SECTION 235400 - FURNACES

This Section specifies gas, oil, or electric forced-air furnaces in most common arrangements, with standard accessories including air conditioning, humidification, and air cleaning.

Manufacturers found in SpecAgent for this Section were identified as representative and not as an endorsement for meeting requirements of this Specification.

This Section includes performance, proprietary, and descriptive specifications. Edit to avoid conflicting requirements.

This Section may include term "Architect/Engineer." "Architect" is used in AIA contract documents; "Engineer" is used in EJCDC contract documents. Retain appropriate term.

See Drawing Coordination Checklist and Evaluations for information needed to coordinate this Specification Section with Drawings.

1. GENERAL
	* + 1. SUMMARY
				1. Section Includes:

Gas-fired furnaces.

Oil-fired furnaces.

Electric furnaces.

Thermostats.

* + - * 1. Related Requirements:

List other Sections directly related to or affecting Work of this Section. Include Sections specifying information expected to be found in this Section as well as Sections required to describe complete system or assembly requirements.

Section 221100 - Facility Water Distribution: Requirements for humidifier supply and condensate drains.

Section 230513 - Common Motor Requirements for HVAC Equipment: Product requirements for electric motors.

Section 231113 - Facility Fuel-Oil Piping: Requirements for fuel-oil piping.

Section 231123 - Facility Natural-Gas Piping: Requirements for natural-gas piping.

Section 231126 - Facility Liquefied-Petroleum Gas Piping: Requirements for LPG piping.

Section 233100 - HVAC Ducts and Casings: Requirements for ductwork and duct liners.

Section 233300 - Air Duct Accessories: Requirements for flexible duct connections.

Section 234000 - HVAC Air Cleaning Devices: Product requirements for air filters and electronic air cleaners.

Section 235100 - Breechings, Chimneys, and Stacks: Requirements for combustion venting.

Section 238126 - Split-System Air-Conditioners: Requirements for condensing units and indoor air handling units with evaporator coils.

Section 238400 - Humidity Control Equipment: Requirements for humidifiers.

Section 260583 - Wiring Connections: Requirements for electrical connections.

Section 262923 - Variable-Frequency Motor Controllers: Variable-speed drives for motors.

* + - 1. REFERENCE STANDARDS

List reference standards included within text of this Section, with designations, numbers, and complete document titles.

* + - * 1. American National Standards Institute:

ANSI Z21.47 - Gas-Fired Central Furnaces.

* + - * 1. Air-Conditioning, Heating, and Refrigeration Institute:

AHRI 210/240 - Performance Rating of Unitary Air-Conditioning and Air-Source Heat Pump Equipment.

* + - * 1. American Society of Heating, Refrigerating and Air-Conditioning Engineers:

ASHRAE/IES 90.1 - Energy Standard for Buildings Except Low-Rise Residential Buildings.

* + - * 1. Codes of New York State:

Energy Conservation Construction Code of New York State

Fuel Gas Code of New York State

* + - * 1. NFPA:

NFPA 31 - Standard for the Installation of Oil-Burning Equipment.

NFPA 54 - National Fuel Gas Code.

NFPA 58 - Liquefied Petroleum Gas Code.

NFPA 211 - Standard for Chimneys, Fireplaces, Vents, and Solid Fuel-Burning Appliances.

* + - * 1. UL:

UL 727 - Standard for Oil-Fired Central Furnaces.

* + - 1. PREINSTALLATION MEETINGS
				1. Section 013000 - Administrative Requirements: Requirements for preinstallation meeting.
				2. Convene minimum [**one week**] [**<\_\_\_\_\_\_\_\_> weeks**] prior to commencing Work of this Section.
			2. SUBMITTALS

Only request submittals needed to verify compliance with Project requirements.

* + - * 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. Section 013300 - Submittal Procedures: Requirements for submittals.
				5. Product Data: Submit rated capacities, efficiencies, weights, required clearances, locations and sizes of field connections, accessories, electrical nameplate data, and wiring diagrams.
				6. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

Include separate Paragraphs for additional certifications.

