SECTION 238123.18 - COMPUTER-ROOM, RACK-COOLING EQUIPMENT

Verify, with manufacturers, that the requirements for prerequisites and credits can be met. To achieve prerequisites and obtain credits, HVAC system design alternatives that do not include computer-room, rack-cooling equipment may be required.

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:

Central refrigeration units.

Horizontally mounted rack-cooling modules.

Overhead-mounted rack-cooling modules.

Rear-mounted rack-cooling modules.

Top-mounted rack-cooling modules.

Fan modules.

* + - 1. DEFINITIONS

Retain terms that remain after this Section has been edited for a project.

* + - * 1. COP: Coefficient of performance.
				2. EER: Energy efficiency ratio.
			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 type of product.

Include material descriptions, dimensions of individual components and profiles, and finishes for computer-room, rack-cooling equipment.

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

* + - * 1. Shop Drawings: For central refrigeration units and rack-cooling units.

Include plans, elevations, sections, and 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.

* + - * 1. Color Samples: For unit cabinets and discharge grille and for each color and texture specified.

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, elevations, and other details, drawn to scale, using input from other trades.

Retain "Seismic Qualification Certificates" 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 Certificates: For computer-room rack-cooling 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 computer-room, rack-cooling equipment to include in emergency, operation, and maintenance manuals.
			2. MAINTENANCE MATERIAL SUBMITTALS
				1. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

Fan: **[One] <Insert number>**.

Pump: **[One] <Insert number>**.

* + - 1. WARRANTY

When warranties are required, verify with Director’s Representative's 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 computer-room, rack-cooling equipment that fails in materials or workmanship within specified warranty period.

Verify available warranties and warranty periods for units and components.

Warranty Period for Compressors: Manufacturer's standard, but not less than **[five] [10] <Insert number>** years from date of Substantial Completion.

Warranty Period for Control Boards: Manufacturer's standard, but not less than **[three] <Insert number>** years from date of Substantial Completion.

1. PRODUCTS

Manufacturers and products listed in SpecAgent and Masterworks Paragraph Builder are neither recommended nor endorsed by the AIA or AVITRU. 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

* + - 1. MANUFACTURERS
				1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

APC by Schneider Electric.

Liebert; Vertiv Holdings Co.

Approved equivalent.

* + - 1. PERFORMANCE REQUIREMENTS

Retain "Seismic Performance" paragraph below with "Seismic Qualification Certificates" 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: Computer-room, rack-cooling equipment shall withstand the effects of earthquake motions determined according to **[ASCE/SEI 7] <Insert requirement>**.

Retain 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 when subjected to the seismic forces specified**[ and the unit will be fully operational after the seismic event]**."

* + - * 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. ASHRAE Compliance:

Fabricate and label refrigeration system to comply with ASHRAE 15, "Safety Standard for Refrigeration Systems."

"ASHRAE Compliance" subparagraph below may be required to comply with Project requirements or authorities having jurisdiction.

ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 4 - "Outdoor Air Quality," Section 5 - "Systems and Equipment," Section 6 - "Ventilation Rate Procedures," and Section 7 - "Construction and Startup."

"ASHRAE/IES Compliance" paragraph below may be required to comply with Project requirements or authorities having jurisdiction.

* + - * 1. ASHRAE/IES Compliance: Applicable requirements in ASHRAE/IES 90.1.
				2. ASME Compliance: Fabricate and label water-cooled condenser shell to comply with ASME Boiler and Pressure Vessel Code: Section VIII, "Pressure Vessels," Division 1.
			1. CENTRAL REFRIGERATION UNIT
				1. Description: Packaged, factory assembled, wired, and piped; consisting of cabinet, refrigeration system, heat exchanger, and controls.
				2. Cabinet and Frame: Powder-painted cabinet, hinged doors, and welded tubular steel frame.
				3. Pumps: **[One] [Two]**, factory piped and wired.
				4. Heat Exchanger: Brazed plate, Type 316 stainless-steel plates.

Retain "Chilled-Water Valve" paragraph below for a water-cooled unit.

* + - * 1. Chilled-Water Valve: Modulating, two-way valve, responding to room dew point temperature changes to optimize the supply water temperature to avoid condensation.
				2. Compressor: Scroll type with a suction gas-cooled motor, vibration isolators, thermal overloads, manual reset high-pressure switch, and pump down low-pressure switch.
				3. Control System:

Unit-mounted microprocessor panel interfacing with the unit controls consisting of contactors, control transformer with circuit breaker, solid-state temperature-**[ and humidity-]**control modules and start-stop switch, **[adjustable humidity set point, ]**and adjustable temperature set point.

Remote panel to monitor and change temperature and humidity set points and sensitivities of the unit and unit alarms.

If Project has more than one type or configuration of central refrigeration unit, delete "Capacities and Characteristics" paragraph below and schedule units on Drawings.

* + - * 1. Capacities and Characteristics:

Retain "Refrigeration System" or "Water-Cooled Heat Exchanger" subparagraph below.

Refrigeration System:

Unit Energy Efficiency: **[COP] [EER]**.

Refrigerant Compressor:

Total Unit Cooling Capacity: **<Insert Btu/h>**.

Sensible Unit Cooling Capacity: **<Insert Btu/h>**.

Number of Compressors: **[One] [Two] <Insert number>**.

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

Retain first subparagraph for units with a refrigeration package.

Refrigerant Heat Exchanger:

Cooling Capacity: **<Insert Btu/h>**.

Entering-Primary Refrigerant Temperature: **<Insert deg F>**.

Leaving-Primary Refrigerant Temperature: **<Insert deg F>**.

Entering-Secondary Refrigerant Temperature: **<Insert deg F>**.

Leaving-Secondary Refrigerant Temperature: **<Insert deg F>**.

Retain first subparagraph below for water-cooled units.

Water-Cooled Heat Exchanger:

Cooling Capacity: **<Insert Btu/h>**.

Primary Water Flow: **<Insert gpm>**.

Cooling Medium: **[Water] [Glycol solution]**.

Entering-Water Temperature: **<Insert deg F>**.

Leaving-Water Temperature: **<Insert deg F>**.

Fluid Pressure Drop: **<Insert feet of head>**.

Electrical Characteristics:

Volts: **[120] [208] [240] [277] [480] <Insert value>**.

Phase: **[Single] [Three]**.

Hertz: 60.

Full-Load Amperes: **<Insert value>**.

Minimum Circuit Ampacity: **<Insert value>**.

Maximum Overcurrent Protection: **<Insert amperage>**.

* + - 1. HORIZONTALLY MOUNTED RACK-COOLING MODULE
				1. Description: Packaged, factory assembled, prewired, and prepiped; consisting of cabinet cooling coil and controls.
				2. Cabinet and Frame: Powder-painted cabinet, hinged doors, and welded tubular steel frame.
				3. Cooling Coil: Aluminum microchannel with drip pan.
				4. Electrical Components:

Each module shall be equipped with two sets of two 10-foot power cords with automatic switching, primary and secondary, attached with IEC connectors to the rear of the unit.

Each cord shall have a NEMA 5-15P (IEC 320-C14) plug at the end.

CE-listed version of the unit shall have permanently attached power cords.

* + - * 1. Refrigerant Piping: ACR copper tubing with brazed joints. Factory-installed piping shall be leak tested and pressure tested prior to shipment from the factory. Factory-supplied pipe connections for field piping.
				2. Discharge Diffusers: Mounted on the unit front, discharging to one or both sides.
				3. Control System:

Factory-installed control boards and condensate detection for the drip pan.

Module with connection points (dry contacts) in the electrical box for connection of outgoing alarm cables for condensate detection, fan failure, and remote shutdown.

If Project has more than one type or configuration of horizontally mounted rack-cooling module, delete "Capacities and Characteristics" paragraph below and schedule modules on Drawings.

* + - * 1. Capacities and Characteristics:

Retain "Supply-Air Fan" subparagraph for cooling modules mounted above racks.

Supply-Air Fan:

Number of Fans: **[Six] <Insert number>** axial fans with finger guards.

Airflow: **<Insert cfm>**.

Minimum Static Pressure: **<Insert inches wg>**.

Refrigerant Heat Exchanger:

Cooling Capacity: **<Insert Btu/h>**.

Entering-Primary Refrigerant Temperature: **<Insert deg F>**.

Entering-Secondary Refrigerant Temperature: **<Insert deg F>**.

Leaving-Primary Refrigerant Temperature: **<Insert deg F>**.

Leaving-Secondary Refrigerant Temperature: **<Insert deg F>**.

Electrical Characteristics:

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

Volts: **[120] [208] [240] [277] [480] <Insert value>**.

Phase: **[Single] [Three]**.

Hertz: 60.

Full-Load Amperes: **<Insert value>**.

Minimum Circuit Ampacity: **<Insert value>**.

Maximum Overcurrent Protection: **<Insert amperage>**.

* + - 1. OVERHEAD-MOUNTED RACK-COOLING MODULE
				1. Description: Packaged, factory assembled, prewired, and prepiped; consisting of cabinet cooling coil and controls.
				2. Cabinet and Frame: Powder-painted cabinet, hinged doors, and welded tubular steel frame.
				3. Cooling Coil: Aluminum microchannel with drip pan.
				4. Electrical Components:

20-A, 120-V ac receptacle.

Lighting fixture mounting capable.

* + - * 1. Refrigerant Piping: ACR copper tubing with brazed joints. Factory-installed piping shall be leak tested and pressure tested prior to shipment from the factory. Factory-supplied pipe connections for field piping.

If Project has more than one type or configuration of overhead-mounted rack-cooling module, delete "Capacities and Characteristics" paragraph below and schedule modules on Drawings.

* + - * 1. Capacities and Characteristics:

Retain "Supply-Air Fan" subparagraph for cooling modules mounted above racks.

Supply-Air Fan:

Number of Fans: **[Six] <Insert number>** axial fans with finger guards.

Airflow: **<Insert cfm>**.

Minimum Static Pressure: **<Insert inches wg>**.

Refrigerant Heat Exchanger:

Cooling Capacity: **<Insert Btu/h>**.

Entering-Primary Refrigerant Temperature: **<Insert deg F>**.

Entering-Secondary Refrigerant Temperature: **<Insert deg F>**.

Leaving-Primary Refrigerant Temperature: **<Insert deg F>**.

Leaving-Secondary Refrigerant Temperature: **<Insert deg F>**.

Electrical Characteristics:

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

Volts: **[120] [208] [240] [277] [480] <Insert value>**.

Phase: **[Single] [Three]**.

Hertz: 60.

Full-Load Amperes: **<Insert value>**.

Minimum Circuit Ampacity: **<Insert value>**.

Maximum Overcurrent Protection: **<Insert amperage>**.

* + - 1. REAR-MOUNTED RACK-COOLING MODULE
				1. Description: Packaged, factory assembled, prewired, consisting of cabinet, refrigeration coils and controls.
				2. Cabinet and Frame: Powder-painted cabinet, hinged doors, and welded tubular steel frame with self-locking door latch.
				3. Cooling Coils: Two aluminum microchannels with drip pan.
				4. Dual power cords with 20-A, 120-V ac receptacle.
				5. Refrigerant Piping: ACR copper tubing with brazed joints. Factory-installed piping shall be leak tested and pressure tested prior to shipment from the factory. Factory-supplied pipe connections for field piping.
				6. Rack Mounting Kit: Black painted steel.

If Project has more than one type or configuration of rear-mounted rack-cooling module, delete "Capacities and Characteristics" paragraph below and schedule modules on Drawings.

* + - * 1. Capacities and Characteristics:

Retain "Supply-Air Fan" subparagraph for cooling modules mounted above racks.

Supply-Air Fan:

Number of Fans: **[Six] <Insert number>** axial fans with finger guards.

Airflow: **<Insert cfm>**.

Minimum Static Pressure: **<Insert inches wg>**.

Refrigerant Heat Exchanger:

Cooling Capacity: **<Insert Btu/h>**.

Entering-Primary Refrigerant Temperature: **<Insert deg F>**.

Entering-Secondary Refrigerant Temperature: **<Insert deg F>**.

Leaving-Primary Refrigerant Temperature: **<Insert deg F>**.

Leaving-Secondary Refrigerant Temperature: **<Insert deg F>**.

Electrical Characteristics:

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

Volts: **[120] [208] [240] [277] [480] <Insert value>**.

Phase: **[Single] [Three]**.

Hertz: 60.

Full-Load Amperes: **<Insert value>**.

Minimum Circuit Ampacity: **<Insert value>**.

Maximum Overcurrent Protection: **<Insert amperage>**.

* + - 1. TOP-MOUNTED RACK-COOLING MODULE
				1. Description: Packaged, factory assembled, prewired, and prepiped; consisting of cabinet cooling coil and controls.
				2. Cabinet and Frame: Powder-painted cabinet, hinged doors, and welded tubular steel frame.
				3. Cooling Coil: Aluminum microchannel with drip pan.
				4. Electrical Components:

Each module shall be equipped with two sets of two 10-foot power cords with automatic switching, primary and secondary, attached with IEC connectors to the rear of the unit.

Each cord shall have a NEMA 5-15P (IEC 320-C14) plug at the end.

CE-listed version of the unit shall have permanently attached power cords.

* + - * 1. Refrigerant Piping: ACR copper tubing with brazed joints. Factory-installed piping shall be leak tested and pressure tested prior to shipment from the factory. Factory-supplied pipe connections for field piping.
				2. Discharge Diffusers: Mounted on the unit front, discharging to one or both sides.

If Project has more than one type or configuration of top-mounted rack-cooling module, delete "Capacities and Characteristics" paragraph below and schedule modules on Drawings.

* + - * 1. Capacities and Characteristics:

Retain "Supply-Air Fan" subparagraph for cooling modules mounted above racks.

Supply-Air Fan:

Number of Fans: **[Six] <Insert number>** axial fans with finger guards.

Airflow: **<Insert cfm>**.

Minimum Static Pressure: **<Insert inches wg>**.

Refrigerant Heat Exchanger:

Cooling Capacity: **<Insert Btu/h>**.

Entering-Primary Refrigerant Temperature: **<Insert deg F>**.

Entering-Secondary Refrigerant Temperature: **<Insert deg F>**.

Leaving-Primary Refrigerant Temperature: **<Insert deg F>**.

Leaving-Secondary Refrigerant Temperature: **<Insert deg F>**.

Electrical Characteristics:

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

Volts: **[120] [208] [240] [277] [480] <Insert value>**.

Phase: **[Single] [Three]**.

Hertz: 60.

Full-Load Amperes: **<Insert value>**.

Minimum Circuit Ampacity: **<Insert value>**.

Maximum Overcurrent Protection: **<Insert amperage>**.

* + - 1. FAN MODULE
				1. Description: Packaged, factory assembled, prewired, consisting of cabinet, fans and controls.
				2. Cabinet and Frame: Powder-painted cabinet, hinged doors, and welded tubular steel frame.
				3. Dual power cords with 20-A, 120-V ac receptacle.

If Project has more than one type or configuration of fan module, delete "Capacities and Characteristics" paragraph below and schedule modules on Drawings.

