SECTION 23 6200

PACKAGED COMPRESSOR AND CONDENSER UNITS

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LANL MASTER SPECIFICATION SECTION

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| --- |
| Rev. 2 Summary of changes Updated manufacturer names. Updated available refrigerant types. Inserted notes to use variable speed compressors if available. Minor editorial updates. |

Word file at <https://engstandards.lanl.gov>

This template must be edited for each project.  In doing so, specifier must add job-specific requirements. Brackets are sometimes used in the text to indicate designer choices or locations where text must be supplied by the designer. Once the choice is made or text supplied, remove the brackets. The specification section must also be edited to delete items for processes, items, or designs that are not included in the project -- and specifier’s notes such as these.  This template is tailored to meet requirements contained in the LANL Engineering Standards Manual (ESM). To seek a variance from requirements of this section that are applicable, contact the ESM Mechanical[POC](http://engstandards.lanl.gov/POCs.shtml#mech). Please contact the POC with suggestions for improvement as well.

When assembling a specification package, include applicable specification sections from all Divisions, especially Division 1, General Requirements.

This template was developed for ML-4 projects. For ML-1, 2, and 3 applications, additional requirements and independent reviews should be added if increased confidence in procurement or execution is desired; see ESM Chapter 1 Section Z10 Specifications and Quality sections.

This template was developed to meet the requirements for ASHRAE 15-2022 & ASHRAE 90.1-2019 and ASME B31.5-2022. The designer is responsible to update the template if the editions for the specific project differ from the above.

Seismic: If all units are not exempt from seismic design per ASCE 7 paragraph 13.1.4 then, prior to attempting to edit this section to be project-specific, refer to Sections 22 0548.23, *Vibration and Seismic Controls for Mechanical Systems*, and 01 8734, *Seismic Qualification of Nonstructural Components (IBC)*, as applicable. To edit this section for job-specific seismic requirements, refer to author notes that begin with “Seismic.” Also, see the Seismic Specification Guide for Mechanical Non-Structural Components webposted with the LANL Master Specifications [here](https://engstandards.lanl.gov/seismic-editing.shtml) for guidance on properly editing this section.

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1. GENERAL
	* + 1. SUMMARY
				1. Section includes air-cooled, packaged refrigerant compressor and condenser units, suitable for [on-the-ground] [or] [rooftop] installation.
			2. PERFORMANCE REQUIREMENTS
2. Compressor, condenser units, and associated motors shall perform satisfactorily in the following service conditions:
	* + 1. Elevation: 7500 feet above sea level.
			2. Maximum ambient temperature: 104 degrees Fahrenheit.
			3. Minimum ambient temperature: Minus 20 degrees Fahrenheit.
			4. 24-hour average temperature: not exceeding 86 degrees Fahrenheit.
			5. Maximum solar heat gain: 110 W/sq ft.
3. Supplier-provided control systems, including instruments, signal transmissions, panels, cabinets, and other instrumentation and control (I&C) requirements shall be coordinated with the I&C Subcontractor and in accordance with Section 25 5000, *Integrated Automated Facility Controls*. Some equipment controls are specified in other portions of the subcontract documents. As part of the work of this section, coordinate with these other suppliers and trades to provide complete and working equipment controls.
4. It is the responsibility of the subcontractor to read and conform to all specification sections, review all drawings, and coordinate with all equipment suppliers under other specification sections.

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Seismic: Delete paragraph below if units are exempt from seismic design. However, if paragraph applies:

* Edit it in accordance with content of 22 0548.23 and/or 01 8734
* The electrical drawings for the controller shall also state that the controller is a Designated Seismic System

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1. Seismic Performance Requirements: The unit(s) shall remain in place without separation of any parts when subjected to the design basis earthquake [per Section 01 8734, *Seismic Qualification of Nonstructural Components (IBC)*] [as represented by the seismic forces derived from the criteria indicated [on the Drawings] [in Section 22 0548.23, *Vibration and Seismic Controls for Mechanical Systems]].*

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Seismic: If the condensing units are exempt from seismic design, then delete both 01 8734 and 22 0548.23. Otherwise, see the seismic portion of the previous author note.

