



# 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 Heater Length	High Fire MBTUH	Low Fire MBTUH	Straight Heaters				U-Tube Heaters				Typical Mounting Height	Wt.**	U-Tube Heater Length
			Natural Gas		Propane LP Gas		Natural Gas		Propane LP Gas				
			Model #	Qty	P*	Qty	Model #	Qty	P*	Qty			
22'-1/4"	85	65	0DI913.20N.S		P*		0DI913.10N.U		P*		11' - 18'	110#	13'
27'-1/4"	85	65	0DI913.25N.S		P*		Na		na		11' - 18'	130#	na
32'-1/4"	100	65	0DI910.30N.S		P*		0DI910.15N.U		P*		12' - 20'	154#	18'
37'-1/4"	100	65	0DI910.35N.S		P*		na		na		12' - 20'	175#	na
42'-1/4"	100	65	0DI910.40N.S		P*		0DI910.20N.U		P*		12' - 20'	200#	23'
42'-1/4"	125	95	0DI930.40N.S		P*		0DI930.20N.U		P*		14' - 25'	200#	23'
42'-1/4"	150	100	0DI935.40N.S		P*		0DI935.20N.U		P*		16' - 30'	200#	23'
47'-1/4"	125	95	0DI930.45N.S		P*		na		na		14' - 25'	220#	na
47'-1/4"	150	100	0DI935.45N.S		P*		na		na		16' - 30'	220#	na
52'-1/4"	125	95	0DI930.50N.S		P*		0DI930.25N.U		P*		14' - 25'	240#	28'
52'-1/4"	150	100	0DI935.50N.S		P*		0DI935.25N.U		P*		16' - 30'	240#	28'
52'-1/4"	175	125	0DI940.50N.S		P*		0DI940.25N.U		P*		17' - 35'	240#	28'
52'-1/4"	200	145	0DI945.50N.S		P*		0DI945.25N.U		P*		19' - 42'	240#	28'
57'-1/4"	150	100	0DI935.55N.S		P*		na		na		16' - 30'	260#	na
57'-1/4"	175	125	0DI940.55N.S		P*		na		na		17' - 35'	260#	na
57'-1/4"	200	145	0DI945.55N.S		P*		na		na		19' - 42'	260#	na
62'-1/4"	150	100	0DI935.60N.S		P*		0DI935.30N.U		P*		16' - 30'	280#	33'
62'-1/4"	175	125	0DI940.60N.S		P*		0DI940.30N.U		P*		17' - 35'	280#	33'
62'-1/4"	200	145	0DI945.60N.S		P*		0DI945.30N.U		P*		19' - 42'	280#	33'
67'-1/4"	175	125	0DI940.65N.S		P*		na		na		17' - 35'	300#	na
67'-1/4"	200	145	0DI945.65N.S		P*		na		na		19' - 42'	300#	na
72'-1/4"	175	125	0DI940.70N.S		P*		0DI940.35N.U		P*		17' - 35'	325#	38'
72'-1/4"	200	145	0DI945.70N.S		P*		0DI945.35N.U		P*		19' - 42'	325#	38'

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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 2516 Leach Road – Rochester Hills, MI 48309-3555 U.S.A.  
 Toll Free: 1-888-852-3611 Phone: 248-852-3611 Fax: 248-852-9165  
 E-mail: info@combustionresearch.com

