Unit(s) shall have the capability of supplying from 20% to 100% fresh air utilizing the 80/20 System. Unit(s) shall have a Variable Air Volume Control System capable of adjusting the CFM of the make-up air unit down to 50% of the maximum design CFM.

Unit(s) shall be factory assembled, tested and shipped as a complete packaged assembly, for indoor or outdoor mounting, consisting of the following:

1. Gas burner  
2. Centrifugal blower (forward curved, double width, double inlet)  
3. Motor starter with thermal overload protection  
4. Motor and drive assembly  
5. Fuel burning and safety equipment  
6. Temperature control system  
7. Gas piping  
8. Proportioning fresh air and bypass air dampers  
9. Variable frequency drive  
10. Automatic modulating burner profile damper  
11. Economizer inlet air thermostat  
12. Outdoor fused disconnects (non-fused for ship loose vfd), mounted on the outside of the unit for easy access  
13. Low fire start to allow the burner circuit to energize only when the modulation control is in low fire position.

APPROVALS

Unit(s) shall be tested in accordance with ANSI Standards Z83.4 and Z83.18, and shall bear the ETL label. All electrical enclosures and remote panels on standard units shall be UL 508A listed.

Casing

Unit casing shall be constructed of 20 Gauge (sizes 9-15) 18 Gauge (sizes 18 and above) G-90 galvanized steel. The wall panels and roof panels shall be fabricated by forming double standing, self-locking seams that require no additional support. The floor shall be constructed of 16 Gauge G-90 galvanized steel. The base and floor support channels shall be constructed of 12 Gauge G-90 galvanized steel. The floor and wall panels shall be caulked air tight with a silicone caulking. All casing panels shall be attached with sheet metal screws which can be removed for field service of large components. The unit base shall be suitable for curb or flat mount.

An observation port shall be located on the exterior of the unit for observation of the main flame and pilot flame. All controls, gas valves, modulating controls and electrical components shall be mounted within the control vestibule. The control vestibule shall be an integral part of the unit and not extend outside the exterior casing of the unit. It shall be complete with hinged access doors and not exposed to the main air stream.

The vestibule full size hinged access doors shall have a minimum of two (2) latches. Vestibule doors shall require tooling access and easy access to controls and gas train components. Blower door shall provide easy access to blower, motor and drives and also include a minimum of two (2) latches. All doors shall include 20 Gauge G-90 galvanized steel liners for added rigidity and positive seal. All access doors shall have a continuous aluminum hinge with stainless steel pin. Latches shall be a heavy duty lift and turn type Latch that is flush to the casing surface. Latches shall have a sealing gasket to prevent water leakage.

Proportioning dampers shall be installed to provide a mixture of outside air and bypass air. These dampers shall be installed parallel to the direct fired burner to provide the ideal mixing of heated air, bypass air and outside air. At no time will the bypass air be allowed to pass through the burner. Dampers shall be of G-90 galvanized steel mounted on friction-free bearings.

Balancing dampers shall be installed in the burner profile to maintain a constant velocity across the burner. Dampers shall be type of G-90 galvanized steel mounted on friction-free bearings.

Finish

Bright spangle G-90 galvanized casing. Optional exterior painted finish shall require the use of galvaneal steel material on casing.

Blower and Drives

Blower(s) shall be forward curved, Class I or II, (depending on requirements of the application) double width, double inlet, with pillow block bearings (standard on Model 18 and above, optional on Model 15 and below), with a minimum life expectancy of 200,000 hours. Unit shall have a heavy duty, solid steel shaft. Blower drives shall be fully adjustable up through 20, fixed on 25 HP and larger. All drives shall be a minimum of 2 grooves above 2 HP.

Blower capacity shall be _____ CFM at 70 degrees F standard air, ____ external static press.

Twin blower assemblies shall be coupled together using Sure-Flex Elastomeric Couplings. Couplings shall be designed for 4-Way flexing action (torsional, angular, parallel and axial) shaft movement. Single blower shafts for twin blower assemblies will not be acceptable.

External Static: The sum of duct loss plus accessory static. Example: filter, hood and damper. All blowers shall be tested and set at rated speed after being installed in the factory assembled unit.

Motor

Blower motor shall be suitable for operation on ______ volts, ______ cycle, ______ phase power. Blower motor shall be a _______________ HP motor (Open Drip Proof)(TEFC)(High Efficiency EPACT)(Premium Efficiency)(High Temp) Motor. Motor shall have an adjustable drive or fixed drive, and will have a 1.15 service factor. Blower motor shall have an adjustable mount, made of heavy gauge steel.

Burner

The gas burner shall be a direct fired, draw through type, sized to provide an output of ______ BTU/hr using (natural) (propane) gas at an inlet-supply pressure to the unit of ______ inches water column.

The burner shall be capable of heating the entire air supply from _____ F° to _____ F° (_____ degrees F temperature rise). The burner shall burn over its entire length at all times when the system is in operation.
The burner shall have non-clogging, 4302B stainless steel combustion baffles attached to an aluminum gas supply section with no moving parts to wear out or fail. The burner shall be capable of 100% combustion efficiency with a maximum turndown ratio of 30 to 1.

