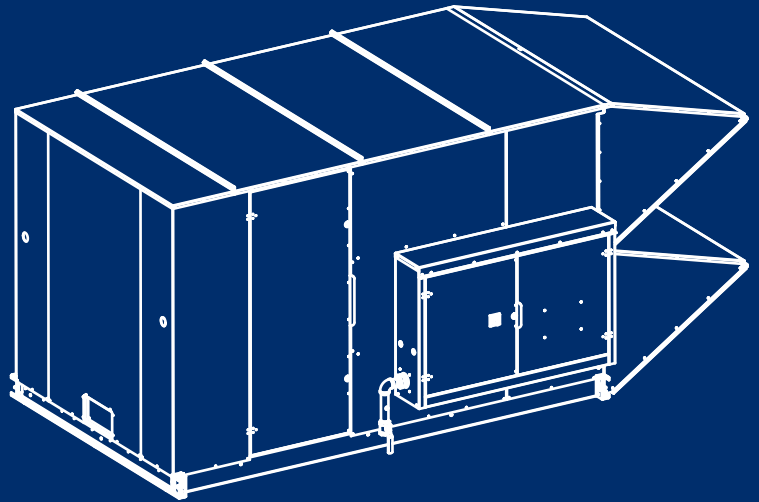
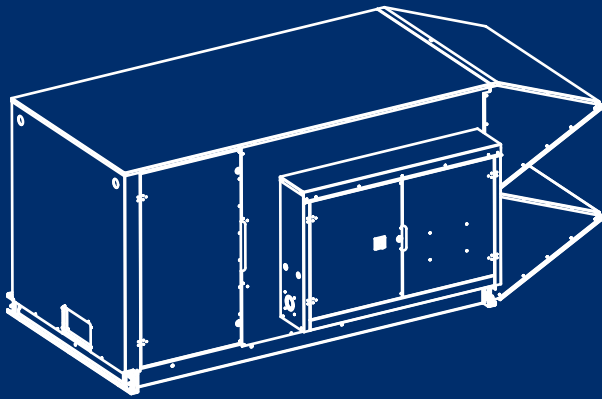


# CAMBRIDGE SPEC AIR SERIES

## DRAW THRU - DIRECT GAS-FIRED VENTILATION UNIT ENGINEERING SPECIFICATIONS MANUAL



6,000 to 34,000 cfm  
Complete Line of Accessories



760 Long Road Crossing Dr., Chesterfield MO 63005 • (636) 532-2233 • (800) 899-1989 • Fax (636) 530-6133 • [www.cambridgeair.com](http://www.cambridgeair.com)



# Spec Air Series Ventilation Units

## Unique Features & Benefits

### Performance

- **Cambridge Burner** - Cambridge designs and manufactures its own proprietary, high efficiency stainless steel burners. Our design has the highest input rating per linear foot of burner (1000 MBH/ft). You can't get the high performance of a Cambridge burner unless you have a Cambridge unit.
- **Ventilation** - A ventilation-driven solution that delivers more ventilation with less BTUs to provide simple freeze-protection heating while meeting minimum ventilation requirements for unoccupied and occupied spaces.

### Reliability

- **Industry's Best Warranty Package** - Includes 2 years on the unit and 5 years on the stainless Cambridge burner.
- **Shielded & Ventilated Motor Assembly** - Motor is shielded from radiant heat of burner flame and is in the cool air stream - Lower maintenance and longer motor life.
- **Low Voltage Hot Surface Igniter** - The most dependable gas ignition system for gas-fired products. Eliminates problems that conventional high voltage spark ignition systems have with moisture laden air.
- **Stainless Steel Burner & Flame Rod** - Reduces maintenance and increases service life.
- **Patented Low Fire Start Technology** - Increases reliability and saves energy by ensuring smooth and consistent main burner light-off without reliance on antiquated pilot ignition controls.
- **Watertight Housing** design with external drains (horizontal roof top configurations) - Stops ingested water from leaking into building by providing weep holes that drain outside the roof curb.
- **Closed Cell, Non-Water Absorbing Insulation** in the base of each horizontal unit - Eliminates condensation problems on underside of unit. Other conventional designs use less expensive, fiberglass insulation which absorbs moisture, effectively reducing its R-value.
- **Dual, Low Velocity Rain Hoods** - Larger inlet surface reduces problems from rain and snow ingestion.

### Safety

- **Cambridge Air Solutions was the first** manufacturer to have its Make-Up Air Heater tested and certified to the industry's harmonized joint US/Canadian standard for Non-Recirculating Direct Gas-Fired Heating And Forced Ventilation Appliances For Commercial And Industrial Application, ANSI Z83.4/CSA 3.7.
- **Integral Non-Fused Disconnect Switch** - Increases safety for maintenance personnel and minimizes initial electrical field wiring expense.

