

Addendum No. 02

TO: PLANS AND SPECIFICATIONS FOR:

**Replace HVAC System, Waggoner Building
General Headquarters Complex
Jefferson City, MO
PROJECT NO. R2411-01**

Bid Opening Date: 1:30 PM, Tuesday, September 29, 2026 (Not Changed)

Bidders are hereby informed that the construction plans and/or specifications are modified as follows:

SPECIFICATION CHANGES:

1. Section 237416.11 Packaged, Small-Capacity, Rooftop Air-Conditioning Units

ADD: Entire section, see attachment

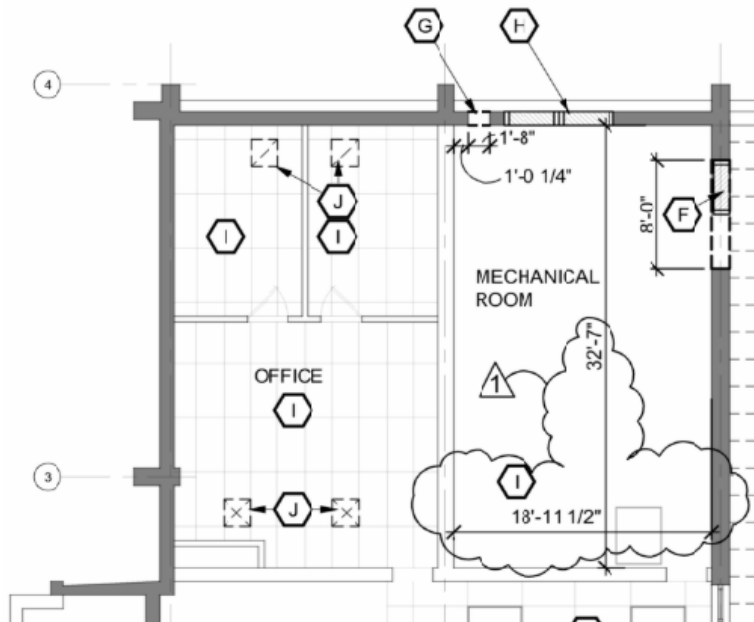
- ## 2. Section 230593 Testing, Adjusting, and Balancing for HVAC

ADD: 1.4-A Quality Assurance: Add AABC as a certified qualification.

DRAWING CHANGES:

1. A-701 – DEMO AND NEW RCP AT WAGGONER BLDG. – 1ST FLOOR

ADD: Dimensions at Mechanical Room.



2. M-111 MECHANICAL SUPPLY BUILDING ROOF PLAN – RENOVATION ALTERNATE #1
MECHANICAL KEYED NOTES

DELETE: from note 1. "MECHANICAL EQUIPMENT RAILS"

ADD: "18" PLENUM ADAPTER CURB (WITH SIDE CONNECTIONS)"

DELETE: from note 6. "ROOF CURB ADAPTER"

ADD: "18" PLENUM ADAPTER (WITH BOTTOM CONNECTIONS)"

#	MECHANICAL KEYED NOTES
1	1. PROVIDE NEW ROOF TOP UNIT AND ALL ASSOCIATED CONTROLS, PIPING, AND NEW 18" PLENUM ADAPTER CURB (WITH SIDE CONNECTIONS).
	2. CONNECT NEW RTU-1 MOUNTED DUCTWORK INTO EXISTING SUPPLY AIR DUCTWORK DOWN. CONNECT NEW RETURN AIR DUCTWORK INTO EXISTING RETURN DUCTWORK DOWN.
	3. EXISTING FLUE PIPING UP THROUGH ROOF STRUCTURE TO BE EXTENDED 3 FEET ABOVE RTU-1.
	4. PROVIDE NEW IN-LINE EXHAUST FAN TO BE INSTALLED BELOW ROOF STRUCTURE. DUCTWORK TO GO UP THROUGH ROOF STRUCTURE AT EXISTING ROOF PENETRATION. ROUTE DISCHARGED EXHAUST AIR 10' AWAY FROM OUTSIDE AIR INTAKE OF RTU-1. DIRECT EXHAUST DUCTWORK 90° DOWNWARD AND PROVIDE WIRE MESH SCREEN PRIOR TO DUCT TERMINATION TO PREVENT WATER AND FOREIGN OBJECTS FROM ENTERING. PROVIDE NEW DUCT SUPPORT RAILS, SEE DETAIL ON M-501.
	5. EXISTING PLUMBING VENTS UP THROUGH ROOF STRUCTURE TO BE EXTENDED 3' ABOVE RTU-1.
1	6. PROVIDE NEW ROOF TOP UNIT AND ALL ASSOCIATED CONTROLS, PIPING, AND NEW 18" PLENUM ADAPTER (WITH BOTTOM CONNECTIONS). CONNECT NEW ROOF TOP UNIT MOUNTED DUCTWORK INTO EXISTING SUPPLY AND RETURN DUCTWORK DOWN.
	7. PROVIDE NEW NATURAL GAS PIPING TO NEW RTU'S. SIZE ROOF TOP UNIT'S NATURAL GAS INLET CONNECTION PER MANUFACTURER'S RECOMMENDATION.