The gas burner shall be furnished with a pilot package arranged so that the pilot flame lights the burner with instantaneous ignition. Pilot assembly includes a flame rod, a spark rod and a pilot inlet automatically ignited by a 6,000 volt ignition transformer. A flame rod rectification system shall be used to prove pilot and main flame.

A pilot access panel shall be provided.

**GAS EQUIPMENT Standard**

All gas equipment shall conform to certification code requirements

Components:

1. pilot gas shut off valve
2. pilot gas regulator
3. pilot gas valve
4. main gas shut-off valve (field supplied)
5. main gas regulator
6. two main valves
7. modulating valve
8. burner

All gas manifold components shall be piped and wired at the factory.

**Optional**

1. high gas pressure regulator (over 5 PSI)
2. motorized gas valves
3. Factory Mutual approved manifold
4. FIA or IRI approved manifold

**SAFETY CONTROLS**

**Standard**

1. motor starter with adjustable overload
2. airflow safety switch
3. electronic flame safety relay
4. high temperature limit switch

**Optional**

1. High gas pressure switches to open circuit to electronic flame safety relay, if gas pressure is too high.
2. Low gas pressure switch to open circuit to electronic flame safety relay, if gas pressure is too low.
3. Adjustable low temperature blower safety control with bypass timer to shut down unit if discharge temperature drops below setting.
4. Proof-of-closure switch to energize the main burner circuit only if the motorized gas valve is in a closed position.
5. Pre-purge timer to allow blower to run for 1 minute, purging any gas residue in the unit, before burner circuit is allowed to energize.
6. Inlet firestat to shut off unit if the inlet temperature exceeds settings. Control shall be rated at 135 degrees F and shall require manual reset.
7. Discharge firestat to shut off the unit if discharge temperature exceeds settings. Control shall be rated at 250 degrees F and shall require manual reset.
8. Ionization-type smoke detector and sampling tube to stop unit operation when a presence of smoke is detected.

**ACCESSORIES**

1. Inlet (horizontal units) or Discharge Dampers: Manufacturer shall provide and install on unit, when possible, a two-position, motor operated damper with internal end switch to energize the blower starter circuit when damper is 70% open. Blades shall be a maximum of 6” wide 16 Gauge G-90 galvanized steel to guarantee the absence of noticeable vibration at design air velocities. Damper blades to be mounted on friction free bearings. Jamb seals to be flexible metal, compression type. (Inlet dampers on indoor units; discharge dampers on outdoor units.) Down discharge units (horizontal only) to have Internal Discharge damper and motor mounted in unit. Internal discharge damper to be Ruston CD60 high performance airfoil blade.
2. Filters: The filters shall be (2”) thick, aluminum slit and expanded mesh in varying pattern, aluminum frames. Disposable 2” filters shall be enclosed in two piece, die cut frame with diagonal supports. Frame shall be constructed of heavy duty beverage board. Filter media is supported on the air leaving side by a metal grid.
   
   **Fresh Air Filter Section:** shall be (insulated) ( uninsulated) constructed of G-90 galvanized steel with filters supported by internal slides and with access doors. Filters shall be provided in a v-bank arrangement.

   **Return Air Filter Section:** shall be (insulated) ( uninsulated) constructed of G-90 galvanized steel with filters supported by internal slides and with access doors. Filters shall be provided in a v-bank arrangement.

3. Fresh-Air Inlet Hood: Shall be constructed of G-90 galvanized steel with bird screen.
4. Fresh-Air Inlet Hood/Filter Combination: Shall be constructed of G-90 galvanized steel with bird screen and (2”) cleanable filters supported by internal slides mounted in the inlet face of the hood.
5. Discharge Diffusers: Shall be constructed of G-90 galvanized steel with horizontal and vertical blades capable of four way diffusion.
6. Vibration Isolators (horizontal only): Shall be supplied for the unit and be: (foot-spring mounted) (hanging-spring mounted) installed by the contractor. Springs shall be designed for 1” deflection.
7. Curb (horizontal only): (14”) (24”) curb shall be constructed of 12 ga G-90 galvanized steel. Extended curb shall be used for mixing section applications.
8. Casing Insulation: Unit casing shall have 1 inch of 1- 1/2# density insulation, with 20 gauge galvanized steel liners on the inside of the unit to prevent damage to insulation from physical abuse and moisture, preventing insulation material from being drawn into the air stream.

**TEMPERATURE CONTROL SYSTEMS**

401M Discharge Air Temperature Control (Maxitrol Series 14): For building exhaust-air replacement to maintain a constant discharge temperature of supply air. The burner flame modulates to compensate for outdoor temperatures. The manual SUMMER/OFF/WINTER selector switch and exhaust system interlock control the heater-blower operation.* Supplied with remote-control panel with temperature selector dial and SUMMER/OFF/WINTER selector.

