

# Direct Gas-Fired Make-Up Air Model TSU

Heavy Duty, High Airflow Applications

- Manufacturing and Industrial Facilities
- Up to 64,000 cfm

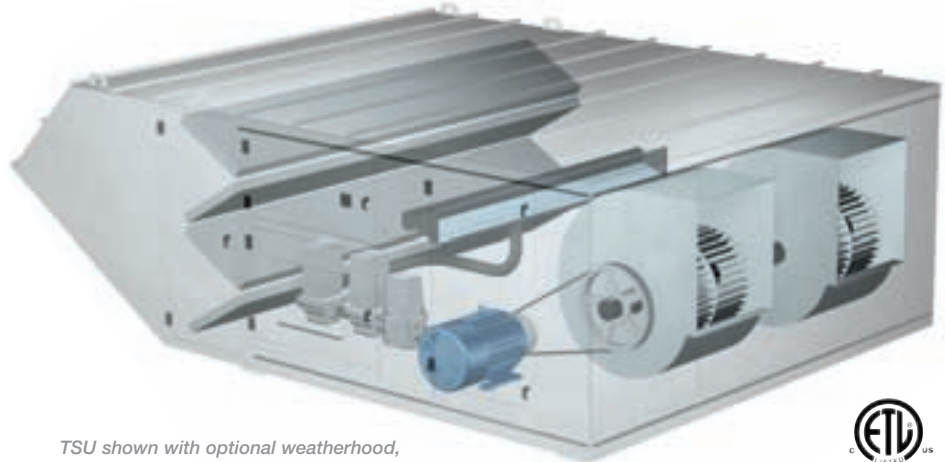


## Model TSU

### Direct Gas-Fired Make-Up Air Unit

The Greenheck model TSU is a 100% efficient direct gas-fired heating and ventilating unit. Airflow options include 100% make-up air for constant volume or variable volume applications. For space heating, a recirculation option is available.

The TSU is specifically designed for providing heating and make-up air for manufacturing facilities and warehouses. Airflow volumes up to 64,000 cfm and heating capacities up to 6,050,000 Btu/hr are offered.



TSU shown with optional weatherhood, filter section and horizontal fan discharge.



Direct Gas-Fired Heat

### Durable Construction

Designed for maximum weather resistance, TSU housings are constructed of heavy gauge G90 galvanized steel. Lifting lugs are standard.

### Direct Gas-Fired System

- Direct gas burners with stainless steel mixing plates
- Maxitrol burner modulation control
- Flame safeguard with digital fault indicator capability
- 25:1 turn down ratio



### Control Center

The control center includes the following standard components:

- Magnetic motor starter with solid state overload protection
- Control transformer with fusing
- Integral door interlocking disconnect switch
- Separately fused motor
- Distribution terminal strip



Premium grade control components are selected for reliable operation. All electrical components are UL Listed, recognized or classified and factory prewired for single point power connection.

### Vibration Isolators

The entire fan and motor assembly is mounted on vibration isolators to minimize noise transmission into the building.



### Reliable Fan Performance



Air performance ratings from Greenheck's accredited test chamber ensure accurate data.

Double width, double inlet forward curved wheels for high efficiency and low sound levels are constructed of heavy gauge steel. Wheels are balanced to ensure vibration free operation.

### Access Doors and Panels

Large access doors and panels are provided for easy inspection and maintenance of motors, drives, fan wheels, filters, and heater controls.

### Factory Wired and Tested

All units are tested prior to shipment. Units are checked for vibration and proper operation.



## Variable Volume

The variable volume option is recommended when a building's exhaust volumes may vary. This option enables the make-up air volume to track with the exhaust volume, providing only the amount of make-up air that is required.

The variable volume TSU saves energy in two ways. First, the fan power is reduced whenever make-up air requirements are less than the maximum. Second, whenever lower air volumes are sufficient, the TSU requires less gas to heat the outdoor air.

### Airflow Control Strategies

Greenheck offers three methods of controlling the make-up air volume. All three vary the fan speed for maximum energy savings.

- **Variable Frequency Drive** controlled by **building pressure**.
- **Variable Frequency Drive** controlled **manually** with a remote potentiometer.
- **2 speed motor** controlled **manually** with a remote switch.

## Recirculation

The Recirculation option is recommended when the ventilation equipment provides the primary source of heating for the space.

