SECTION 235500 - FUEL-FIRED HEATERS

This Section includes indirect fired, gas or oil fired unit heaters, industrial heaters, duct furnaces, gas fired infrared heaters, and fuel fired packaged air units.

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

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

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

See the Drawing Coordination Considerations for information needed to coordinate this specification Section with the Drawings.

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

Gas fired unit heaters.

Oil fired unit heaters.

Gas fired industrial heaters.

Oil fired industrial heaters.

Gas fired duct furnaces.

Oil fired duct furnaces.

High intensity infrared heaters.

Tubular infrared heaters.

Fuel fired packaged air units.

* + - * 1. Related Sections:

Section 230513 - Common Motor Requirements for HVAC Equipment: Product requirements for electric motors for placement by this section.

Section 230529 - Hangers and Supports for HVAC Piping and Equipment: Product requirements for hangers for placement by this section.

Section 230548 - Vibration and Seismic Controls for HVAC Piping and Equipment: Product requirements for vibration isolators for placement by this section.

Section 230900 - Instrumentation and Control for HVAC: Product requirements for thermostats and time clocks for placement by this section.

Section 231113 - Facility Fuel-Oil Piping: Product requirements for fuel oil piping connected to oil-fired heaters.

Section 231123 - Facility Natural-Gas Piping: Product requirements for natural gas piping connected to gas-fired heaters.

Section 231126 - Facility Liquefied-Petroleum Gas Piping: Product requirements for LP gas piping connected to gas-fired heaters.

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

Section 235100 - Breechings, Chimneys, and Stacks: Product requirements for vents for placement by this section.

* + - 1. REFERENCES

List reference standards included within text of this section. Edit the following for Project conditions.

* + - * 1. American National Standards Institute:

ANSI Z83.8 - Gas Unit Heaters.

ANSI Z83.9 - Gas-Fired Duct Furnaces.

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

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

* + - * 1. National Fire Protection Association:

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

NFPA 54 - National Fuel Gas Code.

NFPA 90A - Standard for the Installation of Air Conditioning and Ventilating Systems.

NFPA 90B - Standard for the Installation of Warm Air Heating and Air Conditioning Systems.

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

* + - * 1. Underwriters Laboratories Inc.:

UL 727 - Oil-Fired Central Furnaces.

UL 729 - Oil-Fired Floor Furnaces.

UL 731 - Standard for Safety for Oil-Fired Unit Heaters.

* + - 1. SUBMITTALS
			2. Submittals for this section are subject to the re-evaluation fee identified in Article 4 of the General Conditions.
			3. Manufacturer’s installation instructions shall be provided along with product data.
			4. Submittals shall be provided in the order in which they are specified and tabbed (for combined submittals).
			5. Only request submittals needed to verify compliance with Project requirements.
				1. Section 013300 - Submittal Procedures: Submittals procedures
				2. Shop Drawings: Indicate assembly, required clearances, and locations and sizes of field connections.
				3. Product Data: Submit manufacturer's literature and data indicating rated capacities, weights, accessories, electrical nameplate data, and wiring diagrams.
				4. Manufacturer's Installation Instructions: Submit Indicate rigging and assembly.
				5. Manufacturer's Certificate: Certify products meet or exceed specified requirements.
			6. CLOSEOUT SUBMITTALS
				1. Section 017716 – Contract Closeout.
				2. Project Record Documents: Record actual locations of thermostats or other products not mounted on unit.
				3. Operation and Maintenance Data: Submit manufacturer's descriptive literature, operating instructions, maintenance and repair data, and parts listing.
			7. QUALITY ASSURANCE
				1. Gas-Fired Unit Heater Performance Requirements: Conform to minimum efficiency prescribed by ASHRAE 90.1 “Energy Standard for Buildings Except Low-Rise Residential Buildings” when tested in accordance with ANSI Z83.8 “Gas Unit Heaters”.

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

* + - * 1. Oil-Fired Unit Heater Performance Requirements: Conform to minimum efficiency prescribed by ASHRAE 90.1 “Energy Standard for Buildings Except Low-Rise Residential Buildings” when tested in accordance with UL 731 “Standard for Safety for Oil-Fired Unit Heaters”.

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

* + - * 1. Gas-Fired Duct Furnace Performance Requirements: Conform to minimum efficiency prescribed by ASHRAE 90.1 “Energy Standard for Buildings Except Low-Rise Residential Buildings” when tested in accordance with ANSI Z83.9 “Gas-Fired Duct Furnaces”.

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

* + - * 1. <**\_\_\_\_\_\_\_\_**> Performance Requirements: Conform to minimum efficiency prescribed by ASHRAE 90.1 “Energy Standard for Buildings Except Low-Rise Residential Buildings when tested in accordance with <**\_\_\_\_\_\_\_\_**>.
				2. Perform Work in accordance with [**State**] [**Municipality**] of <**\_\_\_\_\_\_\_\_**> [**Highways**] [**Public Work's**] standards.