* + - * 1. Manufacturer Instructions: Submit detailed instructions on installation requirements, including storage and handling procedures.
				2. Source Quality-Control Submittals: Indicate results of [**shop**] [**factory**] tests and inspections.
				3. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.
				4. Manufacturer Reports: Certify that equipment has been installed according to manufacturer instructions.
				5. Qualifications Statements:

Coordinate following Subparagraphs with requirements specified in QUALIFICATIONS Article.

Submit qualifications for manufacturer and installer.

Submit manufacturer's approval of installer.

* + - * 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).
			1. CLOSEOUT SUBMITTALS
				1. Section 017716 – Contract Closeout000 - Execution and Closeout Requirements: Requirements for submittals.
				2. Project Record Documents: Record actual locations of furnaces, components, and connections.
			2. MAINTENANCE MATERIAL SUBMITTALS
				1. Section 017716 – Contract Closeout000 - Execution and Closeout Requirements: Requirements for maintenance materials.
				2. Extra Stock Materials:

Furnish [**two**] <**\_\_\_\_\_\_\_\_**> pilot thermocouples for each furnace.

Furnish [**two**] <**\_\_\_\_\_\_\_\_**> filters for each furnace.

* + - 1. QUALITY ASSURANCE

Include this Article to specify compliance with overall reference standards affecting products and installation included in this Section.

* + - * 1. Comply with ICC IFGC. Fuel Gas Code of New York State
				2. Minimum Furnace Efficiency:

Comply with ASHRAE/IES 90.1 “Energy Standard for Buildings Except Low-Rise Residential Buildings”.

Testing: Comply with [**ICC IECC Energy Conservation Construction Code of New York State**] [**DOE 10 CFR**] [**ANSI Z21.47**] [**UL 727**].

Certification: Certify to AHRI [**Commercial**] [**Residential**] Furnaces Certification Program.

* + - * 1. Furnish equipment that is UL listed as suitable for clearance space available in installed location.

In following Paragraph insert "State of \_\_\_\_\_\_\_\_ Department of Transportation," "Municipality of \_\_\_\_\_\_\_\_ Department of Public Works," or other agency as appropriate.

* + - * 1. Perform Work according to <**\_\_\_\_\_\_\_\_**> standards.

Include following Paragraph only when cost of acquiring specified standards is justified.

* + - * 1. Maintain <**\_\_\_\_\_\_\_\_**> [**copy**] [**copies**] of each standard affecting Work of this Section on Site.
			1. QUALIFICATIONS

Coordinate following Paragraphs with requirements specified in SUBMITTALS Article.

* + - * 1. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum [**three**] <**\_\_\_\_\_\_\_\_**> years' [**documented**] experience.
				2. Installer: Company specializing in performing Work of this Section with minimum [**three**] <**\_\_\_\_\_\_\_\_**> years' [**documented**] experience [**and approved by manufacturer**].
			1. DELIVERY, STORAGE, AND HANDLING
				1. Section 016500 – Materials and Equipment000 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.
				2. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.
				3. Store materials according to manufacturer instructions.
				4. Protection:

Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.

Provide additional protection according to manufacturer instructions.

* + - 1. AMBIENT CONDITIONS
				1. Section 015000 - Temporary Facilities and Controls: Requirements for ambient condition control facilities for product storage and installation.
			2. EXISTING CONDITIONS
				1. Field Measurements:

Verify field measurements prior to fabrication.

Indicate field measurements on Shop Drawings.

* + - 1. WARRANTY

This Article extends warranty period beyond one year. Extended warranties may increase construction costs and Owner enforcement responsibilities. Specify warranties with caution.

* + - * 1. Section 017716 – Contract Closeout000 - Execution and Closeout Requirements: Requirements for warranties.
				2. Furnish [**five**] [**10**] [**20**] <**\_\_\_\_\_\_\_\_**>-year manufacturer's warranty for heat exchangers.
				3. Furnish [**five**] <**\_\_\_\_\_\_\_\_**>-year manufacturer's warranty for solid-state ignition modules.
1. PRODUCTS
	* + 1. GAS-FIRED FURNACES
				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:

Adams Manufacturing Company.

Amana Heating & Air Conditioning

Comfort-Aire; a division of Heat Controller, Inc.

Goodman Manufacturing Company

Lennox International. Luxaire; brand of Johnson Controls International PLC

Rheem Manufacturing Company

Heating and Cooling Products. Ruud Air Conditioning Division. Thermo Products, Inc.