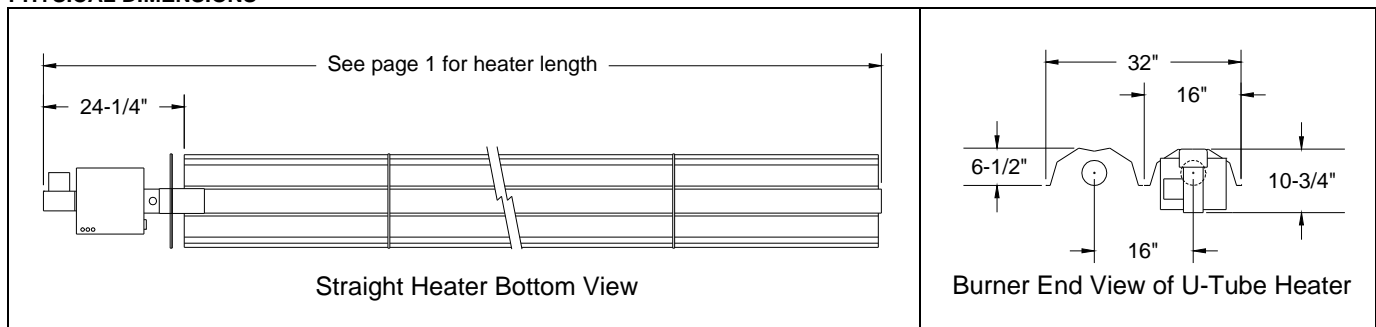


**SPECIFICATIONS AND CLEARANCES**

**TWO-STAGE SERIES SPECIFICATIONS**

<p><b>APPROVALS</b></p> <ul style="list-style-type: none"> <li>• CSA International Design Certified, Report # 163199-1063506.</li> <li>• Indoor / Outdoor Approval.</li> <li>• Commercial / Industrial Approval.</li> </ul> <p><b>BURNER AND CONTROLS</b></p> <ul style="list-style-type: none"> <li>• <b>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.</b></li> <li>• Two-stage gas valve - 30% differential.</li> <li>• Two-speed blower thermally protected and permanently lubricated.</li> <li>• Blower impeller balanced statically and dynamically.</li> <li>• Controls isolated from combustion air.</li> <li>• Safety differential pressure switch.</li> <li>• Redundant gas safety shut-off 100%.</li> <li>• Durable direct spark ignitor.</li> <li>• Independent flame rod sensing.</li> <li>• Sight glass for burner observation.</li> <li>• Pre- and post-purge controls.</li> </ul>	<ul style="list-style-type: none"> <li>• 3 trials for ignition and automatic recycle after inadvertent shutdown.</li> <li>• Self-diagnostic LED and soft lockout.</li> <li>• Controls inside a corrosion resistant housing, yet easily accessible from 3 sides by removing the cover.</li> <li>• 24-volt thermostatic control.</li> </ul> <p><b>HEAT EXCHANGER TUBES</b></p> <ul style="list-style-type: none"> <li>• 16 ga. 4" O.D. aluminized steel for excellent corrosion resistance</li> <li>• Turbulator baffle factory installed.</li> <li>• Swaged/flared force fit heat exchanger joints.</li> </ul> <p><b>COMBUSTION TUBES</b></p> <ul style="list-style-type: none"> <li>• 4" O.D. Alumina Therm for excellent corrosion resistance.</li> </ul> <p><b>REFLECTORS</b></p> <ul style="list-style-type: none"> <li>• 91.7% reflectional efficiency.</li> <li>• Brite finished aluminum.</li> <li>• Rotate sections independently or continuous overlap.</li> </ul>	<p><b>GAS CONNECTION</b></p> <ul style="list-style-type: none"> <li>• ½" FPT gas inlet.</li> </ul> <table border="1"> <tr> <td><b>GAS SUPPLY (W.C.)</b></td> <td><b>NAT</b></td> <td><b>LP</b></td> </tr> <tr> <td>• Manifold pressure (High)</td> <td>5"</td> <td>5"</td> </tr> <tr> <td>• Minimum inlet pressure</td> <td>7"</td> <td>11"</td> </tr> <tr> <td>• Maximum inlet pressure</td> <td>14"</td> <td>14"</td> </tr> </table> <p><b>COMBUSTION AIR / VENTING</b></p> <ul style="list-style-type: none"> <li>• Wall or roof venting – 4" diameter pipe up to 20 linear feet and one 90° elbow.</li> </ul> <p><b>POWER SUPPLY</b></p> <ul style="list-style-type: none"> <li>• 120 VAC, 60 Hz, 1 phase.</li> <li>• Maximum current draw is 1.3 amps.</li> <li>• 3-prong plug power cord 36" long.</li> <li>• Thermostatic 24-volt power supply provided at heater terminal board.</li> </ul> <p><b>LIMITED WARRANTY</b></p> <ul style="list-style-type: none"> <li>• 10 years on Burner Core.</li> <li>• 5 years on <b>All</b> Heat Exchanger &amp; Combustion Tubes.</li> <li>• 2 years on <b>All</b> Burner Controls.</li> </ul> <p><b>MADE IN THE USA</b></p>	<b>GAS SUPPLY (W.C.)</b>	<b>NAT</b>	<b>LP</b>	• Manifold pressure (High)	5"	5"	• Minimum inlet pressure	7"	11"	• Maximum inlet pressure	14"	14"
<b>GAS SUPPLY (W.C.)</b>	<b>NAT</b>	<b>LP</b>												
• Manifold pressure (High)	5"	5"												
• Minimum inlet pressure	7"	11"												
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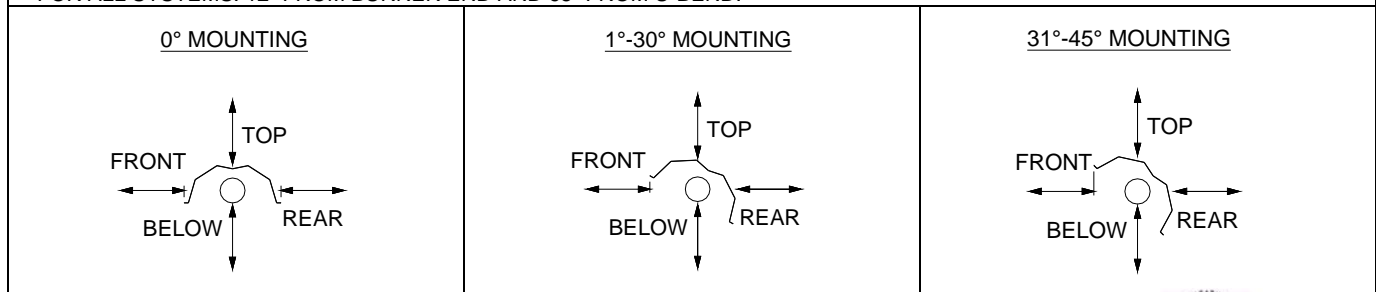
**PHYSICAL DIMENSIONS**



