



**GUIDE SPECIFICATION
ADVANCED RADIANT SYSTEMS
VA VARIABLE OUTPUT RANGE
ADAPTIVE MODULATING INFRARED TUBE HEATERS**

SECTION 15540 - FUEL - FIRED HEATERS
(Alternate - SECTION 235523 - GAS-FIRED RADIANT HEATERS)

This section is based on the products of Advanced Radiant Systems, located at:

Location: 315 N Madison Street
Fortville, IN 46040

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PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Adaptive modulating infrared tube heaters.

1.2 RELATED SECTIONS

- A. Section 15050 – Basic Mechanical Materials and Methods: Fuel service, safety valves and connections.
- B. Section 16050 – Basic Electrical Materials and Methods: Power service and connections.

1.3 REFERENCES

- A. CSA – CSA Group. Canadian Standards Association (CSA).

SUBMITTALS

- A. Submit under provisions of Section 01300.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
- Rated capacities, operating characteristics and accessories for each type of gas-fired radiant heater.
 - Preparation, instructions and recommendations.
 - Storage and handling requirements and recommendations.
 - Installation methods.
- C. Shop Drawings: Submit complete shop drawings indicating system components, control diagrams and load calculations.
- D. Field quality-control test reports.



- E. Installation, Operation and Maintenance Data: Provide copy of Installation, Operation & Maintenance document.
- F. Warranty: Provide copy of manufacturer's warranty statement.

1.4 QUALITY ASSURANCE

- A. Assemblies: Assemblies shall be CSA approved. Low intensity heaters to ANSI Z83.20 (latest revision) and CSA 2.34 (latest revision) for use in commercial and industrial applications.
- B. Approval shall include components of the complete heater, including burners, hangers, reflectors, reflector supports, thermostats and associated controls, and/or other accessories as noted in Contract Document plans and specifications.
- C. Code Compliance: Installations of units shall comply with local building codes, or in their absence, the latest edition of the national regulations and procedures listed below: Electrical: Heaters shall be electrically grounded in accordance with the National Electric Code, ANSI/NFPA 70 in the US, and the Canadian Electric Code, CSA C22.1 in Canada, and shall comply with all local requirements.

General Installation and Gas Codes: Heaters shall be installed only for use with the type of gas appearing on the rating plate, and the installation shall conform to the National Fuel Gas Code, ANSI Z223.1 (NFPA 54) in the US and the Natural Gas and Propane Installation Code, CAN/CGA B 149.1 & B149.2 in Canada.

Aircraft Hangar Installation: Installation in aircraft hangars shall conform to the Standard for Aircraft Hangars, ANSI/NFPA 409 in the US and CAN/CGA B149.1 & B149.2 in Canada.

Public Garage Installation: Installation in public garages shall conform to the Standard for Parking Structures, NFPA-88A or Standard for Repair Garages, NFPA 88B, in the US and CAN/CGA B149.1 & B149.2 in Canada.

Parking Structures: Technical requirements are outlined in the Standard for Parking Structures, ANSI/NFPA 88a, in the US and CAN/CGA B149.1 & B149.2 in Canada. Gas Supply Lines:

- a. Gas supply pipe sizing shall be in accordance with the National Fuel Gas Code, ANSI Z223.1 (NFPA 54) in the US and the Natural Gas and Propane Installation Code, CAN/CGA B149.1 & B149.2 in Canada.
- b. A 1/8 inch (3 mm) NPT plugged tap shall be installed in the gas line connection immediately upstream of the burner farthest from the gas supply meter to allow checking of system gas pressure.

Venting: Refer to the National Fuel Gas Code, (ANSI Z223.1 (NFPA 54) in the US and the Natural Gas and Propane Installation Code, CAN/CGA B149.1 and B149.2 in Canada) for proper location, sizing and installation of vents as well as information on termination clearance requirements when penetrating combustible walls for venting purposes.

- D. Manufacturer Qualifications: Successfully completed and passed the auditing requirements for ISO 9001 - Quality Management System (QMS).
- E. Installer Qualifications: Authorized distributor of products and systems.



1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer's unopened packaging until ready for installation.

1.6 PROJECT CONDITIONS

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's recommended limits.

1.8 WARRANTY

- A. Manufacturer's standard warranty agrees to provide parts to repair or replace components of gas-fired radiant heater that fails in materials or workmanship within specified warranty period.
 1. Warranty Period: 3 year warranty on all components.
 2. Warranty Period: 10 year warranty on aluminized or stainless steel heat exchanger with post purge feature.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturer:

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- B. Substitutions: Not permitted.

2.2 INFRARED TUBE HEATERS

- A. Design and Performance:

1. Reflector Design: Reflector shall be 10-sided reflector design reflecting virtually 100% of the infrared energy out and away from the emitter tubes. Reflector shall be "Deep Dish" design with emitter tubes fully recessed within reflector. Reflectors shall have a minimum 10 reflective surfaces. Reflectors with fewer surfaces allow energy to bounce back to the main heat exchanger tubing, and shall not be allowed. Reflector end caps shall be factory provided as standard and shall be fitted to the end of each reflector run to minimize convective heat loss. Reflectors shall provide a distribution pattern of 90 degrees inclusive beneath the heater. When called for in the Contract Documents and specifications, directing of radiant pattern outside the standard distribution pattern shall be accomplished through use of side shields or bottom shields preferably. 45 degree, tipped reflectors increases the convective loss of the heater and shall not be allowed, unless called for in the Contract documents.

