

# 4000 SERIES

## Equipment Specifications

### SECTION 15624: DIRECT FIRED AIR HANDLERS GUIDE SPECIFICATION

#### PART 1 GENERAL

Provide units with gas-fired heating and ventilating sections, specifically designed and manufactured for indoor or outdoor installation. Units shall be packaged air handlers which include casing, modulating burner, non-overloading fan, mixing chamber, positive position modulating return air dampers, and automated DDC-based controls for temperature control, pressure control and system monitoring.

#### 1.1 SECTION INCLUDES

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

#### 1.2 RELATED SECTIONS

- A. Section 15410 - Plumbing Piping: [Natural] [Propane] gas piping and connections
- B. Section 15860 - Centrifugal Fans: Supply Fans
- C. Section 15885 - Air Cleaning Devices: Filters
- D. Section 15990 - Testing, Adjustment and Balancing
- E. Section 15020 - Mechanical Special Conditions
- F. Section 16180 - Basic Electrical Materials and Methods

#### 1.3 REFERENCES

- A. American National Standards Institute (ANSI): (Establishes requirements applicable to certifying direct gas-fired heaters.)
  - 1. Standard Z83.4; Direct Gas-fired Make-up Air Heaters
  - 2. Standard Z83.18; Direct Gas-fired Industrial Air Heaters
- B. American Society for Testing Materials (ASTM):
  - 1. Standard A526; Steel Sheet Metal - Zinc Coated by Hot Dip Process; G-90
- C. ETL Testing Laboratories, Inc. (ETL): (Independent testing facility 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 owners insurance carrier.)
- E. Industrial Risk Insurance (IRI): (Certifies gas manifold to owners insurance carrier.)
- F. National Electrical Manufacturers Association:
  - 1. Standard 250 (1985); Enclosures for Electrical Equipment (1000V 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): (Independent testing facility certifies code conformance, product labeling and listing.)
  - 1. Standard UL916 Energy Management Equipment
  - 2. Standard UL873 Temperature Indicating & Regulating Equipment

#### 1.4 SUBMITTALS FOR REVIEW

- A. Section 01300 - Submittals: Procedures for submittals
- B. Product Data: Provide data with dimensions, duct and service connections, accessories, controls, electrical nameplate data and wiring diagrams.
- C. Shop Drawings: Indicate dimensions, duct and service connections, accessories, controls, electrical nameplate data and wiring diagrams.

## 1.5 SUBMITTALS FOR INFORMATION

- A. Section 01300 - Submittals: Procedures for submittals
- B. Manufacturer's Instructions: Indicate rigging, assembly and installation instructions.

## 1.6 SUBMITTALS AT PROJECT CLOSEOUT

- A. Section 01700 - Contract Closeout:
- B. Project Record Documents: Record actual locations of remote sensors, control panels and other components.
- C. Operation and Maintenance Data: Include manufacturer's operating instructions, installation instructions, maintenance data, and parts listing.
- D. Warranty: Submit manufacturer's warranty and ensure forms have been filled out in Owner's name and registered with the manufacturer.

## 1.7 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 rotation unit) with a minimum of ten (10) years documented experience. Equipment shall be the standard product of the manufacturer and shall have complete cataloged data.
- B. Installer Qualifications: Company specializing in performing the work of this section with a minimum of three (3) 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.

## 1.8 REGULATORY REQUIREMENTS

- A. Conform to ANSI Standards Z83.18 or Z83.4 and provide evidence that the air handler and its control system have been found in compliance as a system with these standards by an independent national testing laboratory.
- B. Conform to NFPA 90A.
- C. Conform to the National Fuel Gas Code (NFPA 54 / ANSI Z-223.1).
- D. Conform to required or specified insurance specifications (FM, IRI, etc.) for the gas manifold construction.

## 1.9 WARRANTY

- A. Equipment shall have a one (1) year warranty for furnishing parts only of the air handler which become defective in normal operation except for perishable items such as belts and filters. This warranty shall become valid for two (2) years on parts when the startup and maintenance is performed by a Factory Authorized Service Technician.

## 1.10 MAINTENANCE SERVICE

- A. Section 01700 - Contract Closeout
- B. Provide service and maintenance for each air handler for one year from Date of Substantial Completion.

## 1.11 EXTRA MATERIALS

- A. Section 01700 - Contract Closeout
- B. Section 01730 - Operation and Maintenance Data.