**CLEARANCES**

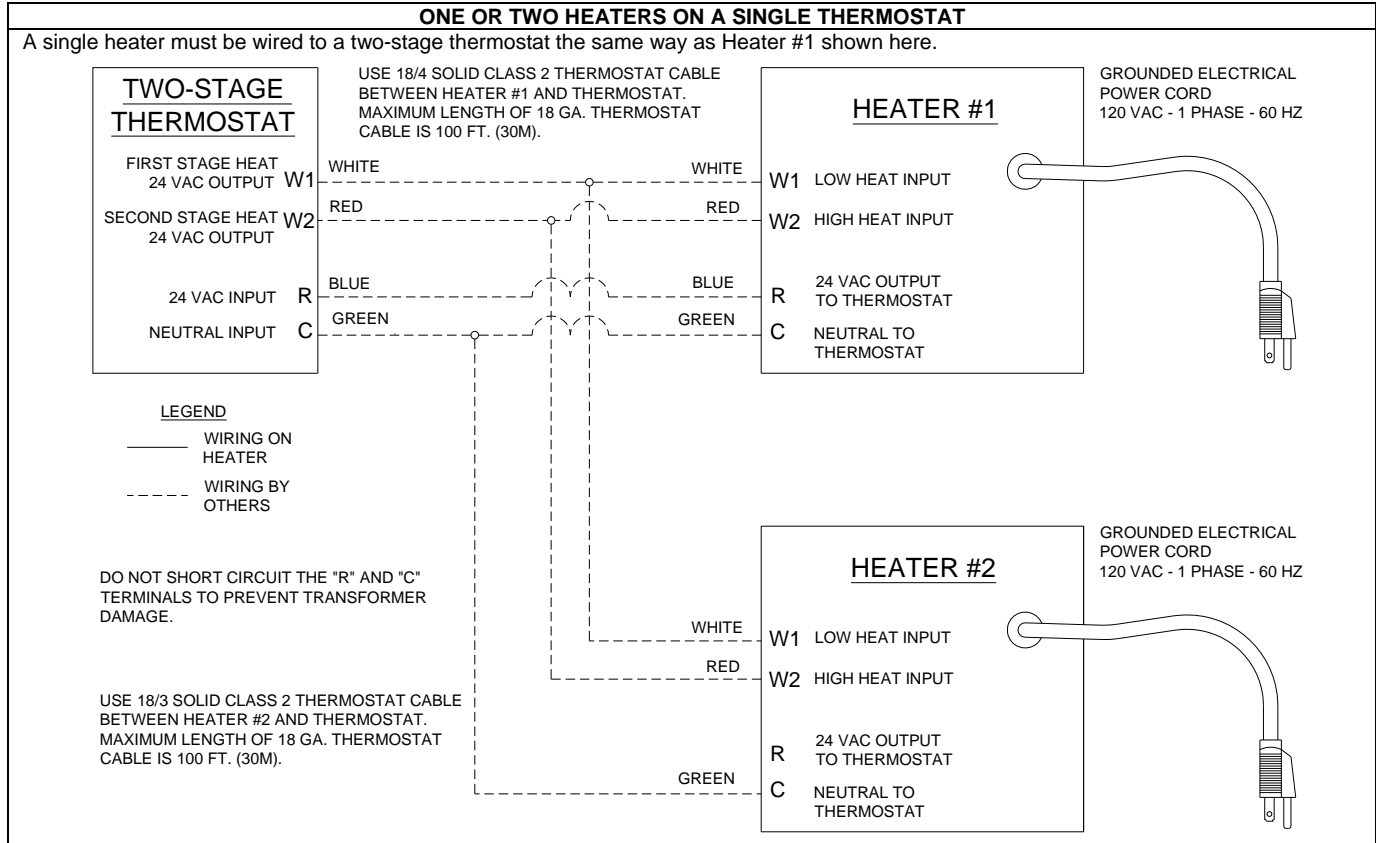
MODELS	CLEARANCES TO COMBUSTIBLES* (INCHES)				
	MOUNTING ANGLE	FRONT	REAR	TOP	BELOW
0DI913.(20,25)N/P.S 0DI913.10N/P.U	0°-30°	24	24	12	60
0DI910.(30,35,40)N/P.S 0DI910.(15,20)N/P.U	0°-30°	24	24	12	60
0DI930.[(30,35)N.S] [(40,45,50)N/P.S] 0DI930.[15N.U] [(20,25)N/P.U]	0°-30°	32	32	12	72
0DI935.(40,45,50,55,60)N/P.S 0DI935.(20,25,30)N/P.U	0°-30°	48	48	12	82
	31°-45°	70	12	12	82
0DI940.(50,55,60,65,70)N/P.S 0DI940.(25,30,35)N/P.U	0°-30°	58	58	12	92
	31°-45°	80	12	12	92
0DI945.(50,55,60,65,70)N/P.S 0DI945.(25,30,35)N/P.U	0°-30°	68	68	12	102
	31°-45°	90	12	12	102

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



FIELD WIRING & ACCESSORIES

FIELD WIRING



RECOMMENDED ACCESSORIES

QTY	ITEM #	DESCRIPTION	NOTES
	5490.03	2-stage standard thermostat	Used for 2-stage operation. (50-90°F) Operates <b>one or two</b> heaters.
	CH-50	Mounting chain set	50 feet of chain plus 16 S-hooks.
	5040.03	Gas ball valve	½" full port ball valve with ½" female NPT pipe threads for gas supply.
	1811.VT.400	4" roof vent cap for single heater	Required for single 4" roof vents.

OTHER ACCESSORIES

QTY	ITEM #	DESCRIPTION	NOTES
	132654	Blower enclosure installed	Protects burner blower motor in harsh environments. Factory installed with air collar.
	132685	90-degree 4" OD tube press-fit elbow	For L-shaped heater. 16 ga. aluminumized steel 90-degree elbow for press-fit tube models.
	5491.05	2-stage rain tight thermostat	Used for 2-stage operation. (40-110°F) NEMA-4X, weather resistant, with stainless steel coil. Operates <b>one or two</b> heaters.
	5491.03	2-stage programmable thermostat	Used for 2-stage operation. (45-90°F) Operates <b>one or two</b> heaters.
	5485.LC	Locking thermostat guard	Metal guard. Specify material: _____.
	1811.VT.400	4" wall vent cap for single heater	Standard for single 4" wall vents.
	0314.00	4" wall air supply kit for single heater	Required for single 4" wall supply. Wall cap, flex duct, sleeve & collar.
	1810.VT.400	4" roof air supply kit for single heater	Required for single 4" roof supply. Roof cap.
	1811.VT.600	6" roof vent cap for venting 2 heaters	Required for common 6" roof vents.
	132861	5" wall vent cap for venting 2 heaters	Required for common 5" wall vents.
	0650.YT.464	4"x4"x6" Individual vent coupler (Y)	Joins <b>two</b> heaters to one common 6" vent using <b>one or two</b> thermostats. (Sheet metal).
	132747	Vent cap for individual vent coupler	Required with 132746 to independently vent <b>two</b> heaters thru one 6" roof vent when using <b>two</b> thermostats.
	910.10	Indoor venting kit	Required for all units when operating unvented. Cap & elbow.
	132115	U-bend reflector assembly	Use when ordering U-tube heater. Includes (2) pipe hangers.
	131421	Corner reflector assembly	Use with 132685 elbow. Includes (2) pipe hangers.
	0366.00	Reflector side extension assembly	Focus radiant heat below and in front of heater. 10-foot long with S-hooks.
	132129	Parabolic reflector assembly	Focus radiant heat below heater. 10-foot long with support brackets.
	132352	End cap for reflector	Cap for reflector at the end of the heater.

**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
- B. 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 48309-3555.

**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 2500 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 specially 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 coupler joining the burner to the combustion chamber shall be cylindrical 4" I.D. by 8" long with a 16 ga. (.065") wall thickness; coupler 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 radius 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

- F. 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.
- G. The direct spark ignitor shall be durable to resist breakage.
- H. Reflectors shall be .025" thick - #3003H25 aluminum brite finish with a geometrically designed configuration not having less than 91.7% reflectional 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.
- I. 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 rattles. Reflectors shall be assembled to the heater without the use of tools.
- J. 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.
- K. Heaters shall be equipped with a sight glass permitting a visual inspection of the spark ignitor and burner operation from the floor.
- L. 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.
- M. 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.
- N. 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**

