

# F-IBT Specification

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## TYPICAL SPECIFICATIONS

**Model:** F-IBT

**Description:** An Indirect-fired gas heating and ventilating unit(s), as indicated on the drawings shall be furnished. Orientation shall be Horizontal (Down) (Side) (Up) discharge. Unit(s) shall be factory assembled, tested and shipped as a complete packaged assembly, for indoor or outdoor mounting, consisting of the following:

- Gas furnace;
- Centrifugal blower (forward-curved double width/double inlet or backward inclined);
- Motor starter with thermal overload protection;
- Motor and drive assembly;
- Fuel burning and safety equipment;
- Temperature control system, and
- Gas piping.

**Approvals:** Unit(s) assembly shall be tested in accordance with Standard, ANSI Z83.8-2006 and CSA 2.6-2006 and shall bear the ETL label. The duct furnace shall be certified by the American Gas Association and approved by the Canadian Gas Association.

### Construction:

#### Housing Standard

Unit housing shall be 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 or indoor installation.

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.

The discharge of the unit (Down/Side/Up) shall be internal to the heating module containing the furnaces.

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.

All furnace exhaust flues shall be of double-wall construction. All furnace exhaust flue connections and roof-penetration seams shall be sealed with High-Temp Fire-Barrier 2000+ type silicone caulking.

All unit housings, sizes 1-3, shall be equipped with Internal Air Distribution Screens on the upstream side of each furnace heat-exchanger.

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.

If an outdoor unit, high wind rain caps shall be installed at the termination of the furnace discharge flues.

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.

#### Housing Optional

- The unit shall have double-wall construction consisting of at least two layers of 20 gauge G-90 galvanized steel.
- The unit shall have a duct connection(s) with an area equal to or greater than that of the total area of all exhaust flues for the introduction of dedicated combustion air to the burner vestibule.

#### Blower

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 vibration isolators.

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

External Static: The sum of duct loss plus duct component static- Example: louvers, diffusers. All blowers shall be tested and set at rated speed after being installed in the factory-assembled unit.

#### Belt Drive

Blower(s) shall be forward-curved, centrifugal, Class I or II (depending on requirements of the application), double width, double inlet, constructed G-90 galvanized steel. Unit shall have a heavy-duty, solid-steel shaft.

#### Direct Drive

Direct drive blower assembly 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.

#### Motor & Motor Compartment

Motors shall be heavy duty ball bearing type and furnished at the specified voltage, phase and enclosure. Motor mounting plate shall be constructed of heavy gauge galvanized steel and shall be designed to provide easy adjustment of belt tension. Blower motor shall be suitable for operation on \_\_\_\_\_ volts, \_\_\_\_\_ cycle, \_\_\_\_\_ phase power. Blower motor shall be a \_\_\_\_\_ HP motor, Open Drip Proof.

## Shaft & 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.

## Belts & Drives (Belt Drive Units Only)

Belts shall be oil and heat resistant, non-static, grip-notch type. Drives shall be cast type, precision machined and keyed and secured attached to the fan and motor shafts. Fan operating speed shall be factory set using adjustable pitch motor pulleys; motors over 3 HP will come standard with double groove pulleys.

## Burner & Heat Exchanger

The gas burner shall be an indirect-fired, push-through type, sized to provide an output of \_\_\_\_\_ BTU/hr using (natural) (LP) gas at an inlet-supply pressure to the unit of \_\_\_\_\_ inches water column (7" w.c. minimum Nat. Gas, 11" w.c. minimum LP Gas).

The burner shall be capable of heating the entire air supply from \_\_\_\_\_ F° to \_\_\_\_\_ F° (\_\_\_\_\_ degrees F temperature rise). Burner shall be a tubular in-shot fired design capable of using natural or LP type 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 during of the trial for 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 vernier-type fully modulating control system capable of achieving 80% combustion efficiency over the entire gas firing range of the unit.

