

SECTION 23 58 30 – KITCHEN VENTILATION SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes natural gas fired make-up air units, up-blast exhaust fans and other accessories. Refer to the contact drawings which may indicate optional equipment that is required. The System to be furnished with controls supplied by the equipment manufacturer and are to be integrated with the process cooking equipment.

1.3 SUBMITTALS

- A. Shop Drawings: Provide plans, elevations, sections, details, and attachments to other work.
 - 1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 2. Wiring Diagrams: For power and demand ventilation control wiring.
- B. Operation and Maintenance Data: For gas-fired make-up units, exhaust fans, controls sequences and other accessories.

1.4 QUALITY ASSURANCE

- A. Unit(s) assembly shall be tested in accordance with UL Standard UL 795, and shall bear the ETL label. The duct furnace shall be certified by the American Gas Association.

1.5 WARRANTY

- A. All equipment, material and labor provided under this specification section shall be warranted for a period of one year from the date of substantial completion.
- B. The make-up air unit is to be provided with a two-year parts warranty. The stainless-steel furnace shall have a twenty-five-year parts warranty.

1.6 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Filters: Two additional sets for each unit.

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS

- A. Manufacturers: Subject to compliance with requirements, provide make-up air units, exhaust fans, controls and all required accessories manufactured by Captive-Air Systems. Products meeting the full requirements of the specification manufactured by one of the following may be considered.
1. Greenheck.
 2. Rupp Air Management systems.

2.2 EXHAUST FANS

- A. Fan(s) shall be a spun aluminum and G90 Galvanized, roof or wall mounted (as required), direct drive, up-blast centrifugal exhaust ventilator. Fans to be ETL Listed and comply with UL705 (electrical) Standards. Models 12 thru 85 are ETL Listed and comply with UL762. Fan shall bear the AMCA certified ratings seal for sound and air performance. Fans to be direct drive and furnished with a factory mounted and wired variable frequency drive.
- B. Exhaust Fan Construction:
1. Housing: The fan windband shall be constructed of heavy gauge aluminum and shall be spun on an automatic lathe to provide consistent dimensions. Horizontal and vertical internal supports shall be used to securely fasten the windband to the discharge apron to provide rigidity for hinging and added strength to reduce shipping damage. The discharge apron shall have a rolled bead for added strength.
 2. Base: The base shall be constructed of galvanized steel for improved rigidity. Base corners shall be welded to provide strength and support for hinging and cleaning and to prevent leakage into the building.
 3. Fan wheel: The fan wheel shall be centrifugal backward inclined and non-overloading. Wheels shall be balanced in two planes and in accordance with AMCA standard 204-96, Balance Quality and Vibration Levels for Fans. The wheel blades shall be aerodynamically designed to minimize turbulence, increase efficiency and reduce noise. The wheel blades shall be welded to the wheel inlet cone. In the event that balancing weights are required they shall be riveted to the blades or wheel. The wheel inlet shall overlap the fan base inlet for maximum performance and efficiency. The wheel shall be firmly attached to the motor shaft with two set screws.
 4. Motor and Motor Compartment: Standard 115-volt, open drip motors shall be permanently lubricated, rated for continuous duty and thermally protected. Motors shall be mounted out of the airstream and furnished at the specified voltage, phase and enclosure. The motor mounting plate shall be constructed of heavy gauge galvanized steel. The motor compartment shall be cooled by outside air drawn through an extruded aluminum conduit tube. To seal the conduit tube passage and prevent noise silicone rubber grommets shall isolate the conduit tube from the fan housing. The motor compartment shall be of a two-piece construction with the cap having quick release clips to provide quick and easy access to the motor compartment.
 5. Provide NEMA 3R disconnect switch.
 6. Grease spout and box: Provide a grease spout made of aluminum tubing shall be welded to the fan housing. The weld shall be factory tested to ensure it will not leak.
 7. Provide nylon washers to offer a tight seal all fasteners in the fan housing shall be backed with nylon washers.
- C. Exhaust Fan Roof Curb(s): Provide / Furnish ventilated roof curb(s) fabricated from minimum 20-gauge galvanized steel. Where required provide curbs to match the roof slope. The roof curb height shall be such that the attached up-blast exhaust fan discharge is located a minimum of 40" above the roof surface.