## PART 2 PRODUCTS

### 2.1 MANUFACTURERS

- A. Rapid Engineering, Inc. Series 4000, incorporating one of the following outdoor air control schemes, as specified herein or shown on the plans:
  - 20 - 100% outdoor air (4000AM)
  - 100% outdoor air (4000MUA or 4000VSD)
  - 100% outdoor air (4000SC)
  - 20% outdoor air (4000AR)
  - 20 - 100% variable air volume (4000VAV)
- B. Section 01600 - Materials and Equipment: Product Options

### 2.2 MANUFACTURED UNITS

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

### 2.3 FABRICATION

- A. Casing and Components: 16-gauge minimum aluminized steel enclosure, arc welded to a steel angle frame. The 16-gauge panels for outdoor units shall be stitch welded and caulked at the seams to provide a watertight enclosure.
- B. Fan Support: The fan and bearings shall be supported by a reinforced steel framework independent of the cabinet.
- C. Access Doors: Neoprene-gasketed 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, with intake hood or plenum.
- E. Lifting Points: Internal members shall be properly sized to allow rigging and handling of the unit from the top.
- F. Finish: All cabinet surfaces inside and out shall be cleaned of oil and grease, treated with a rust-inhibiting, iron phosphate surface coating and then followed by a passivating rinse. After the passivating rinse cabinets shall be baked to ensure all moisture is removed from metal joints before prime coating. All exterior surfaces of the cabinet and any un-coated steel surfaces within shall be painted with a high quality prime and finish coat of waterbase, rust inhibiting, machinery grade enamel.
- G. Observation Port: Provide on burner section for observing main and pilot flames.
- H. Mixing Section: The air handler shall incorporate a separate compartment containing two 16-gauge galvanized dampers interlinked to work opposite each other. Each damper shall control up to 80% of the total air handler fan volume from either the outdoors or the return air from the building. These dampers shall be controlled so as to provide an outdoor air turndown ratio of 5-to-1 based on the fan total flow rate.

## 2.4 BURNER AND GAS TRAIN

- A. Burner: Type NP-LE as manufactured by Maxon Burner Company or type HMA-2 by Midco, specially designed to burn natural gas or propane at or below the non-contaminating levels required by ANSI and OSHA. The burner shall have a [cast iron] [aluminum] manifold and heat resisting Type 430 stainless steel burner plates. The burner shall have a nominal 25:1 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 on all constant volume designs 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 its 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, 5 psig pressure regulator, fully modulating gas control valve, primary and secondary automatic shutoff valves and manual shutoff cock. Pilot gas controls shall include a pilot regulator, normally-closed solenoid shutoff valve, needle valve, high gas pressure switch and manual shutoff cock. 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 5 PSIG.
- D. Pilot: Electric spark ignition through a high voltage ignition transformer.
- E. Damper: Motorized with end switch to prove position before burner will fire (optional on all 2000 air handlers and 4000MUA style air handlers).

## 2.5 FAN AND MOTOR

- A. Fan: Single width, single inlet, efficient silent plenum, and belt driven for the specified air capacity. A precision inlet cone shall be provided for streamlined airflow into the fan wheel to insure full and even loading of the fan blades. Blower wheel, shaft and drive sheaves shall be both statically and dynamically balanced. Each fan and drive combination shall be dynamically balanced during testing at the factory to .1" per second or less equivalent displacement.
- B. Drive: The fan shaft shall be connected to the motor by a multiple V-belt drive designed to handle 50% 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 a fixed design for motors larger than 7.5HP.
- 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 100,000 hours and be equipped with extended lubrication lines. Extended lubrication lines shall be terminated at the unit's outer skin so that all lubrication can be performed without shutting down the system.
- D. Motor: The motor shall be an [open drip proof] [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 75dBA at a distance of ten feet from the air handler discharge opening.
- F. Electrical Characteristics: Refer to Section 16180
- G. *Exhaust mode*: Incorporate controls and additional dampers in the fan section for discharge and exhaust functions.
  - 1. Discharge damper: 16 gauge, galvanized steel with frame supporting damper blades and preventing twisting and flexing; friction free bearings; operator located outside of air stream;
  - 2. Exhaust air damper: maximum leakage of 5 cfm per sq. ft. of damper at 4 inches of W.C. Air velocity through exhaust damper is not to exceed 2000 fpm

## 2.6 CONTROL SYSTEM

- A. Factory Testing: The complete control system and all safety, burner and gas manifold functions shall be factory tested to assure 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 volt and 24 volt 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.

The gas and electrical controls shall conform to requested insurance specifications and the (United States) National Electric Code.
- 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: 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 selectable between 3" w.c. and 21" w.c.
  - 2. Low Gas Pressure: 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 3" w.c.
  - 3. Air Flow: The air flow switches measure air pressure differential across the burner to assure proper air flow during burner operation and prior to ignition. It shall be factory set at 0.2" w.c. for the low setting and 1.35" w.c. 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 150°F.
- E. Sequence of Operation (All control types)

With the main fused disconnect in the "ON" position: The Time Clock settings determine whether the AHU 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 (O.A.) damper and 80% return air (R.A.) damper 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% O.A. damper and 80% R.A. 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 if 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 so that the discharge air does not exceed the high limit discharge temperature (90 degrees F), or fall below the low limit discharge air temperature (40 degrees 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
  - a) During the occupied time period:
    - 1) The "Energy Alert" building pressure override control shall be activated if the pressure drops below the setting (.01") of the Building Pressure Control.
    - 2) An on-delay timer will be activated and start a three (3) minute (adjustable from 0 - 15 minutes) time-out period.
    - 3) After the time-out, an alarm will sound for 10 seconds (adjustable from 0 - 30 seconds) after which 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% O.A. damper will close and the R.A. 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 within 0.02" of the pressure setpoint, the damper control and building temperature will return to the normal "OCCUPIED" mode setpoints.

#### **UNOCCUPIED PERIOD (SETBACK) CONTROL:**

- a) COOLING SEQUENCE (Unoccupied Mode):
  - 1) The fan is shut down.
  - 2) The burner is shut off.
- b) 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 CO (or other sensor) level reaches its Level I setpoint, a 5 minute time delay will energize. This occurs whether the AHU is in the Occupied, or Unoccupied mode.
- Upon a continued alarm after the time delay, the unit return air dampers will modulate to 0 percent, and the outside air damper will position to 100 percent.

#### **EXHAUST MODE CONTROL (OPTIONAL):**

- When the CO (or other sensor) level reaches its Level II setpoint, another 5 minute time delay will energize. This occurs whether the AHU is in the Off, Occupied, or Unoccupied mode.
- Upon a continued alarm after the Level II time delay, the burner shuts off, return air damper will modulates to 100 percent open, exhaust damper modulates to 100 percent open, discharge damper modulates to 0 percent open, and outside air dampers modulate to 0 percent open.
- Upon a continued alarm after the Level II time delay, the unit remains in the 100% outdoor air mode. The time delay relay contact closes to energize the remote exhaust device(s).
- After the CO (or other sensor) indicates a return to normal, the controls will reset the Unit to normal operation.

#### **HUMIDITY CONTROL:**

- The sensors measure space air temperature and humidity.
  - If the space air humidity is greater than a user-selectable set point, 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 user-selectable set point, the burner is de-energized.
  - This monitoring and control sequence is maintained at all times during air handler Occupied period operation.
- F. Conventional Electronic Controls System (Maxitrol)
1. Temperature Controller: Provide Maxitrol 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 AHUs) or inside panel door (for outdoor AHUs) 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:
 

Inside panel:

  - 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.
  - Manual damper control switch with 0% to 100% corresponding face plate.
  - Remote burner reset control.

Mounted on door face:

  - Burner alarm horn with silence switch.
  - SUMMER-OFF-WINTER switch.
  - Pilot lights for Fan on/off and Burner on/off.
  - MANUAL-AUTO switch.
- G. Intelligent Controls 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.
  2. Third Party / External Control Interface: Via an external signal (from any 120V switched device), the Controller can be forced into Occupied, Flush or Exhaust 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 Installer 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 air handlers, an automatic pressure control shall be used to sense the room pressure and modulate the outdoor and return air dampers to maintain the building pressure setpoint. The pressure transducer shall be mounted on the air handler and 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 30oF and 50oF.
6. Information and Control Functions: Individual Controllers shall be capable of communicating information to and receiving control instructions from a remote device. [See the back page of this publication for a table of information and control functions.]
7. PC Graphical Interface (optional): When the Controller(s) are connected with a shielded twisted pair communications cable per the manufacturer's instructions to a(n optional) Windows<sup>TM</sup>-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. The graphic display shall allow simple scrolling between individual air handlers.
  - 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 either hourly or every 5 minutes 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 AHU 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 to the PC, including date, time and full description. Information for the last 4 errors shall be retained in the Controller memory.
  - g) A complete Troubleshooting Guide shall be included with the graphic software.
8. Handheld Interface (optional): The RAPID Remote Station allows complete monitoring and control capability of individual air handler(s), including all of the Information and Control Functions above, except Mode settings and Energy usage.
9. Interoperability (optional): All of the Information and Control Functions above shall be available to a Host control interface using either the BACNet, ModBus, N2 Bus or LONWorks protocol.

## **2.7 AIR HANDLER OPTIONS INCLUDED** *[select applicable options]*

- A. Roof Curb: Each air handler shall have a full perimeter, 20" high curb, formed of minimum 16-gauge galvanized (G-90) steel as required to support the unit.
- B. Light and Receptacle: The air handler shall be provided with a control panel service light and a 120V duplex, manual reset, GFCI receptacle. The light and duplex receptacle shall be located in the air handler's control panel and powered through a line voltage 120V, 750 VA, heavy duty, machinery grade transformer wired from utility side of main air handler disconnect switch.
- C. Inlet Hood (Recommended for inlet velocities not exceeding 600fpm at face of hood): The inlet hood shall mount on the outdoor air intake of the air handler, be constructed of galvanized (G90), sheet metal painted to match color of unit.
- D. Inlet Hood Drift Eliminator: Inlet hood shall be fitted with PVC drift eliminator media on the entering face.
- E. Outdoor Air Intake Plenum: Outdoor air intake plenums shall have vertical, drift eliminator media mounted on three sides and designed to limit entering air velocity to less than 1000 fpm (net). The floor shall be sloped and equipped with drain outlets to the roof.
- F. Insulation: The unit cabinet shall be completely 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 to prevent erosion.
- G. Discharge Head(s): The manufacturer shall provide a 1, 3 or 4 way discharge head as detailed on the plans. The head shall include adjustable, locking, horizontal deflection blades for control of discharge airflow direction. Where shown, the discharge head shall include motorized damper blades for remote control of the blade orientation
- H. Discharge Plate: The plate shall be constructed of 16 gauge galvanized steel.
- I. Filter Mixing Box: The Filter Mixing box includes a filtration section downstream of both the outdoor and return air streams. All filters can be changed from a single location. The filter section shall be designed to prevent mixing combustion and return air so that no return air may pass across the burner.
- J. Outdoor Air Filter Section: The outdoor air (only) is filtered. All filters can be changed from a single location.
- K. Filter Status Indication: Each filter section is provided with a differential pressure switch and status indication to the DDC controls.
- L. Filters: 1" thick, treated on leaving side, linked polyester media.
- M. Service Platform: 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 3 sides and steel safety chains on the remaining side.
- N. Vibration Isolators: Vibration isolators shall utilize a steel housing and an isolation element which is color-coded, oil-resistant neoprene. The isolation element shall be selected for minimum 90% isolation efficiency, have a deflection of 0.25" or less and be supplied by the air handler manufacturer.
- O. Smoke Detector. An ionization type supply air smoke detector shall be provided which shuts off the air handler if smoke is detected.
- P. Remote reset: A remote switch (for DDC controls, a command) shall allow personnel to reset the burner.
- Q. Special Flame Relay: Honeywell 7800 Series flame relays with self-checking UV scanner and diagnostic module.
- R. Interlocking Relay: Provided for Smoke Detector (smoke detector(s) by others)
- S. Energy Alert Building Under-pressurization Control
- T. Flush Mode Control
- U. Exhaust (Smoke Relief) Mode Control
- V. CO Detector: A room-mounted carbon monoxide sensor for initiating Flush or Exhaust modes
- W. CO2 Detector: A room-mounted carbon dioxide sensor for initiating additional outdoor ventilation.
- X. Humidity Control
- Y. Class II fan wheels: When required for the specified fan duty.
- Z. Network PC: Pentium 500MHz w/ 64M Ram, 3M hard drive, 17" monitor, communications hardware and RAPID ICS software.
- AA. Remote Control Station: Provided for local service, allows complete monitoring and control capability of individual air handler(s).
- BB. NFPA 79 Wiring: All wiring to NFPA 79 standards.
- CC. Pressure gauges: Inlet and outlet pressure gauges are provided for each gas manifold. (nominal 5 psig and 10" w.c. spans)
- DD. Additional NEMA starters: As required by equipment schedules, mounted in control enclosure (fed by main AHU disconnect)
- EE. Weather Enclosure: A walk-in weatherproof service enclosure shall be provided with dimensions as shown on the plans. The enclosure shall be designed to allow convenient access to controls and other serviceable components. The floor of the enclosure shall utilize 14-gauge multi-grip plate. All piping or other apparatus in the enclosure walkway shall be installed to allow maximum clearance through the walkway. The enclosure door shall be full size and include a window and locking hardware.
- FF. 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.
- GG. 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.
- B. Install per NFPA 90A.
- C. Install per NFPA 54 (ANSI Z223.1) Provide connection to fuel gas system; refer to Section 15410
- D. Units which are shipped in multiple sections shall be assembled on the jobsite 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. Provide equipment check, test and commissioning by a factory trained and authorized service technician. Provide a copy of the start-up report to the Engineer. This function must be performed by factory authorized personnel, not by the installing contractor unless factory certified personnel are employed by the installing contractor.
- 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.

### **3.2 SCHEDULES**

- A. See plans.

### 2.6.G.7 Intelligent Controls System (Direct Digital Controls)

Table of Information and Control Functions (see page 5 for specifications)

Description	Virtual / Physical	Status	Control
Temp, Room .....	P .....	X	
Temp, Discharge .....	P .....	X	
Temp, Outdoor .....	P .....	X	
%RH, Room .....	P .....	X	
%RH, Outdoor .....	P .....	X	
Pressure, Room .....	P .....	X	
Setpoint, Occupied Room Htg .....	V .....	X	X
Setpoint, Occupied Room Clg .....	V .....	X	X
Setpoint, Unoccupied Room Htg .....	V .....	X	X
Setpoint, low temp shutdown .....	V .....	X	X
Setpoint, minimum discharge temp .....	V .....	X	X
Setpoint, maximum discharge temp .....	V .....	X	X
Setpoint, minimum/maximum humidity .....	V .....	X	X
Setpoint, Room pressure .....	V .....	X	X
Schedule, Occupied * .....	V .....	X	X
Schedule, Holiday ** .....	V .....	X	X
Schedule, Override .....	V .....	X	X
Damper Mode; Auto Pressure, Manual Control .....	V .....	X	X
Cooling Mode; None, DX, Chilled Water, Evap Cooling .....	V .....	X	X
Economizer Mode; None, Dry Bulb, Enthalpy .....	V .....	X	X
Condensation Control Mode; On, Off .....	V .....	X	X
Energy Alert Mode; On, Off .....	V .....	X	X
Error Report *** .....	V .....	X	
Status, fan .....	P .....	X	
Status, burner .....	P .....	X	
Status, schedule .....	V .....	X	
Status, damper position .....	P .....	X	
Status, filter .....	P .....	X	
Htg energy Usage, current .....	V .....	X	
Htg energy Usage totalized by month .....	V .....	X	
Electric usage, current .....	V .....	X	
Electric usage, totalized by month .....	V .....	X	
Maintenance info; Fan Run time, number of fan starts .....	V .....	X	

\* up to 21 per week

\*\* for the entire year

\*\*\* Error Reporting Display of Last (4) Errors including:

- Outdoor Air Damper Failure
- Bypass Air Damper Failure
- Low Temperature Shut Down
- Burner Air Damper Failure
- Fan Start-up Failure
- Safety switches (Low Gas Pressure, High Gas Pressure, High Temperature, Air Flow Switch)
- Burner Lock-out
- Gas Valve (Primary and Block Limit Switches) Failure

**NOTE:** Depending on model and accessories, not all points listed above may be available.



Headquarters:  
 Rapid Engineering, Inc.  
 1100 Seven Mile Road, NW  
 Comstock Park, MI 49321  
 Tel: 1-800-536-3461 Fax: 1-616-784-1910  
 For more information, visit: [www.rapidengineering.com](http://www.rapidengineering.com)

Affiliates: PC Rapid Ltd. Seoul Heating  
 Harrogate, England Seoul, Korea