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

* + - * 1. Maintain [**one copy**] [**<\_\_\_\_\_\_\_\_> copies**] of [**each**] document on site.
			1. QUALIFICATIONS
				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 [**approved by manufacturer**].
			2. PRE-INSTALLATION MEETINGS
				1. Section 013000 - Administrative Requirements: Pre-installation meeting.
				2. Convene minimum [**one**] <**\_\_\_\_\_\_\_\_**> week prior to commencing work of this section.
			3. DELIVERY, STORAGE, AND HANDLING
				1. Section 016500 – Materials and Equipment000 - Product Requirements: Product storage and handling requirements.
				2. Accept heaters and controls on site in factory packaging. Inspect for damage.
			4. FIELD MEASUREMENTS
				1. Verify field measurements prior to fabrication.
			5. WARRANTY

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

* + - * 1. Section 017716 – Contract Closeout000 - Execution and Closeout Requirements: Product warranties and product bonds.
				2. Furnish [**five**] [**ten**] [**twenty**] <**\_\_\_\_\_\_\_\_**>-year manufacturer's warranty for heat exchanger.
			1. EXTRA MATERIALS
				1. Section 017716 – Contract Closeout000 - Execution and Closeout Requirements: Spare parts and maintenance products.
				2. Furnish [**two**] <**\_\_\_\_\_\_\_\_**> [**throwaway filters**] [**ceramic modules**] for each unit.
1. PRODUCTS
	* + 1. GAS FIRED UNIT HEATERS

In this article, list manufacturers acceptable for this Project.

* + - * 1. [Manufacturers:](http://www.specagent.com/Lookup?ulid=9375) Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

[Lennox Industries, Inc.; Lennox International](http://www.specagent.com/Lookup?uid=123456985819).

[Modine Manufacturing Company](http://www.specagent.com/Lookup?uid=123456985820).

[REZNOR, a brand of Nortek Global HVAC](http://www.specagent.com/Lookup?uid=123456985821).

[Sterling HVAC Products; a Mestek company](http://www.specagent.com/Lookup?uid=123456985822).

[Trane](http://www.specagent.com/Lookup?uid=123456985823).

Or equal.

Edit the following descriptive specifications to identify project requirements and to eliminate conflicts with manufacturers' products specified above.

* + - * 1. Self-contained, packaged, factory assembled, pre-wired unit consisting of cabinet, supply fan, heat exchanger, burner, controls, and accessories:

Heating fuel: [**Natural gas fired**] [**Propane gas fired**].

Discharge Louvers: Individually adjustable horizontal [**and vertical**] louvers to match cabinet finish.

Downturn Nozzle: [**30**] [**60**] degree nozzle to match outlet and cabinet finish.

Poly-Tube Outlet Adapter: Transition duct to adapt from unit outlet to round outlet flange for polyethylene tube duct.

Air Filters: Filter cabinet with [**1 inch**] [**2 inch**] thick [**polyurethane, washable**] [**glass fiber, disposable**] type filters.

Gas Control: [**Single stage**] [**Two stage**] [**Modulating-electric or mechanical**].

Ignition System: [**Standing pilot**] [**Electric ignition-pilot to main burner**] [**Electric direct ignition**].

Control Voltage: [**24 volt, 60 hertz**] [**115 volt, 60 hertz**].

Location: [**Floor mounted**] [**Suspended overhead**].

* + - * 1. Cabinet: Galvanized steel, easily removed and secured access panels, insulated or double panel construction.
				2. Supply Fan: [**Propeller**] [**Centrifugal forward curved**] type with [**direct**] [**belt**] drive [**, variable pitch motor pulley**].
				3. Heat Exchanger: [**Aluminized steel**] [**Type E-3 stainless steel**] [**Type 321 stainless steel**] welded construction.
				4. Gas Burner: [**Atmospheric type**] [**Induced Draft**] [**Forced Draft**] [**Gravity vented**] [**Power-vented with non-corrosive air blower with permanently lubricated motor**].
				5. Gas Burner Safety Controls:

Thermocouple sensor: Prevents opening of gas valve until pilot flame is proven and stops gas flow on ignition failure.

Flame rollout switch: Installed on burner box and prevents operation.

Vent safety shutoff sensor: Temperature sensor installed on draft hood and prevents operation, manual reset.

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

Use second paragraph when independent fan control is desired.

* + - * 1. Controls:

Room Thermostat: Adjustable, low voltage, to control [**burner operation,**] [**heater stages in sequence with delay between stages,**] and supply fan to maintain temperature setting. [**Include system selector switch (heat-off-cool) and fan control switch (auto-on).**]

Supply Fan Control: Energize either from discharge temperature independent of burner controls or with timed off delay and timed on delay. Furnish manual switch for continuous fan operation. [**Provide continuous low speed fan operation.**]

Use the following paragraphs and insert performance for one or identical units. When specifying units of differing sizes, use schedule.

* + - * 1. Performance:

Air flow: <**\_\_\_\_\_\_\_\_**> cfm.

External static pressure: <**\_\_\_\_\_\_\_\_**> inch.

Motor: <**\_\_\_\_\_\_\_\_**> hp [**two speed**].

Heating Capacity:

Heating output: <**\_\_\_\_\_\_\_\_**> Btuh.