3. M-601 – MECHANICAL SCHEDULES

ROOF TOP UNIT SCHEDULE – BID ALTERNATE #1

DELETE: NOTES: 1. 18" PERIMETER KNOCK-DOWN CURB.

ADD: NOTES: 1. 18" PLENUM ADAPTER CURB (WITH SIDE CONNECTIONS)

DELETE: 7. UNIT SHALL BE INSTALLED ON RAILS.

ADD: 7. 18" PLENUM ADAPTER CURB (WITH BOTTOM CONNECTIONS)

MARK	UNIT NOM. SIZE (TONS)	GROSS		NET	
		TOTAL	SENS.	TOTAL	SENS.
RTU - 1	4	50.12	36.21	49.07	36.70
RTU - 2	3	38.93	28.88	38.05	28.00
1	NOTES: 1. 18" PLENUM ADAPTER CURB (WITH SIDE CONNECTIONS) 2. DUCTED INLET AND DISCHARGE 3. DISCONNECT SWITCH 4. ECONOMIZER, DBV WITH BAROMETRIC RELIEF 5. MODULATING HOT GAS REHEAT 6. 2" MERV 8 FILTERS 7. 18" PLENUM ADAPTER CURB (WITH BOTTOM CONNECTIONS)				

GENERAL COMMENTS:

1. The Pre-Bid Meeting was held September 9, 2026, at 10:00am, followed by a walk-through of the project site. The Pre-Bid sign-in sheet is attached to Addendum 1.
2. Site visits are available by appointment. Contact Shannon Thompson at 573-257-7137 to set up a time.
3. Please contact April Howser, Contract Specialist, at 573-690-9874 or April.Howser@oa.mo.gov, for questions about bidding procedures, MBE/WBE/SDVE goals, and submittal requirements.
4. The last day for technical questions or substitution requests is September 22, 2026, at 12:00pm.
5. Changes to, or clarification of, the bid documents are only made as issued in the addenda.
6. All correspondence with respect to this project must include the State of Missouri project number as indicated above.
7. Current Planholders list is available online at: <https://oa.mo.gov/facilities/bid-opportunities/bid-listing-electronic-plans>
8. Prospective Bidders contact American Document Solutions, 1400 Forum Blvd Suite 71, Columbia, MO 65203, 573-446-7768 to order official plans and specifications.
9. All bids shall be submitted on the bid form without additional terms and conditions, modifications, or stipulations. Each space on the bid form shall be properly filled including a bid amount for the alternates. Failure to do so will result in rejection of the bid.
10. MBE/WBE/SDVE participation requirement can be found in DIVISION 00. The MBE/WBE/SDVE participation goals are 0%/0%/3%, respectively. All MBE, WBE, and SDVE contractors, subcontractors, and suppliers must be certified by the State of Missouri, Office of Equal Opportunity. No other certifications from other Missouri certifying agencies will be accepted. If a bidder is unable to meet a participation goal, a Good Faith Effort Determination Form must be completed. Failure to complete this process will result in rejection of the bid.
11. The Contractor shall pay not less than the prevailing hourly rate of wages for work of a similar character in the locality in which the work is performed, as determined by the Missouri Department of Labor and Industrial Relations. Bidders are to adhere to Prevailing Wage Hourly Rate of Wages, and the Department of Labor and Industrial Relations can be contacted to determine the applicable wage rate for the work on this project.

