2000 Series

Rapid™ Engineering

Equipment Specifications

1.800.536.3461

INTERTEK ETL LISTED C US

CANADA: 100% OUTSIDE AIR ONLY

DIRECT FIRED AIR HANDLER GUIDE SPECIFICATION

PART 1 GENERAL

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, non-overloading fan, and optional automated DDC-based controls for temperature control, pressure control (AM Model only) and system monitoring. AM (20% - 100% outdoor air) and FR (20% outdoor air) Models also include a mixing chamber and positive position 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 Model: 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):
   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 certifies code conformance.)
   1. Requirements applicable to product labeling and listing in the Directory of ETL Listed Products.

D. Factory Mutual Insurance (FM):
(Certifies gas manifold to owner's insurance carrier.)

E. Industrial Risk Insurance (IRI):
(Certifies gas manifold to owner's insurance carrier.)

F. National Electrical Manufacturers Association (NEMA):
   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):
   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 & Regulating Equipment

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. Shop 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 operating instructions, installation instructions, maintenance data, and parts listing.

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 products specified in this section (proportional, building pressure controlling, modulating direct-fired air handler/ air turnover unit) 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 all circuits for continuity, operability of all valves, control motors, fan speed, linkages, switches and burner. Each air handler shall be test-fired for minimum 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, 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.

1.9 MAINTENANCE SERVICE

A. Provide service and maintenance for each air handler for one year from Date of Substantial Completion.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. RAPID™ 2000 Series, incorporating one of the following outdoor air control schemes, as specified herein or shown on the plans:
   • 20% - 100% outdoor air (AM Model)
   • 100% outdoor air (MUA Model)
   • 20% outdoor air (FR Model)

2.2 MANUFACTURED UNITS

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

2.3 FABRICATION

A. Casing and Components: Galvanized steel panels, minimum 20 gauge; reinforced with a rugged integral frame. Hinged and/or latched access doors to burner, fan, controls and motor.

B. Fan Support: The fan and bearings shall be supported by a reinforced structural steel framework independent of the cabinet.

C. Access Doors: Doors shall be provided to allow easy service of all critical components, controls and fan.

D. Outdoor Installation: Units installed outdoors shall utilize weatherproof construction. Intake hood or plenum shall be used on horizontal units.

E. Lifting Points: Internal members shall be properly sized to allow rigging and handling of the unit from the top.

F. Finish: For Models 2005 - 2030, standard finishes are unpainted galvanized or a heavy-duty white powder-coat. For Models 2040 and 2050, standard finishes are unpainted galvanized or a white waterbase, rust- inhibiting, machinery grade enamel.

G. Observation Port: Provide on burner section for observing main and pilot flames.

H. Mixing Section (Optional): The air handler shall incorporate a galvanized damper designed to deliver to 80% of the total air handler fan volume of either outdoor air or the return air from the building. This damper shall be controlled so as to provide an outdoor air turndown ratio of 5:1 based on the fan total flow rate.

2.4 BURNER AND GAS TRAIN

A. Burner: Line burner specially designed to burn natural or propane gas 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 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 at all times 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 and fuel piping arrangement shall include automatic ignition controls, UV scanner flame failure system (not available on Model 2005), pressure regulator, fully modulating gas control valve, primary and secondary automatic shutoff valves and manual shutoff valve. Pilot gas controls shall include a pilot regulator, normally-closed solenoid shutoff valve, needle valve (FM and IRI manifolds only), and manual shutoff valve. Gas train shall be 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 14" w.c.

D. Pilot: Electric spark ignition through a high voltage ignition transformer.

E. Damper (Optional): Motorized with end switch to prove position before burner will fire.

2.5 FAN AND MOTOR

A. Fan: Built-in, double-width, double-inlet (DWDI), forward-curved type, dynamically balanced with pillow bearings and 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 - 2050) designed to handle 25% more power than the motor name plate 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 final air flow (Models 2005 - 2030 only).

C. Fan Bearings: Self-aligning, pillow block or flange type and shall have (for external static pressure less than 1" w.c.) an ABMA L10 rated life of 30,000 hours.

D. Motor: The motor shall be an [ODP] [TEFC] [premium efficiency] design with minimum service factor of 1.15, wired for the selected voltage, 1750 rpm, standard NEMA frame and mounted on an adjustable slide base.

