

Bananza[®]

B SERIES SPECIFICATION GUIDE (BN2ESNA-REV E)

Note: [Brackets] indicate required choices to be made in preparation of the final specification.

SECTION 23 73 38
DIRECT GAS FIRED PRESSURIZED
HEATING AND VENTILATING SYSTEM

PART 1 GENERAL

- A. Provide self-contained, packaged direct gas fired, dynamically pressure modulated, industrial air handlers including casing, insulation, modulating burner, manifold, forward curve DWDI fan, motor, mixing chamber, positive position modulating return/fresh air dampers specifically designed and manufactured for indoor, or outdoor installation. Optionally equipped with automated factory installed and fully factory tested DDC-based controls for temperature control, pressure control and system monitoring, and all other component parts reasonably incidental to providing a complete pressurized heating system.

- B. Refer to Schedule on Drawings

1.1 SECTION INCLUDES

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

1.2 RELATED SECTIONS

- A. Section 22 00 00 – Scope of Work
- B. Section 22 01 00 – General Provisions
- C. Section 23 31 13 – HVAC Casings
- D. Section 23 07 16 – Insulation
- E. Section 22 10 00 - Plumbing Piping: [Natural] [Propane] gas piping and connections
- F. Section 23 09 00 – Controls and Instrumentation
- G. Section 23 00 00 – Electrical
- H. Section 23 05 13 – Motors
- I. Section 23 34 00 – HVAC Fans
- J. Section 23 05 13 – Testing Adjusting and Balancing for HVAC

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
 - 3. Standard Z83.25; Direct Gas-Fired Process Heaters
- B. Canadian Standards Association (CSA):
(Establishes requirements applicable to certifying direct gas-fired heaters.)
 - 1. Standard 3.7; Non-Recirculating Direct Gas-fired Make-up Air Heaters
 - 2. Standard 3.19; Direct Gas-Fired Process heaters
 - 3. Standard B149.1; Natural Gas and Propane Installation Guide
- C. American Society for Testing Materials (ASTM):
 - 1. Standard A526; Steel Sheet Metal - Zinc Coated by Hot Dip Process; G-90
- D. Intertek 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
- E. Factory Mutual Insurance (FM):
(Certifies gas manifold to owner's insurance carrier.)
- F. GAP-XL (Formerly Industrial Risk Insurance (IRI)):
(Certifies gas manifold to owner's insurance carrier.)
- G. National Electrical Manufacturers Association:
 - 1. Standard 250 (1985); Enclosures for Electrical Equipment (1000V Maximum)
- H. 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
- I. National Roofing Contractors Association (NRCA):
 - 1. The NRCA Roofing and Waterproofing Manual, Second Edition
- J. Occupational Safety and Health Administration (OSHA):
(Enforces air quality standards and safety in the workplace.)
- K. 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 01 33 00 - Submittals: Procedures for submittals
- B. Product Data: Provide data with equipment dimensions, weights, 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 01 33 00 - Submittals: Procedures for submittals
- B. Manufacturer's Instructions: Indicate rigging, assembly and installation instructions.

1.6 SUBMITTALS AT PROJECT CLOSEOUT

- A. Section 01 78 00 - 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 descriptive literature, operating instructions, installation instructions, maintenance and repair 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) 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 or Z83.25 (latest revision), CSA Standard 3.7 or 3.19 (latest revision) and provide evidence that the air handler and the control system have been found in compliance 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 / GAP-XL (IRI), etc.) for the gas manifold construction.

1.9 WARRANTY

- A. The warranty shall cover parts only and the warranty claim must be made within twenty-four (24) months from the Date Of Shipment, subject to the manufacturer's standard warranty limitations. Refer to manufacturer terms and conditions of sale for further warranty information.