ATTACHMENTS:

Specification Section - 237416.11 Packaged, Small-Capacity, Rooftop Air-Conditioning Units

END OF ADDENDUM 02
September 16, 2026

SECTION 237416.11 - PACKAGED, SMALL-CAPACITY, ROOFTOP AIR-CONDITIONING UNITS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Packaged, small-capacity, rooftop air-conditioning units.

1.2 DEFINITIONS

- A. RTU:** Rooftop unit. As used in this Section, this abbreviation means packaged, small-capacity, rooftop air-conditioning units. This abbreviation is used regardless of whether the unit is mounted on the roof or on a concrete base on ground.

1.3 ACTION SUBMITTALS

A. Product Data:

1. For each RTU.
 - a. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
 - b. Include rated capacities, dimensions, required clearances, characteristics, and furnished specialties and accessories.
 - c. Include unit dimensions and weight.
 - d. Include cabinet material, metal thickness, finishes, insulation, and accessories.
 - e. Fans:
 - 1) Include certified fan-performance curves with system operating conditions indicated.
 - 2) Include certified fan-sound power ratings.
 - 3) Include fan construction and accessories.
 - 4) Include motor ratings, electrical characteristics, and motor accessories.
 - f. Include certified coil-performance ratings with system operating conditions indicated.
 - g. Include filters with performance characteristics.
 - h. Include gas furnaces with performance characteristics.
 - i. Include dampers, including housings, linkages, and operators.

- B. Shop Drawings:** For each packaged, small-capacity, rooftop air-conditioning unit.

1. Include plans, elevations, sections, and mounting details.
2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include diagrams for power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

- A. Sample Warranty: For manufacturer's warranty.
- B. System startup reports.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For RTUs to include in emergency, operation, and maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 1. Filters: One set(s) of filters for each unit.

1.7 WARRANTY

- A. Warranty: Manufacturer / Contractor agrees to repair or replace components of packaged, small-capacity, rooftop air-conditioning unit that fail in materials or workmanship within specified warranty period.
 1. Full Warranty Period: Contractor shall provide 4 full seasons from date of Substantial Completion on all parts and labor.
 2. Manufacturer Warranty Period for Complete Unit: Manufacturer's standard, but not less than 1 year from date of Substantial Completion.
 3. Manufacturer Warranty Period for Compressors: Manufacturer's standard, but not less than 5 years from date of Substantial Completion.
 4. Manufacturer Warranty Period for Heat Exchangers: Manufacturer's standard, but not less than 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.
- B. NFPA Compliance: Comply with NFPA 90A for design, fabrication, and installation of RTUs and components.
- C. ASHRAE 62.1 Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."
- D. ASHRAE 15 Compliance: For refrigeration system safety.
- E. ASHRAE/IES 90.1 Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."
- F. UL Compliance: Comply with UL 1995.

2.2 CAPACITIES AND CHARACTERISTICS

- A. See drawing schedule for specific performance requirements not listed within these specifications.

2.3 PACKAGED, SMALL-CAPACITY, ROOFTOP AIR-CONDITIONING UNITS

- A. Unit Casings:
 - 1. General Fabrication Requirements for Casings: Formed and reinforced double-wall insulated panels, fabricated to allow removal for access to internal parts and components, with joints between sections sealed.
 - 2. Wall Construction:
 - a. Casing Wall: Steel, minimum 18 gauge thick with manufacturer's standard powder finish, with pitched roof panels and knockouts with grommet seals for electrical and piping connections and lifting lugs.
 - b. Floor Plate: G90 galvanized steel, minimum 18 gauge thick.
 - c. Casing Insulation: 1 inch thick with thermal break.
 - 3. Panels and Doors:
 - a. Panels:
 - 1) Fabrication: Formed and reinforced with same materials and insulation thickness as casing.