Trane.

YORK; brand of Johnson Controls International plc, Building Solutions North America

Approved equivalent.

\*\*\*\*\*\* [OR] \*\*\*\*\*\*

In following Subparagraph insert "State of \_\_\_\_\_\_\_\_ Department of Transportation," "Municipality of \_\_\_\_\_\_\_\_ Department of Public Works," or other agency as appropriate.

Insert descriptive specifications below to identify Project requirements and to eliminate conflicts with products specified above. Include configuration, size, color, material composition, and other properties needed to describe product.

* + - * 1. Description: Self-contained, packaged, factory assembled, pre-wired unit, consisting of cabinet, supply fan, heating element, controls, air filter, and accessories.
				2. Performance and Design Criteria:

Wiring: Single power connection with control transformer.

Airflow Configuration: [**Upflow**] [**Downflow**] [**Horizontal**].

Fuel: [**Natural gas**] [**Propane**].

Minimum Efficiency, [**Thermal**] [**Annual Fuel Utilization Efficiency (AFUE)**]: <**\_\_\_\_\_\_\_\_**> percent.

Air Handling:

Specify high and low air flow rates if specifying multistage operation.

Air Flow Rate: <**\_\_\_\_\_\_\_\_**> scfm (<**\_\_\_\_\_\_\_\_**> Ncm per min).

External Static Pressure: <**\_\_\_\_\_\_\_\_**> inches wg (<**\_\_\_\_\_\_\_\_**> Pa).

Heating Capacity:

Input: <**\_\_\_\_\_\_\_\_**> Btu/h (<**\_\_\_\_\_\_\_\_**> W).

Output at Installed Altitude: <**\_\_\_\_\_\_\_\_**> Btu/h (<**\_\_\_\_\_\_\_\_**> W).

* + - * 1. Cabinet:

Material: Steel with baked enamel finish.

Access Panels:

Removable.

Furnish safety interlock switches and insulation.

[**Downflow Furnaces: Furnish base if mounted on combustible floor.**]

* + - * 1. Supply Fan:

Type: Centrifugal.

Mounting: Rubberized.

Drive: [**Direct**] [**or**] [**belt**].

[**Furnish adjustable, variable-pitch motor pulley.**]

* + - * 1. Motors:

Comply with Section 230513 - Common Motor Requirements for HVAC Equipment.

Drive: [**Direct**] [**Belt**].

Speed: [**Single; 1750 rpm**] [**Two**] [**Multiple**] [**Variable speed; constant airflow; as specified in Section 262923 - Variable-Frequency Motor Controllers**].

Permanently lubricated.

Mounting: Hinge.

* + - * 1. Heat Exchanger:

Material: [**Aluminized**] [**Stainless**] [**Hot-rolled**] steel [**, ceramic coated**].

Type: [**Clamshell**] [**Wrap around**].

Fabrication: [**Crimped**] [**or**] [**welded**].

\*\*\*\*\*\* [OR] \*\*\*\*\*\*

* + - * 1. Condensing Heat Exchanger:

Primary: [**Aluminized**] [**Stainless**] steel.

Secondary: [**Polyethylene-coated**] [**Stainless**] steel.

* + - * 1. Gas Burner:

Gas Valve: 100 percent safety [**two-stage**] [**modulating**] main gas valve, main shutoff valve, pressure regulator, safety pilot with electronic flame sensor, limit control, transformer, and combination ignition/fan timer control board.

Ignition: Electric pilot ignition, with hot-surface igniter or electric spark ignition.

* + - * 1. Gas Burner Safety Controls:

Electronic Flame Sensor: Prevents gas valve from opening until pilot flame is proven; stops gas flow on ignition failure.

Flame Rollout Switch: Installed on burner box; prevents burner operation.

Limit Control: Fixed stop at maximum permissible setting; de-energizes burner on excessive bonnet temperature; automatic reset.

* + - * 1. Combustion-Air Inducer: Centrifugal fan with thermally protected motor and sleeve bearings prepurges heat exchanger and vents combustion products; pressure switch prevents furnace operation if combustion-air inlet or flue outlet is blocked.
				2. Furnace Controls: Solid-state board integrates ignition, heat, cooling, and fan speeds; adjustable fan-on and fan-off timing; terminals for connection to accessories[**; diagnostic light with viewport**].
				3. Conventional Vent Materials: [**Type B**] <**\_\_\_\_\_\_\_\_**> metal vents.
				4. Condensing Vent Materials: PVC plastic fitting to combine combustion-air inlet and vent through [**outside wall**] [**roof**].
				5. Operating Controls:

[**Digital, Programmable**] Room Thermostat: Cycles furnace on and off to maintain room temperature setting.

Supply Fan Control:

Energization: From outlet air temperature or timer device, independent of burner controls.

Delays: Adjustable timed-off and fixed timed-on.

Furnish manual switch for continuous fan operation.

[**Furnish continuous LOW SPEED fan operation**] [**Furnish continuous HIGH SPEED fan operation**].

* + - * 1. Air Filters:

Type: [**Disposable, extended area panel filters**] <**\_\_\_\_\_\_\_\_**>.

Thickness: 1 inch (25 mm) <**\_\_\_\_\_\_\_\_**>.

Rating: [**MERV 6**] <**\_\_\_\_\_\_\_\_**>.

In following Paragraph, list accessories based on Project requirements.

* + - * 1. Accessories:

Heat exchanger condensate drain.

Roof termination kit.

Wall termination kit.

Concentric roof termination kit.

Concentric wall termination kit.

Electronic Air Cleaner: As specified in Section 234000 - HVAC Air Cleaning Devices.

Humidifier: As specified in Section 238400 - Humidity Control Equipment.

<**\_\_\_\_\_\_\_\_**>.

* + - 1. OIL-FIRED FURNACES

* + - * 1. [Manufacturers:](http://www.specagent.com/Lookup?ulid=9879) Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

[Adams Manufacturing Company](http://www.specagent.com/Lookup?uid=123457139076).

[Bard Manufacturing Company](http://www.specagent.com/Lookup?uid=123457139078).

[Carrier Global Corporation](http://www.specagent.com/Lookup?uid=123457139079).

[Comfort-Aire; a division of Heat Controller, Inc](http://www.specagent.com/Lookup?uid=123457139080).

[Dornback Furnace](http://www.specagent.com/Lookup?uid=123457139082).

[Lennox Industries, Inc.; Lennox International](http://www.specagent.com/Lookup?uid=123457139084).

[Luxaire; brand of Johnson Controls International PLC, Building Solutions North America](http://www.specagent.com/Lookup?uid=123457139085).

[Rheem Manufacturing Company; Heating and Cooling Products](http://www.specagent.com/Lookup?uid=123457139086).

[Ruud Air Conditioning Division](http://www.specagent.com/Lookup?uid=123457139087).

[Thermo Products, Inc](http://www.specagent.com/Lookup?uid=123457139088).

[YORK; brand of Johnson Controls International plc, Building Solutions North America](http://www.specagent.com/Lookup?uid=123457139089).

Approved equivalent.

Insert descriptive specifications below to identify Project requirements and to eliminate conflicts with products specified above. Include configuration, size, material composition, and other properties needed to describe product.

* + - * 1. Description: Self-contained, packaged, factory-assembled, pre-wired unit consisting of cabinet, supply fan, heating element, controls, air filter, and accessories.
				2. Performance and Design Criteria:

Wiring: Single power connection with control transformer.

Airflow Configuration: [**Upflow**] [**Downflow**] [**Horizontal**].

Heating Fuel: [**No. 1 oil**] [**No. 2 oil**] <**\_\_\_\_\_\_\_\_**>.

Minimum Efficiency, [**Thermal**] [**Annual Fuel Utilization Efficiency (AFUE)**]: <**\_\_\_\_\_\_\_\_**> percent.

Comply with UL [**296**] [**727**].

Air Handling:

Specify high and low air flow rates if specifying multistage operation.

Air Flow Rate: <**\_\_\_\_\_\_\_\_**> scfm (<**\_\_\_\_\_\_\_\_**> Ncm/min).

External Static Pressure: <**\_\_\_\_\_\_\_\_**> inches wg (<**\_\_\_\_\_\_\_\_**> Pa).

Heating Capacity:

Input: <**\_\_\_\_\_\_\_\_**> gph (<**\_\_\_\_\_\_\_\_**> L/s) of [**No. 2 oil**] <**\_\_\_\_\_\_\_\_**>.

Output at Installed Altitude: <**\_\_\_\_\_\_\_\_**> Btu/h (<**\_\_\_\_\_\_\_\_**> W).

* + - * 1. Cabinet:

Material: Steel with baked enamel finish.

Access Doors:

Removable.

Furnish glass-fiber insulation and reflective liner.

[**Furnish welded-steel base.**]

* + - * 1. Supply Fan:

Type: Centrifugal.

Mounting: Rubberized.

Drive: [**Direct**] [**or**] [**belt**].

[**Furnish adjustable, variable-pitch motor pulley.**]

* + - * 1. Motors:

Comply with Section 230513 - Common Motor Requirements for HVAC Equipment.

Speed: [**Single**] [**Two**] [**Multiple**] [**Variable speed; constant airflow; as specified in Section 262923 - Variable-Frequency Motor Controllers**].

Permanently lubricated.

Mounting: Hinge.

* + - * 1. Combustion Chamber:

Description: Welded stainless steel with precast refractory and aluminum-finned stainless-steel tube coil.

\*\*\*\*\*\* [OR] \*\*\*\*\*\*

* + - * 1. Combustion Chamber:

Material: Hot-rolled steel.

Type: Wraparound.

* + - * 1. Oil Burner:

Type: High-pressure atomizing.

Mounting: Rubberized.

Furnish integrated fuel pump, hinged flame-inspection port, cadmium-sulfide flame sensor, electrodes, ignition transformer, oil nozzle, and fuel filter.

Furnish barometric draft regulator in flue.

Combustion-Air Blower:

Adjustable.

Material: Corrosion resistant.

Motor: Permanently lubricated.

* + - * 1. Oil Burner Safety Controls:

Time-Delay Relay: Limit time for establishment of main flame.

Flame Sensor:

Monitor flame continuously during burner operation.

Stop burner on flame failure.

Reset: Manual.

Oil-Delay Valve:

Operation: Solenoid.

Open after burner motor is energized and close instantly when burner motor is de-energized.

Limit Control:

Fixed stop at maximum permissible setting.

De-energize burner on excessive outlet air temperature.

Reset: Automatic.

* + - * 1. Furnace Controls:

Solid-state board integrates ignition, heat, cooling, and fan speeds.

Adjustable fan-on and fan-off timing.

Terminals for connection to accessories.

* + - * 1. Vent Materials: [**Type B**] <**\_\_\_\_\_\_\_\_**> metal vents.
				2. Operating Controls:

[**Digital, Programmable**] Room Thermostat: Cycles furnace on and off to maintain room temperature setting.

Supply Fan Control:

Energization: From bonnet temperature independent of burner controls.

Delay: Fixed timed-on.

Furnish manual switch for continuous fan operation.

[**Furnish continuous LOW SPEED fan operation.**]

* + - * 1. Air Filters:

Type: [**Disposable, extended area panel filters**] <**\_\_\_\_\_\_\_\_**>.

Thickness: 1 inch (25 mm) <**\_\_\_\_\_\_\_\_**>.

Rating: [**MERV 6**] <**\_\_\_\_\_\_\_\_**>.

In following Paragraph, list accessories based on Project requirements.

* + - * 1. Accessories:

Electronic Air Cleaner: As specified in Section 234000 - HVAC Air Cleaning Devices.

Humidifier: As specified in Section 238400 - Humidity Control Equipment.

<**\_\_\_\_\_\_\_\_**>.

* + - 1. ELECTRIC FURNACES

* + - * 1. [Manufacturers:](http://www.specagent.com/Lookup?ulid=9881) Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

[Broan-Nutone LLC](http://www.specagent.com/Lookup?uid=123457139007).

[Fedders North America Inc](http://www.specagent.com/Lookup?uid=123457139009).

[Intertherm Heating and Cooling](http://www.specagent.com/Lookup?uid=123457139011).

[Wellman Furnaces, Inc](http://www.specagent.com/Lookup?uid=123457139010).

[YORK; brand of Johnson Controls International PLC, Building Solutions North America](http://www.specagent.com/Lookup?uid=123457139008).

Approved equivalent.