1.10 INSTALLER MAINTENANCE SERVICE

- A. Section 01 78 00 - 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 01 78 00 - Contract Closeout
- B. Section 23 08 00 – Commissioning of HVAC (Operation and Maintenance Data)

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Bananza[®] – B Series; incorporating the following outdoor air control schemes:

1. 100% outdoor air with constant discharge air volume (Make-Up Air [MUA] Style)
2. Variable outdoor air and return air ratio within the range of 100% outdoor air to 0% return air to 20% outdoor air/80% return air with 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)

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:* Heavy gauge galvanized steel panels, minimum 20 gauge; providing a rugged cabinet. Hinged access door to burner, fan, controls and motor as required.

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

C. *Access Doors:* Neoprene-gasketed, hinged 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 shall be used on horizontal units.

E. *Lifting Points:* Internal members shall be properly sized to allow rigging and handling of the unit by its lifting points. The lifting points shall be placed at the top of each air handler section in order to ensure lifting stability, and safety.

F. *Finish:* Exterior surfaces of cabinet shall be unpainted galvanized.

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 up 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 using required actuator(s) and linkage.

2.4 BURNER AND GAS TRAIN

- A. **Burner:** Line burner 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 aluminum manifold and heat resistant Type 430 stainless steel burner plates. The burner shall have a nominal 30:1 turndown ratio and be designed for 100% combustion efficiency for the life of the equipment.
- B. **Burner Profile:** The correct outdoor air velocity across the burner shall be maintained by fixed burner profile plates (burner velocity on 100%OA variable volume (VAV) units shall be regulated via a modulating damper controlled by a differential pressure control. 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, flame rod monitoring / supervision flame failure system, 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 and manual shutoff valve. Gas train shall be sized to provide full unit capacity at specified inlet pressure to the gas train. Gas train shall be constructed in compliance with the requirements of [ANSI] [FM] [GAP- XL – Formerly IRI] Installing contractor shall provide and install a supplementary [high pressure regulator] if not provided, at each unit as necessary to maintain unit inlet pressure at less than 5 PSI (Model B-350 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:** 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 B-350)/multiple V-belt drive (Models B-650 to B-3000) 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 of an adjustable design for balancing final air flow.

- 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 75dBA at a distance of ten feet from the air handler discharge opening.
- F. *Electrical Characteristics*: Refer to Section 23 00 00

2.6 CONTROL SYSTEM

- A. *Factory Testing*: The complete control system, 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), [conventional relay logic controls], [DDC microprocessor, I/O modules], [pressure switch] [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 during abnormal operating conditions.
- D. *Safety Controls*
 - 1. High Gas Pressure (Standard on all FM and GAP-XL 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 (Standard on all GAP-XL (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.
 - 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 the points as dictated by the equipments' ETL Certification report.
 - 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.

2.7 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 with DDC controls.)

A. Cooling / Summer (Occupied Mode):

1. The burner is off completely whenever the Summer / Winter switch is in the "summer position" or the room temperature exceeds the [Cooling] Set point. Burner shall also be de-activated if the outdoor air exceeds the [Outdoor Air Stat] Set point (Outdoor Air Stat optional on non-DDC Controlled air handlers).
2. The damper control operates the dampers as follows (AM units only):
 - a. Automatic 80% OA damper and 80% RA damper dampers modulate as needed to attempt to maintain the indoor building pressure set point (normally .01" w.c.). If equipped with DDC controls, the dampers may also be positioned to maintain a fixed position regardless of measured space pressure. When the economizer cooling function is activated, (DDC units only) the amount of outdoor air will increase (overrides both space pressure and manual damper settings) as needed in an attempt to keep the space at the economizer cooling set point.

B. Heating / Winter (Occupied Mode):

1. The burner is energized whenever the timeclock or the ON/Winter mode calls for fan operation and the room temperature falls below the Heating Set point. The burner operation can also be based strictly upon the outdoor air temperature (DDC units only).
2. The burner is modulated to maintain the applicable Discharge Air or Room Temperature Set point. The discharge air temperature is also monitored (DTC and DDC units only) to ensure it does not exceed the maximum discharge temperature setpoint (recommended setpoint 90° F), or fall below the minimum discharge temperature setpoint (recommended 55° F).
3. Depending on the time, day and controls selected, the burner will be controlled to satisfy:
 - a. The Discharge Air Temperature Set point, or
 - b. The Unoccupied Room Temperature Setpoint.
 - c. The Low-Temperature Limit Control will shut down the unit when the discharge air temperature goes below the set point of the Low Temperature (optional for non-DDC equipped units) Limit Control for longer than 5 minutes.

C. Unoccupied Period (Setback Control):

1. Cooling (Unoccupied Mode):
 - a. The fan is shut down.
 - b. The burner is shut off.

2. Heating (Unoccupied Mode):
 - a. While the space temperature is above the Unoccupied Period Temperature Set point, the fan and burner controls shut down and the dampers return to their normal “off state” positions.
 - b. When the space temperature falls below the Unoccupied Period Temperature Set point, the fan starts, burner ignites and modulates to maintain the Unoccupied Temperature Set point, and the dampers operate in the same manner as for the Occupied Period.

- D. Flush Mode (OPTIONAL) (Sensor Locations as Indicated on Drawing):
 1. When the carbon monoxide (CO) (or other sensor) level reaches its Level I set point, 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 fan will start, and if so equipped, the RA damper will modulate to 0% and the OA damper will position to 100%.

- E. Conventional Electronic Controls System:
 1. Temperature Controller: Provide amplifier with [discharge air temperature controls - SDC remote with discharge air temperature sensor] [space temperature controls - DTC remote with room temperature and discharge air temperature sensors].
 2. Pressure switch: Provide a null position pressure switch for controlling the mixing dampers (on AM units only) or the fan speed (on VAV units only).
 3. Remote Control Panel (One for Each Unit): Mount unit operating switches and pilot lights, as follows:
 - a. Solid state temperature control system.
 - b. Programmable electronic 7 day time clock with minimum of 4 on/off schedules per day and emergency battery power source. Burner failure light, remote burner reset and check filter light kit (optional).
 - c. ON/OFF/AUTO switch.
 - d. Pilot lights for Fan on/off and Burner on/off.
 - e. SUMMER/WINTER switch.

- F. Intelligent Control System (Direct Digital Controls)

General: Regardless of air handler type, cooling or heating system type, the Controller shall be identical.

 1. The current Controller version shall be compatible with all previous versions.
 2. A silence-able alarm notifies the user of any errors.
 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.
 4. Additional sensors mounted in the air handler discharge and inlet shall be used to monitor the discharge and outdoor temperatures.
 5. Automatic Building Pressure Control with Manual Override:

- a. 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 set point. The pressure transducer shall be mounted on the air handler and have a span of $-.3''$ to $+.3''$ w.c.
6. Low Temperature Limit Control: The fan shall shut down when cold air, that is below setpoint, is discharged from the air handler for more than five minutes. The Low Temperature Limit set point may be selected between 30° F and 50° F.
7. Information and Control Functions: Individual Controllers shall be capable of communicating information to, and receiving control instructions from, a remote device.
8. PC Graphical Interface (Optional): When the controller(s) are connected with a shielded twisted pair communications cable per manufacturer's instructions to a customer supplied 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.
 - b. All schedules, set points and limit settings shall be readily adjustable by "pointing and clicking" on the air handler graphic.
 - c. All set points 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.
 - d. All controller status and analog I/O information shall be readily visible on a graphic contained within the program screens.
 - e. The interface shall conveniently display air handler configuration, software version and heating and cooling system type.
 - f. Fan runtime, number of fan starts, building pressure, burner operation, cooling operation, filter status, set points, schedules, etc. shall all be easily available for reference or exporting for further analysis.
 - g. All operational errors shall be reported to the PC, including date, time and full description. Information for the last ninety-nine errors shall be retained in the Controller memory.
9. Handheld Interface (Optional): The Bananza® 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.
10. 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.