2.3 GAS FIRED MAKE-UP AIR FURNACE

- A. General Description: Indirect-fired natural gas heating and ventilating make-up air unit(s). The unit(s) shall be factory assembled, tested and shipped as a complete packaged assembly, for outdoor installations. Unit(s) assembly shall be tested in accordance with Standard, ANSI Z83.8-2006 and shall bear the ETL label. The duct furnace shall be certified by the American Gas Association. Provide factory testing. The make-up air units shall consist of the following:
1. Natural gas fired gas indirect fired furnace.
 2. Centrifugal blower selected for the indicated performance requirements.
 3. Motor starter with thermal overload protection.
 4. Motor and drive assembly.
 5. Temperature control system.
 6. Fuel burning and safety equipment.
 7. Factory installed gas components including but not limited to the following:
 - a. Modulating gas valve(s).
 - b. On/off redundant gas valves.
 - c. Gas burner.
 - d. Main gas shut-off valve.
 - e. Main gas regulator.
 - f. Two solenoid valves.
 - g. Gas pressure gauge.
 - h. High pressure regulator, when required.
 8. Safety controls including but not limited to the following:
 - a. Motor starter with adjustable overloads.
 - b. Main air flow safety switch.
 - c. Electronic flame safety relay.
 - d. Non fused disconnect.
 - e. Flame roll out switch.
 - f. Combustion air proving switch.
 - g. Low temperature blower safety control.
 - h. High gas pressure switch, when required.
- B. Furnace Housing Construction:
1. Unit housing shall be double wall and constructed of 20 Gauge 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 and wall panels shall be caulked air tight with a silicone caulk. All casing panels shall be attached with sheet-metal screws or rivets, which can be removed to field service large components. The unit base shall be suitable for curb or flat mount. The base shall be constructed of galvanized steel for improved rigidity. Base shall be structurally reinforced to accommodate the blower assembly and burner. Housing construction should be suitable for outdoor installation and shall be insulated.
 2. All doors and at least one side of every sheet metal surface of the unit separating two air-masses of different air temperatures shall be faced with properly secured 1" aluminum-faced insulation for condensation prevention.
 3. The discharge of the unit shall be internal to the heating module containing the furnaces.
 4. All electrical controls on the control board shall be mounted in an isolated, fully enclosed and insulated vestibule, completely separated from any combustion air, but accessible for servicing needs.

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5. All furnace exhaust flues shall be provided and fabricated of double-wall construction. All furnace exhaust flue connections and the unit roof penetration seams shall be sealed with High-Temp Fire-Barrier 2000+ type silicone caulking.
 6. All unit housings, sizes 1-3, shall be equipped with Internal Air Distribution Screens on the upstream side of each furnace heat-exchanger.
 7. All gas valves and electrical safety-limits shall be mounted within the burner vestibule; wiring to these components shall be properly secured and away from all high temperature metal surfaces. The burner vestibule shall be an integral part of the unit and not extend outside the exterior casing of the unit and not exposed to the main air stream.
 8. Provide high wind rain caps installed at the termination of the furnace discharge flues.
 9. Provide factory mounted freeze-stat.
 10. The vestibule full-size door shall provide easy access to controls and gas-train components. Blower door shall provide easy access to blower, motor and drives. Access doors shall be provided on both front and back side of unit providing full access to every part of the unit.
- C. Furnace Blowers: Wheels shall be balanced in two planes and done in accordance with AMCA standard 204-96, Balance Quality and Vibration Levels for Fans. The wheel blades shall be aerodynamically designed to minimize turbulence, increase efficiency and reduce noise. The wheel blades shall be securely attached to the wheel inlet ring. The wheel shall be firmly attached to the fan shaft with set screws and keys. The blower assembly shall be isolated from the fan structure with factory installed vibration isolators.
1. Direct drive blowers shall consist of a centrifugal backward inclined, non-overloading wheel secured directly to a heavy duty, ball bearing type motor via two set screws. The motor and wheel assembly shall be mounted to a heavy gauge galvanized steel frame. The motor shall be controlled by a variable frequency drive, allowing for variable airflow without the need of belts and pulleys.
- D. Furnace Motor & Motor Compartment: Motors shall be heavy duty ball bearing type and furnished at the specified voltage and phase. Motor mounting plate shall be constructed of heavy gauge galvanized steel and shall be designed to provide easy adjustment of belt tension.
- E. Furnace Shaft and Bearings: Shafts shall be precision ground and polished. Heavy duty, pre-lubricated bearings shall be selected for a minimum (L50) life in excess of 200,000 hours of operation at maximum cataloged operating speed. They shall be designed for, and individually tested specifically for use in air handling applications.
- F. Furnace Burner & Heat Exchanger: The gas burner shall be an indirect-fired, push-through type, sized to provide an output indicated on the drawings. The unit shall operate using natural gas at an inlet-supply pressure to the unit of 7" w.c. minimum for natural gas and 11" w.c. minimum for LP gas. The burner shall be a tubular in-shot fired design capable of using either gas. Each burner ignition shall be of the direct-spark design with remote flame sensing at inlet of the last firing tube of the gas manifold. Each burner ignition module shall be pre-programmed with an ignition sequence comprised of a 1-minute pre-purge, 1 min inter-purge, 2-minute post-purge, 15 second ignition, 3 trials for ignition, and 60 min lockout. Direct-sparking sequence shall last through the complete trial ignition period for guaranteed light-off. Burner shall always be lit at maximum gas flow and combustion airflow for guaranteed light-off. Each burner ignition module shall have LED indicators for troubleshooting and a set of exposed prongs for testing flame indication signal. All furnaces shall be controlled by an electronic fully modulating control system capable of achieving 80% combustion efficiency over the entire gas firing range of the unit. Each furnace shall be provided with the following:
1. A minimum turndown ratio of 6:1 for natural gas and 5:1 for LP gas.
 2. The heat exchanger shall be a bent-tube style design made entirely of type 409 stainless steel.
 3. Include a blocked vent safety airflow switch with high temperature silicone tubing operating off of absolute pressure measured inside of the power-vent blower housing.
 4. Include a high temperature auto-recycling limit with a maximum non-adjustable set-point of 200F.