402M Room-Override Discharge Air Control (Maxitrol Series 14): For building-exhaust air replacement and auxiliary space heating to maintain a constant supply air discharge temperature. A room override thermostat raises discharge set-point for more heat to maintain room temperature. Discharge temperature probe and room override thermostat modulate burner flame. SUMMER/OFF/WINTER selector switch and exhaust system interlock control heater-blower operation.* Supplied with remote control panel with temperature selection dial, SUMMER/OFF/WINTER selector switch and room-override thermostat.

403M Constant Operation Room Temperature Control (Maxitrol Series 44): For building exhaust-air replacement with modulated space-temperature control. A modulating space thermostat adjusts burner flame to maintain discharge-air temperature to compensate for changing building heat losses or gains. High and low discharge air settings limit maximum and minimum discharge air temperatures. The SUMMER/OFF/WINTER selector switch and exhaust system interlocks control heater-blower operation. Supplied with SUMMER/OFF/WINTER selector switch and a modulating room thermostat.
404M Day & Night Space Heating Control (Maxitrol Series 44): For building exhaust air replacement with total day and night building heating. By adding a night ON/OFF cycle to 403M Controls, this provides for a lower space temperature setting when building is unoccupied and allows heater to cycle on and off when space thermostat calls for heat. The day or occupied space temperature is maintained by room thermostat setting. The heater-blower operation is controlled by a manual SUMMER/OFF/WINTER selector switch, exhaust system interlock,* or ON/OFF room thermostat. Supplied with remote control panels with SUMMER/OFF/WINTER selector switch, modulating room thermostat and ON/OFF room thermostat.

OTHER OPTIONS

1. Operating lights mounted in a remote control panel to indicate: flame failure, low temperature shutdown, burner on and blower on.
2. Clogged filter switch and indicating light to signal when filters are dirty and require service.
3. Audible alarm to signal when unit shuts down on failure of the burner to ignite.
4. Time clock to automatically start and stop the unit, or switch from day to night operation.
5. Extended grease lines shall run from the blower bearings to a common point on the exterior of the unit.
6. Rear access door (vertical only) shall be full height and provide access inside unit from the rear of the unit, opposite from vestibule and motor access door.
7. Non-silicone caulk construction.

80/20 CONTROLS

Electric Two Position: Consists of a field supplied interlock that positions the fresh air/return air dampers at either 100% fresh air or maximum return air.

Manual Positioning Control Option: Consists of a room-mounted potentiometer that adjusts manually from 100% fresh air to maximum return air to satisfy changing building make-up air requirements. When the system is OFF, the return air bypass damper closes by the spring return damper actuator.

Humidity Control Option: A de-humidistat positions damper actuator to use outside air to lower space humidity.

Static-Pressure Positioning Control Option: Consists of a room or unit mounted static pressure controller with an outdoor sensor. The controller can be set to the building's minimum and maximum static pressure requirements. The dampers proportion the fresh air and return air to maintain static pressure between the minimum and maximum settings.

A visual indicator of the building's static pressure is incorporated into the controller. When the System is OFF, the return air bypass damper is driven to the closed position.

VARIABLE AIR VOLUME

Variable air volume shall be accomplished by use of a variable-frequency drive. Unit shall be capable of cfm turndown of 50%, while fast-acting automatic damper maintains proper air velocity across the burner. Unit shall include control interface to prevent over firing at lower cfm's.

Static-Pressure Positioning Control Option: A building Static Pressure Control shall be furnished to track the varying exhaust load of the building. The Static Pressure Control shall consist of a room or unit mounted static pressure controller with an outdoor sensor. The controller can be set to the building's minimum and maximum static pressure requirements. The control shall signal the variable frequency drive to increase or decrease the supply fan motor speed to maintain building static pressure between the minimum and maximum settings. A visual indicator of the building's static pressure is incorporated into the controller.

Manual Speed Control Option: Manual Positioning Control Option is done via vfd control pad for 50% to 100% design cfm's of fresh air to satisfy changing building makeup air requirements.

WIRING AND ELECTRICAL

The control circuit voltage shall be 115 volts. A control transformer shall be provided, when required. The control wiring shall be carried in wire channel or conduit. Wiring in control enclosures shall be in accordance with the National Electrical Code and the local code, as it may affect the installation. Motor control shall be provided when required.

Unit(s) shall be complete with all items such as relays, starters, switches, safety controls, conduit and wire as previously mentioned, and as required for proper operation. All factory mounted controls shall be factory wired in the control vestibule.

FACTORY TESTED

Unit(s) shall be operated, tested and set at the factory using indicated job site conditions for electrical and gas input. All operating and safety controls shall be tested and set at the factory. Adjustable or fixed sheaves shall be set for proper RPM at specified conditions. Burner manifold gas pressure shall be set for specified burning rate at specified inlet pressure.

SERVICE AND PARTS

The supplier shall furnish as built wiring connection and control circuit diagrams, dimension sheets and a full description of the unit(s). Service manual showing service and maintenance requirements shall be provided with each unit.