Each furnace shall have:

- A minimum turndown ratio of 6:1 for natural gas and 5:1 for LP gas.
- Each furnace heat exchanger shall be a bent-tube style design made entirely of type 409 stainless steel.
- Each furnace shall 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.
- Each furnace shall include a high temperature auto-recycling limit with a maximum non-adjustable set-point of 200F.
- Each furnace shall include a manual reset high temperature flame roll out switch with a non-adjustable set-point of 325F.
- Each Furnace shall be accessible from both sides of unit.
- Each Furnace shall 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.
- Every heat-exchanger shall have a manufacturer-backed 10-year pro-rated warranty.
- Every power-vent blower motor and housing shall have a standard 2-year manufacturer-backed warranty.

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.

## GAS EQUIPMENT

### Standard

All gas equipment shall conform to local-Code requirements

Components:

1. Modulating-gas valve
2. On/off redundant gas valve
3. Burner
4. Main-gas shut-off valve
5. Main-gas regulator
6. Two solenoid valves

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

### Optional

High Gas Pressure Regulator

## SAFETY CONTROLS

### Standard

1. Motor starter with adjustable overloads
2. Main air-flow safety switch
3. Electronic flame-safety relay
4. High-temperature limit switch
5. Non-fused disconnect
6. Flame roll-out switch
7. Main-gas regulator
8. Two solenoid valves
9. Modulating-gas valve
10. Burner
11. Combustion air-proving switch

### Optional

- High gas-pressure switches to open circuit to electronic flame-safety relay, if gas pressure is too high.
- Low gas-pressure switch to open circuit to electronic flame safety relay, if gas pressure is too low.
- Adjustable low temperature blower-safety control with bypass timer to shut down unit, if discharge temperature drops below setting.

## ACCESSORIES

- **Inlet 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 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.

- **Filters:** The filters shall be (2") thick, aluminum mesh, 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. Washable 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. **Filter Section:** shall be (insulated) (uninsulated) constructed of G-90 galvanized steel with filters supported by internal slides and with removable access panels. Filters shall be provided in a v-bank arrangement.
- **Fresh-Air Inlet Hood:** Shall be constructed of G-90 galvanized steel with birdscreen.
- **Fresh-Air Inlet Hood/Filter Combination:** Shall be constructed of G-90 galvanized steel with birdscreen and (2") cleanable filters supported by internal slides mounted in the inlet face of the hood.
- **Discharge Diffusers:** Shall be constructed of G-90 galvanized steel with horizontal and vertical blades capable of four-way diffusion.
- **Curb:** 20" curb shall be constructed of 20 ga or greater G-90 galvanized steel as a completed welded assembly.
- **Cooling Coil Section:** Cooling coil section shall be bolted directly to intake of the blower section. Coil section to be designed to fit onto common curb with main unit. Base of coil section to be constructed same as main unit with double pitch stainless steel drain pan for coil. Casing and roof to be 20 ga. G-90 galvanized construction. Inside of section to be fully insulated with foil back insulation. DX or chilled water coil to meet scheduled requirements.

## TEMPERATURE CONTROL SYSTEMS

**HMI Control:** One HMI or Human-Machine Interface to be provided standard. Space HMI or room sensor shall be provided for temperature control utilizing space temperature. Additional HMIs or room sensors can be provided for space averaging. Cat5 connections shall be utilized between all HMIs. All settings and set points shall be able to be controlled at any HMI.

**Activate Based on:** Shall have the ability to activate heating/cooling based on the following.

- Intake temperature only
- Space temperature only
- Intake and space temperature
- Intake or space temperature

**Tempering Mode:** Shall have the ability to control heating/cooling based on the following.

- Discharge - Unit shall modulate to maintain discharge temperature.
- Space - Unit shall modulate to maintain space temperature.
- BAS - Unit shall be controlled via call for fan, call for heat, call for cool (optional), as well as a modulating heat input (0-20mA, 4-20mA, 0-10V, or 2-10V).
- (Optional) DDC - Unit shall be controlled via a DDC controller. Protocols to include BACnet or Lonworks.

