SECTION 236313 - AIR-COOLED REFRIGERANT CONDENSERS

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.

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:

Packaged air-cooled refrigerant condensers.

* + - 1. 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 air-cooled refrigerant condenser.

Include rated capacities, operating characteristics, furnished specialties, and accessories.

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

* + - * 1. Shop Drawings: For air-cooled refrigerant condensers.

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.

* + - 1. 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: Plans, or BIM model, drawn to scale, showing the items described in this Section, and coordinated with all building trades.

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: For air-cooled refrigerant condensers, 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.
      1. CLOSEOUT SUBMITTALS
         1. Operation and Maintenance Data: For air-cooled refrigerant condensers to include in emergency, operation, and maintenance manuals.
      2. COORDINATION
         1. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Section 033000 "Cast-in-Place Concrete."
         2. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Section 077200 "Roof Accessories."
         3. Coordinate location of refrigerant piping and electrical rough-ins.

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.

* + - 1. MANUFACTURERS

* + - * 1. [Manufacturers:](http://www.specagent.com/Lookup?ulid=3562) Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

[Carrier Global Corporation](http://www.specagent.com/Lookup?uid=123457152323).

[Heatcraft Refrigeration Products LLC](http://www.specagent.com/Lookup?uid=123457152319).

[Trane](http://www.specagent.com/Lookup?uid=123457152324).

[USA Coil & Air](http://www.specagent.com/Lookup?uid=123457152321).

[YORK; brand of Johnson Controls International plc, Building Solutions North America](http://www.specagent.com/Lookup?uid=123457152322).

Approved equivalent.

* + - * 1. Source Limitations: Obtain air-cooled refrigerant condensers from single source from single manufacturer.
      1. PERFORMANCE REQUIREMENTS
         1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.
         2. Fabricate and label refrigeration system according to ASHRAE 15 and ASHRAE 34.

"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. Insert a specific version of the standard if required to satisfy a Project sustainability requirement.

* + - * 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-cooled refrigerant condensers 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:

Heat-Rejection Capacity: <**Insert MBh**>.

Condensing Temperature:

Saturated Discharge Temperature: <**Insert deg F**>.

Saturated Suction Temperature: <**Insert deg F**>.

Subcooling Temperature: <**Insert deg F**>.

Ambient-Air Temperature: <**Insert deg F**>.

Refrigerant Pipe Connections:

Number of Connections: <**Insert number**>.

Liquid Pipe Size: <**Insert NPS**>.

Suction Pipe Size: <**Insert NPS**>.

Coils:

Arrangement: <**Insert description**>.

Number of Rows: <**Insert number**>.

In "Fin Spacing" subparagraph below, verify fin spacing with manufacturer. Not all manufacturers offer all fin spacing options listed.

Fin Spacing: [**8 fins/inch**] [**10 fins/inch**] [**12 fins/inch**] [**14 fins/inch**] [**16 fins/inch**] <**Insert value**>.

Total Face Area: <**Insert sq. ft.**>.

Fans:

Number of Condenser Fans: <**Insert number**>.

Diameter: <**Insert inches**>.

[**Constant**] [**Variable**]-speed.

RPM: <**Insert number**>.

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

Condenser Fan Motor Size: <**Insert number**> hp.

Electrical Characteristics:

Kilowatts: <**Insert number**>.

Volts: <**Insert number**>.

Phase: <**Insert number**>.

Hertz: <**Insert number**>.

Maximum Circuit Ampacity: <**Insert number**> A.

Maximum Instantaneous Current Flow during Startup: <**Insert number**>.

Maximum Overcurrent Protection: <**Insert number**> A.

* + - 1. PACKAGED AIR-COOLED REFRIGERANT CONDENSERS
         1. Description: Factory assembled and tested; consisting of casing, condenser coils, condenser fans and motors, and unit controls.

Verify specific refrigerant choices with manufacturers.

* + - * 1. Refrigerant: [**R-134A**] [**R-404A**] [**R-407C**] [**or**] [**R-410A**] <**Insert type**>.
        2. Condenser Coil: Factory tested at 425 psig.

Tube: [**1/2-inch- diameter seamless copper.**] [**3/8-inch- diameter seamless copper.**] [**5/8-inch- diameter seamless copper.**]

Coil Fin: [**Aluminum**] [**Copper**].

Default motor characteristics are specified in Section 230513 "Common Motor Requirements for HVAC Equipment.

Motors: Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 230513 "Common Motor Requirements for HVAC Equipment."