- 2) Fasteners: Two or more camlock type for panel lift-out operation. Arrangement to allow panels to be opened against air-pressure differential.
 - 3) Gasket: Neoprene, applied around entire perimeters of panel frames.
 - 4) Size: Large enough to allow inspection and maintenance of air-handling unit's internal components.
 - b. Access Doors:
 - 1) Hinges: A minimum of two ball-bearing hinges or stainless steel piano hinge and two wedge-lever-type latches. Arrange doors to be opened against air-pressure differential.
 - 2) Gasket: Neoprene, applied around entire perimeters of panel frames.
 - 3) Size: Large enough to allow inspection and maintenance of air-handling unit's internal components.
 - 4) Provide all necessary access doors for unit maintenance and inspection.
4. Cooling Coil Condensate Drain Pans- Stainless steel, 1/8" per foot slope toward outlet, with a minimum 1" threaded drain outlet connection. Bottom of drain pan shall be insulated to prevent condensation under the unit section.

B. Fans, Drives, And Motors:

1. Fan and Drive Assemblies: Statically and dynamically balanced and designed for continuous operation at maximum-rated fan speed and motor horsepower.
2. Supply-Air Fans: Centrifugal, rated according to AMCA 210; galvanized or painted steel; solid-steel shaft.
 - a. Shafts: With field-adjustable alignment.
 - 1) Turned, ground, and polished hot-rolled steel with keyway.
 - b. Shaft Bearings:
 - 1) Heavy-duty, self-aligning, pillow-block type with an L-50 bearing life rating rated life of minimum 100,000 hours according to ABMA 9.
 - c. Housings: Formed- and reinforced-steel panels to form curved scroll housings with shaped cutoff and spun-metal inlet bell.
 - 1) Bracing: Steel angle or channel supports for mounting and supporting fan scroll, wheel, motor, and accessories.
 - d. Centrifugal Fan Wheels: Inlet flange, backplate, and shallow blades with inlet and tip curved forward in direction of airflow and mechanically fastened to flange and backplate; steel or aluminum hub swaged to backplate and fastened to shaft with setscrews.
 - e. Mounting: For internal vibration isolation. Factory-mount fans with manufacturer's standard vibration isolation mounting devices having a minimum static deflection of 1 inch.

- f. Flexible Connector: Factory fabricated with a fabric strip minimum 3-1/2 inches wide, attached to two strips of minimum 2-3/4-inch wide by 0.028-inch thick, galvanized-steel sheet.
 - 1) Flexible Connector Fabric: Glass fabric, double coated with neoprene. Fabrics, coatings, and adhesives to comply with UL 181, Class 1.
- 3. Drives, Direct: Factory-mounted, direct drive.
- 4. Motors:
 - a. Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors specified in Section 230500 "Common Work Results for HVAC."
 - b. 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.
 - c. Enclosure Type: Open, dripproof.
 - d. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in electrical Sections.

C. Coils:

- 1. General Requirements for Coils:
 - a. Comply with AHRI 410.
 - b. Fabricate coils section to allow for removal and replacement of coil for maintenance and to allow in-place access for service and maintenance of coil(s).
 - c. Coils to not act as structural component of unit.
- 2. Supply-Air and Hot Gas Refrigerant Coils:
 - a. Copper tubes with aluminum fins (maximum spacing 12 fins per inch).
 - b. Headers: Seamless-copper headers with brazed connections.
 - c. Frames: Galvanized steel.
 - d. Ratings: Designed, tested, and rated according to ASHRAE 33 and AHRI 410.

D. Refrigerant Circuit Components:

- 1. Compressor: Hermetic, scroll, mounted on vibration isolators; with internal overcurrent and high-temperature protection, internal pressure relief.
- 2. Refrigeration Specialties:
 - a. Refrigerant: R-454B.
 - b. Expansion valve with replaceable thermostatic element.
 - c. Refrigerant filter/dryer.
 - d. Manual-reset high-pressure safety switch.
 - e. Automatic-reset low-pressure safety switch.
 - f. Minimum off-time relay.
 - g. Automatic-reset compressor motor thermal overload.
 - h. Brass service valves installed in compressor suction and liquid lines.