## Easy Installation and Serviceability

- **External Profile Damper Adjustment** - Allows for simple, proper start-up. Eliminates the frustrating and time consuming unit start-up procedure associated with conventional designs that offer only internal profile adjustment.
- **6" Clearance from Combustibles Rating** all units.
- **Factory Tested** as a fully-assembled unit – Minimizes initial start-up requirements.
- **Rigid Construction** – Supplied with structural perimeter base frame. Includes combination lifting eyes/hanging brackets for easy installation.
- **Integral Curb Counterflashing and Factory Assembled Inlet Accessories** - Reduces field labor cost and speeds up installation.
- **Integral Pressure Gauge Ports** for determining pressure drop across burner while adjusting profile dampers – Ensures accurate adjustment at start-up for most efficient operation. (external pressure gauge required).
- **Gas Valve Leak Test Switch** – Allows service technician to readily check the gas tightness of gas valve seats.
- **Service Switches** – Permits local control of blower and burner operation by service technicians.
- **Low Temperature Cutout** prevents building freeze-up. Shuts down blower when burner does not operate and outdoor air temperature is below setpoint. Field selectable setpoint (40°, 45°, 50°, 55°F).
- **Pre-Purge Timer** – Ventilates heater cabinet with minimum four air changes prior to ignition attempt. Selectable time periods up to 32 seconds. Accommodates any attached inlet ducting.
- **Class 2 Wiring for Remote Control Station** – Minimizes field wiring expense.
- **Entering Air Thermostat** – Economizer control to shut down burner operation during mild weather. Field selectable setpoint (45°, 50°, 55°, 57.5°, 60°, 62°, 64°, 66°, 68°, 70°F).

*Enriching Lives*

# Spec Air Series Ventilation Units

## Specifications

**General:** The Spec Air Series Ventilation Units shall be factory assembled and tested to assure proper alignment of subassemblies and proper adjustment and performance of controls. Units must be CSA certified to the Standard for Non-Recirculating Direct Gas-Fired Heating And Forced Ventilation Appliances For Commercial And Industrial Application, ANSI Z83.4/CSA 3.7. Horizontal Mount units shall be manufactured for rooftop applications and configured with a downblast discharge.

**Construction:** The unit housing shall be constructed entirely of G90 galvanized steel. Lifting eyes and hanging brackets shall originate from the base frame.

**Base:** The unit base shall have a full perimeter exterior frame constructed of  12 gauge steel (*for models V18 to V25*)  10 gauge steel (*for model V30*), which forms the integral counterflashing for horizontal curb mount applications. The unit base shall be manufactured with double wall floor panels constructed of 20 gauge steel bottom pan and interior pan that encloses the 1/2" thick, non-water absorbing, closed cell foam insulation which is attached to the base panels with adhesive fully applied to bottom pan and rubber insulation. All floor panel joints shall be sealed to prevent any ingested moisture from leaking into the building. Weep holes, located outside the curb perimeter on horizontal unit configuration, shall be provided at the unit inlet to allow ingested moisture to drain from the unit base.

**Housing:** The unit cabinet is to be constructed of 18 gauge structurally reinforced housing panels. The housing shall withstand a positive or negative pressure up to 2"WC without any adverse effects. An inlet bird screen is required.

The unit cabinet is to be non-insulated. The housing shall be of watertight construction with all joints caulked internally and externally. Unit access doors shall be hinged with full perimeter gaskets and latches. Access doors shall be provided on both sides of the unit.

**Blower:** The blower shall be a Class I, double width, double inlet (DWDI), forward curved centrifugal fan with a  galvanized steel wheel (*for models V18 & V20*),  fully painted steel wheel (*for models V25 & V30*). The blower wheel shall be statically and dynamically balanced. The shaft shall be coated with a rust inhibitor. Shaft critical speeds shall be at least 1.25 times the maximum operating speed. The fan bearings shall be self-aligning, sealed ball or roller bearings with grease fittings.

**Motor/Drives:** The motor shall be \_\_\_hp, \_\_\_volts, \_\_\_phase, 60 hertz, ball bearing type,  Open Drip Proof (*standard*)

The motor shall be shielded from radiant heat from the burner flame and mounted inside the unit housing in a cool air stream on an adjustable slide base. The fan drive shall be a heavy duty V-belt drive designed for a minimum service factor of 1.50 based on motor horsepower. Motor sheaves shall be  Fixed (*above 5HP*)  Adjustable (*5HP and below*). Motors shall  be permanently lubricated (10 hp and below)  have grease fittings (above 10 HP).

**Burner:** The direct gas-fired burner shall be manufactured by Cambridge Air Solutions and be suitable for:

□ Natural Gas. The burner shall be capable of fully modulated operation over a temperature rise range of 5° through 110°F. The burner shall have stainless steel baffles and non-clogging orifices. The burner shall produce no more than 5 PPM (parts per million) carbon monoxide and 0.5 PPM nitrogen dioxide over its entire firing range. The burner shall be warranted by the burner manufacturer for a period of five years. The burner shall be furnished with a low voltage, hot surface ignition system; stainless steel flame rod; direct ignition of the main burner; automatic redundant safety shut-off gas valve(s); two lubricated manual shut-off valves; electric modulating gas valve with patented low fire start controls; gas pressure regulator; and temperature modulation controls to provide a complete assembled package.

**Profile Plate:** Burner profile plate adjustment shall be accomplished from a position that is outside of the unit, while the blower is operating. An external pressure gauge to properly set the profile plate pressure drop is required but not provided.

**Gas Controls:** The discharge temperature modulation control system shall be Maxitrol Series 44 with adjustable space temperature control and sensor (*standard*). A gas valve leak test switch shall be provided to readily permit field verification of the gas tightness of the valve seals (for units rated above 400 MBH). Gauge ports shall be provided to measure the gas supply pressure and the manifold gas pressure of the unit.

**Electric Controls:** The unit shall be furnished with factory mounted controls located in a weather resistant electrical control enclosure. Standard controls to include: selectable low temperature cutout control to shut down the unit if the burner fails to operate on a call for heat within four minutes or when the unit is operating in the ventilation mode and the outdoor temperature drops below the temperature setpoint; selectable entering air thermostat to turn off burner in milder weather; patented low fire start control system to permit direct ignition of the main burner at a reduced firing rate; IEC rated magnetic motor contactor; IEC rated overload with single phase protection; control voltage transformer; control circuit fusing; Class 2 transformer for remote control wiring; and a non-fused NEMA 4 disconnect switch.