Retain "Enclosure Type" subparagraph below if enclosure is not open-dripproof type.

Enclosure Type: [**Totally enclosed, air-over (TEAO)**] [**Open, drip-proof (ODP)**].

Motor Sizes: Minimum size as indicated. If not indicated, large enough, so driven load will not require motor to operate in service factor range above 1.0.

Retain first subparagraph below to require enclosed switches to be supplied with unit.

Mount unit-mounted disconnect switches on [**exterior**] [**interior**] of unit.

If unique characteristics are required for motors in this Section, insert subparagraphs below.

<**Insert unique motor characteristics**>.

Retain first subparagraph below if corrosion-resistant coating is desired and is specified in Section 230546 "Coatings for HVAC." If retaining below, consult manufacturers to confirm that the coatings included in the referenced Section are available as a factory-applied coating.

Comply with Section 230546 "Coatings for HVAC" for corrosion-resistant coating. See Drawings for condensers requiring a corrosion-resistant coating.

Retain "Coating, Coils," "Coating, Fans," and "Coating, Casing" subparagraphs below if corrosion-resistant coating is desired and is specified in "Materials" Article in this Section.

Coating, Coils: [**None**] [**Corrosion resistant**].

Coating, Fans: [**None**] [**Corrosion resistant**].

Coating, Casing: [**None**] [**Corrosion resistant**].

Circuit: To match compressors[**with liquid subcooling coil**].

* + - * 1. Condenser Fans and Drives:

Retain one of first two subparagraphs below to specify fan type.

Directly driven propeller fans with [**aluminum or galvanized-steel**] [**galvanized-steel**] fan blades, for [**vertical**] [**horizontal**] air discharge; manufactured with permanently lubricated ball-bearing motors with integral current- and thermal-overload protection.

Forward-curved centrifugal fans for [**vertical**] [**horizontal**] air discharge.

Fan on steel shaft with self-aligning ball bearings.

V-belt drive with minimum of two belts; variable-pitch drive pulley.

Motor mounted on adjustable slide base.

Verify available motor types with manufacturer.

Fan Motors:

Weather-proof motors with rain shield and shaft slinger.

[**Totally enclosed air-over (TEAO)**] [**Open-drip proof (ODP)**].

Retain second option in subparagraph below when fans are controlled by variable-frequency drives (VFDs).

[**Constant**] [**Variable**] speed.

* + - * 1. Operating and Safety Controls: Include condenser fan motor thermal and overload cutouts; [**115-V**] [**24-V**] control transformer, if required; magnetic contactors for condenser fan motors and a nonfused factory-mounted and -wired disconnect switch for single external electrical power connection.

In "Fan Cycling Control" subparagraph below, retain head pressure sensor option for VFD-controlled motors.

Fan Cycling Control: [**Head pressure switches**] [**Head pressure sensors**] [**Ambient thermostats**].

* + - * 1. Casings: [**Galvanized-steel or zinc-coated-steel treated and finished with manufacturer's standard paint coating**] [**Aluminum**] <**Insert material**>, designed for outdoor installation with weather protection for components and controls, and with the following:

Removable panels for access to controls, condenser fans, motors, and drives.

Coating: [**None**] [**Corrosion resistant**].

[**Vinyl-coated**] [**Plated**] steel fan guards.

Lifting holes.

Retain one of four options in subparagraph below for leg height; 20 inches is standard. Verify availability with the manufacturer. Not all manufacturers offer removable legs. Removable legs facilitate easier shipping.

Removable legs, [**20 inches**] [**30 inches**] [**36 inches**] [**42 inches**] high.

* + - 1. MATERIALS
         1. Steel:

ASTM A36 for carbon structural steel.

ASTM A568 for steel sheet.

* + - * 1. Stainless Steel:

Manufacturer's standard grade for casing.

Manufacturer's standard type, ASTM A240 for bare steel exposed to airstream or moisture.

* + - * 1. Galvanized Steel: ASTM A653.
        2. Aluminum: ASTM B209.

Retain "Corrosion-Resistant Coating" paragraph below if retaining corrosion-resistant coating option in any paragraph above. subparagraph below will allow either a phenolic or an epoxy coating that meets the requirements below. Determine availability with manufacturers.

* + - * 1. Corrosion-Resistant Coating: Coat with a corrosion-resistant coating capable of withstanding a [**500**] <**Insert time**>-hour salt-spray test according to ASTM B117.

Standards:

ASTM B117 for salt spray.

ASTM D2794 for minimum impact resistance of 100 in-lb.