Insert descriptive specifications below to identify Project requirements and to eliminate conflicts with products specified above. Include configuration, size, color, material composition, and other properties needed to describe product.

* + - * 1. Description: Self-contained, packaged, factory-assembled, pre-wired unit consisting of cabinet, supply fan, heating element, controls, air filter, and accessories.
				2. Performance and Design Criteria:

Wiring: Single power connection with control transformer.

Airflow Configuration: [**Upflow**] [**Downflow**] [**Horizontal**].

Air Handling:

Air Flow Rate: <**\_\_\_\_\_\_\_\_**> scfm (<**\_\_\_\_\_\_\_\_**> Ncm/min).

External Static Pressure: <**\_\_\_\_\_\_\_\_**> inches wg (<**\_\_\_\_\_\_\_\_**> Pa).

Motor:

<**\_\_\_\_\_\_\_\_**> hp (<**\_\_\_\_\_\_\_\_**> kW).

<**\_\_\_\_\_\_\_\_**> V, [**single**] [**three**] phase, 60 Hz.

Heating Capacity: <**\_\_\_\_\_\_\_\_**> Btu/h (<**\_\_\_\_\_\_\_\_**> W) electric heating elements.

* + - * 1. Cabinet:

Material: Steel with baked enamel finish.

Access Doors:

Removable.

Furnish glass-fiber insulation and reflective liner.

* + - * 1. Supply Fan:

Type: Centrifugal.

Mounting: Rubberized.

Operation: Direct drive.

* + - * 1. Motors:

Comply with Section 230513 - Common Motor Requirements for HVAC Equipment.

Speed: [**Single**] [**Two**] [**Multiple**] [**Variable speed; constant airflow; as specified in Section 262923 - Variable-Frequency Motor Controllers**].

* + - * 1. Electric Heater: Helix-wound, bare nichrome-wire elements arranged in incremental stages with porcelain insulators.
				2. Operating Controls:

[**Digital, Programmable**] Thermostat: Low-voltage adjustable room thermostat to energize heater stages in sequence with predetermined delay between heating stages.

High-Limit Temperature Control: De-energize heating elements and automatic resets.

Supply Fan:

Starts simultaneously with electric elements or [**after**] [**before**] they are energized, and continue operating until thermostat is satisfied or until outlet air temperature reaches minimum setting.

Furnish manual switch for continuous fan operation.

Outdoor Thermostat: Lock out selected heating elements until outdoor temperature drops.

* + - * 1. Air Filters:

Type: [**Disposable, extended area panel filters**] <**\_\_\_\_\_\_\_\_**>.

Thickness: 1 inch (25 mm) <**\_\_\_\_\_\_\_\_**>.

Rating: [**MERV 6**] <**\_\_\_\_\_\_\_\_**>.

* + - * 1. Accessories:

Electronic Air Cleaner: As specified in Section 234000 - HVAC Air Cleaning Devices.

Humidifier: As specified in Section 238400 - Humidity Control Equipment.

<**\_\_\_\_\_\_\_\_**>.

* + - 1. THERMOSTATS
				1. [Manufacturers:](http://www.specagent.com/Lookup?ulid=9748) Subject to compliance with requirements, [provide products by the following] [provide products by one of the following] [available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:

Carrier

Emerson Electric Co.

Johnson Controls

Approved equivalent.

Insert descriptive specifications below to identify Project requirements and to eliminate conflicts with products specified above. Include configuration, size, color, material composition, and other properties needed to describe product.

* + - * 1. Adjustable Room Thermostat:

Type: Low voltage.

Operation: Control [**heating system ON and OFF**] [**, heater stages in sequence with delay between stages**] [**, and**] supply fan to maintain temperature setting.

[**Furnish system HEAT-OFF-COOL selector switch and AUTO-ON fan control switch.**]

* + - * 1. Digital, Programmable Room Thermostat:

Type: Electric solid state, with remote sensor.

Automatic switching from heating to cooling.

Preferential rate control to minimize overshoot and deviation from set point.

Configuration: Four separate temperatures for each day.

Instant override of set point for continuous or timed period from one hour to 31 days.

Short cycle protection.

Programming: Based on [**weekdays, Saturday, and Sunday**] [**every day of week**].

Selection Features:

Degrees F or degrees C.