**Safety Controls:** The standard safety controls on the unit shall include: solid state flame safeguard relay; flame sensing element (stainless steel flame rod); manual reset high temperature limit; integrated, selectable pre-purge timer; motor starter auxiliary contact interlocked with gas valve circuit; redundant gas valves; high and low airflow switches □ high gas pressure switch (*if gas supply pressure exceeds 14"WC*).

**For selection and definition of additional options and controls, see pages 12-14**

# Spec Air Series Selection Procedure

1. Select desired airflow \_\_\_\_\_ cfm      NOTE: "Net Room Air" = \_\_\_\_\_ cfm  
(see formula on page 14)

2. Determine temperature criteria:

Indoor design temperature \_\_\_\_\_ °F  
 Plus 10-20°F + \_\_\_\_\_ °F  
 Discharge air temperature = \_\_\_\_\_ °F  
 Less outdoor design temp. - \_\_\_\_\_ °F  
 Temperature rise (ΔT) = \_\_\_\_\_ °F  
 Maximum temperature rise = 110°F

City	Elev.	Barom. Press. "Hg
Atlanta	1010	28.84
Baltimore	148	29.76
Birmingham, AL	630	29.24
Charlotte NC	736	29.13
Dallas	481	29.40
Houston	46	29.87
Jacksonville, FL	30	29.89
Louisville	489	29.39
Memphis	258	29.64
Nashville	590	29.29
Portland, OR	39	29.88
Reno	4404	25.45
Richmond VA	164	29.74
Salt Lake City	4220	25.63
Seattle	449	29.44

3. Job location \_\_\_\_\_  
 Elevation \_\_\_\_\_ feet above sea level (from chart at right)  
 4. Select desired unit: V- \_\_\_\_\_ (from table below)  
 Horizontal mount    Down blast

Model (cfm)			
V18	V20	V25	V30
6,000 to 10,000	10,000 to 17,000	15,000 to 26,000	20,000 to 34,000

5. Calculate accessory static pressure losses: (page 7)

Rain hoods + \_\_\_\_\_ "WC  
 Discharge damper + \_\_\_\_\_ "WC  
 Filters + \_\_\_\_\_ "WC  
 Discharge nozzles + \_\_\_\_\_ "WC  
**Total External Static Pressure (TESP) = \_\_\_\_\_ "WC**

6. Select motor horsepower: \_\_\_\_\_ (page 8)

7. Calculate burner input (MBH) @ sea level and 70°F discharge temperature:

Blower cfm x 1.08 x ΔT ÷ 0.92 ÷ 1000 = Burner input<sub>sea level</sub> (MBH)  
 \_\_\_\_\_ cfm x 1.08 x \_\_\_\_\_ °F ÷ 0.92 ÷ 1000 = \_\_\_\_\_ (MBH)

8. Select burner length based on burner input<sub>sea level</sub> (MBH): \_\_\_\_\_ " (page 9)

9. Calculate rated heater input for specific application @ job location:

Burner input (per step 7) \_\_\_\_\_ x correction factor to sea level (table below) \_\_\_\_\_ = \_\_\_\_\_ MBH Rated heater input

Burner Correction Factor to Sea Level									
		50°F	60°F	70°F	80°F	90°F	100°F	110°F	120°F
0 Feet	(29.92 "Hg) SL	1.039	1.019	1.000	0.981	0.964	0.946	0.930	0.914
500 Feet	(29.38 "Hg)	1.020	1.001	0.982	0.964	0.946	0.929	0.913	0.897
1,000 Feet	(28.85 "Hg)	1.002	0.983	0.964	0.946	0.929	0.913	0.897	0.881
5,000 Feet	(24.89 "Hg)	0.865	0.848	0.832	0.816	0.802	0.787	0.774	0.760

10. Specify gas supply: \_\_\_\_\_ psi \_\_\_\_\_ "WC \_\_\_\_\_ oz    natural gas  
 Specify electric supply: \_\_\_\_\_ volt \_\_\_\_\_ Ph \_\_\_\_\_ Hz

11. Select electric controls (pages 13)

12. Select gas controls (page 14)

13. Weight and dimension information on page 10.

Static pressure losses from accessories should be added to other system airflow resistances, such as ductwork, grills and diffusers in order to determine the Total External Static Pressure (TESP) of the heater.

### Inlet Options

Model	cfm	Accessory Static Pressure ("WC)				
		Dual Rain Hood	Inlet Components		Discharge Components	
			Throw Away	Permanent	Discharge Damper	Discharge Nozzles
V18	6,000	0.06	0.11	0.04	0.13	0.02
	7,000	0.09	0.15	0.05	0.18	0.03
	8,000	0.11	0.20	0.07	0.23	0.04
	9,000	0.14	0.25	0.09	0.29	0.05
	10,000	0.17	0.31	0.11	0.36	0.06
V20	11,000	0.08	0.14	0.05	0.16	0.03
	12,000	0.09	0.16	0.06	0.20	0.03
	13,000	0.11	0.19	0.07	0.23	0.04
	14,000	0.13	0.22	0.08	0.27	0.04
	15,000	0.15	0.26	0.09	0.31	0.05
	16,000	0.17	0.29	0.10	0.35	0.06
	17,000	0.19	0.33	0.12	0.39	0.06
V25	18,000	0.09	0.16	0.06	0.20	0.03
	19,000	0.10	0.18	0.06	0.22	0.03
	20,000	0.12	0.20	0.07	0.24	0.04
	21,000	0.13	0.22	0.08	0.27	0.04
	22,000	0.14	0.25	0.09	0.29	0.05
	23,000	0.15	0.27	0.09	0.32	0.05
	24,000	0.17	0.29	0.10	0.35	0.06
	25,000	0.18	0.32	0.11	0.38	0.06
	26,000	0.19	0.34	0.12	0.41	0.06
V30	27,000	0.11	0.19	0.07	0.22	0.04
	28,000	0.11	0.20	0.07	0.24	0.04
	29,000	0.12	0.22	0.08	0.26	0.04
	30,000	0.13	0.23	0.08	0.27	0.04
	31,000	0.14	0.25	0.09	0.29	0.05
	32,000	0.15	0.26	0.09	0.31	0.05
	33,000	0.16	0.28	0.10	0.33	0.05
	34,000	0.17	0.30	0.10	0.35	0.06

