

## Indirect Fired Heater Model A-IBT Specification

### Description

An Indirect-fired gas heating and ventilating unit(s), as indicated on the drawings shall be furnished. Units(s) shall be tested in accordance with ANSI Standard 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. Orientation shall be horizontal, down, side or 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:

1. Gas furnace
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

### 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. 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):*

1. The unit shall have double-wall construction consisting of at least two layers of 20 gauge G-90 galvanized steel.
2. 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.

**Base:** The base shall be constructed of galvanized steel for improved rigidity. Base shall be structurally reinforced to accommodate the blower assembly and burner.

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

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

External Static is 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.

**Motor and 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 the 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 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.

**Belts and Drives:** 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. Blower drives shall be fully adjustable. All drives shall be a minimum of 2 grooves above 2 HP.

**Burner and 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 duration 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 1-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.

### **Electronic Modulation Control System**

Every heater shall operate at **80% constant combustion efficiency over the entire gas firing range.**

Every heater shall have an Electronic Vernier-type Fully Modulating Control System used to control the firing sequencing, gas output and combustion air supply to a single modulation stage furnace and between 0 to 3 additional ON/OFF Furnace Stages. The Heat Control Board shall be programmed for Vernier-type staged modulation and shall be equipped with terminals to power the ON/OFF Furnaces such that a linear output of heat is always achieved as additional furnaces are fired or turned off.

The single modulating furnace shall be located furthest downstream in the unit in order to prevent condensation on the interior of the heat exchanger.

A PID-type capable Heat Control Board, working in conjunction with a discharge sensor, remote thermostat, or separate BAS (Building Automation System) shall be used to generate its own 0-10Vdc output signal based on the required heat load into the tempered space. This 0-10Vdc signal shall be used to control a Modulating Gas Valve located on the modulating furnaces gas train and a motor speed controller used to control the speed of the Power-vent blower supplying the combustion air for the Modulating Stage Furnace. As the need for more heat rises or falls in the building's space, the 0-10Vdc output signal to the gas valve and motor speed controller shall increase or decrease to provide tempered air to within 1 degree Fahrenheit of set-point temperature.

The motor speed controller shall be pre-programmed, based on the 0-10Vdc input signal it receives, to then provide an output voltage to the power-vent motor on the modulating furnace. The supplied combustion air to the burner is the exact amount needed to attain 80% combustion efficiency over the entire gas firing range of the unit.

### **Gas Equipment**

*Standard:* All gas equipment should conform to local code requirements. All gas manifold components shall be piped and wired at the factory. All gas manifold components shall be piped and wired at the factory.

*Components include:* Modulating gas valve, On/Off redundant gas valve, Burner, Main Gas shut-off valve, Main Gas regulator, two solenoid valves. Optional is the High gas pressure regulator.

Line and Manifold pressure gauges come standard on the unit and are installed at the factory before shipment. The Line pressure gauge will ensure proper pressure from the incoming gas line and is capable of measuring from 0 to 35" wc. The Manifold pressure gauge is installed after the combination gas valve to ensure proper pressure into the burner and is capable of measuring -5 to 15" wc. During startup, the Manifold pressure gauge will also help to set high and low fire on the unit.

## Safety Controls

*Standard Components include:* Motor starter with adjustable overloads, Main air-flow safety switch, Electronic flame-safety relay, High-temperature limit switch, Non-fused disconnect, Flame roll-out switch, Main gas regulator, Two solenoid valves, Modulating gas valve, Burner and Combustion air-proving switch.

*Optional Components include:*

1. High gas-pressure switch 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

## Temperature Control Systems

*Discharge Temp Control:* For building exhaust-air replacement to maintain a constant discharge temperature of supply air. The burner flame modulates to compensate for outdoor temperatures. The adjustable dial controller serves is used for set-point adjustment. Supplied with optional remote-control panel with temperature selector dial and SUMMER/OFF/WINTER selector.

*Space Temp Control:* For building-exhaust air replacement and auxiliary-space heating to maintain a constant space temperature. An adjustable dial controller with an internal thermostat is used for set-point adjustment to maintain room temperature. Optional SUMMER/OFF/WINTER selector switch and exhaust-system interlock to control heater-blower operation. Supplied with optional remote-control panel with temperature-selection dial and SUMMER/OFF/WINTER selector switch.

*BAS (Building Automation System) Control:* For building exhaust-air replacement with modulated temperature control based off of BAS supplied 0-10 Vdc or 4-20mA input signal. Auxiliary contacts and relays provided for contractor in the field.

*Other Options:* Operating lights mounted in a remote-control panel to indicated power, burner ON and Blower ON.

## 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 closes and opens contacts on the VFD to accelerate or decelerate the blower speed to maintain the building pressure set on the Static Pressure Controller. Factory supplied automatic dampers maintain the burner profile pressure drop as the blower speed is varied.

*VAV (Manual Potentiometer):* A factory-supplied field wired VFD is provided which varies the speed of the blower wheel. The VFD is controlled by a field wired Manual Potentiometer which is manual adjusted to set the speed of the blower. Factory supplied automatic dampers maintain the burner profile pressure drop as the blower speed is varied.

*VAV (Speed Switch):* A factory-supplied field wired VFD is provided which varies the speed of the blower wheel. The VFD is controlled by a field wired speed switch, which manually switches the VFD between pre-set blower speeds. Factory supplied automatic dampers maintain the burner profile pressure drop as the blower speed is varied.

## **Wiring and Electrical**

### *Standard on unit:*

- 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 on unit:*

- 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 dials for time and temperature settings to shut down the main blower in case of burner failure.
- Fire stat with adjustable set-point 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.

## **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 and shall be made to guarantee the absence of noticeable vibration at design air velocities. Damper blades are to be mounted on friction-free synthetic bearings. Damper edges shall have PVC coated polyester fabric mechanically locked into blade edge. Jamb

seals used are 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 either insulated or non-insulated 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 bird screen.

*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.

*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 18-gauge G-90 galvanized steel as a completed welded assembly.

*Cooling Coil Section:* Cooling coil section shall be bolted directly to discharge of 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-gauge G-90 galvanized construction. Inside of section to be fully insulated with foil back insulation. DX or chilled water coil to meet scheduled requirements.



## Suggested Specifications

### Integrated Suggested Specifications:

#### ***Metal Type and Construction***

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. Housing construction should be suitable for outdoor or indoor installation.

#### ***Access Doors***

Access doors shall be provided on both front and backside of unit providing full access to every part of the unit. Each Furnace shall be accessible from both sides of unit.

#### ***Foil Face Insulation***

Internal ridged board 1" x 1.5" foil face installation shall be installed on roof, walls and base of casing.

#### ***Galvanized Steel Base***

The base shall be constructed of galvanized steel for improved rigidity. Base shall be structurally reinforced to

accommodate the blower assembly and burner.

### ***Heat Exchanger and Furnace***

The heat exchanger shall be a bent-tube style design made entirely of type 409 stainless steel. Burner shall be a tubular in-shot fired design capable of using natural or LP type gas. Each furnace shall have a minimum turndown ratio of 6:1 (5:1 for LP gas) and up to a max turndown of 28:1 depending on input MBH and furnace quantity. 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 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. The single modulating furnace shall be located furthest downstream in the unit in order to prevent condensation on the interior of the heat exchanger.

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modulation and shall be equipped with terminals to power the ON/OFF Furnaces such that a linear output of heat is always achieved as additional furnaces are fired or turned off. Every heater shall operate at **80% constant combustion efficiency over the entire gas firing range.**

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### ***Variable Power-vent Blower Speed Control***

The motor speed controller shall be pre-programmed, based on the 0-10Vdc input signal it receives, to then provide an output voltage to the power-vent motor on the modulating furnace. The supplied combustion air to the burner is the exact amount needed to attain 80%+ combustion efficiency over the entire gas firing range of the unit.

### ***Line and Manifold Pressure Gauges***

Line and Manifold pressure gauges shall come standard on the unit and shall be installed at the factory before shipment. The Line pressure gauge shall ensure proper pressure from the incoming gas line and shall be capable of measuring from 0 to 35" w.c. The Manifold pressure gauge shall be installed after the modulating gas valve to ensure proper pressure into the burner and shall be capable of measuring 0-10" w.c. During startup, the Manifold pressure gauge shall also help in setting high and low fire on the unit.

### ***Single Power Connection***

A single point electrical connection shall be supplied. 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 starter shall be provided. Starter shall be line voltage, definite purpose type.

### ***Standard Disconnect***

A safety disconnect switch shall be standard on all units and shall be sized according to the unit.

***As-built Wiring and Control Diagram***

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.

***Standard High Fire Start***

Direct-sparking sequence shall last through the complete duration 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.