Heating input: <**\_\_\_\_\_\_\_\_**> Btuh.

Annual fuel utilization efficiency (AFUE): <**\_\_\_\_\_\_\_\_**> percent.

Gas heating capacities are sea level ratings.

* + - 1. OIL FIRED UNIT HEATERS

In this article, list manufacturers acceptable for this Project.

* + - * 1. [Manufacturers:](http://www.specagent.com/Lookup?ulid=9374) Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

[Modine Manufacturing Company](http://www.specagent.com/Lookup?uid=123456985815).

[REZNOR, a brand of Nortek Global HVAC](http://www.specagent.com/Lookup?uid=123456985816).

[Sterling HVAC Products; a Mestek company](http://www.specagent.com/Lookup?uid=123456985817).

Approved equivalent.

Edit the following descriptive specifications to identify Project requirements and to eliminate conflicts with manufacturers specified above.

* + - * 1. Self-contained, packaged, factory assembled, pre-wired unit consisting of cabinet, supply fan, heat exchanger, burner, controls, and accessories:

Discharge Louvers: Individually adjustable horizontal [**and vertical**] louvers to match cabinet finish.

Downturn Nozzle: [**30**] [**60**] degree nozzle to match outlet and cabinet finish.

Poly-Tube Outlet Adapter: Transition duct to adapt from unit outlet to round outlet flange for polyethylene tube duct.

Air Filters: Filter cabinet with [**1 inch (25 mm)**] [**2 inch (50 mm)**] thick [**polyurethane, washable**] [**glass fiber, disposable**] type filters.

Control Voltage: 24 volt, 60 hertz.

Location: [**Floor mounted**] [**Suspended overhead**].

* + - * 1. Cabinet: Galvanized steel, easily removed and secured access panels, double panel or insulated construction.
				2. Supply Fan: [**Propeller**] [**Centrifugal forward curved**] type with [**direct**] [**belt**] drive [**, variable pitch motor pulley**].
				3. Combustion Chamber: [**UL 727;**] [**UL 729;**] [**welded stainless steel**] [**precast refractory**].
				4. Oil Burner: High pressure atomizing type, rubber mounted, adjustable combustion air blower, integrated fuel pump, fuel filter, hinged flame inspection port, cadmium sulfide flame sensor, electrodes, ignition transformer, oil nozzle.

Barometric draft regulator in flue.

Non-corrosive combustion air blower with permanently lubricated motor.

* + - * 1. Oil Burner Safety Controls:

Time delay relay limits time for establishment of main flame.

Flame sensor monitors flame continuously during burner operation and stops burner on flame failure with manual reset.

Solenoid operated oil delay valve opens after burner motor is energized and closes instantly when burner motor is de-energized.

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

Use second paragraph when independent fan control is desired.

* + - * 1. Controls:

Room Thermostat: Adjustable, low voltage, to control [**burner operation,**] [**heater stages in sequence with delay between stages,**] and supply fan to maintain temperature setting. [**Include system selector switch (heat-off-cool) and fan control switch (auto-on).**]

Supply Fan Control: Energize from bonnet temperature independent of burner controls, with fixed timed on delay, with manual switch for continuous fan operation. [**Provide continuous low speed fan operation.**]

Use the following paragraphs and insert performance for one or identical units. When specifying units of differing sizes, use schedule.

* + - * 1. Performance:

Air flow: <**\_\_\_\_\_\_\_\_**> cfm (<**\_\_\_\_\_\_\_\_**> L/s).

External static pressure: <**\_\_\_\_\_\_\_\_**> inch wg (<**\_\_\_\_\_\_\_\_**> Pa).

Motor: <**\_\_\_\_\_\_\_\_**> hp (<**\_\_\_\_\_\_\_\_**> kW) [**two speed**].

Heating Capacity:

Heating output: <**\_\_\_\_\_\_\_\_**> Btuh (<**\_\_\_\_\_\_\_\_**> kW).

Heating input: <**\_\_\_\_\_\_\_\_**> gph (<**\_\_\_\_\_\_\_\_**> L/s) No. 2 oil.

Annual fuel utilization efficiency (AFUE): <**\_\_\_\_\_\_\_\_**> percent.

* + - 1. GAS FIRED INDUSTRIAL HEATERS

In this article, list manufacturers acceptable for this Project.

* + - * 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]:

Lennox Industries Inc.

Modine Mfg. Co.

Trane Co.

Approved equivalent.

Edit the following descriptive specifications to identify Project requirements and to eliminate conflicts with manufacturers specified above.

* + - * 1. Self-contained, packaged, factory assembled, pre-wired unit consisting of cabinet, supply fan, emitter, burner or heater, controls [**, air filter**].
				2. Cabinet: Galvanized steel with baked enamel finish, easily removed and secured access-doors, glass fiber insulation and reflective liner.
				3. Heat Exchanger: [**Aluminized**] [**Titanium stainless**] steel welded construction.
				4. Supply Fan: Centrifugal type with belt drive, variable pitch motor pulley.
				5. Filter: 1 inch (25 mm) thick [**glass fiber throwaway**] [**permanent washable**] type, located to filter air before fan.
				6. Mixing:

Dampers: Outside and return dampers with damper operator and control package to automatically vary outside air quantity. Outside air damper fail to closed position.

