



2000-Series

Rapid[®] *Engineering LLC*

**Direct-Fired Heating, Cooling And
Pressurization Systems**



Equipment Specifications

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www.rapidengineering.com



Intertek

CANADA: 100% OUTSIDE AIR ONLY

RAPID® DIRECT-FIRED AIR HANDLER GUIDE SPECIFICATION

Part 1: GENERAL

Please note: Brackets indicate required choices to be made in preparation of the final specification.

Provide units with gas-fired heating and ventilating sections, designed and manufactured for indoor or outdoor installation. Units shall be packaged air handlers which include casing, modulating burner, and non-overloading fan. Fixed Recirculation (FR) and Air Management (AM) configurations also include a positive position [fixed][modulating] return air dampers.

1.1 SECTION INCLUDES

- A. Direct-fired air handler
- B. Controls

1.2 REFERENCES

- A. American National Standards Institute (ANSI): Establishes requirements applicable to certifying direct gas-fired heaters.
 - 1. MUA, VAV Models: Standard Z83.4: Non-Recirculating Direct Gas-Fired Industrial Air Heaters
 - 2. AM, FR Models: Standard Z83.18: Recirculating Direct Gas-Fired Industrial Air Heaters
- B. American Society for Testing Materials (ASTM): Establishes standards for materials, products, systems and services.
 - 1. Standard A653/653M: Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot Dip Process
- C. ETL Testing Laboratories, Inc. (ETL): Nationally recognized testing laboratory ensures code compliance.
 - 1. Requirements applicable to product labeling and listing in the Directory of ETL Listed Products.
- D. Factory Mutual Insurance (FM): Ensures compliance of gas manifold to owner's insurance carrier.
- E. XL Insurance (formerly IRI): Ensures compliance of gas manifold to owner's insurance carrier.
- F. National Electrical Manufacturers Association (NEMA): Establishes technical standards for the electroindustry.
 - 1. Standard 250: Enclosures for Electrical Equipment (1000 V Maximum)
- G. National Fire Protection Association (NFPA): Establishes fire prevention standards.
 - 1. Article 54: National Fuel Gas Code
 - 2. Article 70: National Electric Code
 - 3. Article 90A: Installation of Air Conditioning and Ventilating Systems
- H. National Roofing Contractors Association (NRCA): Establishes best practices for the roofing industry.
 - 1. The NRCA Roofing and Waterproofing Manual, Second Edition

- I. Occupational Safety and Health Administration (OSHA): Enforces air quality standards and safety in the workplace.
- J. Underwriters Laboratories, Inc. (UL): Nationally recognized testing laboratory certifies code conformance, product labeling and listing.
 - 1. Standard UL916: Energy Management Equipment
 - 2. Standard UL873: Temperature Indicating and Regulating Equipment
- K. Canadian Standards Association (CSA): Standards Development Organization.
 - 1. CSA B149.1 National Gas and Propane Installation Guide

1.3 SUBMITTALS FOR REVIEW

- A. Product Data: Provide data with dimensions, duct and service connections, accessories, controls, electrical nameplate data and wiring diagrams.
- B. Submittal Drawings: Indicate dimensions, duct and service connections, accessories, controls, electrical nameplate data and wiring diagrams.

1.4 SUBMITTALS FOR INFORMATION

- A. Manufacturer's Instructions: Indicate rigging, assembly and installation instructions.

1.5 SUBMITTALS AT PROJECT CLOSEOUT

- A. Project Record Documents: Record actual locations of remote sensors, control panels and other components.
- B. Operation and Maintenance Data: Include manufacturer's Installation, Operation and Service Manual.
- C. Warranty: Submit manufacturer's warranty and ensure forms have been filled out in owner's name and registered with the manufacturer.

1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the product specified in this section (modulating direct-fired air handler) with a minimum of ten years documented experience. Equipment shall be the standard product of the manufacturer and shall have complete cataloged data.
- B. Installer Qualifications: All installation and service of direct-fired air handlers must be performed by a contractor qualified in the installation and service of said products with proof of a minimum of three years documented experience.
- C. Factory Testing: Each air handler shall be factory-tested. Testing shall consist of checking circuits for continuity, operability of valves, control motors, fan speed, linkages, switches and burner. Each air handler shall be test-fired for low and high fire conditions. See "Fan and Motor" for additional fan testing requirements.

1.7 REGULATORY REQUIREMENTS

- A. Conform to ANSI Standards Z83.18 or Z83.4 (latest revision) and provide evidence that the air handler and its control system have been found in compliance with these standards by a nationally recognized testing laboratory.
- B. Conform to NFPA 90A.
- C. Conform to the National Fuel Gas Code (NFPA 54/ANSI Z223.1).
- D. Conform to required or specified insurance specifications [FM, XL Insurance (formerly known as IRI), etc.] for the gas manifold construction.

1.8 WARRANTY

- A. The product shall have a manufacturer's limited warranty of at least 24 months, subject to the manufacturer's standard warranty limitations.

Part 2: PRODUCTS

2.1 MANUFACTURERS

- A. RAPID® 2000-Series, incorporating one of the following styles as specified herein or shown on the plans:
 - 1. 100% outdoor air with constant discharge air volume (Make-Up Air [MUA] Style)
 - 2. Variable outdoor air/return air ratio within the range of 100% outdoor air/0% return air to 20% outdoor air/80% return air with a constant discharge air volume (Air Management [AM] Style)
 - 3. Fixed 80% return air and 20% outdoor air with a constant discharge air volume (Fixed Recirculation [FR] Style)
 - 4. 100% outdoor air with 50%-100% variable discharge air volume (Variable Air Volume [VAV] Style)

2.2 MANUFACTURED UNITS

- A. Unit: [Constant] [Variable] volume [outdoor] [indoor] direct-fired air handler.

2.3 FABRICATION

- A. Casing and Components: Units to have a bolt and screw construction. The casing shall be constructed of a minimum of 20 gauge, galvanized steel panels reinforced with a rugged integral frame. The roof and floor panels shall be 18 gauge.
- B. Fan Support: The fan and bearings shall be supported by a reinforced structural steel framework independent of the cabinet (Model 2010-2030)/ self-supported fan with self-aligning, ball bearings (Model 2005).
- C. Access Doors: Hinged and/or latched access doors to allow service access to burner, fan, controls, motor and bearings.
 - 1. Control Enclosure: Hinged door with vinyl edge trim on interior flange (Model 2010-2030)/ removable panel door (Model 2005).
 - 2. Bearing Access: Heavy-duty gauge panel with outward facing flange affixed to unit with weather-resistant vinyl foam rubber and self-drilling sheet metal screws (Model 2010-2030 only).

- D. [Outdoor][Indoor] Installation: Including caulking of unit seams between panels and around control enclosure. Inlet hood shall be used on outdoor horizontal units.
- E. Lifting Points: Internal members shall be properly sized to allow rigging and handling of the unit from the top.
- F. Finish: Standard finish is [unpainted galvanized][acrylic modified alkyd enamel].
- G. Observation Port: A permanent observation port shall be provided in the burner section to allow observation of both the pilot and main flame.
- H. Bearing Access Panel (Models 2010-2030 only): Provide on fan section for access to blower shaft bearings.

2.4 BURNER AND GAS TRAIN

- A. Burner: NP-II LE line burner specially designed to burn natural gas or LPG at or below the non-contaminating levels required by ANSI and OSHA. The burner shall have a cast iron manifold and heat resistant Type 430 stainless steel burner plates. The burner shall have a nominal turndown ratio of 30:1 and be designed for 100% combustion efficiency for the life of the equipment.
- B. Burner Profile: The outdoor air velocity across the burner shall be controlled by fixed burner profile plates. The design of the unit profile plates shall maintain manufacturer's specified air velocity over the burner during operation. No air from the occupied space shall be allowed to recirculate across the burner at any time.
- C. Burner Assembly / Gas Train: The burner assembly shall include automatic ignition controls, ultraviolet (UV) scanner flame failure system (Model 2010-2030)/ flame rod (Model 2005), primary and secondary automatic shutoff valves, [modulating valve][modulating valve with pressure regulator] and manual shutoff valve. Pilot gas controls shall include [combination regulator/solenoid valve][regulator and solenoid valve] and manual shutoff valve. Gas train shall be composed of black pipe and sized to provide full unit capacity at specified inlet pressure to the gas train. Provide and install a supplementary pressure regulator at each unit as necessary to maintain unit inlet pressure at less than 5psi.
 - 1. ANSI-Compliant Gas Train: Shall accept maximum inlet gas pressure of 14" wc (34.9 mbar).
 - 2. FM-Compliant Gas Train: Shall contain all items on ANSI-Compliant manifold in addition to high gas pressure switch with manual reset and additional venting on modulating valve with pressure regulator and pilot regulator. FM-Compliant manifolds can accept a maximum inlet gas pressure of 5psi.
 - 3. XL-Compliant Gas Train (former IRI): Shall contain all items on FM-Compliant manifold in addition to low gas pressure switch with manual reset and a normally open solenoid vent valve. XL-Compliant manifolds can accept a maximum inlet gas pressure of 5psi.
- D. Pilot: Electronic spark ignition through a high voltage ignition transformer.
- E. Positive Low-Fire Start (Optional): Positive low-fire start helps ensure the burner ignites at its low-fire setting. The burner maintains its low-fire setting for a factory-set duration of ten seconds, after which time the burner begins to modulate.

2.5 FAN AND MOTOR

- A. Fan: Built-in, double-width, double-inlet (DWDI), forward curved (FC) type, v-belt driven, dynamically balanced with a rugged solid steel shaft ground smooth for extended life and durability.
- B. Drive: The fan shaft shall be connected to the motor by a single V-belt drive (Model 2005)/multiple V-belt drive (Models 2010-2030) designed to handle 25% more power than the motor nameplate capacity. The fan wheel and bearings shall be supported by reinforced structural steel framework independent of the unit housing. The motor sheave shall be an adjustable design balancing air flow.
- C. Fan Bearings: Self-aligning, ball bearing type (Model 2005) / pillow block type (Model 2010-2030) and shall have (for external static pressures less than 1" wc [2.5 mbar]) an American Bearing Manufacturers Association (ABMA) L10 rated life of 30,000 hours.
- D. Extended Grease Lines (Optional on Model 2010-2030): Extended grease lines extend the fan bearing grease fittings to the fan cabinet exterior on the control side.
- E. Motor: The motor shall be an [open drip proof (ODP)] [totally-enclosed, fan-cooled (TEFC)], premium efficiency design with minimum service factor of 1.15, wired for [208 V, 3Ø] [230 V, 1Ø] [230 V, 3Ø] [460 V, 3Ø] [575 V, 3Ø] 1750 rpm, standard NEMA frame and mounted on an adjustable slide base.
- F. Sound Power: The fan sound power shall not exceed 85 dBA at a distance of 10' (304 cm) from the air handler discharge opening.

2.6 CONTROL SYSTEM

- A. Factory Testing: The complete control system and all burner and gas manifold functions shall be factory tested for proper operation and to simplify field commissioning.
- B. Control Enclosure: The unit control enclosure shall be constructed to NEMA 3R specifications with a removable panel style door (Model 2005)/ hinged door (Model 2010-2030). The control enclosure shall contain the gas train and all principal electrical components, such as motor starter, fused rotary disconnect (fuses included), 120V and 24V transformers, control circuit protection, control relay(s), circuit check lights, flame relay and full numbered terminal strip.
- C. Flame Relay: The air handler control panel shall have a burner flame relay to lock out the flame in abnormal conditions. Shall operate with intermittent pilot (Model 2005-2010B)/ interrupted pilot (Model 2020 & 2030).
- D. Safety Controls:
 1. High Gas Pressure Switch (Standard on FM-Compliant manifolds above 2,500 MBH and XL-Compliant manifolds only): The high gas pressure switch, located on the burner end of the manifold, shall be factory set [1 in wc (2.5 mbar) above the maximum high fire gas pressure/adjustable setting established during commissioning] and turn the burner off when the gas pressure is above its setpoint.
 2. Low Gas Pressure Switch (Standard on XL-Compliant manifolds only): The low gas pressure switch, located on the inlet end of the manifold, shall be factory

set [minimum required as indicated on data plate/ adjustable setting established during commissioning] and turn the burner off when the gas pressure is below its setpoint.

3. Air Flow Switches: The air flow switches measure air pressure differential across the burner during burner operation and prior to ignition. The low air flow switch shall be factory set at 0.32" wc (0.8 mbar). The high air flow switch shall be factory set at 1.40" wc (3.5 mbar). Pressure switches shall not be field adjustable.
 4. High Temperature Limit Switch: A manual reset high temperature switch shall turn the burner off when air is discharged above its set point. The high temperature limit switch shall be factory set at 160° F (71.1° C).
 5. Carbon Dioxide Interlock: For FR and AM-style units, a field-supplied carbon dioxide detector needs to be installed to limit the room air carbon dioxide concentration to less than 5000 ppm.
- E. Conventional Electronic Controls System:
1. Temperature Controller: Provide amplifier with room temperature control, room temperature sensor and discharge air temperature sensor.
 2. Photohelics (VAV Style Only): Provide a photohelic for controlling proper air velocity over the burner and is factory set for a minimum pressure of 0.75" wc (1.9 mbar) and a maximum pressure of 0.90" wc (2.2 mbar). A second photohelic controls building pressure and is factory set for a minimum pressure of 0.05" wc (0.12 mbar) and a maximum pressure of 0.10" wc (0.25 mbar). Both photohelics are located inside the control enclosure.
 3. Null Pressure Switch (AM Style Only): Provide a null pressure switch for controlling the outdoor air and return air dampers. Pressure switch is factory set to 0.01" wc (0.03 mbar) with a tolerance of 0.01" wc (0.03 mbar).
 4. Remote Control Panels (Optional): Mount unit operating switches and pilot lights, as follows:
 - Basic Remote: Includes fan on/off switch; burner on/off switch; status lights for fan and burner operation; and Maxitrol Series 14 discharge temperature selector in a NEMA 1 enclosure.
 - Standard Discharge Control Remote: Includes fan on/off/auto switch; burner summer/winter switch; status lights for fan operation, burner operation, clogged filters and burner lockout; Maxitrol Series 14 discharge temperature selector; and space thermostat in a NEMA 1 enclosure.
 - Deluxe Temperature Control Remote: Includes fan on/off/auto switch; burner summer/winter switch; status lights for fan operation, burner operation, clogged filters and burner lockout; Maxitrol Series 44 temperature selector; and night setback thermostat in a NEMA 1 enclosure.

5. Control Options (Optional):

- BMS-Ready: Provides inputs to receive control signals from a customer determined control system. Each BMS input is capable of receiving a 4-20mA or 0-10 VDC signal from the control system. Each package includes a signal conditioner for burner modulation control. Discharge temperature monitoring is satisfied by customer supplied control system.
- Auxiliary Relay: The auxiliary relay shall provide for [air handler interlock/ customer defined purpose]. Each relay shall be double pole double throw (DPDT) type available in 24V or 120V signals.
- Low Temperature Limit Switch with Bypass Timer: The low temperature limit shall turn the unit off when air is discharged below its setpoint for a period in excess of the timer setpoint. The switch shall be factory set at 50° F (10.0° C). The bypass timer, which allows the fan to run while burner operation is established during initial unit start-up, shall be factory set at 5 minutes.
- Control Enclosure Heater: The electric control enclosure heater shall provide temperature control for control components within the control enclosure. Recommended for installations below 15°F (-9°C).
- Fail-Safe Unit/ Exhaust Interlock: This interlock shall incorporate the low temperature limit switch with override timer and an exhaust fan air flow switch monitor. Powered air handler requires 5 minute establishing period for low temperature limit switch and exhaust fan interlock. Fallen discharge temperature (below limit) or exhaust fan failure will result in air handler shut down. Reset established by fan switch turned off and continuously on.
- Ground Fault Interrupter: This ground fault interrupter shall provide a unit mounted service receptacle. Available in 208V, 230V, 460V and 575V wired internally. Power to the receptacle is supplied by the installer.
- Outside Air Stat: The outside air stat shall turn off the air handler burner when the ambient air reaches or exceeds the setpoint. The stat shall be factory set at 85°F (29.4°C).
- Remote Reset Kit: The remote reset kit shall allow the air handler to be reset from the remote panel alternative to the ignition module in the control enclosure.
- Room Override Stat (Use with 1014 Amplifier Only): The room override stat shall provide additional thermostat capability based on room temperature. Override temperature can be set to 0°F - 40°F above the temperature selection dial on the remote panel.