E. Sound Power: The fan sound power shall not exceed 85 dBA at a distance of ten feet 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 hinged door. The control enclosure shall contain the gas train and all principal electrical components, such as motor, motor starter, fused disconnect switch, 120 V and 24 V transformers, control circuit fuses, control relay(s), [circuit check lights], [DDC microprocessor, I/O modules], pressure transducer, flame relay and full number-coded terminal strip.

C. Flame Relay: The air handler control panel shall have a burner flame relay to lock out the flame in abnormal conditions.

D. Safety Controls

1. High Gas Pressure (Optional on all ANSI manifolds; standard on all FM and IRI Manifolds): The high gas pressure switch, located on the burner end of the manifold, shall turn the burner off when the gas pressure is above its setpoint. The maximum gas pressure shall be set to 1" w.c. above the maximum high fire gas pressure.
2. Low Gas Pressure (Optional on all ANSI manifolds and 2005 - 2020 manifolds; standard on 2030 - 2050 FM manifolds and all IRI Manifolds): The low gas pressure switch, located on the inlet end of the manifold, shall turn the burner off when the gas pressure is below its setpoint. The minimum gas pressure shall be set at 7" w.c.
3. Air Flow: The air flow switch measures air pressure differential across the burner to assure proper air flow during burner operation and prior to ignition. It shall be factory set at approximately 0.2" w.c. for the low setting and where applicable 1.4" w.c. for 2005 - 2030 and 0.9" w.c. for 2040 - 2050 for the high setting.
4. High Temperature Limit: 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 (Models 2005 - 2030) / 150° F (Models 2040 and 2050).

E. Sequence of Operation (All Control Types)

With the main fused disconnect in the "ON" position:

The time clock settings determine whether the air handler operates in the Occupied or Unoccupied modes. (Time clock is software-based for DDC controls.)

COOLING / SUMMER SEQUENCE (Occupied Mode):

- The burner is off completely whenever the room temperature exceeds the [Cooling] [Outdoor Air Stat] Setpoint.
- The damper control operates the dampers as follows:
  a) The "MANUAL" mode allows manual positioning of the 80% outside air (OA) damper and 80% return air (RA) damper by

changing the damper position setpoint. This setting overrides the pressure control and economizer operation.

b) The "AUTO PRESSURE" mode provides automatic building pressure control by modulating the 80% OA damper and 80% RA damper to maintain the indoor building pressure setpoint (normally .01" w.c.).

c) While in this mode, the air handler will bring in additional outdoor air to cool the building to the Cooling Setpoint of the Economizer is enabled.

HEATING / WINTER SEQUENCE (Occupied Mode):

- The burner is energized whenever the room temperature falls below the Heating Setpoint.
- The burner is modulated to maintain the applicable Room Temperature Setpoint and also so that the discharge air does not exceed the maximum discharge temperature setpoint (recommended setpoint 90° F), or fall below the minimum discharge temperature setpoint (recommended 55° F).
- Depending on the time and day, the burner will be controlled to satisfy:
  a) The Occupied Room Temperature Setpoint, or
  b) The Unoccupied Room Temperature Setpoint.
- The Low-Temperature Limit Control will shut down the unit when the discharge air temperature goes below the setpoint of the Low Temperature Limit Control for longer than 5 minutes.
- "Energy Alert" building underpressure control (patented). (Option available on DDC Controls Only.)
  a) During the Occupied Mode:
  1) The "Energy Alert" building pressure override control shall be activated if the pressure drops .01" w.c. below the setting of the Building Pressure Control.
  2) An on-delay timer will be activated and start a ten minute time-out period.
  3) After the time-out, an alarm will sound and an indicator light will be activated indicating "LOW BUILDING PRESSURE". An Alarm Silence Switch shall be provided which automatically resets with the Energy Alert controls.
  4) The 80% OA damper will close and the RA damper will go to full open.
  5) The Control System shall go to the "Unoccupied" temperature control setpoint.
  6) After a 20 minute period, or immediately when the pressure returns to the pressure setpoint, the damper control and building temperature will return to the normal Occupied Mode setpoints.

UNOCCUPIED PERIOD (SETBACK) CONTROL:

COOLING SEQUENCE (Unoccupied Mode):

1) The fan is shut down.
2) The burner is shut off.

HEATING SEQUENCE (Unoccupied Mode):

1) While the space temperature is above the Unoccupied Period Temperature Setpoint, the fan and burner controls shut down and the dampers return to their normal positions.
2) When the space temperature falls below the Unoccupied Period Temperature Setpoint, the fan starts, burner ignites and modulates to maintain the Unoccupied Temperature Setpoint, and the dampers operate in the same manner as for the Occupied Period.