Gaskets: Tight fitting dampers with edge gaskets [**, maximum leakage 5 percent at 2 inches (500 Pa) pressure differential**].

Damper Operator: [**24 volt with gear train sealed in oil.**] [**Pneumatic piston or gear-driven type with spring return.**]

Mixed Air Control Sequence: Maintain selected supply-air temperature and return dampers to minimum position on call for heating.

* + - * 1. Gas Burner:

Forced draft type with adjustable combustion air supply.

Gas-valve [**, two stage**] provides 100 percent safety gas shut-off; 24 volt combining pressure regulation, safety pilot, manual set (On-Off), pilot filtration, automatic electric valve.

Electronic pilot ignition, with [**electric spark**] [**hot surface**] igniter.

[**Combustion air damper**] [**Automatic vent damper**] with synchronous spring return damper motor.

Non-corrosive combustion air blower with permanently lubricated motor.

* + - * 1. Gas Burner Safety Controls:

Thermocouple sensor: Prevents opening of gas valve until pilot flame is proven and stops gas flow on ignition failure.

Flame rollout switch: Installed on burner box and prevents operation.

Vent safety shutoff sensor: Temperature sensor installed on draft hood and prevents operation, manual reset.

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

* + - * 1. Burner Operating Controls:

High Limit Control: Fixed stop at maximum permissible setting, de-energizes burner on high bonnet temperature and re-energizes when temperature drops to lower value.

Fan Control: Bonnet thermostat and independent of burner controls, cycles supply fan, with manual switch for continuous fan operation.

* + - * 1. Controls: Adjustable, room thermostat, low voltage, to control [**burner operation,**] [**heater stages in sequence with delay between stages,**] and supply fan to maintain temperature setting. [**Include system selector switch (heat-off)**] [**and**] [**fan control switch (auto-on).**]

Use the following paragraphs and insert performance for one or identical units. When specifying units of differing sizes, use schedule.

* + - * 1. Performance:

Air flow: <**\_\_\_\_\_\_\_\_**> cfm (<**\_\_\_\_\_\_\_\_**> L/s).

External static pressure: <**\_\_\_\_\_\_\_\_**> inch (<**\_\_\_\_\_\_\_\_**> Pa).

Motor: <**\_\_\_\_\_\_\_\_**> hp (<**\_\_\_\_\_\_\_\_**> kW) [**two speed**].

Heating Capacity:

Heating output: <**\_\_\_\_\_\_\_\_**> Btu/hr (<**\_\_\_\_\_\_\_\_**> kW).

Heating input: <**\_\_\_\_\_\_\_\_**> Btu/hr (<**\_\_\_\_\_\_\_\_**> kW).

Annual fuel utilization efficiency (AFUE): <**\_\_\_\_\_\_\_\_**> percent.

Gas heating capacities are sea level ratings.

* + - 1. OIL FIRED INDUSTRIAL HEATERS

In this article, list manufacturers acceptable for this Project.

* + - * 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]:

Dunham-Bush Inc.

Hastings Industries Inc.

Modine Mfg. Co.

Approved equivalent.

Edit the following descriptive specifications to identify Project requirements and to eliminate conflicts with manufacturers specified above.

* + - * 1. Units: Self-contained, packaged, factory assembled, pre-wired unit consisting of cabinet, supply fan, heat exchanger, burner or heater, controls [**, air filter**].
				2. Cabinet: Galvanized steel with baked enamel finish, easily removed and secured access-doors, glass fiber insulation and reflective liner.
				3. Combustion Chamber: [**UL 727;**] [**UL 729;**] [**welded stainless steel.**] [**cast refractory.**]
				4. Supply Fan: Centrifugal type with belt drive, variable pitch motor pulley.
				5. Filter: One inch (25 mm) thick [**glass fiber throwaway**] [**permanent washable**] type, located to filter air before fan.
				6. Mixing:

Dampers: Outside and return dampers with damper operator and control package to automatically vary outside air quantity. Outside air damper fail to closed position.

Gaskets: Tight fitting dampers with edge gaskets [**, maximum leakage 5 percent at 2 inches (500 Pa) pressure differential**].

Damper Operator: [**24 volt with gear train sealed in oil.**] [**Pneumatic piston or gear driven with spring return.**]

Mixed Air Control Sequence: Maintain selected supply-air temperature and return dampers to minimum position on call for heating.

* + - * 1. Burner:

Oil Burner: High pressure atomizing type, adjustable combustion air blower, fuel pump, fuel filter, hinged flame inspection port, cadmium sulfide flame sensor, electrodes, ignition transformer, oil nozzle, and barometric draft regulator in flue.

Oil Burner Safety Controls: Thermostat energizes burner motor and electric ignition. Time delay relay limits time for establishment of main flame. Flame sensor monitors flame continuously during burner operation and stops burner on flame failure with manual reset. Solenoid operated oil valve opens after burner motor is energized and closes instantly when burner motor is de-energized.