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5. Include a manual reset high temperature flame roll out switch with a non-adjustable set-point of 325F.
 6. The furnace shall be accessible from both sides of unit.
 7. Include a power-vent assembly for exhausting flue gases with a type PSC type motor that is securely mounted with rubber vibration isolators and easily accessible/removable for service.
 8. Each furnace module gas inlet shall be equipped with a 0-35" w.c. gas pressure gauge. A 0-10" w.c. gas pressure gauge shall be installed on the gas manifold of each furnace.
- G. Filters: Provide 2" thick washable aluminum mesh filters coated with super-filter adhesive. Aluminum mesh filters shall have aluminum frames with media to be layers of slit and expanded aluminum, varying in pattern to obtain maximum depth loading.
- H. Electrical and wiring:
1. Provide single point electrical connection.
 2. Provide 24-volt control circuit and transformer. Unit shall have standing 120 volt power. 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.
 3. Provide a line voltage motor starter shall be provided.
 4. 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.
 5. Provide a blower delay timer to pre-heat the heat-exchanger prior to energizing the main blower.
 6. Convenience outlet shall be provided on the control board with 120-volt service.
 7. Provide a freeze stat with adjustable temperature set point to shut down the main blower in case of burner failure.
 8. Provide dirty filter airflow switch with LED indicator light on remote panel.
 9. Cabinet heater strip with thermostat.
 10. All factory-mounted controls shall be factory prewired to the unit control panel.
- I. Inlet Dampers: Provide a two-position, motor-operated damper with internal end switch to energize the blower-starter circuit, when damper is 80% open. Blades shall be a maximum of 6" wide 16 Gauge G-90 galvanized steel shall be made to guarantee the absence of noticeable vibration at design air velocities. Damper blades to be mounted on friction-free synthetic bearings. Damper edges shall have PVC coated polyester fabric mechanically locked into blade edge. Jamb seals to be flexible metal, compression type.
- J. Fresh Air Inlet Hood: Provide inlet hood constructed of G-90 galvanized steel with birdscreen.
- K. Roof curb: Provide 20" high roof curb(s) fabricated from 20-gauge galvanized steel. Provide curbs to match the roof slope.

2.4 DEMAND CONTROL VENTILATION (DCV) SYSTEM

- A. Provide a Demand Control Ventilation System that is ETL and UL listed. The system shall comply with the requirements indicated in the International Energy Efficiency Code. The Demand Control Ventilation System is designed to automatically reduce exhaust and supply airflow quantities, while ensuring hood performance is maintained. The DCV uses variable frequency drives (VFD) and temperature sensors in the exhaust ducts to modulate the fans speed during cooking operation and maximize energy savings. The LCD screen interface provides fan(s) control, system configuration, and diagnostic information.
- B. DCV System to include the following:
1. Smart controller.
 2. LCD screen interface.
 3. Duct temperature sensors.