2. Heat Uniformity: Burner shall distribute hot gases evenly along the length of the emitter tubes.

3. Serviceability: Burner controls shall be located outside of the air supply stream. Service and diagnostic



control checks shall be possible with the blower fan running. Controls shall be proven, name brand supported manufacturer.

4. Certified by Canadian Standards Association (CSA) for both US and Canadian applications.

5. Construction:

a. Control Box: Heavy-duty powder coated galvanized steel.

b. Emitter Tube: Shall be 4 inch (102 mm) diameter, minimum 16 gauge thickness and shall be one of, or a combination of, the following allowed materials as called for in the Contract documents

1. Heat-treated Type 1 aluminized steel tube.
2. Type 409 Stainless steel tube.
3. High temperature epoxy coated steel tube.

c. Combustion Tube: 4 inches (102 mm) diameter, 16 gauge, heat treated type 1 aluminized steel tubing shall be required for all firing rates. Hot rolled steel shall not be allowed. Combustion tubing shall incorporate a welded, 11 gauge steel - 4 bolt flange to orient the burner to the tube as designed.

6. Couplings: Shall be 16 gauge aluminized steel, minimum 12 inches in length and be of heavy duty design incorporating two 1-inch wide draw bands.

7. Reflector: Deep dish, 100% efficient, mill-finished aluminum, ASTM 1100, .024 inch thickness aluminum sheet metal with two reflector support brackets for each 10 feet (3048 mm) reflector section. Reflectors shall extend below the lowest position of the tubing at all times, and include standard end caps.

8. Reflector Extension Shields: When called for in the contract documents, reflector extensions shall be the same material as reflectors, arranged for fixed connection to lower reflector lip and incorporate rigid support to provide 100 percent cutoff of direct radiation from tubing at angles greater than 30 degrees from vertical.

9. Reflector end caps: Shall be fitted to the end of each reflector run to reduce convective heat loss, and shall be standard equipment.

10. Hangers: Heavy duty (minimum 0.3125 inch), chrome plated, wire-formed hangers shall be included as standard. Stainless steel hangers shall be an approved alternate. Hangers shall allow for tipping the reflector up to 45 degrees from horizontal centerline of the heat exchanger.

11. Burner: Shall be a positive pressure burner system, where exhaust gases and other products of combustion are not routed through the blower. The burner shall operate at a minimum gas inlet pressure of 5.3 inches W.C. (natural gas) or 11.8 inches W.C. (propane) and draw no more than 1 Amp at 120VAC, 60Hz. A higher electrical draw rating, such as those needed for hot surface ignition shall not be allowed.

12. Burner housing shall include certain factory supplied features to insure easy commissioning, operation, and limited future maintenance as follows (as a minimum):



- a. Adaptive modulation operation of both the gas and air within the burner housing to allow firing rates to be reduced up to 40% from rating plate maximum. Modulating heaters that operate on a fixed, preprogrammed relationship of air and gas through the firing range shall not be allowed, as they do not (cannot) compensate for changes in heater operating characteristics over an approved range of vent and outside air duct lengths.
- b. Removable access doors (easy to service).
- c. Flame observation port
- d. Unit shall continue running during servicing.
- e. Direct spark ignition (DSI), minimum 3 try ignition including pre and post purge sequencing, automatic 1 hour retry after lockout, and self-diagnostic module.
- f. Operation indicator lights for heater power and operation.
- g. 0 to 10 volt (DC) analog control signal.
- h. Isolated electrical components within the burner housing (electrical components are not in air stream).
- i. Moisture sealed burner housing, and potted control module, approved by CSA for outdoor use.

13. Burner head shall be chrome plated steel.

14. Burner operation controls: Shall be factory assembled, piped, and wired and comply with ANSI Z83.20/CSA 2.34. Controls shall vary both gas and air supply to the heater as directed by the on board modulation controller in response to sensor input from the space. Modulation range shall be from 60% to 100% of rated capacity. Gas and electric controls shall be separated from the combustion air stream.

15. Operating sequence on each heater energization shall include an initial controlled ignition period, followed by an initial high fire operation for up to 4 minutes, to bring the heat exchanger to maximum radiant output quickly, before responding to the proportional signal required by the sensor in the space.

16. Burner Safety Controls:

- a. Gas Control Valve shall be a proportional, regulated, redundant 24VAC electric gas valve, incorporating an adaptive pressure regulator and manual shutoff all in one body.
- b. Control Panel Interlock: Burner shall be serviceable while system is running with no requirements for safety interlock.
- c. Dual integral air pressure switches shall provide for both air proving and shall monitor adequate inlet air and vent flow.
- d. Indicator Lights: Burner on and run indicator lights shall be standard equipment.