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* + - 1. RELATED SECTIONS
				1. Section 01 2500, *Substitution Procedures*
				2. [Section 01 8734, *Seismic Qualification of Nonstructural Components (IBC)*, for requirements.]
				3. [Section 01 8113.13 *Sustainable Design* [LEED v4]: Requirements for water efficiency, energy efficiency, material composition, and indoor air quality requirements]
				4. [Section 22 0548.23, *Vibration and Seismic Controls for Mechanical Systems,* for [seismic-design criteria,] submittal requirements, devices for seismic restraint, and installation requirements for these devices.]
				5. Section 22 0554, *Identification for Plumbing, HVAC, and Fire Piping and Equipment*
				6. Section 22 0813, *Testing Piping Systems*
				7. Section 23 2300, *Refrigerant Piping*
				8. Section 25 5000, *Integrated Automated Facility Controls*
			2. REFERENCES
				1. Air-Conditioning, Heating and Refrigeration Institute (AHRI)
			3. AHRI 210/240 – *Performance Rating of Unitary Air-Conditioning and Air-Source Heat Pump Equipment.*
			4. AHRI 270 – *Sound Performance Rating of Outdoor Unitary Equipment.*
			5. AHRI 340/360 – *Performance Rating of Commercial and Industrial Unitary Air-Conditioning and Heat Pump Equipment.*
			6. AHRI 365 – Performance Rating of *Commercial and Industrial Unitary Air-Conditioning Condensing Units.*
			7. AHRI 370 – *Sound Performance Rating of Large Air-Cooled Outdoor Refrigerating and Air-Conditioning Equipment.*
			8. AHRI 460 – *Performance Rating of Remote Mechanical-Draft Air-Cooled Refrigerant Condensers.*
				1. American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE)
1. ASHRAE 15 – *Safety Standard for Refrigeration Systems.*
2. ASHRAE 20 – *Method of Laboratory Testing Remote Mechanical-Draft Air-Cooled Refrigerant Condensers.*
3. ASHRAE 23 – *Methods of Performance Testing Positive Displacement Refrigerant Compressors and Compressor Units.*
4. ASHRAE 90.1 – *Energy Standard for Buildings Except Low-Rise Residential Buildings.*
	* + - 1. American Society of Mechanical Engineers (ASME)
5. ASME B31.5 – *Refrigeration Piping and Heat Transfer Components*
	* + - 1. ASTM International

ASTM B117 – *Standard Practice for Operating Salt Spray (Fog) Apparatus*

* + - * 1. National Electrical Manufacturers Association (NEMA)

NEMA 250 – *Enclosures for Electrical Equipment (1000 Volts Maximum).*

* + - * 1. National Fire Protection Association (NFPA)

NFPA 70 – *National Electric Code.*

* + - * 1. Underwriters Laboratories Inc. (UL)

UL 207 – *Refrigerant-Containing Components and Accessories, Nonelectrical.*

UL 1995 – *Heating and Cooling Equipment*.

* + - 1. ACTION SUBMITTALS
				1. Product Data: For each compressor and condenser unit.

Include manufacturer’s technical data.

Include rated capacities, dimensions, required clearances, characteristics, and furnished specialties and accessories.

Include energy efficiency ratings that meet ASHRAE 90.1 [FEMP designated product requirements] [Energy Star].

* + - * 1. Sustainable Design Submittals:

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Additional submittals may be required if the project is seeking LEED certification. Consult with the project’s LEED Accredited Professional.

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* + - * 1. Shop Drawings: For compressor and condenser units. Include plans, elevations, sections, details, and attachments to other work.

Retain subparagraph below if equipment includes wiring.

Wiring Diagrams: For power, signal, and control wiring.

Paragraph below is defined in Section 01 3300 "Submittal Procedures" as a "delegated-design submittal." Retain if Work of this Section is required to withstand specific design loads and design responsibilities have been delegated to Subcontractor or if structural data are required as another way to verify compliance with performance requirements. Professional engineer qualifications are specified in Section 01 4000 "Quality Requirements."

* + - 1. INFORMATIONAL SUBMITTALS

Retain first paragraph below if Drawings do not include detailed plans or if Project involves unusual coordination requirements.

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

Structural members to which compressor and condenser units will be attached.

Liquid and vapor pipe sizes.

Refrigerant specialties.