This option recirculates up to 80% of the supply air and efficiently heats it to maintain the desired space temperature. A minimum of 20% outdoor air is mixed with the recirculated air to provide a continuous source of fresh air.

Only outdoor air is used for combustion. This eliminates the possibility of contaminants in the recirculated air from crossing the burner.

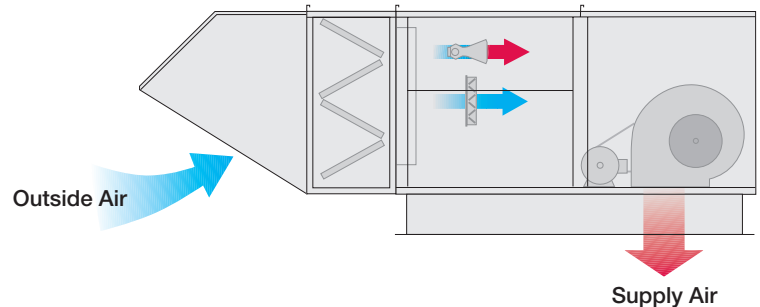
### Airflow Control Strategies

Greenheck offers four methods of controlling the recirculated air to outdoor air ratio. The ratio is determined by the outdoor air and recirculated air damper positions. The methods for adjusting damper positions are outlined below:

- **Modulating actuator** controlled by **building pressure**.
- **Modulating actuator** controlled **manually** with a remote potentiometer.
- **Two position actuator** controlled **manually** with a remote switch.
- **Manually operated damper quadrants** set to a **fixed position**.

## Temperature Control

A Room Temperature Control package is included with the Variable Volume systems. The space temperature is controlled by a room mounted thermostat. A factory supplied remote control panel is required.



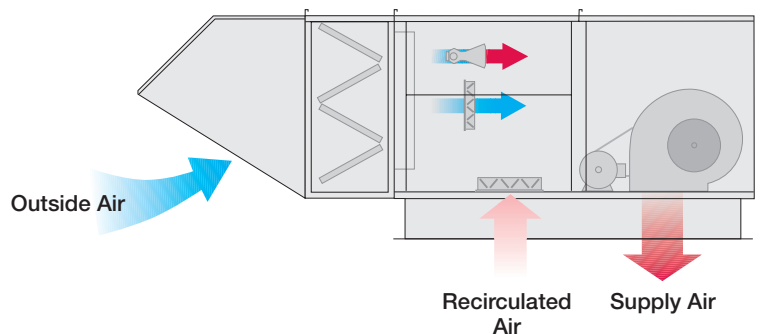
### Burner By-Pass Damper

Both the Variable Volume and Recirculation option include a patented burner by-pass damper, which maintains the pressure drop across the burner as air volumes change. This assures that complete and proper combustion occurs. The by-pass damper is self-adjusting, designed for minimal maintenance, and requires no controls.

In all cases, the fan provides a constant volume of supply air.

## Temperature Control

A Room Temperature Control package is included with the Recirculation system. The space temperature is controlled by a room mounted thermostat. A factory supplied remote control panel is required.



## Evaporative Cooling

The evaporative cooling section includes a galvanized steel housing with a louvered intake, 2-inch aluminum mesh filters and stainless steel evaporative cooling modules. The evaporative cooling media is Munters GLASdek and has a 90% cooling effectiveness. Airflow capacity for evaporative cooling is up to 60,000 cfm.

The entire section mounts directly to the intake end of the fan/heater section, eliminating transition or ductwork by others. Drain and overflow are conveniently tapped through the front of the cooling section. The supply line connection is field located where convenient. Freeze protection and automatic drain & fill options are also available.



## Additional Accessories

### V-Bank Filters

Washable 2-inch aluminum mesh filters or 2-inch disposable (30% efficient) filters are available.

### Air Filter Gauge

The air filter gauge indicates when filters become dirty. An indicator light may be wall/beam mounted or provided with a remote control panel.

### Motorized Dampers

Intake or discharge dampers are available to prevent backdrafts when the fan is not in operation. Intake dampers are factory mounted and wired.

### Spring Vibration Isolation

Spring vibration isolators are available in lieu of neoprene isolators.

### Freezestat

An on/off type discharge duct stat (with a timer) prevents the discharge of cold air into the building when the burner is not providing adequate tempering.

### Inlet Air Sensor

An on/off type duct stat automatically de-energizes the gas system and interrupts the flow of gas to the burner when the inlet air temperature is above the desired setting.