17. Burner ignition system: Shall be direct spark (DSI) with gas ignition and flame proving taking place within the main burner cup for reliability. Igniters that traverse the gas stream add turbulence to the burner flame and shall not be allowed. DSI ignition control shall:

- a. Provide for 3 trials for ignition before lockout.
- b. Recycle again in one hour after lockout, with 3 subsequent trials for ignition.
- c. Provided a lighted diagnostic display capability.
- d. Provide openly accessible sense current measurement contacts within the housing.
- e. Provide a standard blower post purge function when called for in the Contract documents.



- f. Accept 24V thermostat wiring
- g. The ignition control shall be potted to seal against moisture and contamination.

18. Air blower motor shall be totally enclosed, requiring no oiling and shall be equipped with a thermal overload switch.

19. Secure burner fastening: Hanger shall incorporate chrome plated fastening means to secure burner and prevent rotation about the centerline axis of the heat exchanger over time.

20. Combustion-Air Connection: Duct connection to burner for combustion air to be drawn directly from outside or inside shall be provided as factory standard.

- B. Heaters shall be factory designed and approved to operate on either Natural gas (NG) or Liquid propane gas (LPG) as called for in the contract documents.

Controls: Burner shall operate on any of the following:

- a. Factory supplied Modulating thermostat
- b. Manual potentiometer
- c. As directed by Building management system
- d. Multiple units can be multiplexed to operate on a single thermostat control

- C. Products.

D. Low Intensity Adaptive Modulating Infrared Tube Heaters: The Modulus (Model AM) Heavy duty industrial/commercial infrared heater featuring the best overall performance in the industry automatically adjusts air and gas to properly regulate the temperature in a given space through a patent applied for technology. It has up to 40% modulating differential, the largest in the industry. While many other units require a complicated interface, the Modulus has a direct analog signal, meaning no interface. The controls are simple, effective and non-proprietary. The Modulus reads the room and adjusts itself accordingly, it is not preprogrammed. Firing rates as called for in the Contract documents within the range of 80 MBH to 200 MBH. Steady state thermal efficiency will be in excess of 80%. 100% efficient reflector design with minimum 65% radiant factor as determined by independent lab testing to EN416-2 Standard. Baffles required as per manufacturer's instructions.

- E. Product shall be Low Intensity Infrared Heater: Model AM as manufactured by Superior Radiant Products.

- a. Input rate shall be as called for in the Contract documents within the range of 80,000 to 200,000 BTU/H (full fire).
- b. Radiant Tube Length shall be as called for on the Contract documents within the range of 20 feet (6096 mm) to 70 feet (21336 mm). Refer to drawing schedule.
- c. Recommended Range of Minimum Hanging Heights shall be 15 feet to 29 feet (4572 to 8839 mm) as called for in the Contract documents.
- d. All burner operating components shall be enclosed in burner housing sealed against moisture and approved by CSA for outdoor use.



PART 3 EXECUTION

3.1. EXAMINATION

- A. Do not begin installation until services and supports have been properly prepared.
- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 INSTALLATION

- A. Installation shall comply with manufacturer supplied Instruction manual, approved drawings and applicable local codes and/or gas utility requirements. In the absence of any of the former, reference should be made to CAN 1-B149.1 and B149.2 Installation Codes and/or National Fuel Gas Code ANSI Z223.1 (NFPA54). Comply with manufacturer's recommendations including the following:
 - 1. Clearance to combustibles shall comply with those in the Installation, Operation and Maintenance manual supplied by the manufacturer for the firing rate specified.
 - 2. Provide manufacturer approved flexible gas connectors.
 - 3. Wire heaters in accordance with the National Electrical Code ANSI/NFPA 70 and local ordinances and/or Canadian Electrical Code.
 - 4. Suspend heater units in accordance with manufacturer's instruction with chain and turnbuckles exceeding 540 lb. (245 kg) pull test.
 - 5. Install and connect gas-fired radiant heaters and associated fuel and vent features and systems according to either NFPA 54 or CAN/CSA B149.1 as applicable for local codes and regulations. Sidewall vents shall be as approved with the appliance by the manufacturer.
 - 6. Install products in accordance to manufacturer's written installation instructions.
 - 7. Hang suspended units from substrate using chain hanger kits and building attachments as required for safe installation and to meet all seismic requirements for specific building location.
 - 8. Connections: Provide all electrical connections required for complete installation including installation of electrical devices furnished with heaters but not specified to be factory mounted
 - 9. Install piping to gas-fired radiant heaters to allow service and maintenance as required.
 - 10. Connect gas piping to gas train inlet; provide union with enough clearance for burner removal and service.
 - 11. Connect vent connections as required.



3.3 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test and adjust components, assemblies, and equipment installations, including connections, and to assist in testing. Testing shall include the following:
 - 1. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 - 2. Verify proper motor rotation.
 - 3. Test Reports: Prepare a written report to record the following:
 - a. Test procedures used.
 - b. Test results that comply with requirements.
 - c. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.
- B. Remove and replace malfunctioning units and retest until satisfactory results are obtained.

3.4 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain gas-fired radiant heaters.

3.5 PROTECTION

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION