MODULATED TWO-STAGE TUBE HEATERS

ENGINEERING SUBMITTAL DATA
TWO-STAGE LOW INTENSITY GAS-FIRED INFRA-RED TUBE HEATERS

WARNING! These heaters must be installed and serviced by trained gas heater installation and service personnel only! Improper installation, adjustment, alteration, service or maintenance can cause property damage, injury or death. Read the installation, operating, and maintenance instructions thoroughly before installing or servicing this equipment. Observe all safety information. Retain instructions for future reference.

Straight Heaters
<table>
<thead>
<tr>
<th>Straight Heater Length</th>
<th>High Fire MBTUH</th>
<th>Low Fire MBTUH</th>
<th>Natural Gas Model #</th>
<th>Qty</th>
<th>P*</th>
<th>Propane LP Gas Model #</th>
<th>Qty</th>
<th>P*</th>
<th>Natural Gas Model #</th>
<th>Qty</th>
<th>P*</th>
<th>Propane LP Gas Model #</th>
<th>Qty</th>
<th>P*</th>
<th>Typical Mounting Height</th>
<th>Wt.**</th>
<th>U-Tube Heater Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>22'-1/4&quot;</td>
<td>85</td>
<td>65</td>
<td>0DI913.20N.S</td>
<td>P*</td>
<td></td>
<td>0DI913.10N.U</td>
<td>P*</td>
<td></td>
<td>11' – 18'</td>
<td>110#</td>
<td></td>
<td>13'</td>
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<td>27'-1/4&quot;</td>
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<td>65</td>
<td>0DI913.25N.S</td>
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<td>Na</td>
<td>Na</td>
<td></td>
<td>11' – 18'</td>
<td>130#</td>
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<td></td>
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<tr>
<td>32'-1/4&quot;</td>
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<td>65</td>
<td>0DI910.30N.S</td>
<td>P*</td>
<td></td>
<td>Na</td>
<td>Na</td>
<td></td>
<td>12' – 20'</td>
<td>154#</td>
<td></td>
<td>18'</td>
<td></td>
<td></td>
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<td>37'-1/4&quot;</td>
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<td>Na</td>
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<td>12' – 20'</td>
<td>175#</td>
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<td>Na</td>
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<td>65</td>
<td>0DI910.40N.S</td>
<td>P*</td>
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<td>0DI910.20N.U</td>
<td>P*</td>
<td></td>
<td>12' – 20'</td>
<td>200#</td>
<td></td>
<td>23'</td>
<td></td>
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<td>47'-1/4&quot;</td>
<td>125</td>
<td>95</td>
<td>0DI930.40N.S</td>
<td>P*</td>
<td></td>
<td>0DI930.20N.U</td>
<td>P*</td>
<td></td>
<td>14' – 25'</td>
<td>200#</td>
<td></td>
<td>23'</td>
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<td>52'-1/4&quot;</td>
<td>125</td>
<td>95</td>
<td>0DI930.50N.S</td>
<td>P*</td>
<td></td>
<td>0DI930.25N.U</td>
<td>P*</td>
<td></td>
<td>14' – 25'</td>
<td>240#</td>
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<td>28'</td>
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<td>57'-1/4&quot;</td>
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<td>P*</td>
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<td>P*</td>
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<td>16' – 30'</td>
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<td>28'</td>
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<td>62'-1/4&quot;</td>
<td>150</td>
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<td>P*</td>
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<td>Na</td>
<td>Na</td>
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<td>16' – 30'</td>
<td>260#</td>
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<td>Na</td>
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<tr>
<td>67'-1/4&quot;</td>
<td>175</td>
<td>125</td>
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<td>P*</td>
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<td>0DI940.25N.U</td>
<td>P*</td>
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<td>17' – 35'</td>
<td>260#</td>
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<td>28'</td>
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<td>72'-1/4&quot;</td>
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<td>P*</td>
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<td>Na</td>
<td>Na</td>
<td></td>
<td>17' – 35'</td>
<td>260#</td>
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<tr>
<td>77'-1/4&quot;</td>
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<td>0DI945.25N.U</td>
<td>P*</td>
<td></td>
<td>19' – 42'</td>
<td>260#</td>
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<td>38'</td>
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<tr>
<td>82'-1/4&quot;</td>
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<td>Na</td>
<td>Na</td>
<td></td>
<td>19' – 42'</td>
<td>260#</td>
<td></td>
<td>Na</td>
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<td>0DI940.30N.U</td>
<td>P*</td>
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<td>17' – 35'</td>
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<td>Na</td>
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<td>17' – 35'</td>
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<td>P*</td>
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<td>0DI945.30N.U</td>
<td>P*</td>
<td></td>
<td>19' – 42'</td>
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<td>33'</td>
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<td>102'-1/4&quot;</td>
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<td>Na</td>
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<td>19' – 42'</td>
<td>300#</td>
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<td>107'-1/4&quot;</td>
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<td>225</td>
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<td>P*</td>
<td></td>
<td>0DI940.35N.U</td>
<td>P*</td>
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<td>17' – 35'</td>
<td>325#</td>
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<td>38'</td>
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<td>112'-1/4&quot;</td>
<td>275</td>
<td>225</td>
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<td>0DI940.35N.U</td>
<td>P*</td>
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<td>19' – 42'</td>
<td>325#</td>
<td></td>
<td>38'</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