2.8 AIR HANDLER OPTIONS AVAILABLE [Select Applicable Options]

- A. Auxiliary relay package: Air handler shall be equipped with three relays. Two relays will provide a contact closure whenever the fan is on, the third relay will accept a 24VAC signal by others and be field configurable to either enable or disable the air handler upon receipt of that signal.
- B. Burner lockout light, remote burner reset and check filter light kit (for SDC and DTC remotes only): Two pilot lights and a reset button are added to the face of the remote panel. The lights provide visual indication of a burner lockout and possible dirty filter condition and the reset button allows the customer to attempt a reset of the air handler flame safety system from the remote panel location.
- C. Carbon Dioxide (CO₂) Detector: A room-mounted carbon dioxide sensor for initiating additional outdoor ventilation.
- D. Carbon Monoxide (CO) Detector: A room-mounted carbon monoxide sensor for initiating additional outdoor ventilation.
- E. Contractor Lighting Box Assembly: Provides three separate contacts (each rated at 30A / 120VAC) to be used for interlocking facility / booth lighting with the operation of the air handler.
- F. Control enclosure heater: Provides a thermostatically controlled, factory installed / wired electric resistance heater intended to maintain a minimum temperature in the control enclosure. Required for VAV / VFD applications where unit is installed outdoors and exposed to ambient temperatures below 15°F.
- G. Damper - Discharge: Supply air opening shall be equipped with a normally closed damper which shall reduce building air exfiltration / infiltration when the fan is not in operation.
- H. Damper - Inlet: Outdoor air opening shall be equipped with a normally closed damper which shall reduce building air exfiltration / infiltration when the fan is not in operation.
- I. Discharge Head: The manufacturer shall provide a 3-way discharge as detailed on the plans. The head shall include adjustable, locking, horizontal deflection blades for control of discharge airflow direction.
- J. Splash Plate: The plate, intended for suspension below the discharge opening of a horizontal mounted air handler, shall be constructed of 16 gauge galvanized steel.
- K. Extended Grease Fittings (not available for Model B-350): Grease fittings for the fan bearings shall be extended to the exterior of the unit casing to allow for lubrication without shutting down the air handler.

- L. Fail safe unit - exhaust interlock: Provides a contact closure (rated for 120VAC 10 amp maximum load) intended to activate customer provided exhaust fan. Also includes a relay intended to accept a 24VAC signal when the exhaust fan operation is proven. If either the air handler fan or the exhaust fan fail after 5 minutes of operation, both are deactivated.
- M. Front end network software (1-10 units): Provides web based software for networking / monitoring up to ten direct fired air handlers (when all units equipped with DDC controls).
- N. Front end network software (11-20 units): Provides Web based software for networking / monitoring up to 20 direct fired air handlers (when all units equipped with DDC controls).
- O. Filter Section / Outdoor Air: The outdoor air (only) is filtered. All filters can be changed from a single location.
- P. Filter Section / Mixbox: The outdoor and return air streams both pass through a single bank of filters. All filters can be changed from a single location.
- Q. Filters - Aluminum Washable (for use in outdoor air or filter mixbox sections): 2" thick, treated on leaving side, linked polyester media. (Other filtration options available.)
- R. Filters - Pleated (for use in outdoor air or filter mixbox sections): 2" thick, pleated filters. (Other filtration options available.)
- S. Filters - Polylink (for use in outdoor air or filter mixbox sections): 1" thick, treated on leaving side, linked polyester media. (Other filtration options available.)
- T. High Gas Pressure Regulator: A regulator shall be provided to reduce the entering supply gas pressure below 5 PSI (inlet pressure = 5 to 25 PSI).
- U. High Temperature Limit Switch remote reset kit: The burner safety circuit's high temperature limit switch is mounted within the main air handler's control enclosure. This allows the customer or service tech to reset the high temperature limit switch without having to access the interior of the fan section.
- V. DDC Remote Control Station: Provided for local service, allows complete monitoring and control capability of individual air handler(s) (DDC Controls only).
- W. Inlet Hoods: The inlet hood shall mount on the outdoor air intake of the air handler and be constructed of galvanized sheet metal. Finish to match air handler. [Disposable Polylink filters shall be provided on the face of the inlet hood] or [Moisture limiters shall be provided on the face of the inlet hood].

- X. 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.
- Y. Low Limit Stat/Freeze stat (non DDC units only): The Low-Temperature Limit Control will shut down the unit when the discharge air temperature falls below the set point of the Low Temperature Limit Control for longer than 5 minutes.
- Z. Manual Potentiometer: A manual potentiometer is provided which can be used to control the speed of a customer provided exhaust fan VFD (VFD and all field interconnect wiring by others).
- AA. Mild Weather Stat (non DDC units only): A unit mounted (field adjustable) stat is provided to monitor the outdoor air temperature and lock-out burner operation when the OA temp is above the setting of this stat.
- BB. Painted exterior: Exterior surfaces of air handler shall be pre-coated steel.
- CC. Roof Curb: Each air handler shall have a full perimeter, 19" high curb formed of minimum 16-gauge galvanized steel as required to support the unit.
- DD. Room Override Stat (units equipped with SDC remotes only): A remote panel mounted (field adjustable) stat is included to boost the discharge air temperature set point if the space falls below the set point of this stat.
- EE. Smoke detector: An ionization type smoke detector shall be shipped loose with the air handler and is intended to monitor the discharge air stream within the conditioned space. Field mounting / wiring of the detector is by others.
- FF. Support legs: Legs shall be provided to support air handler and any optional sections. Legs shall be of a sufficient height to minimize the potential for entraining moisture in the outdoor air entering the air handler.
- GG. VFD Exhaust Auto-balance w/Photohelic® Control: A Photohelic® switch is mounted within the air handlers main control panel and is intended to modulate the speed of a customer supplied/installed VFD. This VFD is assumed to control an exhaust fan serving the same conditioned space as the air handler. The Auto-balance provides space pressure control by increasing / decreasing the exhaust fan speed.
- HH. VFD for Exhaust Fan, powered by others: Provides a VFD for field adjusting the speed of a customer supplied/installed exhaust fan. Supply voltage to the VFD is by others.
- II. VFD for Exhaust Fan, powered by unit: Provides a VFD for field adjusting the speed of a customer supplied/installed exhaust fan. The main disconnect on the air handler is increased to a size sufficient to provide for a single power source connection of both the air handler and the exhaust fan.

- JJ. VFD for Supply Fan: Provide a VFD for field balancing of air handler. This VFD intended only to adjust fan RPM to provide specified CFM at actual site conditions (static pressure) within specified product limits.
- KK. 120VAC Duplex GFCI service outlet (powered by others): Provide a factory mounted 120VAC manual reset, GFCI receptacle. The duplex receptacle shall be located on the exterior of the air handler's control enclosure and powered by a customer provided 120VAC power source.
- LL. 120VAC Duplex GFCI service outlet (powered by unit): The air handler shall be provided with a 120V duplex, manual reset, and GFCI receptacle. The duplex receptacle shall be located on the exterior of 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.

2.9 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.
- E. 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).
- F. Contractor shall extend pressure sensing tubes to inside and to outside of building as recommended by the air handler manufacturer.
- G. 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.
- H. Furnish Division 16 (Electrical) Contractor with field wiring diagram and electrical data to permit power wiring connections to the unit.

- I. Installation contractor is to provide equipment check, test and commissioning in strict accordance with manufacturer's instructions.
- 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 ("unresponsive ") 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.
- O. Provide the owner's operating personnel with instruction on proper use of the air handler and controls.

3.2 SCHEDULES

- A. See plans.

Installation Code and Annual Inspections:

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

Further Information: Applications, engineering and detailed guidance on systems design, installation and product performance is available through BANANZA® 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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