2.7 AIR HANDLER UPGRADES AND ACCESSORIES [Select Applicable Items]

- A. Roof Curb: The roof curb shall be 19" (48.2 cm) full-perimeter (burner and blower sections only), formed of minimum 16-gauge galvanized steel as required to support the unit with all the hardware for bolt-together assembly in the field. Roof curb to be used on horizontal air handlers only.
- B. Stand: The stand shall measure 30" (76.2 cm) (Model 2005)/ 53" (134.6 cm) or 72" (182.8 cm) (Model 2010-2030). Stand to be used on upright air handlers only.

- C. Legs: The [painted][unpainted] legs shall measure 46" (116.8 cm) high and be formed of minimum 16 gauge galvanized steel as required to support the unit. Legs to be used on horizontal air handlers only.
- D. Suspension Kits (Model 2005-2010B only): Suspension kits shall be composed of two end pieces (Model 2005)/ two side pieces and two end pieces (Model 2010 & 2010B). Kits to be field assembled using factory provided hardware. Once assembled, suspend using field provided threaded rod. Suspension kits to be used on horizontal air handlers only.
- E. Inlet Hood: The [painted][unpainted] inlet hood shall mount on the outdoor air intake and be constructed of galvanized steel. Inlet hood with [1" (2.5 cm) permanent aluminum mesh filters (Model 2005-2030)][birdscreen (Model 2005-2030)][moisture limiter media (Model 2010-2030)] be available for face installation. All hardware required for bolt-together assembly in the field is included. The inlet hood shall be used on horizontal air handlers only.
- F. Insulation: The unit walls and ceiling downstream of the burner shall be lined with 1" (2.5 cm), 1.5 lb/ft² (7.3 kg/m²) density, neoprene coated, glass fiber insulation, which complies with UL181 for erosion and NFPA 90A for fire resistivity. The insulation shall be secured via adhesive and mechanical pin fasteners per SMACNA standards. Exposed edges shall be coated.
- G. Three-Way Discharge Head: The head openings are offset 40° from each other, resulting in a total air distribution range of 120°. Each opening includes adjustable horizontal deflection blades for control of discharge airflow direction. The unpainted discharge head is shipped loose for field installation. The three-way discharge head shall be used on horizontal air handlers with an end discharge or upright air handlers with a side discharge.
- H. Splash Plate: The [painted][unpainted] splash plate shall be constructed of 16 gauge galvanized steel and to be suspended below a horizontal air handler with bottom discharge. Splash plate shipped loose for installation and with field provided threaded rod.
- I. Outdoor Air Filter Section: The [painted][unpainted] filter section shall only filter outside air and be constructed of galvanized steel. Filter section with [2" (5.1 cm) (Model 2005)/ 1" (2.5 cm) (Model 2010-2030) permanent aluminum mesh][1" (2.5 cm) disposable polyester (Model 2005-2030)] filters. All hardware required for [bolt-together assembly (Model 2010-2030)][assembled (Model 2005)] in the field is included.
- J. High Gas Pressure Regulator: The high gas pressure regulator regulates down the inlet gas pressure to a level accepted by the unit manifold.
- K. Opposite Hand Controls: The opposite hand controls option moves the control panel and access door to the opposite side of the unit. (As standard, controls on Model 2005 are located on the left-hand side of the unit when looking down from the inlet end. Model 2010-2030 have controls located on the right-hand side of the unit when looking downstream from the inlet end.)
- L. Dampers: [Inlet][Discharge] dampers are motorized with end switch to prove position before burner will fire.