MBTUH = 1000 BTU per hour.
na = not available.
P* = P replaces N in the model number for Propane / LP gas models.
Wt.** = Shipping Weight. Add 25# to weight for U-tube heaters.

Submitted by: ______________________________________ Date: ___________________________
Job Title: ___________________________________________________________________________
Address: __________________________ City: ________________ State: _________ Zip: __________
Contractor: _________________________________________ Phone #: ________________________
Address: __________________________ City: ________________ State: _________ Zip: __________
Engineer: __________________________________________________________________________
Local Representative: _________________________________________________________________
Notes: _____________________________________________________________________________

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E-mail: info@combustionresearch.com
## SPECIFICATIONS AND CLEARANCES

### TWO-STAGE SERIES SPECIFICATIONS

**APPROVALS**
- CSA International Design Certified, Report # 163199-1063506.
- Indoor / Outdoor Approval.
- Commercial / Industrial Approval.

**BURNER AND CONTROLS**
- Two-stage Control of Both Gas and Air for Precise Air to Gas Ratios and Complete Efficient Combustion at Both High and Low Fire Rates.
- Two-stage gas valve - 30% differential.
- Two-speed blower thermally protected and permanently lubricated.
- Blower impeller balanced statically and dynamically.
- Controls isolated from combustion air.
- Safety differential pressure switch.
- Redundant gas safety shut-off 100%.
- Durable direct spark ignitor.
- Independent flame rod sensing.
- Sight glass for burner observation.
- Pre- and post-purge controls.

### GAS CONNECTION
- ½” FPT gas inlet.

### GAS SUPPLY (W.C.)
- NAT: Manifold pressure (High) 5”
- LP: Minimum inlet pressure 7”
- LP: Maximum inlet pressure 14”

### COMBUSTION AIR / VENTING
- Wall or roof venting – 4” diameter pipe up to 20 linear feet and one 90° elbow.

### POWER SUPPLY
- 120 VAC, 60 Hz, 1 phase.
- Maximum current draw is 1.3 amps.
- 3-prong plug power cord 36” long.
- Thermostatic 24-volt power supply provided at heater terminal board.

### LIMITED WARRANTY
- 10 years on Burner Core.
- 5 years on All Heat Exchanger & Combustion Tubes.
- 2 years on All Burner Controls.

**MADE IN THE USA**

### PHYSICAL DIMENSIONS

<table>
<thead>
<tr>
<th>MODELS</th>
<th>CLEARANCES TO COMBUSTIBLES* (INCHES)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>MOUNTING ANGLE</td>
</tr>
<tr>
<td>0DI913.(20,25)N/P.S</td>
<td>0°-30°</td>
</tr>
<tr>
<td>0DI913.10N/P.U</td>
<td>0°-30°</td>
</tr>
<tr>
<td>0DI910.(30,35,40)N/P.S</td>
<td>0°-30°</td>
</tr>
<tr>
<td>0DI910.(15,20)N/P.U</td>
<td>0°-30°</td>
</tr>
<tr>
<td>0DI930.([30,35]N.S)[[40,45,50]N/P.S]</td>
<td>0°-30°</td>
</tr>
<tr>
<td>0DI930.[15N.U][[20,25]N/P.U]</td>
<td>0°-30°</td>
</tr>
<tr>
<td>0DI935.(40,45,50,55,60)N/P.S</td>
<td>31°-45°</td>
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<tr>
<td>0DI935.(20,25,30)N/P.U</td>
<td>0°-30°</td>
</tr>
<tr>
<td>0DI940.(20,25,30,35)N/P.S</td>
<td>31°-45°</td>
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</tbody>
</table>

* FOR ALL SYSTEMS: 12" FROM BURNER END AND 68" FROM U-BEND.

### CLEARANCES

**CLEARANCES TO COMBUSTIBLES**

*See page 1 for heater length:* 24-1/4"
FIELD WIRING

ONE OR TWO HEATERS ON A SINGLE THERMOSTAT

A single heater must be wired to a two-stage thermostat the same way as Heater #1 shown here.

TWO-STAGE THERMOSTAT

HEATER #1

W1 LOW HEAT INPUT
W2 HIGH HEAT INPUT

W1 WHITE
W2 WHITE

R RED
C BLUE

USE 18/4 SOLID CLASS 2 THERMOSTAT CABLE BETWEEN HEATER #1 AND THERMOSTAT. MAXIMUM LENGTH OF 18 GA. THERMOSTAT CABLE IS 100 FT. (30M).

GREEN

DO NOT SHORT CIRCUIT THE "R" AND "C" TERMINALS TO PREVENT TRANSFORMER DAMAGE.

HEATER #2

W1 LOW HEAT INPUT
W2 HIGH HEAT INPUT

W1 WHITE
W2 WHITE

R RED
C BLUE

USE 18/3 SOLID CLASS 2 THERMOSTAT CABLE BETWEEN HEATER #2 AND THERMOSTAT. MAXIMUM LENGTH OF 18 GA. THERMOSTAT CABLE IS 100 FT. (30M).

C GREEN

GREEN

GROUNDED ELECTRICAL POWER CORD
120 VAC - 1 PHASE - 60 HZ

GROUNDED ELECTRICAL POWER CORD
120 VAC - 1 PHASE - 60 HZ

FIELD WIRING & ACCESSORIES

RECOMMENDED ACCESSORIES

<table>
<thead>
<tr>
<th>QTY</th>
<th>ITEM #</th>
<th>DESCRIPTION</th>
<th>NOTES</th>
</tr>
</thead>
<tbody>
<tr>
<td>5490.03</td>
<td>2-stage standard thermostat</td>
<td>Used for 2-stage operation. (50-90°F) Operates one or two heaters.</td>
<td></td>
</tr>
<tr>
<td>CH-50</td>
<td>Mounting chain set</td>
<td>50 feet of chain plus 16 S-hooks.</td>
<td></td>
</tr>
<tr>
<td>5440.03</td>
<td>Gas ball valve</td>
<td>½ full port ball valve with ½” female NPT pipe threads for gas supply.</td>
<td></td>
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<tr>
<td>1811.12</td>
<td>4” roof vent cap for single heater</td>
<td>Required for single 4” roof vents.</td>
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</table>

OTHER ACCESSORIES

<table>
<thead>
<tr>
<th>QTY</th>
<th>ITEM #</th>
<th>DESCRIPTION</th>
<th>NOTES</th>
</tr>
</thead>
<tbody>
<tr>
<td>132654</td>
<td>Blower enclosure installed</td>
<td>Protects burner blower motor in harsh environments. Factory installed with air collar.</td>
<td></td>
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<tr>
<td>132685</td>
<td>90-degree 4&quot; OD tube press-fit elbow</td>
<td>For L-shaped heater. 16 ga. aluminumized steel 90-degree elbow for press-fit tube models.</td>
<td></td>
</tr>
<tr>
<td>5491.05</td>
<td>2-stage rain tight thermostat</td>
<td>Used for 2-stage operation. (40-110°F) NEMA-4X, weather resistant, with stainless steel coil. Operates one or two heaters.</td>
<td></td>
</tr>
<tr>
<td>5491.03</td>
<td>2-stage programmable thermostat</td>
<td>Used for 2-stage operation. (45-90°F) Operates one or two heaters.</td>
<td></td>
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<tr>
<td>5485.LC</td>
<td>Locking thermostat guard</td>
<td>Metal guard. Specify material: _____________.</td>
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<tr>
<td>1811.11</td>
<td>4” wall vent cap for single heater</td>
<td>Standard for single 4” wall vents.</td>
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<tr>
<td>0314.00</td>
<td>4” wall air supply kit for single heater</td>
<td>Required for single 4” wall supply. Wall cap, flex duct, sleeve &amp; collar.</td>
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<tr>
<td>1810.14</td>
<td>4” roof air supply kit for single heater</td>
<td>Required for single 4” roof supply. Roof cap.</td>
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<tr>
<td>1811.15</td>
<td>6” roof vent cap for venting 2 heaters</td>
<td>Required for common 6” roof vents.</td>
<td></td>
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<tr>
<td>132863</td>
<td>5” wall vent cap for venting 2 heaters</td>
<td>Required for common 5” wall vents.</td>
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<tr>
<td>0650.YT.464</td>
<td>4”x4”x6” Individual vent coupler (Y)</td>
<td>Joins two heaters to one common 6” vent using one or two thermostats. (Sheet metal).</td>
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</tr>
<tr>
<td>132747</td>
<td>Vent cap for individual vent coupler</td>
<td>Required with 132746 to independently vent two heaters thru one 6” roof vent when using two thermostats.</td>
<td></td>
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<tr>
<td>910.10</td>
<td>Indoor venting kit</td>
<td>Required for all units when operating unvented. Cap &amp; elbow.</td>
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<tr>
<td>132115</td>
<td>U-bend reflector assembly</td>
<td>Use when ordering U-tube heater. Includes (2) pipe hangers.</td>
<td></td>
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<tr>
<td>131421</td>
<td>Corner reflector assembly</td>
<td>Use with 132865 elbow. Includes (2) pipe hangers.</td>
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<tr>
<td>0366.00</td>
<td>Reflector side extension assembly</td>
<td>Focus radiant heat below and in front of heater. 10-foot long with S-hooks.</td>
<td></td>
</tr>
<tr>
<td>132129</td>
<td>Parabolic reflector assembly</td>
<td>Focus radiant heat below heater. 10-foot long with support brackets.</td>
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</tr>
<tr>
<td>132352</td>
<td>End cap for reflector</td>
<td>Cap for reflector at the end of the heater.</td>
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Combustion Research Two-Stage Gas Infra-Red Tube Heaters

WRITTEN SPECIFICATIONS

SECTION 23 55 23 – FUEL-FIRED RADIANT HEATERS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS
A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, and Division 01 Specification Sections apply to this Section.