Piping including connections, oil traps, and double risers.

Compressors.

Evaporators.

Retain first paragraph below if required by seismic criteria applicable to Project. Coordinate with Section 23 0548.23 "Vibration and Seismic Controls for Mechanical Systems." See ASCE/SEI 7 for certification requirements for equipment and components.

* + - * 1. Field quality-control reports.
				2. At Closeout:

Operation and Maintenance Data: For compressor and condenser units to include, operation, and maintenance manuals.

Refrigeration Appliance Inventory Form: Complete form as required by LANL (e.g., procedure EPC-CP-QP-0311).

Warranty: Sample of special warranty.

* + - 1. QUALITY ASSURANCE
				1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, and any nationally recognized testing laboratory (NRTL), and marked for intended location and application.
				2. Fabricate and label refrigeration system according to Section 22 0554, *Identification for Plumbing, HVAC, and Fire Piping and Equipment.*
				3. Performance Ratings: Seasonal Energy Efficiency Ratio (SEER) not less than prescribed by ASHRAE 90.1 [FEMP designated product requirements] [Energy Star].
			2. WARRANTY
				1. The equipment manufacturer shall provide, at no additional cost, a standard parts warranty in which manufacturer agrees to repair or replace components of compressor and condenser units that fail in materials or workmanship within the warranty period.

Failures include, but are not limited to, compressor failures and condenser coil leaks.

1. PRODUCTS

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For condensing units that are not exempt from seismic, if project specification package includes 22 0548.23, and if mounting and/or anchorage devices are to be used that differ from those specified in 22 0548.23, they must be described herein (in PART 2).

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* + - 1. PRODUCT OPTIONS AND SUBSTITUTIONS
				1. Alternate products may be accepted; follow Section 01 2500, *Substitution Procedures.*
				2. Manufacturer must clearly define any exceptions made to drawings or specification sections. Any deviations in layout or arrangement shall be submitted to LANL Engineering Services prior to bid date. Acceptance of deviation(s) from specification sections shall be in the form of written approval from LANL Engineering Services. Vendor is responsible for expenses that occur due to exceptions made.
			2. COMPRESSOR AND CONDENSER UNITS, AIR-COOLED (1 TO 5 TONS)
				1. Manufacturers:

Daikin Manufacturing

Trane Technologies

* + - * 1. Description: Packaged, factory assembled and tested, suitable for outdoor use; consisting of casing, compressors, condenser coils, condenser fans and motors, and unit controls.
				2. Unit Casing: Galvanized steel finished with baked enamel; with removable panels for access to controls, weep holes for water drainage, and mounting holes in base. Mount service valves, fittings, and gage ports on exterior of casing. Meet salt spray test in accordance with ASTM B117.

Nonfused disconnect switch, factory mounted and wired, for single external electrical power connection.

* + - * 1. Compressor: Scroll, hermetically sealed, with rubber vibration isolators.

Motor: [Single] [Two] speed, and includes thermal- and current-sensitive overload devices, start capacitor, relay, and contactor.

Two-Speed Compressor: Include manual-reset, high-pressure switch and automatic-reset, low-pressure switch.

* + - * 1. Refrigerant: [R-410A] [R-407C] [R-32] [R-454B] [ ].
				2. Condenser Coil: Seamless copper-tube, aluminum-fin coil; circuited for integral liquid subcooler, with removable drain pan and brass service valves with service ports.
				3. Condenser Fan: Direct-drive, aluminum propeller fan; with permanently lubricated ball bearings, totally enclosed fan cooled motor with thermal-overload protection.
				4. Accessories:

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Select one or more of the following subparagraphs appropriate to equipment requirements.

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Cycle Protector: Automatic-reset timer to prevent rapid compressor cycling.

Electronic programmable thermostat to control compressor and condenser unit and evaporator fan.

Evaporator Freeze Thermostat: Temperature-actuated switch that stops unit when evaporator reaches freezing temperature.

Crankcase heater.

Filter-dryer.

High-Pressure Switch: Automatic-reset switch cycles compressor off on high refrigerant pressure.

Liquid-line solenoid.

Low-Ambient Controller: Cycles condenser fan to permit operation down to 0 degrees Fahrenheit ambient temperature.

Low-Pressure Switch: Automatic-reset switch cycles compressor off on low refrigerant pressure.

Precharged and insulated suction and liquid tubing.

Sound Hood: Wraps around sound attenuation cover for compressor.

Thermostatic expansion valve.

Time-Delay Relay: Continues operation of evaporator fan after compressor shuts off.

Condenser coil hail guard.

* + - 1. COMPRESSOR AND CONDENSER UNITS, AIR-COOLED (6 TO 120 TONS)
				1. Manufacturers

Daikin Manufacturing

Trane Technologies.

* + - * 1. Product Description: Packaged, factory assembled and tested, suitable for outdoor use; consisting of casing, compressors, condenser coils, condenser fans and motors, and unit controls.
				2. Unit Casings: Steel, galvanized or zinc coated, for exposed casing surfaces; treated and finished with manufacturer's standard paint coating. Provide removable panels for access to compressors, controls, condenser fans, motors, and drives. Meet salt spray test in accordance with ASTM B117. Additional features include the following:

Perimeter base rail with forklift slots and lifting holes to facilitate rigging.

Gasketed control panel door.

Nonfused disconnect switch, factory mounted and wired, for single external electrical power connection.

Condenser coil hail guard.

* + - * 1. Compressor: Hermetic scroll compressor [Hermetic or semi-hermetic rotary screw compressor] designed for service with crankcase sight glass, crankcase heater, and backseating service access valves on suction and discharge ports.

Capacity Control: [On-off compressor cycling] [Variable-frequency controller] [Modulating slide-valve assembly or port unloaders].

Use variable speed compressor when available

* + - * 1. Refrigerant: [R-410A] [R-134A] [R-407C] [R-32] [R-454B].
				2. Condenser Coil: Seamless copper-tube, aluminum-fin coil, including subcooling circuit and backseating liquid-line service access valve. Factory pressure test condenser coils and dehydrate by drawing a vacuum and fill with a holding charge of nitrogen or refrigerant.
				3. Condenser Fan: Propeller-type vertical discharge; either directly or belt driven. Dynamically and statically balanced fan assemblies. Permanently lubricated, ball-bearing totally enclosed fan cooled motors.
				4. Accessories:

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Select one or more of the following subparagraphs appropriate to equipment requirements.

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Electronic programmable thermostat to control compressor and condenser unit and evaporator fan.

Low-Ambient Controller: Cycles condenser fan to permit operation down to 0 degrees Fahrenheit ambient temperature.

Gage Panel: Package with refrigerant circuit suction and discharge gages.

Part-winding-start timing relay, circuit breakers, and contactors.

* + - * 1. Operating and safety controls include the following:

Manual-reset, high-pressure cutout switches.

Automatic-reset, low-pressure cutout switches.

Low-oil-pressure cutout switch.

Compressor-winding thermostat cutout switch.

Three-leg, compressor-overload protection.

Control transformer.

Magnetic contactors for compressor and condenser fan motors.

Timer to prevent excessive compressor cycling.

* + - 1. CONTROLS
				1. Factory wired and mounted control panel, NEMA 250 Type [1] [4] [ ] enclosure, containing fan motor starters, compressor interlock and control transformer [fan cycling thermostats,] [head pressure controls].
				2. See Article *Performance Requirements* for Control Requirements.
				3. Refer to Section 25 5000, *Integrated Automated Facility Controls*. All necessary controls shall be factory installed and wired.
				4. Evaporator defrost control shall be included to prevent compressor slugging by temporarily interrupting compressor operation when low evaporator coil temperatures are encountered.
			2. SOURCE QUALITY CONTROL
				1. Testing Requirements: Factory test sound-power-level ratings according to [AHRI 270] [AHRI 370].

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480 psig referenced in paragraph below is based on R-410A design pressures; see ASME B31.5 538.3 Factory Testing of Refrigerant Piping.

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* + - * 1. Manufacturer to pressure test all coils at a minimum of 110% design pressure not to exceed 130% of design pressure. Minimum test pressure is 480 psig for R410A system. See Section 23 2300, *Refrigerant Piping,* for pressures for other refrigerants.

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Retain "Energy Efficiency" Paragraph below for compliance with ASHRAE 90.1. LEED Prerequisite EA 2 requires compliance with ASHRAE 90.1.

