

SolutionAir RegenCore™ High Effectiveness Energy Recovery Units

Division 23 – Heating, Ventilating, and Air Conditioning

Section 23 72 00 – Air-to-Air Energy Recovery Equipment

The following specification is for a defined application. SolutionAir would be pleased to assist in developing a specification for your specific need.

PART 1 – GENERAL

1.01 Section Includes:

- A. RegenCore™ High Effectiveness Energy Recovery units

1.02 Related Requirements:

- A. Section 23 05 13 - Common Motor Requirements for HVAC Equipment
- B. Section 23 05 48 - Vibration and Seismic Controls for HVAC Piping and Equipment
- C. Section 23 09 13 - Instrumentation and Control Devices for HVAC: Control components, time clocks
- D. Section 23 33 00 - Air Duct Accessories: Flexible duct connections
- E. Section 23 34 16 - Centrifugal HVAC Fans: Supply fans
- F. Section 23 40 00 - HVAC Air Cleaning Devices: Filters
- G. Section 26 27 17 - Equipment Wiring: Electrical characteristics and wiring connections

1.03 Reference Standards

- A. All referenced standards and recommended practices in this section pertain to the most recent publication thereof, including all addenda and errata.
- B. AMCA 500-D – Laboratory Methods of Testing Dampers for Rating
- C. AMCA 511 – Damper Certified Ratings Program – Product Rating Manual for Air Control Devices
- D. ASHRAE 62.1 – Standards for Ventilation and Indoor Air Quality
- E. ANSI/AHRI 1350 - Mechanical Performance Rating of Central Station Air-handling Unit Casings
- F. ASTM B117 – Standard Practice for Operating Salt Spray (Fog) Apparatus
- G. ASTM D610 – Standard Practice for Evaluating Degree of Rusting on Painted Steel Surfaces
- H. ASTM D714 – Standard Test Method for Evaluating Degree of Blistering of Paints
- I. ASTM D1308 – Standard Test Method for Effect of Household Chemicals on Clear and Pigmented Organic Finishes
- J. ASTM D4752 – Standard Practice for Measuring MEK Resistance of Ethyl Silicate (Inorganic) Zinc-Rich Primers by Solvent Rub
- K. UL 900 – Standard for Air Filter Units

1.04 Administrative Requirements

- A. Pre-installation Meeting: Contractor shall conduct a pre-installation meeting one week prior to the start of the work of this section; require attendance by all affected installers.
- B. Sequencing: Contractor shall ensure that utility connections are achieved in an orderly and efficient manner.

1.05 Submittals

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data:
 - 1. Provide data indicating dimensions, duct and service connections, accessories, controls, electrical nameplate data, and wiring diagrams.
 - 2. The performance schedule shall include the following information (**select all that apply**):
 - a. Unit weight
 - b. Electrical Characteristics
- C. Shop Drawings:
 - 1. Provide general layout drawings with plan and elevation views including relevant dimensions to include duct, piping, and electrical service connection locations for the following items:
 - a. Provide roof curb mounting details.
 - b. Provide electrical schematics including field wiring connections.
 - c. Provide component details including construction method and materials.

1.06 Quality Assurance

- A. Manufacturer Qualifications:
 - 1. The manufacturer shall be a company specializing in manufacturing the type of products specified in this section, with a minimum of 5 years of documented experience.
- B. The unit shall bear certification label by ETL, UL, or CSA.

SUGGESTED SPECIFICATIONS

1.07 Inspection, Storage, and Rigging

- A. Inspection:
 - 1. The unit shall be inspected immediately upon delivery to ensure there is no apparent physical damage.
 - 2. Any damage claims should be filed immediately with the carrier.
 - 3. The manufacturer shall not assume responsibility for damage caused during shipment, handling, storage and rigging.
- B. Storage:
 - 1. Equipment shall be stored in the original factory shipping packaging away from construction areas where it will be safe from damage and protected from harmful weather conditions.
 - 2. Factory shipping packaging shall remain in place until unit is ready to be installed.
 - 3. The make-up air unit is not to be used for temporary heating, cooling or ventilation during construction. Doing so will void the terms of the equipment warranty.
- C. Rigging:
 - 1. Follow manufacturer's instructions for rigging and placement of equipment.

1.08 Coordination

- A. Coordinate all system connections and building penetrations including electrical and duct connections.
- B. Coordinate curb placement, structural and roofing.

1.09 Warranty

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. The manufacturer will provide a parts only warranty of 12-month from startup or 18-months from shipping, whichever comes first.