### Fiberglass Insulation

Fiberglass insulation is used to line the housing to prevent the formation of condensation and to form an acoustical barrier.

### 115 Volt GFCI Service Receptacle

A 115 volt GFCI outlet is mounted in the heater control compartment for the convenience of field service personnel. A separate 115 volt power source is required.

### Roof Curbs

Factory provided roof curbs are available to ensure compatibility between make-up air unit and roof curb. Standard construction is G90 galvanized steel. Curbs ship knocked down.

### Weatherhood

Standard construction is G90 galvanized steel. Weatherhood for housing size 40 ships assembled as standard.

### Propane Gas

A propane heater may be provided in lieu of natural gas.

### Gas Pressure Regulator

Required if building gas line pressure exceeds 5 psi.

### Special Coatings

Greenheck's Permator coating is available for a durable, long lasting finish. Decorative paints are also available in a variety of colors to match existing building fixtures. Consult your Greenheck representative for paint selections.

## Remote Control Panels

A wide variety of remote control panels are available. Specify the desired combination of switches, thermostats, temperature selectors and indicator lights (see examples below). A terminal strip within the remote control panel makes connection to the TSU control center simple.



Basic remote control panel with thermostat for room temperature control option.



Remote panel with circuit analyzer and thermostat for room override option.

## Temperature Controls

### Discharge Temperature Control

Control of discharge air temperature is accomplished with a factory installed sensor located at the fan discharge. A Maxitrol 14 system controls the gas valve to provide the desired discharge temperature.

### Room Override

This option, available with the Maxitrol 14 system, enables a room thermostat to increase the TSU supply temperature above its discharge temperature set point. Discharge sensor is factory installed. Room sensor may be wall/beam mounted or included on a remote control panel.



### Room Temperature Control

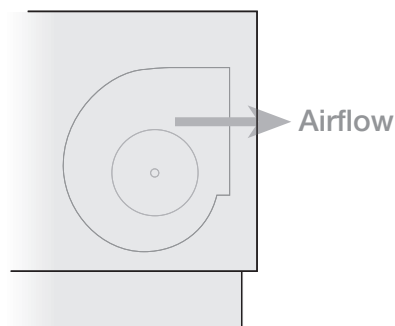
Specify this option when the TSU has the primary responsibility for controlling the room temperature. A room mounted thermostat (shown below) senses the room temperature and provides feedback to the Maxitrol 44 control system. The gas valves are then modulated to satisfy the selected room temperature.

The thermostat is manually adjustable to the desired room temperature. The room thermostat may be wall/beam mounted or included on a remote control panel.

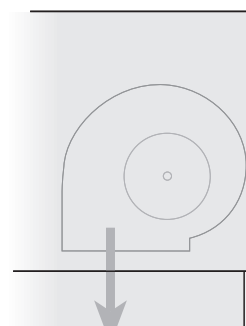


## Discharge Arrangements

For installation flexibility, fan discharges are available in either Horizontal (HZ), Downblast (DB), or Upblast (UB) configuration.



Arrangement HZ



Arrangement DB

## Housing Size 40

Model	CFM		TOTAL STATIC PRESSURE IN INCHES OF WG					Maximum MBH	
			0.75	1.00	1.25	1.50	1.75		2.00
TSU-218	14,000	RPM	612	672	726	779			1,830
		BHP	5.0	5.7	6.5	7.4			
	18,000	RPM	691	738	788	836	881	923	2,350
		BHP	8.7	9.6	10.6	11.6	12.6	13.6	
	22,000	RPM	787	825	865	902	944	985	2,875
		BHP	14.3	15.4	16.5	17.5	18.8	20.0	
TSU-220	20,000	RPM	575	621	667	711	752	791	2,610
		BHP	8.3	9.3	10.3	11.4	12.5	13.7	
	24,000	RPM	636	677	716	755	792	830	3,135
		BHP	12.6	13.9	15.1	16.3	17.5	18.9	
	28,000	RPM	703	739	774	809	841	875	3,600
		BHP	18.4	19.9	21.3	22.8	24.2	25.6	

