypass control; second, for tilt control. Delete if controls are specified in Section 230923 "Direct Digital Control System for HVAC," or if these types of controls are not required for the application. Not all manufacturers offer bypass control. Not all manufacturers offer or recommend tilt control. Consult manufacturers.

* + - * 1. Control: Integral plenum containing heat-pipe coil and gasketed, face-and-bypass, opposed-blade dampers with rods extended outside casing for damper operator and linkage.
				2. Control: Pivot center of bottom of heat-pipe coil on shaft and bearings to tilt coil. Include tilt controls with electronic controller, electric actuator and linkage, thermostats, sensors, and polyester fabric with PVC-coated flexible connector for automatic supply temperature regulation, summer/winter changeover, and frost protection.
			1. SOURCE QUALITY CONTROL
				1. AHRI Certification: Certified according to AHRI 410.
1. EXECUTION
	* + 1. EXAMINATION
				1. Examine areas and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

Do not retain first paragraph below if tilt control is not retained in "Control" paragraph in "Heat-Pipe Heat Exchangers" Article.

* + - * 1. Examine roughing-in for electrical services to verify actual locations of connections before installation.
				2. Proceed with installation only after unsatisfactory conditions have been corrected.
			1. INSTALLATION

Retain first paragraph below for heat-pipe heat exchangers.

* + - * 1. Install heat-pipe heat exchangers so supply and exhaust airstreams flow in opposite directions.[**Install flexible connectors on ducts to enable tilt control; make connections airtight and with slack to compensate for full tilt.**]

Install heat exchanger with clearance space for heat-pipe coil removal.

Install duct access doors in both supply and exhaust ducts, both upstream and downstream, for access to both sides of heat-pipe coil. Access doors and panels are specified in Section 233300 "Air Duct Accessories."

Install tilt-control components, including electronic controller, electric actuator and linkage, thermostats, and sensors.

* + - * 1. Install floor-mounted units on 4-inch- high, concrete base[**designed to withstand, without damage to equipment, seismic force required by code**].
				2. Equipment Mounting:

Retain subparagraph below to require equipment to be installed on cast-in-place concrete equipment bases without vibration isolation devices.

Install air-to-air energy recovery equipment on cast-in-place concrete equipment bases. Comply with requirements for equipment bases and foundations specified in Section 033000 "Cast-in-Place Concrete."

Retain first paragraph below for air-to-air energy recovery equipment requiring seismic restraints.

* + - * 1. Install seismic restraints according to manufacturers' written instructions.
				2. Install units with clearances for service and maintenance.
			1. PIPING CONNECTIONS

Coordinate piping installations and specialty arrangements with Drawings and with requirements specified in piping systems. If Drawings are explicit enough, these requirements may be reduced or omitted.

* + - * 1. Comply with requirements for piping specified in Section 232113 "Hydronic Piping" and Section 232116 "Hydronic Piping Specialties." Drawings indicate general arrangement of piping, fittings, and specialties.
				2. Where installing piping adjacent to unit, allow space for service and maintenance.
				3. Connect piping to units mounted on vibration isolators with flexible connectors.

Retain one of two "Condensate Drain Piping" paragraphs below.

* + - * 1. Condensate Drain Piping: Pipe drains from drain pans to nearest floor drain; use ASTM B88, Type L, drawn-temper copper water tubing with soldered joints, same size as condensate drain connection.
				2. Condensate Drain Piping: Pipe drains from drain pans to nearest floor drain; use ASTM D1785, Schedule 40 PVC pipe and solvent-welded fittings, same size as condensate drain connection.
				3. Condensate Drain Piping Installation: Extend to nearest equipment or floor drain. Construct deep trap at connection to drain pan and install cleanouts at changes in direction.
			1. ELECTRICAL CONNECTIONS

Do not retain this article if tilt control is not retained in "Control" paragraph in "Heat-Pipe Heat Exchangers" Article.

* + - * 1. Connect wiring according to Section 260529 "Low-Voltage Electrical Power Conductors and Cables."
				2. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."
				3. Install electrical devices furnished with units, but not factory mounted, according to NFPA 70 and NECA 1.
				4. Install nameplate for each electrical connection, indicating electrical equipment designation and circuit number feeding connection.

Retain one of two subparagraphs below. First subparagraph cross-references Section 260553 "Identification for Electrical Systems" and should be retained for consistent electrical identification. Second subparagraph is an abbreviated version of the product specified in Section 260553 "Identification for Electrical Systems."

Nameplate shall be laminated acrylic or melamine plastic signs, as specified in Section 260553 "Identification for Electrical Systems."

Nameplate shall be laminated acrylic or melamine plastic signs with a black background and engraved white letters at least 1/2 inch high.

* + - 1. CONTROL CONNECTIONS

Do not retain this article if tilt control is not retained in "Control" paragraph in "Heat-Pipe Heat Exchangers" Article.

* + - * 1. Install control and electrical power wiring to field-mounted control devices.
				2. Connect control wiring according to Section 260523 "Control-Voltage Electrical Power Cables."
			1. FIELD QUALITY CONTROL

Do not retain this article if tilt control is not retained in "Control" paragraph in "Heat-Pipe Heat Exchangers" Article.

Retain one of first three paragraphs below.

Retain "Testing Agency" paragraph below to require Contractor to hire an independent testing agency.

* + - * 1. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

Retain "Manufacturer's Field Service" paragraph below to require a Company Service Advisor to perform tests and inspections.

* + - * 1. Manufacturer's Field Service: Engage a Company Field Advisor per OGS Spec Section 014216 to test and inspect components, assemblies, and equipment installations, including connections.

Retain "Perform the following tests and inspections" paragraph below to require Contractor to perform tests and inspections and retain option to require Contractor to arrange for the assistance of a Company Service Advisor.

* + - * 1. Perform the following tests and inspections[**with the assistance of a Company Field Advisor per OGS Spec Section 014216**

Operational Test: After electrical circuitry has been energized, start units to confirm proper tilt control and unit operation.

Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

Set field-adjustable switches and circuit-breaker trip ranges as indicated.

* + - * 1. Air-to-air energy recovery equipment will be considered defective if it does not pass tests and inspections.
				2. Prepare test and inspection reports.
			1. STARTUP SERVICE

Do not retain this article if tilt control or bypass damper options are not retained in "Control" paragraphs in "Heat-Pipe Heat Exchangers" Article.

* + - * 1. [**Engage a Company Field Advisor per OGS Spec Section 014216 to perform**] [**Perform**] startup service.

Complete installation and startup checks according to manufacturer's written instructions.

Verify that shipping, blocking, and bracing are removed.

Verify that unit is secure on mountings and supporting devices and that connections to electrical systems are complete. Verify that proper thermal-overload protection is installed.

Verify tilt mechanism operation.

Verify that moving parts are lubricated with factory-recommended lubricants.

* + - * 1. Starting procedures for air-handling units include the following:

Energize actuator motor and verify proper operation of motor and tilt system.

Measure and record motor electrical values for voltage and amperage.

Operate bypass dampers from full closed to fully open position.

* + - 1. ADJUSTING
				1. Adjust tilt mechanism for proper operation.
				2. Adjust bypass dampers for proper operation.
				3. Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC" for air-handling system testing, adjusting, and balancing.
			2. CLEANING

Retain option in paragraph below if retaining tilt control in "Control" paragraph in "Heat-Pipe Heat Exchangers" Article.

* + - * 1. After completing system installation and testing, adjusting, and balancing air-to-air heat recovery unit,[**and after completing startup service,**] clean unit to remove foreign material and construction dirt and dust.
			1. DEMONSTRATION
				1. [**Engage a Company Field Advisor per OGS Spec Section 014216 to train**] [**Train**] Facility’s maintenance personnel to adjust, operate, and maintain heat pipe air-to-air energy recovery units.

END OF SECTION 237216