<sup>1</sup>Assumes air filters are in clean condition.

## Unit & Motor Horsepower Selection

Airflow (cfm)	Total External Static Pressure (TESP)													
	0.25"WC		0.50"WC		0.75"WC		1.00"WC		1.25"WC		1.50"WC		1.75"WC	
		V18		V18		V18		V18		V18				
6,000		3		3		3		5		5			V18	
6,500		3		3		5		5		5		5		V18
7,000		3		5		5		5		5		5		7½
7,500		5		5		5		5		7½		7½		7½
8,000		5		5		5		7½		7½		7½		7½
8,500		5		5		7½		7½		7½		7½		7½
9,000		7½		7½		7½		7½		7½		7½		
9,500	V20	7½	V20	7½	V20	7½	V20	7½	V20		V20			
10,000	5	7½	5	7½	7½	7½	7½		7½		7½		V20	
11,000	7½		7½		7½		7½		7½		10		10	
12,000	7½		7½		7½		10		10		10		15	
13,000	10		10		10		10		15		15		15	
14,000	10	V25	10	V25	15	V25	15		15		15		15	
15,000	15	7½	15	7½	15	7½	15	V25	15		15		15	
16,000	15	7½	15	7½	15	10	15	10		V25				
17,000	15	7½		10		10		10		15		V25		
18,000		10		10		10		15		15		15		V25
19,000	V30	10	V30	10	V30	15	V30	15		15		15		15
20,000	7½	10	7½	15	10	15	10	15	V30	15	V30	15		20
22,000	10	15	10	15	10	15	15	20	15	20	15	20	V30	20
24,000	10	15	15	20	15	20	15	20	15	20	20		20	
26,000	15	20	15	20	15		15		20		20		20	
28,000	15		15		20		20		20		20		25	
30,000	15		20		20		20		25		25		25	
32,000	20		20		25		25		25		25			
34,000	25		25		25		25							

Over 1.75"WC TESP consult factory.



Burner Data			Standard Pressure <sup>1</sup>			
Burner Length	Max Burner Input <sup>2</sup> (MBH)	Max Gas Supply Pressure <sup>3</sup>	Minimum Gas Supply Pressure based on Gas Train Pipe Size ("WC)			
				<b>1"</b>		
12"	928	1 psi		9.7	<b>1 1/4"L</b>	
16"	1240	1 psi	<b>1 1/4"H</b>		8.5	
20"	1565	5 psi	9.7			
24"	1906	5 psi	10.2			
28"	2244	5 psi	11.7	<b>1 1/2"</b>		
32"	2588	5 psi	13.7	12.1		
36"	2952	5 psi	16.4	14.0	<b>2"</b>	
40"	3110	5 psi	17.2	14.4	9.7	
44"	3675	5 psi	24.0	19.0	11.3	
48"	4056	5 psi	29.9	22.6	12.2	
54"	4630	5 psi	42.2	29.9	13.6	

<sup>1</sup>STANDARD PRESSURE is considered to be between the Minimum and Maximum Gas Supply Pressure listed for the unit.

<sup>2</sup>Maximum Burner Input is based on a 70°F discharge temperature at sea level.

<sup>3</sup>A high pressure gas regulator is required if the gas supply pressure at the unit exceeds the maximum value shown.

Burner Length	V18	V20	V25	V30
<b>Minimum</b>	12"	16"	24"	36"
<b>Maximum</b>	20"	28"	44"	54"

## Electrical Requirements

### Total Unit Amperage<sup>4</sup>

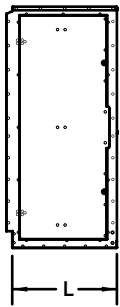
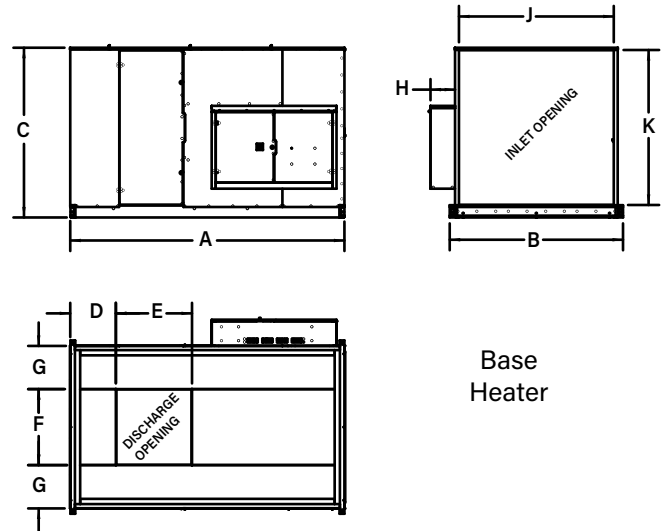
Motor Horsepower	Input Power		
	208V/3Ph	230V/3Ph	460V/3Ph
3	12.0	10.9	5.5
5	18.1	16.5	8.3
7½	25.6	23.3	11.7
10	32.2	29.3	14.7
15	47.6	43.3	21.7
20	60.8	55.3	27.7
25	76.2	69.3	34.7

<sup>4</sup>Includes control amps based on 300VA control circuitry load.

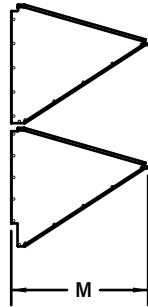
# Horizontal Mount - Dimensions and Weights

## Dimensions

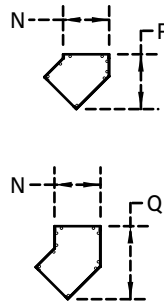
Reference (inch)	V18	V20	V25	V30
A	94 3/4"	94 3/4"	112 3/8"	112 1/4"
B	53"	59"	71"	92 3/4"
C	52 3/4"	52 3/4"	69 5/8"	69 1/2"
D	13 1/4"	13 1/4"	18 3/4"	18 5/8"
E	18 1/2"	24 5/8"	31 1/4"	36 5/8"
F	19 7/8"	23 7/8"	31 1/8"	36
G	14 3/8"	15 3/8"	17 3/4"	26 1/8"
H	10 1/8"	10 1/8"	10 1/8"	10 1/8"
J	45 3/8"	51 1/2"	63 1/2"	85 1/8"
K	47 1/8"	47 1/8"	63 3/8"	63 1/2"
L	30"	30"	30"	36"
M	30 7/8"	35 3/8"	39 1/4"	46 1/8"
N	6 3/4"	8 3/4"	11 1/2"	14 1/2"
P	10 3/8"	11 3/4"	13 3/4"	15 7/8"
Q	12 7/8"	15 1/8"	18 1/4"	21 5/8"
R	48"	48"	48"	48"
S	23 1/2"	27 1/2"	33"	39"
Inlet Opening (ft <sup>2</sup> )	14 7/8"	16 7/8"	28"	37 1/2"



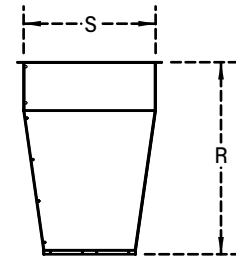
Filter Section



Dual Rain Hoods



Discharge Nozzles



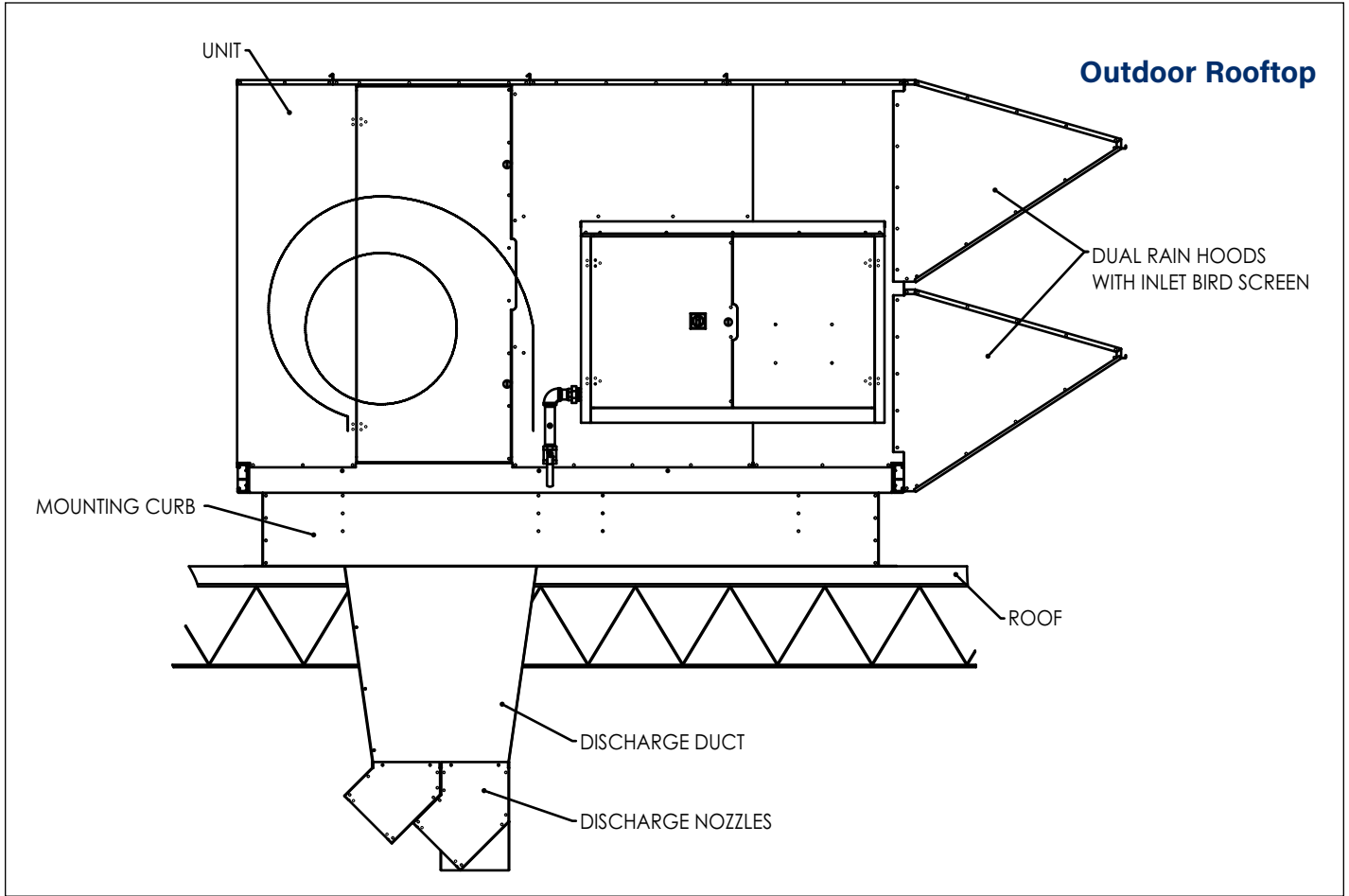
Discharge Duct

## Weights (lbs.)

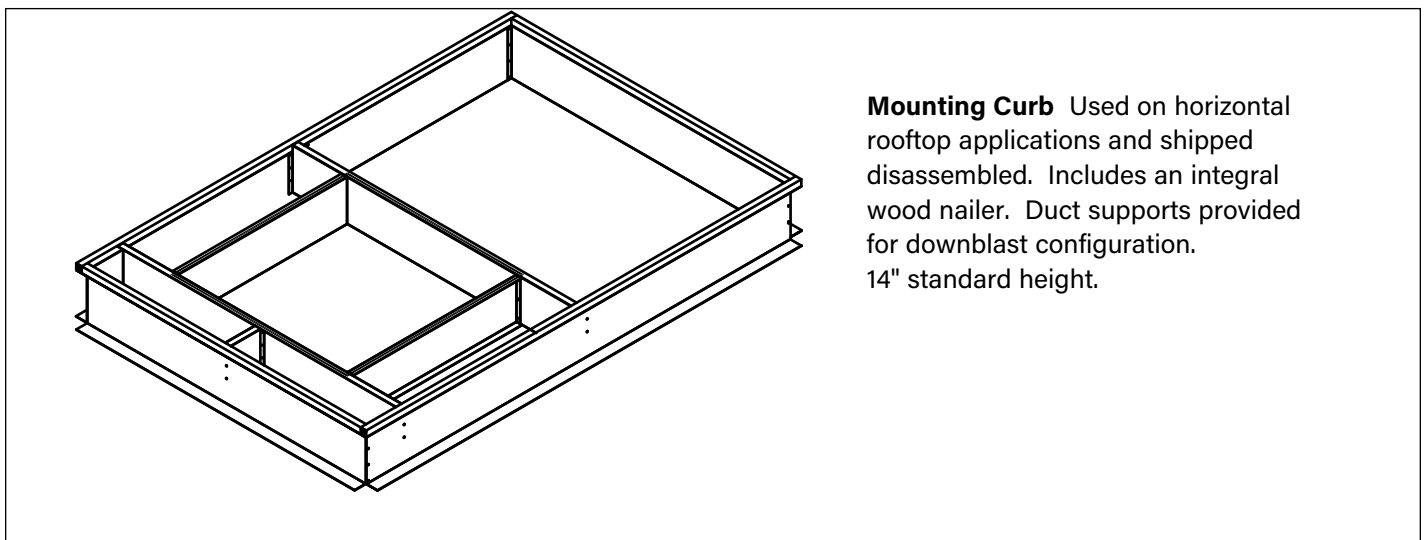
Component	Model			
	V18	V20	V25	V30
Base Unit <sup>1</sup>	1275	1325	1750	2270
Rain Hoods - Dual	120	150	210	310
Filters	20	30	45	60
V-Bank Filter Section	200	215	275	395
Discharge Duct - 50"	65	80	95	110
Discharge Nozzles	20	25	35	50
Discharge Damper	20	25	30	40
Curb - 14"	100	120	180	210
3HP motor	70			
5HP motor		75		
7.5HP motor		120		
10HP motor			135	
15HP motor			220	
20HP motor				230
25HP motor				250

<sup>1</sup>Primary drive motor not included

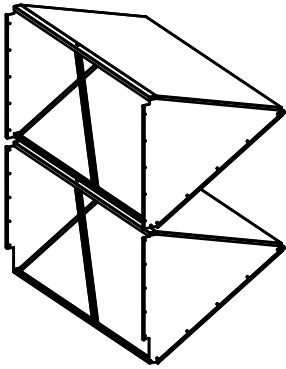
## Horizontal Mount - Typical Configurations



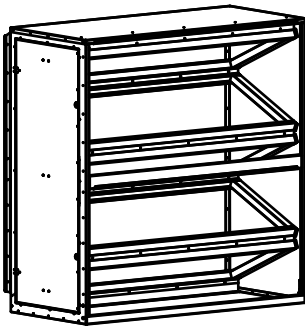
## Mounting and Service Options



## Inlet Components

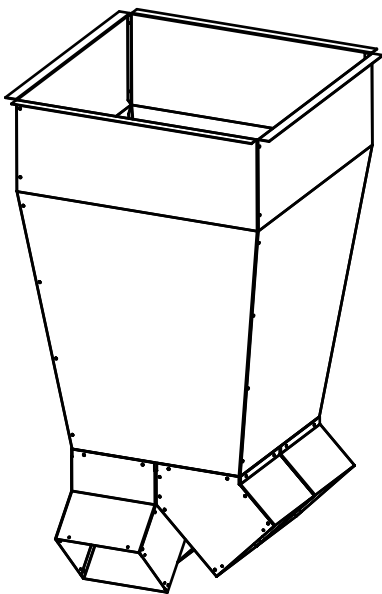


**Dual Rain Hoods (Required)** Lightweight dual rain hoods with integral birdscreens. Upper and lower hoods attach separately.



**V-Bank Filter Section (Optional)** Attaches to unit inlet and is supplied with one filter access door. Filters may be: [2" Permanent Metal Mesh] or [2" Pleated].

## Discharge Components



**Discharge Damper (Optional)** Utilizes a two-position Belimo damper motor with attached end switch that signals the unit controls when the damper is open. The damper is factory mounted in the fan discharge.

**Discharge Duct (Required)** 50" long tapered, uninsulated discharge duct.

**Discharge Nozzles (Required)** High velocity discharge nozzles attach to bottom of discharge duct. Direction is configurable by end-user.

**Relief Damper/Exhaust Fan Contact** Auxiliary dry contact is mechanically interlocked to operation of the unit's motor starter and provided with terminals located in unit's electrical enclosure. The dry contact is typically wired into the relief damper or exhaust fan control circuit to activate the pressure relief damper or exhaust fan so that it is driven by the ventilation unit.

**Convenience Outlet** A 115 volt GFI duplex receptacle is provided outside the unit's electrical enclosure. The electrical supply source for this device is the unit's control power transformer (5 amps max).

**Remote Control Station (RCS)** Lockable NEMA 1 enclosure (9"wide x 14"high x 5"deep), equipped with a three position keylock selector switch (Summer Ventilation-Off-Heating) and indicating lights for blower operation (green), burner operation (red), reset (amber).

### Remote Control Station Control Method Options

**Occupancy Switch** In summer vent mode, blower runs continuously regardless of occupancy switch position. In heat - occupied mode, blower runs continuously and discharge temperature modulates to maintain space temperature set point. In heat - unoccupied mode, unit does not run.

**Operating Thermostat and Occupancy Switch** In summer vent mode, blower runs continuously regardless of occupancy switch position. In heat - occupied mode, blower runs continuously and discharge temperature modulates to maintain space temperature set point. In heat - unoccupied mode, blower runs only during a call for heat, as determined by an adjustable setpoint operating thermostat.

**Temperature Setback** A combination thermostat/seven day programmable timer controls unit operation. The system includes independent programs for summer ventilation/heating modes, separate selectable occupied/unoccupied temperatures and an override/temporary occupancy timer. An auto-tuning, optimum start algorithm is available to maximize energy savings.

In summer vent mode, the summer ventilation occupancy schedule drives blower operation (blower runs continuously during occupied times). In heat mode, the heating occupancy schedule controls unit operation. During unoccupied times, blower runs only during a call for heat, as determined by selectable temperature setpoints. During occupied times, blower runs continuously and discharge temperature modulates to maintain space temperature set point.

**Occupancy Switch** (if included) is mounted on the exterior of the RCS door for easy access.

## Gas Control Options

**Maxitrol Series 44 Modulating Controls** Electronic discharge temperature control system maintains a constant space temperature (adjustable from 40° to 80°F). Discharge temperature modulates between the minimum (adjustable from 40° to 80°F) and maximum (adjustable from 80° to 140°F) setpoints on the amplifier. Includes an adjustable space temperature control and sensor.

**High Pressure Regulator** A positive shut-off high pressure regulator is required when the gas supply pressure exceeds the maximum gas pressure requirements or is specified by local codes or local utilities. Furnished with a manual high pressure shut-off cock and pressure tap. Venting of this regulator to outdoors is required. Specify gas supply pressure and burner input capacity for regulator selection. (field installed)

## Net Room Air

The net air volume delivered to a space is the result of the heated discharge air volume cooling and contracting as it mixes with ambient room air. To determine net room air, multiply the discharge cfm times the ratio of the room temperature to the discharge temperature expressed in degrees Rankine (°R).

$$cfm_{Net} = cfm_{Discharge} \times (460 + T_{Room}) \div (460 + T_{Discharge})$$

Calculate the burner input using the following formula:

$$\text{Btu/hr} = \text{cfm} \times \rho \times c_p \times 60 \times \Delta T \div 0.92$$

**Where:** **cfm** is the discharge air volume of the blower  
**ρ** is the density of the air handled by the blower (lb/ft<sup>3</sup>) (Note 1)  
**c<sub>p</sub>** is the specific heat of the air (0.240 Btu/lb°F)  
**60** is the conversion from minutes to hours  
**ΔT** is the temperature rise (°F) (Note 2)  
**0.92** is the conversion from sensible heat to total heat (output to input)

**Note 1:** Density is calculated from the following formula:

$$\rho = 1.32605 \times (\text{Barometric pressure} \div T_{\text{Discharge}})$$

**Where:** Barometric pressure is in terms of inches of mercury ("Hg)  
 (See chart on page 6 for barometric pressures for selected cities)  
 Discharge temperature is in terms of degrees Rankine (°R)

$$T_{\text{Discharge}} = (460 + \text{°F})$$

**Note 2:** The temperature rise for make-up air units is typically determined by calculating the difference between the outdoor design temperature and the indoor design temperature (room temperature) plus 10 to 20°F. Max temp. rise = 110°F