## Housing Size 50

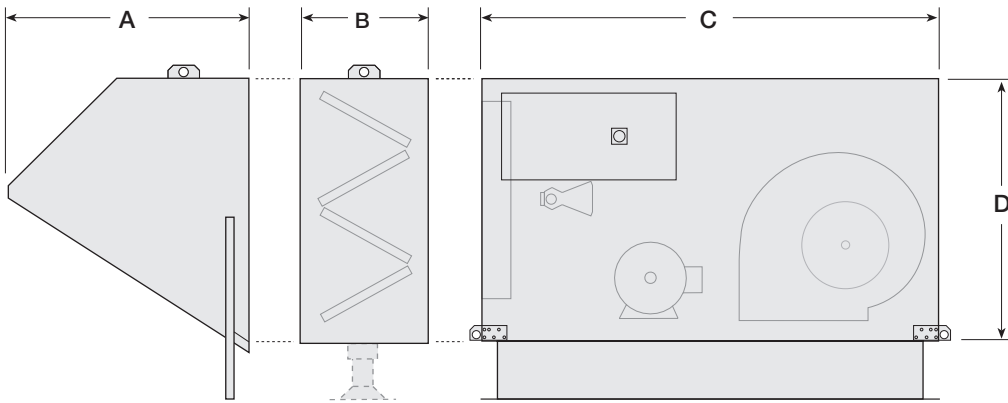
Model	CFM		TOTAL STATIC PRESSURE IN INCHES OF WG					Maximum MBH	
			0.75	1.00	1.25	1.50	1.75		2.00
TSU-225	32,000	RPM	446	482	515	548			3,830
		BHP	12.1	13.8	15.4	16.9			
	38,000	RPM	491	523	553	582	610	638	4,550
		BHP	18.0	19.8	21.9	23.9	25.7	27.5	
	45,000	RPM	547	575	603	629	655	679	5,390
		BHP	27.4	29.5	31.6	33.9	36.3	38.7	
TSU-230	44,000	RPM	401	429	456	483	509	535	5,270
		BHP	16.8	18.9	21.2	23.7	26.3	29.0	
	52,000	RPM	446	470	494	516	539	562	6,050
		BHP	24.9	27.3	29.8	32.2	35.0	38.0	
	60,000	RPM	494	514	535	556	576	596	6,050
		BHP	36.2	38.3	40.9	43.9	46.7	49.5	

### PRESSURE DROP DATA

Housing Size	CFM	2-inch 30% Filter	Inlet Damper	Gas Burner
40	14,000	0.14	0.05	0.625
	28,000	0.28	0.16	
50	30,000	0.14	0.04	0.625
	60,000	0.28	0.15	

Note: The air performance data shown does not include internal static pressure losses due to items such as filters and dampers. For exact air performance data based on specific unit configuration, use the Greenheck CAPS selection program.

## Direct Gas-Fired

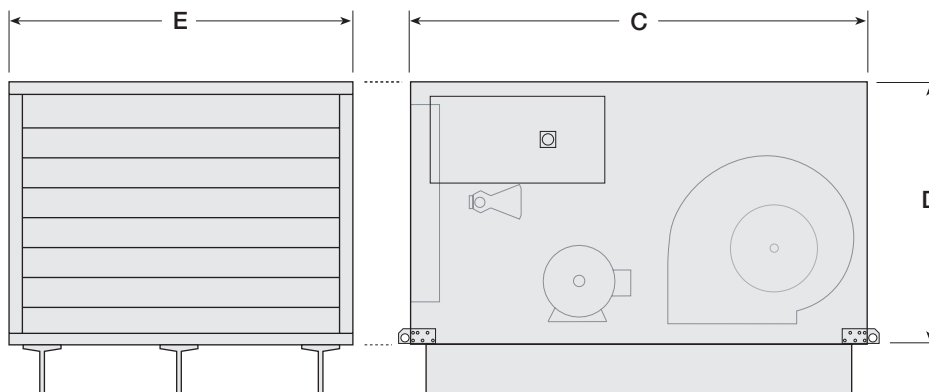


### DIMENSIONS

Housing Size	Width	A	B	C	D
40	110	46	25	88	51
50	156	71	31	100	64

All dimensions are shown in inches.

## Evaporative Cooling (with or without heating)



### DIMENSIONS

Housing Size	Width	C	D	E
40	110	88	51	88
50	156	100	64	100

All dimensions are shown in inches.

# Typical Specifications

**General:** Make-up air unit shall be as manufactured by Greenheck or approved equal provided all specifications are met. Greenheck Model TSU equipment is used as the basis of design. Performance to be as scheduled on plans. Make-up air unit shall be ETL listed to ANSI Z83.4 - 1999, CSA 3.7 - M99 (for 100% outdoor air) or ANSI Z83.18 - 2000 (for recirculation).