1.2 SUMMARY
A. Section includes:
1. Gas-Fired Infra-Red Tube Heaters
2. Related Sections:
   1. Division 23, Section 23 10 00 “Facility Fuel Systems”
   2. Division 23, Section 23 51 00 “Breechings, Chimneys, and Stacks”

1.3 QUALITY ASSURANCE
A. Building Codes and Standards
1. Two-stage radiant tube heaters shall be Design Certified by CSA and comply with current Occupational Safety and Health (OSHA) Requirements. The supplier shall provide the CSA Certification Number and the heaters shall bear the CSA Seal of Certification. The heater's low fire and high fire modes of operation must be Design Certified by CSA.
2. Gas-fired two-stage radiant tube heaters shall be furnished and installed in accordance with local codes, building drawings and manufacturer's recommendations.

1.4 SUBMITTALS
A. The supplier shall furnish the owner/contractor with copies of the engineering specification forms, showing physical dimensions, installation detail, recommendations, and field wiring.

1.5 WARRANTY
A. The supplier shall provide a manufacturer's published warranty covering the heater's burner core for a period of ten (10) years, heat exchanger and combustion chamber tubes for a period of five (5) years, and all components utilized in the heater control assembly for a period of two (2) years.

PART 2 – PRODUCTS

2.1 MANUFACTURER
A. Two-stage radiant tube heaters shall be COMBUSTION RESEARCH CORPORATION TWO-STAGE of the model numbers and inputs in MBTUH as manufactured by Combustion Research Corporation, Rochester Hills, Michigan 48309-3556.

2.2 DESCRIPTION
A. The heaters shall provide Two-Stage Control of Both Gas and Air to provide precise air to gas ratios and the most efficient and complete combustion at both high and low fire rates.
B. Two-stage radiant tube heaters shall be designed to satisfactorily operate at a minimum inlet pressure of 7 inches W.C. when specified for natural gas or 11 inches W.C. when specified for LP/propane gas and at a maximum inlet pressure of 14 inches W.C.
C. Two-stage radiant tube heaters shall be designed to operate without adjustments when burning natural gas having a heat value of 1000 BTU per cubic foot with a specific gravity of .65, or when burning LP/propane gas having a heat value of 2000 BTU per cubic foot with a specific gravity of 1.53.

2.3 CONSTRUCTION
A. The heater's controls shall be totally enclosed with a corrosion resistant housing. The controls shall be easily accessible from three sides by removing the cover. The burner core assembly shall be constructed of durable materials specifically designed for high efficiency, maximum heat transfer, extremely quiet operation and extended life.
B. The heater's combustion chamber shall be 4" O.D. Aluma Therm (aluminized titanium alloy steel) (85-100 MBTUH) or Aluma Therm finished with a high emissivity rated, corrosion resistant, black coating (125-200 MBTUH). Aluma-Therm provides excellent mechanical properties at elevated temperatures and for corrosion / oxidation resistance is coated with 8% silicon/aluminum alloy, and shall meet MIL 500 hour salt spray test.
C. The heater's heat exchanger shall be 4" O.D., 16 ga. (.065") wall thickness aluminized steel for corrosion and oxidation resistance, and shall meet MIL 500 hour salt spray test.
D. The burner connector joining the burner to the combustion chamber shall be cylindrical 4" I.D. by 8" long with a 16 ga. (.065") wall thickness; connector shall be aluminized steel for corrosion and oxidation resistance, and shall meet MIL 500 hour salt spray test; center of the coupler shall have an internal radiused extrusion limiting and assuring proper tube insertion, seating and concentricity with two (2) sets of two (2) clearance holes for screws; burner coupler connection shall couple only the burner to the combustion chamber with four (4) hi-tech multi-metal self-drilling screws.
E. The heat exchanger joint connections shall be a forced fit flared/swaged configuration; swaged end of heat exchanger shall have a black line visual indicator, 3" from the swaged end, where the flared end of the next heat exchanger shall be forcibly aligned to assure proper insertion, seating and concentricity; flared end of a heat exchanger shall have two clearance holes, for two (2) hi-tech multi-metal self-drilling screws.
F. The direct spark igniter shall be durable to resist breakage.
G. Reflectors shall be .025" thick - #3003/H25 aluminum brite finish with a geometrically designed configuration not having less than 91.7% reflective efficiency, shall be held by a .229" diameter aluminized steel wire hanger. Hanger shall incorporate the geometric ability to rotate the reflector up to 45 degrees, in either direction from horizontal using the center of the combustion chamber or heat exchanger as the axis of rotation.
H. Each 5 or 10-foot reflector section shall have the ability to be independently rotated from all other 5 or 10-foot sections, or overlapped between 5 or 10-foot sections, or a combination of both over the entire length of the system. The heater’s reflector hanging system shall be designed to permit expansion while minimizing noise and/or rattle. Reflectors shall be assembled to the heater without the use of tools.
I. Heaters shall utilize a downstream turbulator that shall be factory installed in the last 10-foot heat exchanger section, wave formed for optimal turbulence, acceleration and impingement of the products of combustion resulting in appropriate velocity pressure and momentum for maximum thermal efficiency.
J. Heaters shall be equipped with a sight glass permitting a visual inspection of the spark ignitor and burner operation from the floor.
K. The two-stage radiant tube heaters shall be designed such that, at the customer's option, outside combustion air may be supplied without the use of additional supply fans.
L. Heaters shall be either directly vented outdoors with insulated flue pipe, or indirectly vented by positive air displacement of 4 CFM and one square inch of net free area per 1,000 BTUH input.
M. Heaters shall come with a 36" long stainless steel flexible gas connector.

