**PART I – GENERAL**

* 1. SCOPE
		1. This section includes gas-fired, positive pressure, two stage, low intensity tubular radiant heaters.
	2. SUBMITTALS
		1. Product Data: For each type of gas-fired radiant heater indicated, include rated capacities, operating characteristics, and optional accessories.
		2. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
		3. Equipment Detail: Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of field connection.
	3. DRAWINGS
		1. Coordination Drawings: Include plans, elevations, and other details, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:
			1. Illustrations showing how and where equipment shall be applied.
			2. Wall or roof penetrations for purposes of depicting the location of either (both) supply air intake or exhaust venting.
			3. Gas piping size and appliance connections.
			4. Thermostat (controls) placement with applicable wiring diagram detail.
	4. LIMITED WARRANTY
		1. Manufacturer shall provide a Limited Appliance Warranty no less than: three (3) years on all internal control components, five (5) years on radiant pipe exchangers, and ten (10) years on stainless steel burner from date of substantial completion.

**PART II – EQUIPMENT**

* 1. APPLIANCE CONSTRUCTION STANDARDS
		1. Equipment shall be certified to the ANSI Z83.20 standard and bear the CSA mark for [United States] [Canada].
		2. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
	2. APPLIANCE APPLICATION STANDARDS
		1. Installation of this heater must comply with all applicable local, state, and national specifications, regulations, and building codes. In the absence of local codes, the installation must conform to the latest edition of:
			1. United States: National Fuel Gas Code, ANSI Z223.1 (NFPA 54).
			2. Canada: CAN/CGA B149.1 and .2, Canadian Electrical Code C22.1
		2. When applicable, follow building specific codes and regulations as dictated in the heater’s Installation, Operation and Maintenance Manual (IOPM).
	3. APPLIANCE PERFORMANCE STANDARDS
		1. Appliance manufacturer shall be equipped with a Radiant Efficiency testing apparatus capable of providing model specific Radiant Efficiency Values (aka–Infrared Factor (IF) or Radiant Emission Value (REV) as per the requirements stated in the AHR Standard 1330-2015/18.
		2. Radiant Efficiency shall be reported in accordance with AHRI Standard 1330-2015, Section 7 and must include the following reporting criteria:
			1. Model Number
			2. Heat Input, kW (BTU/h)
			3. Length of Heat Exchanger Tube
			4. Infrared Factor
			5. Mounting Angle
		3. In no case shall a Radiant Efficiency rating or value be reported on a series of heaters nor an individual component thereof.
	4. TUBULAR INFRARED HEATER CONSTRUCTION
		1. Basis-of-Design Product: Provide Detroit Radiant Products Company; Re-Verber-Ray two stage REV Series.
		2. Fuel Type: Burner shall be designed for [natural] [propane] gas having characteristics the same as those of gas available at project site.
		3. Gas Control: Operation shall include a defined input differential via a two stage positive pressure gas valve. Heater must be CSA Design Certified to operate at an input differential of at least 30% between the low and nominal rated input modes.
		4. Combustion Chamber: Shall be 4-inch O.D., 16 ga. titanium-stabilized aluminized steel (150-200 MBH) or aluminized steel (below 150 MBH), finished with a corrosion-resistant, black coating with an emissivity level documented at 0.92 or higher.
		5. Burner Type: Unit shall be a positive pressure (push) burner with a combustion fan upstream of the burner and exhaust gases for component longevity, maximum combustion efficiency, and energy transfer. Negative pressure (pull) appliances shall not be permitted.
		6. Combustion Air: Unit shall incorporate a connection between the burner box and reflector to supply pre-heated combustion air.
		7. Fan Enclosure: Combustion fan shall be totally housed inside burner control box and not exposed. Appliances with exposed combustion/exhauster fans shall not be permitted.
		8. Premium Combustion Burner: Shall be constructed from 304-grade stainless steel and die formed in a venturi-style design. Flame arrestor shall be a minimum of ¼” thick constructed from sintered steel or perforated stainless steel. Burner design shall also include secondary air vanes to maximize flame rotation and heat distribution. Non-venturi or ceramic style flame arrester designs shall not be permitted.
		9. Radiant Emitter Tube: Shall be 4-inch O.D., 16 ga. aluminized steel finished with a corrosion-resistant, black coating with an emissivity level documented at 0.92 or higher. Calorized or hot rolled steel tubes shall not be permitted.
		10. Tube Connections: The heater’s combustion chamber and radiant emitter tube shall connect via a 4-inch slip-fit, interlocking connection in which the upstream tube slides into the next tube and is held by a 4-inch aluminized bolted clamp. 4-inch 304-grade stainless steel clamps shall be used to join combustion tubes to radiant tubes on systems 150 MBH and above. A non-swaged or butted tube connection system shall not be permitted.
		11. Hangers: Hangers shall be a floating design which allows for tube movement independent of reflectors.
		12. Control Box: Heater’s exterior control chassis shall be constructed of corrosion-resistant enameled steel. The heater’s top cover shall be constructed of ABS plastic material with hinged and fitted design properties and shall be accessible without the use of tools.
		13. Sight Glass: Heater shall be equipped with a sight glass allowing a visual inspection of igniter and burner operation from floor level.
		14. Air Intake: An air intake collar shall be supplied as part of the burner control assembly fitted to accept a 4-inch O.D. PVW or DWV air supply duct.
		15. Baffle: Heater shall utilize downstream turbulator baffle(s) for maximum heat transfer.
	5. EXTRUDED ALUMINUM RAIL & REFLECTOR CONSTRUCTION.
		1. Material: Reflector shall be solid extruded aluminum with a minimum core wall thickness of 0.070-in. (15-gauge). Rolled or pressed reflectors shall not be permitted.
		2. Design Configurations: Reflector shall feature at least four (4) field configurable designs, with a minimum option of:
			1. A standard “dual pass” (88% design effective) geometric profile, designed to increase tube temperatures and maximize radiant output.
			2. A wide-angle “single pass” (100% design effective) geometric profile, designed to lessen tube temperature and maximize radiant flux patterns.
		3. Mounting Rail: Reflector shall feature an integrated sliding track rail with fitted brackets to allow selectable hanging locations. Heaters requiring a predefined mounting location shall not be permitted.
		4. Energy Capturing Cavities: Reflector shall feature integral, insulating, energy cavities designed to capture heat energy to pre-heated combustion air to the burner while concurrently reducing the heater’s top clearances to combustibles to a distance as low as 2 inches. Single or dual wall reflectors shall not be permitted.
		5. Reflector Facets: Reflector shall incorporate a minimum of eighteen (18) “reverberatory” facets to best optimize the radiant flux pattern AFF.
		6. Side Shield Mount: Reflector may be mounted with a 35-degree forward throw side shield using only the supplied materials. No additional accessories shall be required to achieve this profile.
		7. Sway Bracing: Reflector shall be supplied with sway bracing brackets for use in high wind or vibration applications. Sway brackets shall be secured with a factory installed nutsert anchor design.
		8. Energy Optimizer: Reflector shall be capable of being fitted with an optional field mount heat extraction or recapture device. Device shall be designed to release the heat captured in the Energy Capturing Chambers as usable convective air.
	6. BURNER CONTROLS, OPERATION & MARKINGS
		1. Heater controls shall include a single differential pressure switch to monitor combustion air flow so as to provide complete burner shutdown in the event of insufficient combustion air or flue blockage.
		2. Staged operation shall be mechanical in nature and controlled via a direct 24 V connection directly to the valve assembly. Heaters that control staging via air pressure or air ducting shall not be permitted.
		3. The heater shall incorporate a self-diagnostic ignition module and feature an ignition system with three (3) tries prior to entering soft lockout followed by hard lockout.
		4. Burner assembly shall not require or incorporate the use of air filters.
		5. Heater control assembly shall include three (3) operational indicator lights indicating status of low fire operation, high fire operation, and pressure switch operation.
		6. The heater’s ignitor warm-up control system shall provide a 45-second pre-purge prior to initiating burner operation and a 90-second post-purge upon completion, effectively removing all combustion by-products from the heat exchangers.
		7. Ignition System: Hot surface ignition with silicon carbide glo-bar. Direct spark ignition systems shall not be permitted. The heater’s ignition and control compartment shall be accessible without the use of tools and serviceable while the heater is operating.
		8. The rating label shall state the heater is approved for outdoor use when applicable.
		9. Heater will depict the published clearances to combustibles for adherence during both installation and operation. Clearance safety tags restating this hazard shall also be provided and located near the heater’s control device.
		10. Thermostat control shall be two stage operating on 24 volts.