**Gas Train and Controls:** Direct gas-fired system shall have a draw through design and field adjustable burner baffles. Gas trains shall include a pilot ignition system and shall have digital coded fault indicator capability. Fault indicator shall provide service history by storing codes for the last five faults. Dual safety shutoff valves shall be industrial duty and use 120 VAC control signals. Temperature control shall incorporate a Maxitrol electronic modulation control system.

**Unit Casing and Frames:** Unit shall be of internal frame type construction of galvanized steel. All frames and panels shall be G90 galvanized steel. Where top panels are joined there shall be a standing seam to insure positive weather protection. All metal-to-metal surfaces exposed to the weather shall be sealed, requiring no caulking at job site. All components shall be easily accessible through removable doors.

**Insulation:** Unit casing to be lined with 1-inch fiberglass insulation. Insulation shall be in accordance with NFPA 90A and tested to meet UL 181 erosion requirements. Double wall shall be provided if specified.

**Fan Section:** Centrifugal fans shall be double width, double inlet. The fan and the motor shall be mounted on a common base and shall be internally isolated. All blower wheels shall be balanced. Ground and polished steel fan shafts shall be mounted in ball bearing pillow blocks. Bearings shall be selected for a minimum (L10) life in excess of 100,000 hours at maximum cataloged speeds.

**Motors and Drives:** Motors shall be energy efficient, complying with EPACT standards, for single speed ODP and TE enclosures. Motors shall be permanently lubricated, heavy duty type, matched to the fan load and furnished at the specified voltage, phase and enclosure. Drives shall be sized for a minimum of 150% of driven horsepower. Pulleys shall be cast and have machined surfaces, 10 horse power and less shall be supplied with an adjustable drive pulley.

**Electrical:** All internal electrical components shall be prewired for single point power connection. All electrical components

shall be UL Listed, recognized or classified where applicable and wired in compliance with the National Electrical Code. Control center shall include motor starter, control circuit fusing, control transformer for 24 VAC circuit, integral disconnect switch and terminal strip. Contactors, Class 20 adjustable overload protection and single phase protection shall be standard.

**Filter Section:** Filters shall be mounted in a V-bank arrangement such that velocities across the filters do not exceed 550 feet per minute. Filters shall be easily accessible through a removable access panel.

**Weatherhood:** Weatherhood shall be constructed of G90 galvanized steel with birdscreen mounted at the intake.

**Recirculation (optional):** Recirculation airflow shall be controlled by adjustment of return damper position. Input signal for return damper shall be from building pressure sensors, potentiometer or manual switch. Recirculated air shall not be permitted to pass across the burner. A self-adjusting burner bypass damper shall maintain a constant air volume across the burner to ensure proper gas combustion. Bypass damper shall operate automatically without an electronic input control signal.

**Variable Volume (optional):** Volume shall be varied by either a 2-speed motor or variable frequency drive. Input signal for fan speed shall be from building pressure sensors, potentiometer or manual switch. A self-adjusting burner bypass damper shall maintain a constant air volume across the burner to ensure proper gas combustion. Bypass damper shall operate automatically without an electronic input control signal.

**Evaporative Cooling Section (optional):** Evaporative cooling section shall include a galvanized steel housing with louvered intake, 2 inch aluminum mesh filters and a stainless steel evaporative cooling module all provided by the make-up air unit manufacturer. The louver shall be stationary type with drainable blades, designed to withstand wind loads of 25 PSF. Evaporative cooling media shall be Munters GLASdek with a depth of 12 inches for a cooling effectiveness of 90%. Drain and overflow connections shall be provided.



## Our Warranty

Greenheck warrants this equipment to be free from defects in material and workmanship for a period of one year from the purchase date. Any units or parts which prove defective during the warranty period will be replaced at our option when returned to our factory, transportation prepaid. Motors are warranted by the motor manufacturer for a period of one year. Should motors furnished by Greenheck prove defective during this period, they should be returned to the nearest authorized motor service station. Greenheck will not be responsible for any removal or installation costs.

*As a result of our commitment to continuous improvement, Greenheck reserves the right to change specifications without notice.*

**Greenheck P.O. Box 410 • Schofield, WI 54476-0410 • Phone (715) 359-6171 • [greenheck.com](http://greenheck.com)**