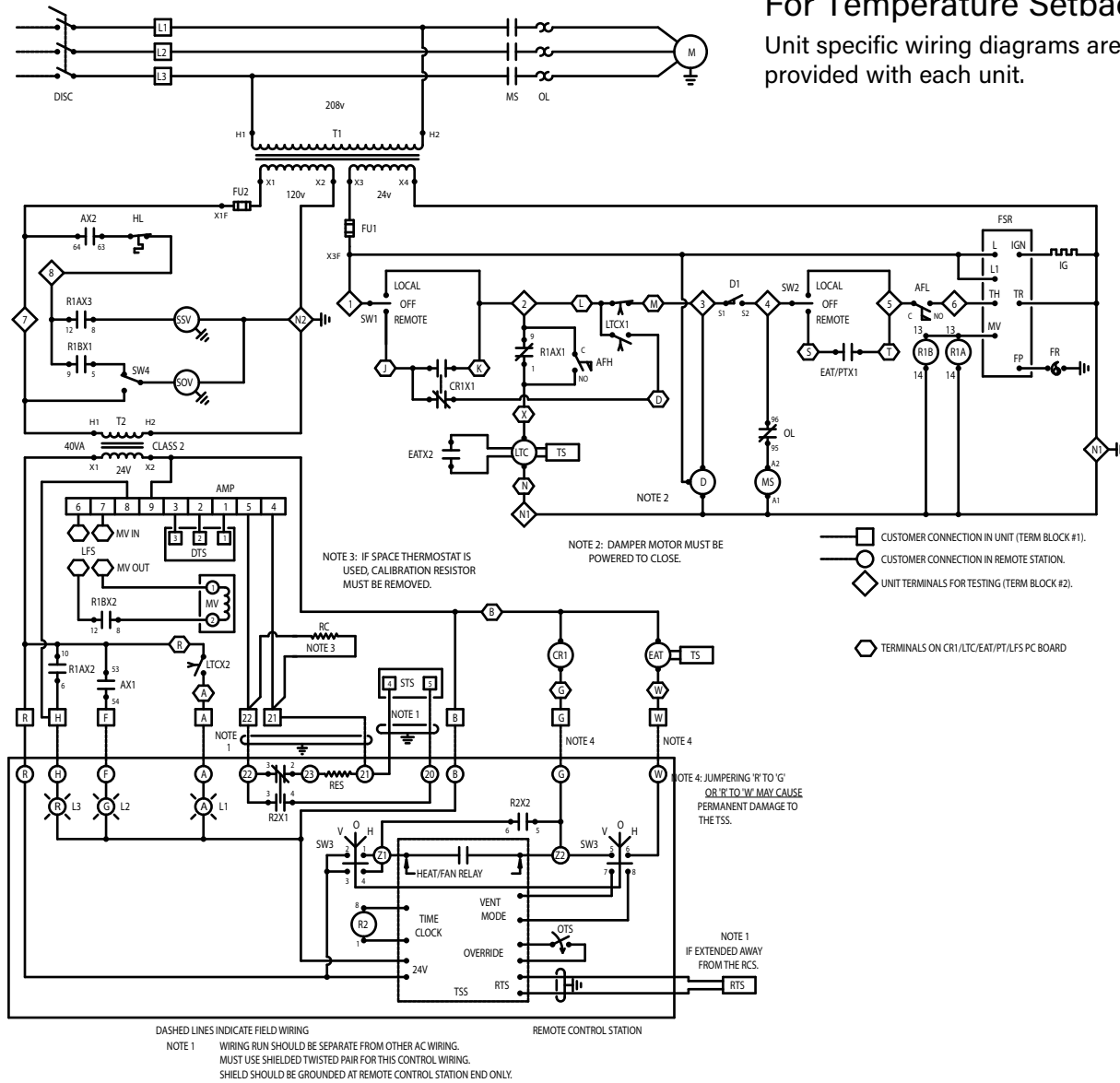
## Limited Warranty

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# Typical Wiring Diagram

For Temperature Setback Only

Unit specific wiring diagrams are provided with each unit.



Symbol	Description
AFH	Air Flow Switch - High
AFL	Air Flow Switch- Low
AMP	Amplifier Solid State
AXI	Auxiliary Contact
AX	Auxiliary Contact
CB	Circuit Breaker - Outlet
CRI	Control Relay
D & DI	Damper Motor & End Switch
DISC	Service Disconnect Non-Fused
DTS	Discharge Temperature Sensor
EAT	Entering Air Thermostat
EFI	Exhaust Fan Interlock
FR	Flame Rod
FSR	Flame Safeguard Relay (HSI)
FU1	Fuse 24 Volt Control
FU2	Fuse 120 Volt Control

Symbol	Description
FU3	120v Circuit Control Fuse
HGP	High Gas Pressure Switch
HL	High Limit
IG	Igniter
L1	Light-Alarm
L2	Light-Fan
L3	Light-Heat
LFS	Low Fire Start
LTC	Low Temperature Cutout
M	Motor
MS	Motor Starter
MV	Modulating Valve
OL	Overload Relay
PCB	Printed Circuit Board
PT	Purge Timer
RA	Remote Adjust
R1A	Relay Valve-Gas
R1B	Relay Valve-Gas
R2	Relay - Make-up Air Mode

Symbol	Description
RC	Resistor - Calibration
REC	Receptacle - Service Outlet
RES	Resistor - Thermostat Override
RTS	Remote Temperature Sensor
SOV	Shut-Off Valve-Gas
SSV	Safety Shut-Off Valve
STS	Space Temperature Selector
SW1	Service Switch-Fan
SW2	Service Switch-Heat
SW3	Switch-On/Off/Heat
SW4	Switch-SOV Leak Test
T1	Dual Output Transformer (24&120 Volt)
T2	Class 2 Transformer (24 Volt)
T3	Multi-Tap Transformer
TS	Temperature Sensor - LTC/EAT
TSS	Temp Setback System