1. Discharge Damper: Discharge damper shall be shipped loose for field installation.
2. Inlet Damper: Inlet damper shall be factory mounted to the inlet of the air handler. Damper will close in the event of thermostat satisfaction or air handler is turned off. MUA/VAV style shall utilize 100% outside air damper; FR/AM style shall utilize 20% outside air damper.

M. Double-Wall Construction: The unit walls and ceiling shall be lined with 1" (2.5 cm), 1.5 lb/ft² (7.3 kg/m²) density, neoprene coated, glass fiber insulation. This insulation shall then be covered by metal liners with a minimum thickness of 20 gauge. All exposed edges shall be covered by metal liners

2.8 PERFORMANCE

- A. See Schedule on plans.

Part 3: EXECUTION

3.1 INSTALLATION

- A. Install equipment in strict accordance with manufacturer's instructions and in accordance with applicable governmental regulations by a contractor qualified in the installation of the manufacturer's product.
- B. Install per NFPA 90A.
- C. Install per NFPA 54 (ANSI Z223.1) by providing connection to fuel gas system.
- D. Units which are shipped in multiple sections shall be assembled on the job site by the installing contractor. Assembly includes caulking all seams weather tight and extending electrical power and network control wires to the terminals provided, reconnecting the motor and control wiring between sections to create a complete and operable installation (per air handler manufacturer's recommendations).
- E. Contractor shall extend pressure sensing tubes to inside and to outside of building as recommended by the air handler manufacturer.

Installation Code and Annual Inspections:

All installation and service of RAPID® equipment must be performed by a contractor qualified in the installation and service of equipment sold and supplied by Rapid Engineering LLC and conform to all requirements set forth in the Rapid Engineering LLC manuals and all applicable governmental authorities pertaining to the installation, service, operation and labeling of the equipment. To help facilitate optimum performance and safety, Rapid Engineering LLC recommends that a qualified contractor conduct, at a minimum, annual inspections of your RAPID® equipment and perform service where necessary, using only replacement parts sold and supplied by Rapid Engineering LLC.

Further Information: Applications, engineering and detailed guidance on systems design, installation and equipment performance is available through RAPID® representatives. Please contact us for any further information you may require, including the Installation, Operation and Service Manual.

This product is not for residential use.

This document is intended to assist licensed professionals in the exercise of their professional judgment.

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- F. Contractor shall provide a proper gas service drip leg and a lockable, lever handle manual shutoff valve then followed by a union. A high gas pressure regulator shall be installed if manifold pressure exceeds [14" wc (34.9 mbar) ANSI-Compliant manifold][5 psi (344.7 mbar) FM-Compliant or XL-Compliant manifolds].
- G. Furnish Contractor with field wiring diagram and electrical data to permit power wiring connections to the unit.
- H. Installation contractor is to provide equipment check, test and commissioning in strict accordance with manufacturer's instructions.
- I. Provide the owner's operating personnel with instruction on proper use of the air handler and controls.
- J. Contractor shall supply all necessary hanger rods and install the discharge head or splash plate (if provided) in accordance with manufacturer's instructions.
- K. Contractor shall level the roof curb and install a cant strip and wood nailer per applicable details on the plans.
- L. Install [carbon monoxide][carbon dioxide][smoke detector] sensors in the vicinity of the source contaminant (e.g., an operating vehicle), preferable at the breathing level of the occupants. Do not install sensors in confined ("dead") spaces.
- M. The air handler shall be either an upright or horizontal design as shown on the plans and designed to be supported (e.g., legs, suspension rods, stand, etc.) as shown on the plans.
- N. Installation shall take place within three months following date of shipment of product by manufacturer.

3.2 SCHEDULES

- A. See plans.