12- or 24-hour clock.

Remote sensor.

Fan ON-AUTO.

Battery replacement without program loss.

Thermostat Display:

Time of day.

Actual room temperature.

Programmed temperature.

Programmed time.

Duration of timed override.

Day of week.

System mode indication: HEATING [**, AUTO**] [**, OFF**] [**, FAN AUTO**] [**FAN ON**].

* + - 1. OPERATION
				1. Electrical Characteristics:

[**<\_\_\_\_\_\_\_\_> hp (<\_\_\_\_\_\_\_\_> W)**] [<\_\_\_\_\_\_\_\_> RLA].

Voltage: <**\_\_\_\_\_\_\_\_**> V, [**single**] [**three**] phase, 60 Hz.

Maximum [**Fuse Size**] [**Circuit Breaker Size**] [**Overcurrent Protection**]: <**\_\_\_\_\_\_\_\_**> A.

Minimum Circuit Ampacity: <**\_\_\_\_\_\_\_\_**>.

Minimum Power Factor: <**\_\_\_\_\_\_\_\_**> percent at rated load.

* + - * 1. Motors: As specified in Section 230513 - Common Motor Requirements for HVAC Equipment.
				2. Control Panel:

Factory mounted.

NEMA 250 “Enclosures for Electrical Equipment” Type [**1**] [**4**] <**\_\_\_\_\_\_\_\_**>.

Single-point power connection and grounding lug.

* + - * 1. Disconnect Switch: Factory mounted [**in control panel**] [**on equipment**].
			1. SOURCE QUALITY CONTROL
				1. Provide shop inspection and testing of completed assembly.

Include one or both of following Paragraphs to require Owner's inspection or witnessing of test at factory.

* + - * 1. Director’s Representative Inspection:

Make completed furnaces available for inspection at manufacturer's factory prior to packaging for shipment.

Notify Director’s Representative at least [**seven**] <**\_\_\_\_\_\_\_\_**> days before inspection is allowed.

* + - * 1. Director’s Representative Witnessing:

Allow witnessing of factory inspections and tests at manufacturer's test facility.

Notify Director’s Representative at least [**seven**] <**\_\_\_\_\_\_\_\_**> days before inspections and tests are scheduled.

Include following Paragraph if reliance on manufacturer's approved quality-control program is sufficient for Project requirements.

* + - * 1. Certificate of Compliance:

If manufacturer is approved by authorities having jurisdiction, submit certificate of compliance indicating Work performed at manufacturer's facility conforms to Contract Documents.

Specified shop tests are not required for Work performed by approved manufacturer.

1. EXECUTION
	* + 1. EXAMINATION
				1. Verify that building is ready for installation of units.
				2. Verify that openings are as indicated on [**Shop**] Drawings.
			2. INSTALLATION
				1. According to manufacturer instructions.
				2. Gas-Fired Furnaces: Comply with NFPA 54 “National Fuel Gas Code”.

\*\*\*\*\*\* [OR] \*\*\*\*\*\*

* + - * 1. Install oil-fired furnaces in accordance with NFPA 31 “Standard for the Installation of Oil-Burning Equipment”.
				2. Vent Connections: Comply with NFPA 211 “Standard for Chimneys, Fireplaces, Vents, and Solid Fuel-Burning Appliances and NFPA 54 “National Fuel Gas Code”.
				3. Downflow Furnaces Installed on Combustible Floors: Mount on combustion-proof base.
				4. Natural-Gas Piping:

Connections:

Comply with NFPA 54 “National Fuel Gas Code”.

Arrange piping with clearances for burner maintenance.

Accessories:

As specified in Section 231123 - Facility Natural-Gas Piping.

Strainer.

Pressure gage.

Shutoff valve.

Pressure-reducing valve.

\*\*\*\*\*\* [OR] \*\*\*\*\*\*

* + - * 1. Propane-Gas Piping:

Comply with NFPA 58 “Liquefied Petroleum Gas Code”.

Connections: Arrange piping with clearances for burner service.

Accessories:

As specified in Section 231126 - Facility Liquefied-Petroleum Gas Piping.

Strainer.

Pressure gage.

Shutoff valve.

Pressure-reducing valve.