- i. Hot-gas reheat solenoid valve single stage with a replaceable magnetic coil.
 - j. Hot-gas bypass solenoid valve with a replaceable magnetic coil.
 - k. Four-way reversing valve with a replaceable magnetic coil, thermostatic expansion valves with bypass check valves, and a suction line accumulator.
- E. Air Filtration- Panel Filters: pleated 2", MERV 8 filters in standard off the shelf dimensions.
- F. Gas Heating:
 - 1. Description: Factory assembled, piped, and wired; complying with ANSI Z21.47/CSA 2.3 and NFPA 54.
 - 2. CSA Approval: Designed and certified by and bearing label of CSA.
 - 3. Burners: Stainless steel.
 - a. Modulating, natural gas.
 - b. Ignition: Electronically controlled electric spark or hot-surface igniter with flame sensor.
 - c. Gas Train: Single-body, regulated, redundant, 24-V ac gas valve assembly containing pilot solenoid valve, pilot filter, pressure regulator, pilot shutoff, and manual shutoff.
 - 4. Drain Pan: Stainless steel.
 - 5. Venting, Gravity: Gravity vented.
 - 6. Safety Controls for Gas Manifold: Safety switches and controls complying with ANSI standards.
- G. Dampers:
 - 1. Outdoor- and Return-Air Dampers: Low-leakage, double-skin, airfoil-blade, galvanized-steel dampers with compressible jamb seals and extruded-vinyl blade edge seals in parallel-blade arrangement with zinc-plated steel operating rods rotating in sintered bronze or nylon bearings mounted in a single galvanized-steel frame, and with operating rods connected with a common linkage. Leakage rate must not exceed 4 cfm/sq. ft. at 1-inch wg and 8 cfm/sq. ft. at 4-inch wg rated in accordance with AMCA 500D.
 - 2. Electronic Damper Operators:
 - a. Direct-coupled type designed for minimum 60,000 full-stroke cycles at rated torque.
 - b. Electronic damper position indicator to have visual scale indicating percent of travel and 2- to 10-V dc, feedback signal.
 - c. Size dampers for running torque calculated as follows:
 - 1) Parallel-Blade Damper with Edge Seals: 7 inch-lb/sq. ft. of damper.
 - 2) Parallel-Blade Damper without Edge Seals: 4 inch-lb/sq. ft of damper.
 - d. Coupling: V-bolt and V-shaped, toothed cradle.
 - e. Overload Protection: Electronic overload or digital rotation-sensing circuitry.
 - f. Fail-Safe Operation: Mechanical, spring-return mechanism with external, manual gear release on nonspring-return actuators.

- g. Power Requirements (Modulating): Maximum 10 VA at 24 V ac or 8 W at 24 V dc.
 - h. Proportional Signal: 2 to 10 V dc or 4 to 20 mA (coordinate with Owners designated Controls Contractor), and 2- to 10-V dc position feedback signal.
 - i. Temperature Rating: Minus 22 to plus 122 deg F.
 - j. Run Time: 12 seconds open, 5 seconds closed.
- H. Electrical Power Connections- single connection of power to unit with unit-mounted disconnect switch accessible from outside unit and control-circuit transformer with built-in overcurrent protection.
- I. Controls:
 - 1. All controls and equipment shall be coordinated with Owners existing control system and contractor.
 - 2. Basic Unit Controls:
 - a. Control-voltage transformer.
 - b. Wall-mounted thermostat or sensor with the following features:
 - 1) Heat-cool-off switch.
 - 2) Fan on-auto switch.
 - 3) Automatic changeover.
 - 4) Adjustable deadband.
 - 5) Exposed set point.
 - 6) Exposed indication.
 - 7) Degree F indication.
 - 8) Unoccupied-period-override push button.
 - c. Annunciator Panel for Each Unit:
 - 1) Configuration: Unit-mounted.
 - 2) Lights to indicate power on, cooling, heating, fan running, filter dirty, and unit alarm or failure.
 - 3) DDC controller or programmable timer and interface with HVAC instrumentation and control system.
 - 4) Digital display of outdoor-air temperature, supply-air temperature, return-air temperature, economizer damper position, indoor-air quality, and control parameters.
 - 3. Controller:
 - a. Type: DDC.
 - b. Controller to have volatile-memory backup.
 - c. Safety Control Operation:
 - 1) Smoke Detectors: Stop fan and close outdoor-air damper if smoke is detected. Provide additional contacts for alarm interface to fire-alarm control panel.

- 2) Fire-Alarm Control Panel Interface: Provide control interface to coordinate with Fire-Alarm Systems.
 - 3) Defrost Control for Condenser Coil: Pressure differential switch to initiate defrost sequence.
 - d. Scheduled Operation: Occupied and unoccupied periods on seven-day clock with a minimum of four programmable periods per day.
 - e. Refrigerant Circuit Operation:
 - 1) Occupied Periods: Cycle compressor and operate hot-gas bypass to match compressor output to cooling load to maintain room temperature. Cycle condenser fans to maintain maximum hot-gas pressure. Operate low-ambient control kit to maintain minimum hot-gas pressure.
 - 2) Unoccupied Periods: Cycle compressors and condenser fans for heating to maintain setback temperature.
 - 3) Switch reversing valve for heating or cooling mode on air-to-air heat pump.
 - f. Hot-Gas Reheat-Coil Operation:
 - 1) Occupied Periods: Humidistat opens hot-gas valve to provide hot-gas reheat, and cycles the compressor.
 - 2) Unoccupied Periods: Reheat not required.
 - g. Gas Furnace Operation:
 - 1) Occupied Periods: Modulate burner to maintain room temperature.
 - 2) Unoccupied Periods: Cycle burner to maintain setback temperature.
 - h. Fixed Minimum Outdoor-Air Damper Operation:
 - 1) Occupied Periods: Open to maintain CFM scheduled.
 - 2) Unoccupied Periods: Close the outdoor-air damper.
 - i. Economizer Outdoor-Air Damper Operation:
 - 1) Morning warm-up, cool-down, building outdoor-air flush cycles.
 - 2) Occupied Periods: Open to scheduled minimum outside air CFM, and maximum 100 percent of the fan capacity. Controller is to permit air-side economizer operation when outdoor air is less than 60 deg F (adjustable). Use mixed-air temperature to adjust mixing dampers. During economizer cycle operation, lock out cooling.
 - 3) Unoccupied Periods: Close outdoor-air damper and open return-air damper.
4. Interface Requirements for HVAC Instrumentation and Control System:
 - a. Interface relay for scheduled operation.
 - b. Interface relay to provide indication of fault at the central workstation and diagnostic code storage.

- c. Provide BACnet compatible interface for central HVAC control workstation for the following:
 - 1) Adjusting set points.
 - 2) Monitoring supply fan start, stop, and operation.
 - 3) Inquiring data to include outdoor-air damper position, supply- and room-air temperature.
 - 4) Monitoring occupied and unoccupied operations.
 - 5) Monitoring constant and variable motor loads.
 - 6) Monitoring cooling load.
 - 7) Monitoring economizer cycles.
- J. Roof Curbs:
 - 1. Materials: Galvanized steel with corrosion-protection coating, watertight gaskets, and factory-installed wood nailer; complying with NRCA standards.
 - a. Plenum type curb with field connections cut into bottom and sides as shown on drawings.
 - b. Curb Insulation and Adhesive: Comply with NFPA 90A or NFPA 90B.
 - 1) Materials: ASTM C1071, Type I or II.
 - 2) Thickness: 1 inch.
 - c. Application: Factory applied with adhesive and mechanical fasteners to the internal surface of curb.
 - 1) Liner Adhesive: Comply with ASTM C916, Type I.
 - 2) Mechanical Fasteners: Galvanized steel, suitable for adhesive attachment, mechanical attachment, or welding attachment to duct without damaging liner when applied as recommended by manufacturer and without causing leakage in cabinet.
 - 3) Liner materials applied in this location to have airstream surface coated with a temperature-resistant coating or faced with a plain or coated fibrous mat or fabric depending on service air velocity.
 - 2. Curb Dimensions: Height of 18 inches.
- K. Accessories:
 - 1. Duplex, 115-V, ground-fault-interrupter outlet with 15-A overcurrent protection. Include transformer if required.
 - 2. Filter differential pressure switch with sensor tubing on either side of filter. Set for final filter pressure loss.
 - 3. Remote potentiometer to adjust minimum economizer damper position.
 - 4. Return-air bypass damper.
 - 5. Barometric relief.
 - 6. Safeties:
 - a. Smoke detector.