2.4 CONTROLS
A. The two-stage radiant tube heater’s normal sequence of operation shall include a defined input differential. The heater must be CSA Design Certified to operate at an input differential of at least 30% between the low fire and high fire modes.
B. Heater controls shall be isolated from combustion air to prevent corrosion from wet or dirty air.
C. Heaters shall be equipped with a direct spark ignition system with three (3) trials-for-ignition and upon loss of flame sensing three (3) re-trials-for-ignition. Flame sensing shall be via an independent sensing rod and circuit.
D. Power supplied to each burner shall be 120 VAC, 60 Hz. Maximum heater electrical current draw shall not exceed 1.3 amps.
E. The heater controls shall have a three (3) copper conductor electrical power cord extending a minimum of thirty-six (36) inches from the control box with a three (3) prong plug.
F. Heater controls shall include a safety differential pressure switch to monitor combustion airflow, so as to provide complete burner shutdown due to insufficient combustion air or flue blockage. Gas valve shut-off shall be of the redundant type.
G. The heater shall incorporate a self-diagnostic ignition module, include an external LED readout display, and automatically recycle itself after an inadvertent shutdown.
H. The heater’s control system shall be designed to shut off the gas flow to the burner in the event either a gas supply or power supply interruption occurs.
I. The heater’s blower motor shall be thermally protected, permanently lubricated and the blower motor’s impeller shall be both statically and dynamically balanced.
J. The heater’s air flow control system shall provide a 30-second pre-purge prior to initiating burner operation and a 120-second post-purge upon completion, effectively removing all products of combustion from the heat exchanger and/or radiant tubes.
K. No condensation shall form as a result of combustion in the combustion chamber or heat exchanger tubes while at operating temperatures.
L. The thermostats shall be two-stage operating on 24 volts.
M. The heater control shall provide the 24-volt power supply for the thermostat at the heater terminal board. No additional 24-volt power supply is required.
N. Total heater shutdown shall occur in the event of circuit control lockout, including burner operation and combustion air blower. An interruption of power (reset thermostat) will restart the firing sequence.

PART 3 – EXECUTION

3.1 INSTALLATION
A. Installation shall be in accordance with the requirements of the manufacturer.
An Installation, Operation, and Maintenance Manual shall be supplied with each heater.

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