\*\*\*\*\*\* [OR] \*\*\*\*\*\*

* + - * 1. Fuel-Oil Piping:

Comply with NFPA 31 “Standard for the Installation of Oil-Burning Equipment”.

Connections: Arrange piping with clearances for burner service.

Accessories:

As specified in Section 231113 - Facility Fuel-Oil Piping.

Strainer.

Shutoff valve.

* + - * 1. Humidifier: Connect to domestic water piping as specified in Section 221100 - Facility Water Distribution.
				2. Drain: Pipe drain from [**humidifier**] [**Category III and IV gas-fired furnaces heat exchangers**] to nearest [**floor drain**] [**stormwater drain or rain leader discharging to exterior**].
				3. Power and Controls:

Connect units to electric supply.

Connect controls remote from units.

Install control components supplied with equipment and provide control wiring.

Install control wiring between thermostat, indoor unit, and outdoor unit.

* + - * 1. Connect return air duct to system ductwork with flexible duct connection as specified in Section 233300 - Air Duct Accessories.
			1. FIELD QUALITY CONTROL
				1. Manufacturer Services: Furnish services of manufacturer's representative Field Advisor per OGS Spec Section 014216 experienced in installation of products furnished under this Section for not less than <**\_\_\_\_\_\_\_\_**> [**days**] [**hours**] on Site for installation, inspection, startup, field testing, and instructing Facility’s Owner's personnel in operation and maintenance of equipment.
				2. Equipment Acceptance:

Adjust, repair, modify, or replace components failing to perform as specified and rerun tests.

Make final adjustments to equipment under direction of manufacturer's representative.

* + - * 1. Furnish installation certificate from equipment manufacturer's representative attesting that equipment has been properly installed and is ready for startup and testing.
			1. ADJUSTING
				1. Check control functions and adjust as required.
			2. DEMONSTRATION
				1. Demonstrate equipment startup, shutdown, routine maintenance, and emergency repair procedures to Facility’s Owner's personnel.
			3. MAINTENANCE
				1. Section 017716 – Contract Closeout.

Evaluate need for maintenance and emergency service based on Project requirements. If desired, retain following Paragraphs.

* + - * 1. Provide service and maintenance of furnace and accessories for one year from date of Substantial Completion.
				2. Services:

Provide systematic examination, adjustment, and lubrication.

Repair or replace parts as required.

Use parts produced by manufacturer of original equipment.

* + - 1. SCHEDULES

When relying on separate schedules, tables, illustrations, or forms to specify product requirements, include list of each attachment. Include identical list of attachments in Project Manual table of contents.

Consider including schedule if there is more than one of each size or type of unit. Coordinate equipment tags and abbreviations with project specific requirements.

Insert attachments following END OF SECTION. Consider following examples when developing Project schedule.

* + - * 1. Furnace Schedule:

Equipment Tag: <F-1>:

[**Manufacturer: <\_\_\_\_\_\_\_\_>.**]

[**Model: <\_\_\_\_\_\_\_\_>.**]

Heating Output: <**\_\_\_\_\_\_\_\_**>.

Heating Input: <**\_\_\_\_\_\_\_\_**>.

Efficiency (AFUE): <**\_\_\_\_\_\_\_\_**>.

Heating and Cooling Airflow Capacity: <**\_\_\_\_\_\_\_\_**>.

External Static Pressure: <**\_\_\_\_\_\_\_\_**>.

Fan RPM: <**\_\_\_\_\_\_\_\_**>.

Motor Size: <**\_\_\_\_\_\_\_\_**>.

Equipment Tag: <F-2>:

[**Manufacturer: <\_\_\_\_\_\_\_\_>.**]

[**Model: <\_\_\_\_\_\_\_\_>.**]

Heating Output: <**\_\_\_\_\_\_\_\_**>.

Heating Input: <**\_\_\_\_\_\_\_\_**>.

Efficiency (AFUE): <**\_\_\_\_\_\_\_\_**>.

Heating and Cooling Airflow Capacity: <**\_\_\_\_\_\_\_\_**>.

External Static Pressure: <**\_\_\_\_\_\_\_\_**>.

Fan RPM: <**\_\_\_\_\_\_\_\_**>.

Motor Size: <**\_\_\_\_\_\_\_\_**>.

END OF SECTION 235400