- b. Condensate overflow switch.
- c. Phase-loss reversal protection.
- d. High and low pressure control.
- e. Gas furnace airflow-proving switch.
- 7. Hail guards of galvanized steel, painted to match casing.
- 8. Concentric diffuser with white louvers and polished aluminum return grilles, insulated diffuser box with mounting flanges, and interior transition.
- 9. Door switches to disable heating or reset set point when open.
- 10. Outdoor-air intake weather hood with moisture eliminator.
- 11. Oil separator.

2.4 MATERIALS

A. Steel:

- 1. ASTM A36/A36M for carbon structural steel.
- 2. ASTM A568/A568M for steel sheet.

B. Stainless Steel:

- 1. Manufacturer's standard grade for casing.
- 2. Manufacturer's standard type, ASTM A240/A240M for bare steel exposed to airstream or moisture.

C. Galvanized Steel: ASTM A653/A653M- G90 minimum.

D. Aluminum: ASTM B209 (ASTM B209M).

E. Corrosion-Resistant Coating: Coat with a corrosion-resistant coating capable of withstanding a 3000-hour salt-spray test according to ASTM B117.

1. Standards:

- a. ASTM B117 for salt spray.
- b. ASTM D2794 for minimum impact resistance of 100 in-lb (11.3 N-m).
- c. ASTM B3359 for cross-hatch adhesion of 5B.

2. Application: Powder Coated.

3. Thickness: Minimum 1 mil.

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

2.5 SOURCE QUALITY CONTROL

A. AHRI Compliance:

- 1. Comply with AHRI 210/240 for testing and rating energy efficiencies for RTUs.
- 2. Comply with AHRI 270 for testing and rating sound performance for RTUs.

B. AMCA Compliance:

1. Comply with AMCA 11 and bear the AMCA-Certified Ratings Seal for air and sound performance according to AMCA 211 and AMCA 311.
2. Damper leakage tested according to AMCA 500-D.
3. Operating Limits: Classify according to AMCA 99.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of RTUs.
- B. Examine roughing-in for RTUs to verify actual locations of piping and duct connections before equipment installation.
- C. Examine roofs for suitable conditions where RTUs will be installed.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF PACKAGED, SMALL-CAPACITY, ROOFTOP AIR-CONDITIONING UNITS

- A. Roof Curb: Install on roof structure and secure, according to manufacturer's written installation instructions. Secure RTUs to upper curb rail, and secure curb base to roof framing with anchor bolts. Coordinate sizes and locations of roof curbs with actual equipment provided.
- B. Unit Support: Install unit level on structural curbs. Coordinate wall penetrations and flashing with wall construction. Secure RTUs to structural support with anchor bolts.

3.3 PIPING CONNECTIONS

- A. Connect condensate piping to drain pans without reducing pipe size. Extend to nearest equipment or roof drain. Construct deep trap at connection to drain pan and install cleanouts at changes in direction.
- B. Gas Piping: Comply with applicable requirements in Section 231123 "Facility Natural-Gas Piping." Connect gas piping to burner, full size of gas train inlet, and connect with union and shutoff valve with sufficient clearance for burner removal and service.
- C. Refrigerant Piping: Comply with manufacturer's written installation instructions for refrigerant piping.

3.4 DUCT CONNECTIONS

- A. Comply with duct installation requirements specified in other HVAC Sections. Drawings indicate general arrangement of ducts. The following are specific connection requirements:
 - 1. Install ducts to termination at top of roof curb.
 - 2. Remove roof decking only as required for passage of ducts. Do not cut out decking under entire roof curb.
 - 3. Connect supply ducts to RTUs with flexible duct connectors specified in Section 233300 "Air Duct Accessories."
 - 4. Install return-air duct continuously through roof structure.

3.5 ELECTRICAL CONNECTIONS

- A. Connect electrical wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
- B. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."
- C. Install electrical devices furnished by manufacturer, but not factory mounted, according to NFPA 70 and NECA 1.
- D. Install nameplate for each electrical connection, indicating electrical equipment designation and circuit number feeding connection.
 - 1. Nameplate is to be laminated acrylic or melamine plastic signs as layers of black with engraved white letters at least 1/2 inch high.
 - 2. Locate nameplate where easily visible.

3.6 CONTROL CONNECTIONS

- A. Install control and electrical power wiring to field-mounted control devices.

3.7 STARTUP SERVICE

- A. Perform startup service.
 - 1. Complete installation and startup checks according to manufacturer's written instructions.
 - 2. Inspect for visible damage to unit casing.
 - 3. Inspect for visible damage to furnace combustion chamber.
 - 4. Inspect for visible damage to compressor, coils, and fans.
 - 5. Inspect internal insulation.
 - 6. Verify that labels are clearly visible.
 - 7. Verify that clearances have been provided for servicing.
 - 8. Verify that controls are connected and operable.
 - 9. Verify that filters are installed.

10. Clean condenser coil and inspect for construction debris.
11. Clean furnace flue and inspect for construction debris.
12. Connect and purge gas line.
13. Remove packing from vibration isolators.
14. Inspect operation of barometric relief dampers.
15. Verify lubrication on fan and motor bearings.
16. Inspect fan-wheel rotation for movement in correct direction without vibration and binding.
17. Adjust fan belts to proper alignment and tension.
18. Start unit according to manufacturer's written instructions.
 - a. Start refrigeration system.
 - b. Do not operate below recommended low-ambient temperature.
 - c. Complete startup sheets and attach copy with Contractor's startup report.
19. Inspect and record performance of interlocks and protective devices; verify sequences.
20. Operate unit for an initial period as recommended or required by manufacturer.
21. Perform the following operations for both minimum and maximum firing. Adjust burner for peak efficiency:
 - a. Measure gas pressure on manifold.
 - b. Inspect operation of power vents.
 - c. Measure combustion-air temperature at inlet to combustion chamber.
 - d. Measure flue-gas temperature at furnace discharge.
 - e. Perform flue-gas analysis. Measure and record flue-gas carbon dioxide and oxygen concentration.
 - f. Measure supply-air temperature and volume when burner is at maximum firing rate and when burner is off. Calculate useful heat to supply air.
22. Calibrate thermostats.
23. Adjust and inspect high-temperature limits.
24. Inspect outdoor-air dampers for proper stroke and interlock with return-air dampers.
25. Start refrigeration system and measure and record the following when ambient is a minimum of 15 deg F above return-air temperature:
 - a. Coil leaving-air, dry- and wet-bulb temperatures.
 - b. Coil entering-air, dry- and wet-bulb temperatures.
 - c. Outdoor-air, dry-bulb temperature.
 - d. Outdoor-air-coil, discharge-air, dry-bulb temperature.
26. Inspect controls for correct sequencing of heating, mixing dampers, refrigeration, and normal and emergency shutdown.
27. Measure and record the following minimum and maximum airflows. Plot fan volumes on fan curve.
 - a. Supply-air volume.
 - b. Return-air volume.
 - c. Relief-air volume.
 - d. Outdoor-air intake volume.

28. Simulate maximum cooling demand and inspect the following:
 - a. Compressor refrigerant suction and hot-gas pressures.
 - b. Short circuiting of air through condenser coil or from condenser fans to outdoor-air intake.
29. Verify operation of remote panel including pilot-light operation and failure modes. Inspect the following:
 - a. High-temperature limit on gas-fired heat exchanger.
 - b. Low-temperature safety operation.
 - c. Filter high-pressure differential alarm.
 - d. Economizer to minimum outdoor-air changeover.
 - e. Relief-air fan operation.
 - f. Smoke and firestat alarms.
30. After startup and performance testing and prior to Substantial Completion, replace existing filters with new filters.

3.8 ADJUSTING

- A. Adjust damper linkages for proper damper operation.
- B. Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC" for air-handling system testing, adjusting, and balancing.
- C. Occupancy Adjustments: When requested within four full seasons from date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

3.9 CLEANING

- A. After completing system installation and testing, adjusting, and balancing RTUs and air-distribution systems, clean RTUs internally to remove foreign material and construction dirt and dust. Clean fan wheels, cabinets, dampers, coils, and filter housings, and install new, clean filters.

3.10 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections:
 1. After installing RTUs and after electrical circuitry has been energized, test units for compliance with requirements.
 2. Inspect for and remove shipping bolts, blocks, and tie-down straps.

3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
 4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- C. RTU will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.

3.11 DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, and maintain RTUs.

END OF SECTION 237416.11