* + - * 1. Capacities and Characteristics:

Retain "Supply-Air Fan" subparagraph for cooling modules mounted above racks.

Supply-Air Fan:

Number of Fans: **[Six] <Insert number>** axial fans with finger guards.

Airflow: **<Insert cfm>**.

Minimum Static Pressure: **<Insert inches wg>**.

Electrical Characteristics:

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

Volts: **[120] [208] [240] [277] [480] <Insert value>**.

Phase: **[Single] [Three]**.

Hertz: 60.

Full-Load Amperes: **<Insert value>**.

Minimum Circuit Ampacity: **<Insert value>**.

Maximum Overcurrent Protection: **<Insert amperage>**.

* + - 1. REFRIGERANT
				1. Refrigerant Type: **[R-134A] <Insert type>**.
			2. MOTORS

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

* + - * 1. Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors specified in Section 230513 "Common Motor Requirements for HVAC Equipment."

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

Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in electrical Sections.

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

**<Insert unique motor characteristics>**.

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 the Work.
				2. Examine roughing-in for refrigeration piping systems to verify actual locations of piping connections before equipment installation.
				3. Examine walls, floors, and roofs for suitable conditions where units will be installed.
				4. Proceed with installation only after unsatisfactory conditions have been corrected.
			2. INSTALLATION
				1. Layout and install computer-room rack-cooling equipment and suspension system coordinated with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.
				2. Install computer-room, rack-cooling equipment level and plumb, maintaining manufacturer's recommended clearances.**[ Install according to AHRI Guideline B.]**

Coordinate with Drawings and Sections specifying vibration and seismic controls. Retain or insert amount of required deflection.

* + - * 1. Suspended Units: Install using continuous-thread hanger rods and **[elastomeric hangers] [spring hangers] [spring hangers with vertical-limit stop]** of size required to support weight of computer-room, rack-cooling equipment.

Comply with requirements for vibration isolation devices specified in **[Section 230548 "Vibration and Seismic Controls for HVAC."] [Section 230548.13 "Vibration Controls for HVAC."]** Fabricate brackets or supports as required.

Comply with requirements for hangers and supports specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."

* + - 1. 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. Piping installation requirements are specified in other heating, ventilating, and air-conditioning Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
				2. Where installing piping adjacent to computer-room rack-cooling equipment, allow space for service and maintenance.
				3. Refrigerant Piping: Comply with applicable requirements in Section 232300 "Refrigerant Piping." Provide shutoff valves and piping.
			1. FIELD QUALITY CONTROL

Retain "Testing Agency," "Manufacturer's Field Service," and "Perform the following tests and inspections" paragraphs below to identify who shall perform tests and inspections. If retaining second option in "Testing Agency" paragraph or if retaining "Manufacturer's Field Service" or "Perform the following tests and inspections" paragraph, retain "Field quality-control reports" paragraph in "Informational Submittals" Article.

Retain "Manufacturer's Field Service" paragraph below to require a factory-authorized service representative 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.

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

Inspect for and remove shipping bolts, blocks, and tie-down straps.

After installing computer-room rack-cooling equipment and after electrical circuitry has been energized, test for compliance with requirements.

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

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

* + - * 1. Computer-room, rack-cooling equipment will be considered defective if it does not pass tests and inspections.
				2. Prepare test and inspection reports.
			1. ADJUSTING
				1. Adjust initial temperature**[ and humidity]** set points.
				2. Set field-adjustable switches and circuit-breaker trip ranges as indicated.
				3. Occupancy Adjustments: When requested within **[12] <Insert number>** months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to **[two] <Insert number>** visits to Project during other-than-normal occupancy hours for this purpose.
			2. DEMONSTRATION
				1. **[Engage a Company Field Advisor per OGS Spec Section 014216to train] [Train]** Director’s Representative 's Facility’s maintenance personnel to adjust, operate, and maintain computer-room, rack-cooling equipment.

END OF SECTION 238123.18