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4. Variable frequency drives.
- C. All controls to be listed by ETL (UL 508A)
 - D. The system includes an LCD screen interface for fan(s) and hood lights control, gas valve reset, programmable schedule, Max Air Override function, Preparation Time mode, and diagnostics including VFD status. The LCD screen shows descriptive plain text explaining the functions or values. The LCD screen interface will be installed on the face of the hood, on the face of the utility cabinet or on the face of a wall mounted control enclosure. Provide a NEMA 1 rated control enclosure listed for installation inside of the exhaust hood utility cabinet. Control enclosure to be constructed of stainless steel.
 - E. The smart controller will constantly monitor the exhaust air temperature through the riser mounted temperature sensor and modulate the fan speeds accordingly.
 - F. A room temperature sensor will also be provided for field installation in the kitchen space in order to start the fan(s) based on the fixed temperature differential between the room and the exhaust air in the duct rather than fixed set-points.
 - G. Fan(s) maximum and minimum speeds will be adjustable for proper kitchen balance.
 - H. Duct Temperature Sensor(s) will be mounted in the exhaust hood duct riser. Temperature probe will be constructed of stainless steel. The system will be factory pre-set to modulate fan speed within a range of 45° F for 600° F and 700° F cooking applications and a range of 5°F for 400° F cooking applications. Set-points are fully adjustable through the touch screen interface based on application needs.
 - I. The panels include color coded wiring with as-built wiring diagrams and spare terminals controlled by the fire system micro switch. The panel is factory pre-wired to shut supply fans down in a fire condition. Options to turn ON the exhaust fans or turn off the hood lights in a fire condition will be configurable through the smart controller, but only through a password protected menu to prevent any changes after a fire inspection has been performed.
 - J. DCV System Sequence of Operation: The system shall be capable of operating in any of the following methods:
 1. Automatic operation based on controls provide with the system that will determine the temperature difference between the room and the temperature within the hood. The controls will modulate the exhaust fan and make-up air units accordingly.
 2. Manual control.
 3. Scheduled operation to be operational at a specified period throughout the day.
 4. Fire mode: upon activation of the hood fire protection system the exhaust fan will start or continue to run and the make-up air unit will shut-down. The gas supply will be shut off.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install units according to manufacturer's written instructions. Include all required controls and control wiring to provide a fully operational system.
- B. Provide installation of the exhaust fan(s), make-up air units, temperature sensors and all required controls to provide a complete and fully operational ventilation system(s). This work is to be performed per the manufacturer installation instructions.

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- C. Roof curb: provide a roof curb for all roof mounted units. Install the roof mounted unit(s) on the roof curb immediately after the curb is installed. If immediate installation is not performed provide temporary watertight covering, for all curb openings, consisting of minimum ¾" exterior grade plywood and watertight rubber or plastic cover.
- D. At the direction of the owner's representative, the contractor shall install the extra filters in the respective equipment. If no additional installation is required, the contractor shall forward, to the owner, all extra filters.

3.2 CONNECTIONS

- A. Install piping adjacent to gas-fired duct heaters to allow service and maintenance. Duct Connections: Comply with Division 23 Section, Metal Ducts.
- B. Provide control wiring and interlocks to shut down the supply fan when the fire suppression system is activated, the exhaust fan shall continue to operate. If the system is not operating, provide an interlock to start the exhaust fan if the fire suppression system is activated. Provide all control and relay wiring between the ventilation system fans and an adjustable temperature switch to be located within the kitchen hood to automatically activate the Kitchen Ventilation system when heat is detected.

3.3 START-UP AND COMMISSIONING

- A. Start-up service shall be provided by the equipment manufacturer's authorized representative and shall include complete testing of all controls and unit operation for all units. The agency responsible for start-up shall record all operating data. Copies of this data are to be supplied to the owner.

3.4 ADJUSTING AND CLEANING

- A. Adjust initial temperature set points.
- B. Adjust burner and other unit components for optimum heating performance and efficiency.
- C. Clean units internally, on completion of installation, according to manufacturer's written instructions. Clean fan interiors to remove foreign material and construction dirt and dust. Vacuum clean fan wheels, cabinets, and coils entering air face.

3.5 DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, and maintain units.

END OF SECTION 23 58 20