PART 2 – PRODUCTS

2.01 General

- A. Basis of Design: SolutionAir Group.
 - 1. High Effectiveness Energy Recovery Unit [SolutionAir Model PRC and PRCX]
 - 2. Light Duty High Effectiveness Energy Recovery Unit [SolutionAir Model PRCLC]
- B. General Product Information:
 - 1. Furnish and install SolutionAir [PRC and PRCX] or [PRCLC] energy recovery units, as indicated on the plans with capacities and characteristics as listed in the schedule and the specifications that follow.

2.02 Performance

- A. General:
 - 1. The energy recovery units shall provide the performance as detailed on the schedule.
- B. [Optional] Variable Air Volume:
 - 1. The energy recovery unit shall operate with air flow rates as low as 20% of the nominal unit airflow.
 - 2. Supply and exhaust airflows shall be capable of being unbalanced up to 50%.

2.03 Construction

Post and Panel

- A. Cabinet Construction:
 - 1. The cabinet shall be fabricated from panels mechanically fastened to extruded aluminum posts.
 - 2. All doors shall be sealed with a permanent EPDM rubber gasket.
 - 3. The cabinet shall be built up on a steel or aluminum channel base, engineered to prevent deflection during rigging. Lifting lugs shall be [welded] or [bolted].
 - 4. **[For outdoor applications only]** The posts shall have a thermally-broken construction with hermetic seals between posts and joints to minimize energy losses.
- B. Panels:
 - 1. Panels shall be 2 inch nominal thick construction.
 - 2. The outer panel and inner liner shall be constructed of 22 gauge galvanized steel or 12 gauge aluminum. Panels shall be removable without affecting the structural integrity of the entire unit. Outer Panels shall be painted as required.
 - 3. Roof panel construction shall match the wall panel construction. The roof skin shall include a 1-1/2 inch standing seam with a rain-guard drip-edge around the full perimeter.
 - 4. **[For outdoor applications only]** The panels shall be a double-wall assembly for outdoor applications, with injected polyurethane foam insulation.
 - a. Panels shall be of a thermally-broken construction, as required.
 - b. The polyurethane foam insulation shall be in accordance with the following:

SUGGESTED SPECIFICATIONS

- i. The insulation shall have a flame spread and smoke development index of 0, when tested according to ASTM E84, CAN/ULC S102, and UL723.
 - ii. The insulation shall be chemically inert, water resistant, and shall not rot or sustain vermin.
 - iii. The insulation shall be corrosion resistant when tested according to ASTM C795 and ASTM C665
 - iv. The insulation shall not promote the growth of fungi or mildew, when tested according to ASTM C1338.
 - v. The insulation shall display low moisture sorption when tested according to ASTM C1104.
 - vi. The insulation shall have a VOC content of 0, and shall be non-off-gassing.
- C. Access Doors:
1. Access doors shall be 2 inch nominal thick construction, and shall be flush, hinged and supplied with handles.
- D. Finish:
1. All exterior galvanized steel shall be coated with a weather resistant paint, as required, capable of withstanding surface degradation and substrate corrosion after at least 1500 hours of salt spray exposure (per ASTM B117).