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* + - * 1. Energy Efficiency: Equal to or greater than prescribed by ASHRAE 90.1, [FEMP designated product requirements] [Energy Star].
1. EXECUTION

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For condensing units that are not exempt from seismic, if project specification package includes 22 0548.23, and if requirements associated with installation, testing, and inspection of mounting and/or anchorage devices differ from those requirements in 22 0548.23, they must be described herein (in PART 3). Also, if this is applicable, identify special types of seismic-control devices required for each application using the same terminology used for those devices in PART 2.

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* + - 1. EXAMINATION
				1. Examine rough-in for refrigerant piping systems to verify actual locations of piping connections before equipment installation.
				2. Examine condition of locations where the packaged compressor and condenser unit will be installed.
				3. Proceed with installation only after unsatisfactory conditions have been corrected.
			2. INSTALLATION
				1. Comply with ASHRAE 15 procedures for charging and purging of systems and for disposal of refrigerant.
				2. [Comply with requirements for vibration isolation and seismic control devices specified in Section 22 0548.23, *Vibration and Seismic Controls for Mechanical Systems.*]
				3. Install packaged units level and plumb, firmly anchored in locations indicated; and maintain manufacturer's recommended clearances for service and maintenance.

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Retain paragraph below for compressor and condenser units mounted on concrete base/housekeeping pad.

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* + - * 1. Concrete Bases:

For equipment supported on concrete pad, install anchor bolts according to anchor-bolt manufacturer's written instructions.

Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

Install anchor bolts to elevations required for proper attachment to supported equipment.

* + - 1. CONNECTIONS
				1. Install refrigerant piping and refrigerant specialties (pressure relief, service valve, filter-dryer, and moisture indicator on each refrigerant-circuit liquid line) in accordance with Section 23 2300, *Refrigerant Piping*.
				2. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.
				3. Connect precharged refrigerant tubing to unit's quick-connect fittings. Install tubing so it does not interfere with access to unit. Install furnished accessories.
				4. Install electrical components, devices, and accessories and connection to electrical power wiring that are not factory mounted.
			2. FIELD QUALITY CONTROL
				1. Perform field tests and inspections and prepare test reports.
				2. Tests and Inspections:

Perform each visual and mechanical inspection and electrical test. Certify compliance with test parameters.

Leak Test: Provide leak test and pressure testing per Section 22 0813, *Testing Piping Systems*.

Operational Test: After electrical circuitry has been energized, start units to confirm proper motor operation and unit operation, product capability, and compliance with requirements.

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.
			1. STARTUP SERVICE
				1. 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.

* + - 1. Verify that controls are connected and operational.
		1. Lubricate bearings on fans.
		2. Verify that fan wheel is rotating in the correct direction and is not vibrating or binding.
		3. Start unit according to manufacturer's written instructions and complete manufacturer's startup checklist.
		4. Measure and record airflow over coils.
		5. Verify proper operation of capacity control device.
		6. Verify that vibration isolation and flexible connections properly dampen vibration transmission to structure.
		7. After startup and performance test, lubricate bearings.
			1. SCHEDULE
				1. See the equipment schedule on the drawings.

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As a minimum, the following information and performance characteristics shall be shown on the drawings as part of the equipment schedule.

* + - * 1. Capacities and Characteristics:

Compressor and Condenser Unit:

Full-Load Cooling Capacity, MBH

Compressor Suction Temperature, degrees Fahrenheit

Capacity Steps

Seasonal Energy-Efficiency Ratio (SEER)

Refrigerant Connections:

Liquid Pipe Size

Suction Pipe Size

Compressors:

Number of Compressors

Rated-Load Amperes

Power Input, kW

Air-Cooled Condenser:

Ambient-Air Temperature, degrees Fahrenheit

Airflow, cfm

Number of Condenser Fans

Condenser Fan Motor Size, HP

Electrical Characteristics:

Kilowatt Input

Volts, single or three phase, 60 Hz.

Maximum Circuit Amperes

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END OF SECTION

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Do not delete the following reference information.

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THE FOLLOWING STATEMENT IS FOR LANL USE ONLY

This project specification section is based on LANL Master Specification Section 23 6200 Rev. 2, dated July 24, 2024.