FLUSH MODE CONTROL (OPTIONAL) (Sensor Locations as Indicated on Drawing):

- When the carbon monoxide (CO) (or other sensor) level reaches its Level I setpoint, a five minute time delay will energize. This occurs whether the air handler is in the Off, Occupied or Unoccupied Mode.
- Upon a continued alarm after the time delay, the RA damper will modulate to 0% and the OA damper will position to 100%.

HUMIDITY CONTROL (Option Available on DDC Controls Only):

- The sensors measure space air temperature and humidity.
- If the space air humidity is greater than the user-selectable setpoint, the burner ignition sequence is initiated and the burner modulates to maintain the room temperature at a temperature which reduces the humidity to the selected level.
- When the space air humidity is less than the user-selectable setpoint, the burner is de-energized.
- This monitoring and control sequence is maintained at all times during the air handler's Occupied Mode.

F. Conventional Electronic Controls System:

1. Temperature Controller: Provide amplifier with room temperature control, room temperature sensor and discharge air temperature sensor.
2. Pressure switch: Provide a null position pressure switch for controlling the mixing dampers.
3. Pilot (Indicating) Lights (Optional): Install UL labeled lights in panel door (for indoor air handlers) or inside panel door (for outdoor air handlers) to indicate operation of control components as follows:
   - Power on
   - Low temperature limit switch
   - Power to fan starter
   - Fan on
   - High temperature limit switch
   - High gas pressure switch
   - Low gas pressure switch
   - Fan airflow switch
   - Ignition
   - Pilot valve
   - Power to valves
   - Power to temperature control
4. Remote Control Panel (One for Each Unit): Mount unit operating switches and pilot lights, as follows:
   - Solid state temperature control system, including occupied and unoccupied switches and room temperature thermostats.
   - Programmable electronic 7 day time clock with minimum of 4 on/off schedules per day and emergency battery power source (optional).
   - Remote burner reset control (optional).
   - Burner alarm horn with silence switch (optional).
   - ON/OFF/AUTO switch.
   - Pilot lights for Fan on/off and Burner on/off.
   - SUMMER/WINTER switch.

G. Intelligent Control System (Direct Digital Controls)

1. General: Regardless of air handler type, cooling or heating system type, the Controller shall be identical. The current Controller version shall be compatible with all previous versions. A silenceable alarm notifies the user of any errors.
2. Third Party / External Control Interface: Via an external signal (from any 120 V switched device), the Controller can be forced into Occupied, or Flush modes (optional feature).
3. Space Temperature Control System: The temperature control system shall utilize a factory supplied temperature sensor to be mounted in the space by the installing contractor where indicated on the plans. Additional sensors mounted in the air handler discharge and inlet shall be used to monitor the discharge and outdoor temperatures.
4. Automatic Building Pressure Control with Manual Override:
   For modulating outdoor air type handlers, an automatic pressure control shall be used to sense the room pressure and modulate the OA and RA dampers to maintain the building pressure setpoint. The pressure transducer shall be mounted on the air handler ad have a span of -.3" to +.3" w.c.

5. Low Temperature Limit Control: The fan shall shut down when cold air is discharged from the air handler for more than five minutes. The Low Temperature Limit setpoint may be selected between 30° F and 50° F.
6. Information and Control Functions: Individual Controllers shall be capable of communicating information to and receiving control instructions from a remote device.
7. PC Graphical Interface (Optional): When the controller(s) are connected with a shielded twisted pair communications cable per manufacturer's instructions to an (optional) Windows™-based computer, the following monitoring and control features are available:
   a) The DDC controller shall provide a Windows™-style color graphic display of each individual air handler, the entire system / group of air handlers (spreadsheet format), and all digital I/O points. All schedules, setpoints and limit settings shall be readily adjustable by "pointing and clicking" on the air handler graphic.
   b) All setpoints and actual values for temperatures, building pressure, heating/cooling capacity, damper position, and fan/burner status information shall be displayed on the graphic and automatically stored on the PC hard disk in user-defined intervals for reference or exporting for further analysis.
   c) All controller status and analog I/O information shall be readily visible on a graphic based on a photo of the actual controller.
   d) The interface shall conveniently display air handler configuration, including jumper positions, software version and heating and cooling system type.
   e) Fan runtime, number of fan starts, daily electrical usage and daily gas usage shall all be easily available for reference or exporting for further analysis.
   f) All operational errors shall be reported be reported to the PC, including date, time and full description. Information for the last four errors shall be retained in the Controller memory.
   g) A complete digital Troubleshooting Guide, Wiring Schematic and Installation, Operation and Service Manual shall be included with the graphic software.
8. Handheld Interface (Optional): The RAPID™ Remote Station allows complete monitoring and control capacity of individual air handler(s), including all of the Information and Control functions above, except energy usage.
9. Interoperability (Optional): All of the information and control functions above shall be available to a host control interface using either BACNet®, ModBus®, N2 Bus® or LONWorks®, etc. protocol.