2.04 Components

- A. Supply/Return Fans shall be either [select one] direct-drive airfoil plenum or housed centrifugal fans with a belt driven motor and matching motor sheaves and belts. Fans are available with optional air flow monitoring instrumentation.
- Direct Drive Airfoil Plenum fans
1. The energy recovery unit shall be provided with direct-drive airfoil plenum supply and return fans. The fan assemblies shall be dynamically balanced and selected at speed below critical RPM.
 2. The fan and motor shall be mounted internally on a steel base-frame complete with spring vibration type isolators. The unit casing shall include a hinged access door to permit access to the motor, drive, and bearings.
 3. The motor shafts shall be steel construction, and shall be solid, ground and polished, keyed, and protectively coated with lubricating oil. Hollow shafts shall not be acceptable.
- Housed Centrifugal Fans
1. The fans shall be statically and dynamically balanced.
 2. The fans shall be [mounted on a solid steel shaft with heavy duty self-aligning pre-lubricated ball bearings.
 3. Fan bearings shall be greasable, self-aligning pillow block type with L-10 life of 60,000 hours.
 4. Motor mounts shall be on an adjustable base for belt tensioning.
 5. Belts shall be rated for with service factor of 1.2.
 6. [Optional] Manufacturer shall supply one extra set of belts per fan motor.
 7. The fan and motor assembly shall be mounted on common base with (**select one**):
 - a. Rubber in shear (RIS) isolation;
 - b. [One-inch] or [two-inch] deflection spring isolation;
 - c. [One-inch] or [two-inch] deflection seismic rated spring isolation
 8. The fan shall be connected to fan bulkhead by a canvas type flex connector.
 9. [Optional] The fan shall be provided with [OSHA style] belt guard.
- B. Electrical:
1. The air handler shall bear an ETL, UL, or CSA listing label. The electrical components shall be CSA, UL or CE listed, as applicable.
 2. The unit shall be supplied with a single point power supply connection.
 3. Terminal lugs shall be provided in accordance with the branch circuit conductor quantities, sizes, and materials indicated.
 4. All wires shall be tagged and cross-referenced to the wiring diagram for ease of troubleshooting.
 5. Fan motors shall be premium efficiency totally-enclosed fan-cooled (TEFC) or open drip proof (ODP), driven with a variable-frequency drive (VFD). Electrical characteristics shall be as shown in the equipment schedule.
- C. Filters:
1. The unit shall be supplied with filters supported in racks, which shall be accessible through hinged and latching access-doors on at least one side of the unit.
 2. The filter media shall be UL 900 listed, Class I or Class II.
 3. Filters shall be mounted in a flat or angled arrangement with [2 inch, 50 millimeter] or [4 inch, 100 millimeter] pleated panel filters.
- D. Energy Recovery Cores:
1. Unit shall be equipped with SolutionAir RegenCore™ Energy Recovery Technology. The unit shall have sensible effectiveness of 90 percent (plus or minus 5 percent) in winter and up to 80 percent in summer. The unit shall also provide up to 70 percent latent recovery.
 2. Unit shall accomplish energy recovery without a defrost cycle down to -40 degrees Fahrenheit (-40 degrees Celcius). Devices employing defrost cycles that bypass the heat recovery device or reduce the effectiveness shall not be acceptable.
 3. The energy recovery cores shall consist of 0.032 inch thick type 1100 aluminum alloy plates.

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E. Dampers:

1. The unit shall be supplied with a switchover damper system comprised of four multi-section, low-leakage, AMCA certified dampers.
2. The dampers shall meet the following requirements:
 - a. AMCA Leakage Class 1A at 1 inch water gauge static pressure differential.
 - b. AMCA Leakage Class 1 at 4 inches water gauge static pressure differential.
3. The dampers shall be operated by CSA-listed electric motors. The motors shall drive the dampers full-open to full-closed and full-closed to full-open in less than 0.75 seconds.
4. The damper blades shall be aluminum for long life expectancy, and shall be insulated and thermally-broken dampers, as required to meet the job requirements.
5. The switchover damper system shall be capable of closing off outside-air to the building without needing additional shut-off dampers.
6. The unit dampers shall be capable of positioning to allow 100 percent recirculation of air without using the heat recovery device for off-peak or unoccupied heating modes. Units incapable of these operations shall not be acceptable.
7. Unit capable of cold weather warm up mode without additional dampers.
8. External, insulated dampers available as required.

2.05 Controls

A. Microprocessor-Based Controls:

1. The unit shall have a microprocessor control system that provides digital control and visibility of the unit's operation and its systems.
2. The controller shall contain an internally networked control structure allowing detailed querying of all installed components, locally or over the internet.
3. The controller shall have the following features:
 - a. Alarm log
 - b. Run capacity display for cooling and heating
 - c. Clock and calendar with battery back-up, leap year, and daylight saving time
 - d. Service overrides and manual operation modes for all connected components
 - e. Hour meters for total run time
 - f. 7 day programmable occupancy and on/off time schedules
4. The controller shall be capable of being remotely operated via web browser or remote digital display.
 - a. Remote operation of the controller shall provide the same functionality as operating the physical controller.
 - b. Remote operation via a web browser will be facilitated through an Ethernet connection.
 - c. Alarm and operational data logs are viewable and downloadable via web browser operation.
5. The controller shall be capable of adjustable ambient lockout.
6. The controller shall be capable of being integrated into building management systems via BACnet (IP, MS/TP) or Modbus.
7. The controller shall utilize proportional-integral control to regulate gas fired heating, electric heating, and DX mechanical cooling output.
8. The controller shall have a backlit LCD screen and shall be menu driven. The screen commands and outputs shall be in plain English. Alphanumeric codes shall not be acceptable.
9. The controller shall have battery back-up protecting all user settings in the event of a power outage.
10. The controller shall function in ambient conditions from -4 to 140 °F (-20 to 60 °C) and 90% relative humidity (RH) non-condensing.

2.06 Refrigeration Package

A. Chilled Water Coil:

1. The unit shall include aluminum fin copper tube type chilled water coil where indicated on the plans.
2. The chilled water coils shall be certified per AHRI 410.
3. The chilled water coil shall be mounted in a rack over a stainless steel double sloped condensate pan.
4. [Optional] The chilled water coil shall include a piping vestibule.

B. DX Coil:

1. The unit shall include aluminum fin copper tube type DX coils where indicated on the plans.
2. The DX coils shall be mounted in a rack over a stainless steel double sloped condensate pan.
3. The coil shall contain a nitrogen holding charge to prevent atmospheric contamination.

C. Integral DX Cooling System:

1. The unit shall include an integral DX cooling system including evaporator coil, condensing section, and compressors where indicated on the plans.
2. The DX coil(s) shall:
 - a. Be of non-corrosive aluminum fin, non-corrosive aluminum frame, and copper tube construction.
 - b. Be mounted over a non-corrosive, non-cathodic, marine grade aluminum double sloped drain pan.
3. The unit shall include a controller with the capability of remote connectivity to a virtual network interface, and with remote diagnostic capabilities.
 - a. Temperature sensors shall be provided on all:
 - 1) Liquid line(s);
 - 2) Suction line(s);
 - 3) Compressor(s)
 - b. Sensors shall be provided for head and suction pressure.
 - c. The controller shall be capable of providing all normal refrigeration operating parameters without the connection of service manifolds or supplementary temperature measurement devices.
 - d. The manufacturers shall be capable of providing a cellular modem to service personnel when servicing units without connectivity.
4. The condensing section shall include:

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- a. A low noise, high efficiency condenser fan assembly.
 - b. Direct drive condensing fan motor(s) that are rated for 158°F/70°C operation.
5. The unit shall also include:
- a. Scroll compressors.
 - b. Filter driers.
 - c. Electronic expansion valves.
6. Unit shall be factory charged with refrigerant and include all necessary controls and safeties for standalone operation. Split units will be disassembled after testing.
7. The condenser coils shall be of non-corrosive aluminum fins, non-corrosive aluminum frame and copper tube construction with low fins per inch to reduce external coil contamination.
8. Each unit shall have heavy-duty scroll compressor(s).
- a. The compressors shall be isolated with resilient neoprene rubber isolators to decrease noise transmission.
 - b. Each compressor shall be supplied complete with:
 1. High and low pressure protection;
 2. Motor overload protection;
 3. [Optional] Crankcase heater
9. To maintain desired temperature control, the unit shall have standard:
- a. A minimum two stages of capacity control [when providing 8 to 12 tons of cooling capacity]
 - b. A minimum four stages of capacity control [when providing 14 or more tons of cooling capacity]
 - c. [Optional] Full variable capacity control [when providing 8 or more tons of cooling capacity]
10. Refrigeration capacity control shall be accomplished by (**select one**):
- a. Staging of the unit's multiple compressors;
 - b. Full modulation of the unit's digital scroll compressor(s) through (**select one**):
 - 1) Cascading control with one digital circuit combined with one or more fixed circuits.
 - 2) Parallel control with all circuits being digital.
11. All compressor capacity control staging shall be controlled by the factory installed main unit control system.
12. [Optional] The modulating hot gas reheat shall be provided complete with modulating valves, reheat coil and low dew point capabilities for dehumidification control.
13. [Optional] The unit will operate low ambient conditions, at temperatures down to 45°F/ 7.2°C.
14. [Optional] The unit can supply air with dew points down to 42°F/ 5.5°C
15. [Optional] The unit shall operate in outdoor ambient temperatures up to 105°F/ 40°C
16. [Optional] The unit shall have a hot gas bypass system for use in variable air volume applications. (**select all that apply**)
- a. The hot gas bypass control shall be factory installed on [a single] or [all] refrigerant circuit(s).
 - b. The hot gas bypass control shall include a modulating hot gas bypass control valve, all associated piping, and shall be automatically operated by the unit's control.
- D. Performance:
1. The unit shall meet or exceed scheduled performance
- E. Refrigerant:
1. The unit shall only use R-410A refrigerant.

2.07 Hydronic Package

- A. Chilled Water Coil:
1. The unit shall include aluminum fin, galvanized steel frame, and copper tube type chilled water coil(s) as indicated on the plans.
 2. The chilled water coil(s) shall be mounted over a stainless steel, double sloped condensate drain pan.
 3. The chilled water coil(s) shall be certified per AHRI 410.
 4. [Optional] A piping vestibule shall be included.
- B. Hot Water Coil:
1. The unit shall include aluminum fin, galvanized steel frame, and copper tube type hot water coil(s) as indicated on the plans.
 2. The hot water coil(s) shall be certified per AHRI 410.
 3. [Optional] The hot water coil(s) shall be mounted over a stainless steel, double sloped condensate drain pan.
 4. [Optional] A piping vestibule shall be included.

2.05 Furnace and Gas Train (Burners)

Drum and Tube Furnace

- A. Construction:
1. The heat exchanger shall be indirect fired type with a [three] or [four] pass drum and turbulator style tubes for increased heat transfer. The heat exchanger shall be 80% non condensing.
 2. Both primary and secondary heat exchangers shall be constructed of [409] or [304] stainless steel.
 3. The heat exchanger shall include condensate connections for a field installed trap.
 4. The gas burner shall be a modulating, blow-through type mounted outside of the airstream, and shall include:
 - a. Flame safe guard;
 - b. Timed pre-purge;
 - c. Flame sensing.
 5. The gas train shall include the following equipment:

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- a. Manual main shut off valve;
 - b. Main line appliance regulator;
 - c. Motorized electric main gas valve;
 - d. Modulating gas valve;
 - e. Manual pilot gas shut-off valve;
 - f. Manual pilot gas pressure regulator;
 - g. Pilot gas valve.
6. The gas unit controls shall include:
- a. Intermittent pilot ignition;
 - b. [Flame rod sensor] or [UV scanner] (**select one**);
 - c. High temperature limit;
 - d. Air proving sensor;
 - e. Modulating temperature control system.
 - f. Induced draft (ID) fan (optional on AW-I units only)
7. The unit shall include an observation port for inspecting the pilot and main flame.
8. The gas train shall include:
- a. Main manual shut off valve;
 - b. Main line appliance regulator;
 - c. Motorized electric main gas valve;
 - d. Modulating gas valve;
 - e. Manual pilot gas shut off valve;
 - f. Manual pilot gas pressure regulator;
 - g. Pilot gas valve, designed to operate to -40°F (-40°C).
9. [Optional] Burner profile dampers and actuators shall be provided for VAV operation.
- a. Dampers shall be controlled for [2-speed] or [continuous modulation] from 50 – 100 percent of design airflow.
 - b. The damper actuator shall have an end switch to prove position before the blower will start.
10. A regulator shall be required for initial gas pressure as specified in the plans and drawings.
11. The pilot shall be electrically ignited by spark rod through a high voltage ignition transformer.

CONVOLUTED TUBE FURNACE

A. Construction

1. The heat exchanger shall be 409 stainless steel construction, convoluted style tubes with in shot [80 percent non-condensing] or [90 percent condensing] efficient burners.
2. The heat exchanger shall be power vented with negative pressure with respect to the supply airstream.
3. The heat exchanger shall include condensate connections for a field installed trap.
4. The gas burner shall be a modulating type mounted outside of the airstream.
5. Units with multiple heat exchangers shall have on/off type for all subsequent (second, third, etc) heat exchangers.
6. Furnace controls shall include:
 - a. Spark ignition system with flam rod sensor;
 - b. Preset high temperature limit switch;
 - c. Air proving switch.
7. Ninety percent (90%) efficient burners shall include:
 - a. Factory provided condensate lines with heat trace from the burner to the pipe chase;
 - b. Heat trace, field wired to dedicated 120 volt circuit;
 - c. Field provided and installed condensate drains from the unit condensate drains into the conditioned building space;
 - d. Factory provided condensate neutralizer kits for field installation inside the conditioned building space.
8. The gas train shall include:
 - a. Main manual shut off valve;
 - b. Main line appliance regulator;
 - c. Motorized electric main gas valve;
 - d. Modulating gas valve;
 - e. Manual pilot gas shut off valve;
 - f. Manual pilot gas pressure regulator;
 - g. Pilot gas valve designed to operate to -40°F (-40°C).

PART 3 EXECUTION

3.01 Installation

- A. The energy recovery unit shall be installed in accordance with the manufacturer's installation instructions and all applicable building codes.

3.02 Environmental Requirements

- A. 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.

3.03 Maintenance

- A. Refer to Section 01 70 00 - Execution and Closeout Requirements for additional requirements relating to maintenance service.
- B. A separate maintenance contract shall be provided for specified maintenance service.