### Blower Mode:

- Manual (On) - Blower shall run constantly regardless of heating/cooling based on blower on/off button on HMI.
- Auto - Blower shall only run on a call for heating or cooling.
- Interlock (Off) - Blower shall only run when unit interlock is energized.

**Scheduling (Optional):** Shall have the ability for 7 day scheduling.

- Shall have the ability to schedule 2 Occupied periods per day.
- Separate temperature set points for Occupied and Unoccupied periods.
- Separate Blower Modes for Occupied and Unoccupied periods.
- Occupied Override.

### Service Functionality:

- Ability to monitor temperatures and VFD feedback real-time throughout unit.
- Test Fan, Heat (high/low fire setting) and Cooling.
- Fault history storing past twenty faults.
- VFD parameter adjustment through HMI.

## Re-Circulating Control Options

**Manual/0-10V Control:** The dampers can be manually controlled from the HMI in the unit or from a remote HMI to any position from 0% to 100% fresh air to match building ventilation requirements.

**Field Wired Control (Two Position):** The dampers can be controlled by a two position switch (field supplied switch device) to open the fresh air to 100%.

**Outdoor Air Percentage:** The dampers can be controlled from the HMI in the unit or from a remote HMI to any position from 0% to 100%. The IBT board utilizes an algorithm to alter its 0-10V output to the mixing box damper to maintain an exact outdoor air percentage based on entering and leaving temperatures.

**Static Pressure Control (Photohelic):** The dampers can be controlled by a building static pressure control. This controller will sense the difference between pressure inside the building and pressure outside the building, and position the dampers to maintain the pressure setting on the controller.

**Building Automation System (BAS) Control:** The supply and return dampers will modulate based on a 0-10 VDC signal from a building automation system.

**Schedule Control:** The supply and return damper will change based on the schedule; the unit will maintain the appropriate outdoor air percentage based on the schedule state.

## VAV OPTIONS

**VAV (Static Pressure Control):** A factory-supplied field wired VFD is provided which varies the speed of the blower wheel. The VFD is controlled by a field wired Static Pressure Controller which measures building pressure and uses auxiliary inputs on the IBT control board to accelerate or decelerate the blower speed to maintain the building pressure set on the Static Pressure Controller.

**VAV (Manual):** A factory-supplied field wired VFD is provided which varies the speed of the blower wheel. The VFD is controlled by a preset speed on the IBT control board.

**VAV (Preset Speeds):** A factory-supplied field wired VFD is provided which varies the speed of the blower wheel. The VFD is controlled using auxiliary pins on the IBT control board to switch between preset speeds.

**VAV (0-10VDC):** A factory-supplied field wired VFD is provided which varies the speed of the blower wheel. The VFD is controlled using external 0-10VDC signal to vary blower speed.

## WIRING AND ELECTRICAL

### Standard

- The control circuit voltage shall be 24 volts.
- A control transformer shall be provided.
- Unit shall have standing 120 Vac 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.
- Motor starter shall be provided.
- Starter shall be line voltage, definite purpose type.
- 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 prewired to the unit control panel.

#### **Optional**

- Single point electrical connection shall be supplied.
- Blower-on delay timer to pre-heat the heat-exchanger prior to energizing the main blower.
- Convenience outlet shall be provided on the control board with 120 Vac service.
- Freeze-stat shall be provided with adjustable temperature set point to shut down the main blower in case of burner failure.
- Fire stat with adjustable set-p temperature.
- Dirty filter airflow switch with LED indicator light on remote panel.
- Cabinet heater strip with thermostat.
- Variable Frequency Drive for main blower motor.

#### **FACTORY TESTED**

Unit(s) shall be operated, tested and set at the factory using 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. Gas-pressure regulator shall be set for specified burning rate at specified inlet pressure.

#### **SERVICE AND PARTS**

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