* + - * 1. Burner Operating Controls:

High Limit Control: Fixed stop at maximum permissible setting, de-energizes burner on high bonnet temperature and re-energizes when temperature drops to lower value.

Fan Control: Bonnet thermostat and independent of burner controls, cycles supply fan, with manual switch for continuous fan operation.

* + - * 1. Controls: Adjustable, room thermostat, low voltage, to control [**burner operation,**] [**heater stages in sequence with delay between stages,**] and supply fan to maintain temperature setting. [**Include system selector switch (heat-off)**] [**and**] [**fan control switch (auto-on).**]

Use the following paragraphs and insert performance for one or identical units. When specifying units of differing sizes, use schedule.

* + - * 1. Performance:

Air flow: <**\_\_\_\_\_\_\_\_**> cfm (<**\_\_\_\_\_\_\_\_**> L/s).

External static pressure: <**\_\_\_\_\_\_\_\_**> inch wg (<**\_\_\_\_\_\_\_\_**> Pa).

Motor: <**\_\_\_\_\_\_\_\_**> hp (<**\_\_\_\_\_\_\_\_**> kW) [**two speed**].

Heating Capacity:

Heating output: <**\_\_\_\_\_\_\_\_**> Btuh (<**\_\_\_\_\_\_\_\_**> kW).

Heating input: <**\_\_\_\_\_\_\_\_**> gph (<**\_\_\_\_\_\_\_\_**> L/s) No. 2 oil.

Annual fuel utilization efficiency (AFUE): <**\_\_\_\_\_\_\_\_**> percent.

* + - 1. GAS FIRED DUCT FURNACES.

In this article, list manufacturers acceptable for this Project.

* + - * 1. [Manufacturers:](http://www.specagent.com/Lookup?ulid=9373) Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

[Lennox Industries, Inc.; Lennox International](http://www.specagent.com/Lookup?uid=123457051267).

[Modine Manufacturing Company](http://www.specagent.com/Lookup?uid=123457051268).

[REZNOR, a brand of Nortek Global HVAC](http://www.specagent.com/Lookup?uid=123457051269).

[Sterling HVAC Products; a Mestek company](http://www.specagent.com/Lookup?uid=123457051270).

Approved equivalent.

Edit the following descriptive specifications to identify Project requirements and to eliminate conflicts with manufacturers specified above.

* + - * 1. Self-contained, packaged, factory assembled, pre-wired unit consisting of cabinet, heat exchanger, burner, controls, and accessories.

Gas control: [**Single stage**] [**two stage**] [**Modulating- electric or mechanical**].

Ignition System: [**Standing pilot**] [**Electric ignition pilot to main burner**] [**Electric direct ignition**].

Control Voltage: [**24 volt, 60 hertz**] [**115 volt, 60 hertz**].

Location: [**Floor mounted**] [**Suspended overhead**].

* + - * 1. Cabinet: Galvanized steel, easily removed and secured access panels, insulated or double panel construction.
				2. Heat Exchanger: [**Aluminized steel**] [**Type E-3 stainless steel**] [**Type 321 stainless steel**] welded construction.
				3. Gas Burner: [**Atmospheric type.**] [**Induced Draft.**] [**Forced Draft.**] [**Gravity vented**] [**Power vented with non-corrosive air blower with permanently lubricated motor**].
				4. Gas Burner Safety Controls:

Thermocouple sensor: Prevents opening of gas valve until pilot flame is proven and stops gas flow on ignition failure.

Flame rollout switch: Installed on burner box and prevents operation.

Vent safety shutoff sensor: Temperature sensor installed on draft hood and prevents operation, manual reset.

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

* + - * 1. Controls: Adjustable, room thermostat, low voltage, to control [**burner operation**] [**heater stages in sequence with delay between stages**].

Use the following paragraphs and insert performance for one or identical units. When specifying units of differing sizes, use schedule.

* + - * 1. Performance:

Air flow: <**\_\_\_\_\_\_\_\_**> cfm (<**\_\_\_\_\_\_\_\_**> L/s).

Static pressure drop: <**\_\_\_\_\_\_\_\_**> inch wg (<**\_\_\_\_\_\_\_\_**> Pa).

Heating capacity:

Heating output: <**\_\_\_\_\_\_\_\_**> Btuh (<**\_\_\_\_\_\_\_\_**> kW).

Heating input: <**\_\_\_\_\_\_\_\_**> Btuh (<**\_\_\_\_\_\_\_\_**> kW).

Annual fuel utilization efficiency (AFUE): <**\_\_\_\_\_\_\_\_**> percent.

Gas heating capacities are sea level ratings.

* + - 1. OIL FIRED DUCT FURNACES

In this article, list manufacturers acceptable for this Project.

* + - * 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.

Edit the following descriptive specifications to identify Project requirements and to eliminate conflicts with manufacturers specified above.

* + - * 1. Self-contained, packaged, factory assembled, pre-wired unit consisting of cabinet, heat exchanger, burner, controls, and accessories.
				2. Cabinet: Galvanized steel with baked enamel finish, easily removed and secured access-doors, glass fiber insulation and reflective liner.
				3. Combustion Chamber: [**UL 727;**] [**UL 729;**] [**welded stainless steel**] [**precast refractory**].
				4. Oil Burner: High pressure atomizing type, rubber mounted, adjustable combustion air blower, integrated fuel pump, fuel filter, hinged flame inspection port, cadmium sulfide flame sensor, electrodes, ignition transformer, oil nozzle.

Barometric draft regulator in flue.

Non-corrosive combustion air blower with permanently lubricated motor.

* + - * 1. Oil Burner Safety Controls:

Time delay relay limits time for establishment of main flame.

Flame sensor monitors flame continuously during burner operation and stops burner on flame failure with manual reset.

Solenoid operated oil delay valve opens after burner motor is energized and closes instantly when burner motor is de-energized.

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

* + - * 1. Controls: Adjustable, room thermostat, low voltage, to control [**burner operation**] [**heater stages in sequence with delay between stages**].

Use the following paragraphs and insert performance for one or identical units. When specifying units of differing sizes, use schedule.

* + - * 1. Performance:

Air flow: <**\_\_\_\_\_\_\_\_**> cfm (<**\_\_\_\_\_\_\_\_**> L/s).

Static pressure drop: <**\_\_\_\_\_\_\_\_**> inch wg (<**\_\_\_\_\_\_\_\_**> Pa).

Heating Capacity:

Heating output: <**\_\_\_\_\_\_\_\_**> Btuh (<**\_\_\_\_\_\_\_\_**> kW).

Heating input: <**\_\_\_\_\_\_\_\_**> gph (<**\_\_\_\_\_\_\_\_**> L/s) No. 2 oil.

Annual fuel utilization efficiency (AFUE): <**\_\_\_\_\_\_\_\_**> percent.

* + - 1. HIGH INTENSITY INFRARED HEATERS

In this article, list manufacturers acceptable for this Project.

* + - * 1. [Manufacturers:](http://www.specagent.com/Lookup?ulid=6993) Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

[Combustion Research Corporation](http://www.specagent.com/Lookup?uid=123457044731).

[Detroit Radiant Products Company](http://www.specagent.com/Lookup?uid=123457044732).

[Roberts-Gordon, Inc](http://www.specagent.com/Lookup?uid=123457044733).

[Schwank Inc](http://www.specagent.com/Lookup?uid=123457044734).

[Solaronics, Inc](http://www.specagent.com/Lookup?uid=123457044735).

[Space-Ray; a division of Gas-Fired Products Inc](http://www.specagent.com/Lookup?uid=123457044736).

[Sterling HVAC Products; a Mestek company](http://www.specagent.com/Lookup?uid=123457044737).

[Superior Radiant Products Ltd](http://www.specagent.com/Lookup?uid=123457044740).

Approved equivalent.

Edit the following descriptive specifications to identify Project requirements and to eliminate conflicts with manufacturers specified above.

* + - * 1. Self-contained, packaged, factory assembled, factory wired unit consisting of cabinet, heat exchanger, burner, reflector and controls.
				2. Cabinet: Galvanized steel with baked enamel finish.
				3. Ceramic Emitter: Assembly of high temperature ceramic tiles with stainless steel housing and reflector.
				4. Gas Burner:

Atmospheric type with adjustable combustion air supply.

Gas valve provides 100 percent safety gas shut-off; 24-volt combining pressure regulation, safety pilot, manual set (On-Off), pilot filtration and automatic electric valve.

Electronic pilot ignition, with [**electric spark**] [**hot surface**] igniter.

* + - * 1. Gas Burner Safety Controls: Thermo-couple sensor prevents opening of solenoid gas valve until pilot flame is proven and stops gas flow on ignition failure.
				2. Controls: Room thermostat, low voltage, to control burner operation.

Use the following paragraphs and insert performance for one or identical units. When specifying units of differing sizes, use schedule.

* + - * 1. Performance:

Heating output: <**\_\_\_\_\_\_\_\_**> Btuh (<**\_\_\_\_\_\_\_\_**> W).

Heating input: <**\_\_\_\_\_\_\_\_**> Btuh (<**\_\_\_\_\_\_\_\_**> W).

Minimum combustion efficiency [**90**] <**\_\_\_\_\_\_\_\_**> percent.

Gas heating capacities are sea level ratings.

* + - 1. TUBULAR INFRARED HEATERS

In this article, list manufacturers acceptable for this Project.

* + - * 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]:

Combustion Research Corp.

Panelbloc Corp.

Renzor

Approved equivalent.

Edit the following descriptive specifications to identify Project requirements and to eliminate conflicts with manufacturers specified above.

* + - * 1. Packaged, [**partially**] factory assembled, pre-wired unit consisting of cabinet, burner, heat exchanger, radiant tube, reflector and controls for [**natural gas**] [**propane gas**].
				2. Heat Exchanger: Aluminized tubular steel combustion chamber with [**aluminized**] steel tube with aluminum reflector.
				3. Gas Burner:

Gas Burner: [**Forced draft**] [**Induced draft**] type with adjustable combustion air supply.

Gas valve provides 100 percent safety gas shut-off; 24-volt combining pressure regulation, safety pilot, manual set (On-Off), pilot filtration and automatic electric valve.

Electronic pilot ignition, with [**electric spark**] [**hot surface**] igniter.

Non-corrosive [**burner**] [**exhaust**] air blower with permanently lubricated motor.

* + - * 1. Gas Burner Safety Controls: Thermo-couple sensor prevents opening of solenoid gas valve until pilot flame is proven and stops gas flow on ignition failure.
				2. Controls: Low voltage room thermostat cycles burner to maintain room temperature setting.

Use the following paragraphs and insert performance for one or identical units. When specifying units of differing sizes, use schedule.

* + - * 1. Performance:

Heating output: <**\_\_\_\_\_\_\_\_**> Btuh (<**\_\_\_\_\_\_\_\_**> W).

Heating input: <**\_\_\_\_\_\_\_\_**> Btuh (<**\_\_\_\_\_\_\_\_**> W).

Minimum combustion efficiency: [**90**] <**\_\_\_\_\_\_\_\_**> percent.

Gas heating capacities are sea level ratings.

* + - 1. FUEL FIRED PACKAGED AIR UNITS

In this article, list manufacturers acceptable for this Project.

* + - * 1. [Manufacturers:](http://www.specagent.com/Lookup?ulid=3593) Subject to compliance with requirements, provide products by one of the following:

[CES Group](http://www.specagent.com/Lookup?uid=123457144500).

[Greenheck Fan Corporation](http://www.specagent.com/Lookup?uid=123457144480).

[Sterling HVAC Products; a Mestek company](http://www.specagent.com/Lookup?uid=123457144505).

[Titan Air](http://www.specagent.com/Lookup?uid=123457144486).

[Trane Company (The)](http://www.specagent.com/Lookup?uid=123457144504).

[Weather-Rite, a brand of Specified Air Solutions](http://www.specagent.com/Lookup?uid=123457144487).

Approved equivalent.

Edit the following descriptive specifications to identify Project requirements and to eliminate conflicts with manufacturers specified above.

* + - * 1. Self-contained, packaged, factory assembled, pre-wired unit consisting of cabinet and supply fan assembly, and duct furnaces each consisting of heat exchanger and burner.
				2. Cabinet: Galvanized steel with baked enamel finish, easily removed and secured access-doors, glass fiber insulation and reflective liner.
				3. Supply Fan: Centrifugal type rubber mounted with belt drive, variable pitch motor pulley.
				4. Filter: 1 inch (25 mm) thick [**glass fiber throwaway**] [**permanent washable**] type, located to filter air before fan.
				5. Gas Fired Duct Furnace Units:

Heat Exchanger: [**Aluminized steel**] [**Type E-3 stainless steel**] [**Type 321 stainless steel**] welded construction.

Gas Burner:

Atmospheric type with adjustable combustion air supply.

Gas valve [**, two stage**] provides 100 percent safety gas shut-off; 24 volt combining pressure regulation, safety pilot, manual set (On-Off), pilot filtration, automatic electric valve.

Electronic pilot ignition, with [**electric spark**] [**hot surface**] igniter.

[**Combustion air damper**] [**Automatic vent damper**] with synchronous spring return damper motor.

Non-corrosive combustion air blower with permanently lubricated motor.

Gas Burner Safety Controls:

Thermocouple sensor: Prevents opening of gas valve until pilot flame is proven and stops gas flow on ignition failure.

Flame rollout switch: Installed on burner box and prevents operation.

Vent safety shutoff sensor: Temperature sensor installed on draft hood and prevents operation, manual reset.

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

Use the following paragraphs and insert performance for one or identical units. When specifying units of differing sizes, use schedule.

Performance:

Heating output: <**\_\_\_\_\_\_\_\_**> Btuh (<**\_\_\_\_\_\_\_\_**> kW).

Heating input: <**\_\_\_\_\_\_\_\_**> Btuh (<**\_\_\_\_\_\_\_\_**> kW).

Annual fuel utilization efficiency (AFUE): <**\_\_\_\_\_\_\_\_**> percent.

Gas heating capacities are sea level ratings.

* + - * 1. Oil Fired Duct Furnace Units:

Combustion Chamber: [**UL 727;**] [**UL 729;**] [**welded stainless steel**] [**precast refractory**].

Oil Burner: High pressure atomizing type, rubber mounted, adjustable combustion air blower, integrated fuel pump, fuel filter, hinged flame inspection port, cadmium sulfide flame sensor, electrodes, ignition transformer, oil nozzle.

Barometric draft regulator in flue.

Non-corrosive combustion air blower with permanently lubricated motor.

Oil Burner Safety Controls:

Time delay relay limits time for establishment of main flame.

Flame sensor monitors flame continuously during burner operation and stops burner on flame failure with manual reset.

Solenoid operated oil delay valve opens after burner motor is energized and closes instantly when burner motor is de-energized.

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

* + - * 1. Mixing Dampers:

Dampers: Outside and return dampers with damper operator and control package to automatically vary outside air quantity. Outside air damper fail to closed position.

Gaskets: Fit dampers with edge gaskets [**, maximum leakage 5 percent at 2 inches wg (500 Pa) pressure differential**].

Damper Operator: [**24 volt with gear train sealed in oil**] [**Pneumatic piston or gear driven type**] [**with spring return**].

Mixed Air Control Sequence: Maintain selected supply-air temperature and return dampers to minimum position on call for heating.

* + - * 1. Controls: Adjustable, room thermostat, low voltage, to control [**burner operation**] [**heater stages in sequence with delay between stages**] to maintain space temperature setting.

Use the following paragraphs and insert performance for one or identical units. When specifying units of differing sizes, use schedule.

* + - * 1. Performance:

Air flow: <**\_\_\_\_\_\_\_\_**> cfm (<**\_\_\_\_\_\_\_\_**> L/s).

External static pressure: <**\_\_\_\_\_\_\_\_**> inch wg (<**\_\_\_\_\_\_\_\_**> Pa).

Motor: <**\_\_\_\_\_\_\_\_**> hp (<**\_\_\_\_\_\_\_\_**> kW) [**two speed**].

Heating Capacity:

Heating output: <**\_\_\_\_\_\_\_\_**> Btuh (<**\_\_\_\_\_\_\_\_**> kW).

Heating input: <**\_\_\_\_\_\_\_\_**> gph (<**\_\_\_\_\_\_\_\_**> L/s) No. 2 oil.

Annual fuel utilization efficiency (AFUE): <**\_\_\_\_\_\_\_\_**> percent.

1. EXECUTION
	* + 1. EXAMINATION
				1. Section 013000 - Administrative Requirements: Coordination and project conditions.
				2. Verify space is ready for installation of units and openings are as indicated on shop drawings.
			2. INSTALLATION
				1. Install units in accordance with [**NFPA 90A**] [**and**] [**NFPA 90B**] [**gas fired units to NFPA 54**] [**oil fired units to NFPA 31**].
				2. Installation - Natural Gas Piping:

Connect natural gas piping in accordance with NFPA 54 “National Fuel Gas Code”.

Connect natural gas piping to unit, full size of unit gas train inlet. Arrange piping with clearances for burner service.

Install the following piping accessories on natural gas piping connections. Refer to Section 231123.

Strainer.

Pressure gage.

Shutoff valve.

Pressure reducing valve.

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

* + - * 1. Installation - Propane Gas Piping:

Connect propane piping in accordance with NFPA 58.

Connect propane piping to unit, full size of unit gas train inlet. Arrange piping with clearances for burner service.

Install the following piping accessories on propane piping connections. Refer to Section 231126.

Strainer.

Pressure gage.

Shutoff valve.

Pressure reducing valve.

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

* + - * 1. Installation - Fuel Oil Piping:

Connect fuel oil piping in accordance with NFPA 31 “Standard for the Installation of Oil-Burning Equipment”.

Connect fuel oil piping to unit, full size of unit connection. Arrange piping with clearances for burner service.

Install the following piping accessories on fuel oil piping connections. Refer to Section 231113.

Strainer.

Shutoff valve.

* + - * 1. Install vent connections in accordance with NFPA 211 “Standard for Chimneys, Fireplaces, Vents, and Solid Fuel Burning Appliances”. Install vents and stacks. Refer to Section 235100.
				2. Install [**unit heaters**] [**packaged air units**] with vibration isolation. Refer to Section 230548.
				3. Provide hangers and supports for suspended units. Support infrared radiant heaters in fixed position.
				4. Provide hangers and supports for suspended units. Refer to Section 230529.
				5. Provide operating controls. Refer to Section 230900.
				6. Provide connection to electrical power systems. Refer to Section 260503.
			1. SCHEDULES

Include schedule when more than one different size unit is specified. Coordinate equipment tags and abbreviations with project specific requirements.

Consider the following examples when developing Project schedule.

* + - * 1. Fuel-Fired Heaters:

Equipment Tag: <H-1>:

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

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

Fuel Type: <**\_\_\_\_\_\_\_\_**>.

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

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

[**Minimum Efficiency (AFUE): <\_\_\_\_\_\_\_\_>.**]

[**Air Flow Rate: <\_\_\_\_\_\_\_\_>.**]

[**External SP: <\_\_\_\_\_\_\_\_>.**]

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

Voltage/Phase: <**\_\_\_\_\_\_\_\_**>/<**\_\_\_\_\_\_\_\_**>.

Equipment Tag <H-2>:

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

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

Fuel Type: <**\_\_\_\_\_\_\_\_**>.

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

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

[**Minimum Efficiency (AFUE): <\_\_\_\_\_\_\_\_>.**]

[**Air Flow Rate: <\_\_\_\_\_\_\_\_>.**]

[**External SP: <\_\_\_\_\_\_\_\_>.**]

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

Voltage/Phase: <**\_\_\_\_\_\_\_\_**>/<**\_\_\_\_\_\_\_\_**>.

END OF SECTION 235500