2.7 AIR HANDLER OPTIONS AVAILABLE [Select Applicable Options]

A. Roof Curb: Each air handler shall have a full perimeter, 10" high curb (Models 2005 - 2030) / 20" high curb (Models 2040 - 2050), formed of minimum 16-gauge galvanized steel as required to support the unit.

B. Inlet Hood (Recommended for inlet velocities not exceeding 600 fpm at face of hood): The inlet hood shall mount on the outdoor air intake of the air handler and be constructed of galvanized sheet metal painted to match color of unit. Aluminum washable filters shall be provided on the face of the inlet hood.

C. Insulation: The unit cabinet shall be lined with 1", 1.5 lb 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. All exposed edges shall be coated.

D. Discharge Head(s): The manufacturer shall provide a 3-way discharge head (Models 2005 - 2030) / 1-way discharge head (Models 2040 - 2050) as detailed on the plans. The head shall include adjustable, locking, horizontal deflection blades for control of discharge airflow direction (optional vertical blades available). Where shown, the discharge head shall include motorized damper blades for remote control of the blade orientation.

E. Discharge Plate: The plate shall be constructed of 16 gauge galvanized steel.

F. Filter Status Indication: Each filter section is provided with a differential pressure switch and status indication.

G. Outdoor Air Filter Section: The outdoor air (only) is filtered. All filters can be changed from a single location.

H. Filters: 1" thick, treated on leaving side, linked polyester media. (Other filtration options available.)

I. Service Platform (Available on Models 2040 and 2050 only): Each air handler shall be furnished with a minimum 46" deep service platform running the full width of the air handler. The platform shall be constructed with minimum 1" thick galvanized grating, an OSHA approved handrail on three sides and steel safety chains on the remaining side.

J. Smoke Detector. An ionization type supply air smoke detector shall be provided which shuts off the air handler if smoke is detected.

K. Remote Reset: A remote switch (for DDC controls, a command) shall allow personnel to reset the burner.

L. Flame Relay: A self-checking UV scanner and diagnostic module.

M. Interlocking Relay: Provided for field interface with remote devices.

N. Energy Alert Building Under-Pressure Control (DDC Controls only)

O. Flush Mode Control (DDC controls only)

P. Carbon Dioxide (CO_2) Detector: A room-mounted carbon dioxide sensor for initiating additional outdoor ventilation.

Q. Humidity Control (DDC Controls only)

R. Network PC Control: As required for RAPID™ ICS Software (DDC Controls only)

S. Remote Control Station: Provided for local service, allows complete monitoring and control capability of individual air handler(s) (DDC Controls only).

T. NFPA 79 Wiring: All wiring to NFPA 79 standards.

U. Additional NEMA Starters: As required by equipment schedules, mounted in control enclosure (fed by main air handler disconnect).

V. Support Channels: Formed or structural channels designed to adequately support the air handler and (if specified) service platform. These shall be furnished by the manufacturer. Hangers and miscellaneous hardware shall be furnished by the installing contractor.

W. Marine Light: One light in each specified air handler section.

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.

F. Contractor shall provide a proper gas service drip leg and a lockable, lever handle manual shutoff valve. A high pressure regulator shall be installed if manifold pressure will exceed 5 psig.

G. Furnish Division 16 (Electrical) 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 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 / nitrogen dioxide 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 by rods, structural platform, 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.

Installation Code and Annual Inspections:
All installations and service of RAPID™ products must be performed by a contractor qualified in the installation and service of products sold and supplied by Rapid Engineering and conform to all requirements set forth in the Rapid Engineering manuals and all applicable governmental authorities pertaining to the installation, service and operation of the equipment. To help facilitate optimum performance and safety, Rapid Engineering recommends that a qualified contractor annually inspect your RAPID™ products and perform service where necessary, using only RAPID™ replacement parts.

Further Information: Applications, engineering and detailed guidance on systems design, installation and product 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 judgement.

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