**PART III – EXECUTION**

* 1. INSTALLATION
		1. Install and connect gas-fired radiant heaters, associated fuel and vent features, and system according to NFPA 54, applicable local codes and regulations, and manufacturer’s written installation instructions.
		2. Suspend heater from substrate as per the manufacturer’s instructions using fittings (chain, cable, rod, etc.) rated for the working load limit and area conditions.
		3. Maintain manufacturer’s published clearances to combustibles. In locations used for the storage of combustible materials, signs must be posted to specify the maximum permissible stacking height.
	2. CONNECTIONS
		1. Piping and installation requirements are specified in other Division 23 Sections.
		2. Drawings indicate general arrangement of piping, fittings, and specialties.
			1. Install piping adjacent to gas-fired radiant heaters to allow service and maintenance. Refer to manufacturer’s instructions for proper gas connection details.
		3. Gas Piping: Comply with NFPA 54 and manufacturer’s installation instructions.
		4. Vent Connections: Adhere to manufacturer’s installation instructions.
		5. Electrical Connections: Comply with applicable requirements in Division 26 Sections. Install electrical devices furnished with heaters but not specified to be factory mounted.
	3. FIELD QUALITY CONTROL
		1. Manufacturer’s Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
		2. Replace damaged and malfunctioning controls and equipment.

**END OF SECTION 235523**