ASTM B3359 for cross hatch adhesion of 5B.

Application: [**Immersion**] [**Spray**].

Thickness: [**1 mil**] <**Insert value**>.

Gloss: Minimum gloss of 60 on a 60 degree meter.

1. EXECUTION
   * + 1. EXAMINATION
          1. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of air-cooled refrigerant condensers.
          2. Examine roughing-in for refrigerant piping systems to verify actual locations of piping connections before equipment installation.
          3. Examine walls, floors, and roofs for suitable conditions where air-cooled condensers will be installed.
          4. Proceed with installation only after unsatisfactory conditions have been corrected.
       2. INSTALLATION
          1. Install units level and plumb, firmly anchored in locations indicated; maintain manufacturer's recommended clearances.
          2. Equipment Mounting:

Retain first subparagraph below to require equipment to be installed on cast-in-place concrete equipment bases.

Install air-cooled condenser refrigerant condensers on cast-in-place concrete equipment bases. Comply with requirements for equipment bases and foundations specified in Section 033000 "Cast-in-Place Concrete."

Retain one of two subparagraphs below. Retain first for projects in seismic areas; retain second for projects not in seismic areas. Indicate vibration isolation and seismic-control device type and minimum deflection in supported equipment schedule on Drawings.

Comply with requirements for vibration isolation and seismic-control devices specified in Section 230548 "Vibration and Seismic Controls for HVAC."

Comply with requirements for vibration isolation devices specified in Section 230548.13 "Vibration Controls for HVAC."

* + - * 1. Maintain manufacturer's recommended clearances for service and maintenance.
        2. Loose Components: Install electrical components, devices, and accessories that are not factory mounted.
      1. PIPING CONNECTIONS

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

* + - * 1. Piping installation requirements are specified in Section 232300 "Refrigerant Piping." Drawings indicate general arrangement of piping, fittings, and specialties.
        2. Install piping adjacent to machine to allow service and maintenance.
        3. Refrigerant Piping: Where indicated on Drawings, connect piping to unit with pressure-relief, service valve, filter-dryer, and moisture indicator on each refrigerant-circuit liquid line.
        4. Apply labels to refrigerant lines in accordance with Section 230553, "Identification for HVAC Piping and Equipment."
      1. ELECTRICAL CONNECTIONS
         1. Install field power to each condenser unit electrical power connection.
         2. Connect wiring in accordance with Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
         3. Ground equipment in accordance with Section 260526 "Grounding and Bonding for Electrical Systems."
         4. Install electrical devices furnished by manufacturer, but not factory mounted, in accordance with NFPA 70 and NECA 1.
         5. 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**] <**Insert dimension**> high.

* + - 1. CONTROL CONNECTIONS
         1. Install control and electrical power wiring to field-mounted control devices.
         2. Connect control wiring in accordance with Section 260523 "Control-Voltage Electrical Power Cables."
         3. Install nameplate for each control connection, indicating field control panel designation and I/O control designation feeding connection.
      2. STARTUP SERVICE
         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 and perform the following:

Inspect for physical damage to unit casing.

Verify that access doors move freely and are weathertight.

Clean units and inspect for construction debris.

Verify that all bolts and screws are tight.

Adjust vibration isolation and flexible connections.

Verify that controls are connected and operational.

Retain first subparagraph below only for units with centrifugal fans.

Lubricate bearings on fan motors.

Verify that fan wheel is rotating in the correct direction and is not vibrating or binding.

Retain first subparagraph below for units with belt-driven condenser fans.

Adjust fan belts to proper alignment and tension.

Start unit according to manufacturer's written instructions and complete manufacturer's startup checklist.

Measure and record airflow and air-temperature rise over coils.

Verify proper operation of capacity control device.

Verify that vibration isolation and flexible connections properly dampen vibration transmission to structure.

Retain subparagraph below only for units with centrifugal fans.

After startup and performance test, lubricate bearings.

* + - 1. FIELD QUALITY CONTROL

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

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

Retain test requirements below with any combination of paragraphs above.

* + - * 1. Tests and Inspections:

Perform electrical test and visual and mechanical inspection.

Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.

Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation. Complete manufacturer's starting checklist.

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

Verify proper airflow over coils.

* + - * 1. Verify that vibration isolation and flexible connections properly dampen vibration transmission to structure.
        2. Air-cooled refrigerant condensers will be considered defective if they do not pass tests and inspections.
        3. Prepare test and inspection reports.
      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 air-cooled refrigerant condensers.

END OF SECTION 236313