



# Packaged Rooftop Air Conditioners IntelliPak™ 2

90 to 150 Tons — Air-Cooled Condensers





# Introduction

## IntelliPak™ 2 Rooftops Designed For Today, Tomorrow and Beyond

Built on the legacy of Trane's industry leading IntelliPak, the IntelliPak 2 90 to 150 ton platform is designed for the future. Expanded features and benefits, controls enhancements and world class energy efficiencies make the IntelliPak 2 the right choice for demanding applications today, and tomorrow.

The addition of the Symbio 800 controller and TD7 touch screen user interface provides a high degree of control, superior monitoring capability, and unmatched diagnostic information.

The Symbio 800 controller integrates with all common standard building communication protocols, including BACnet® MS/TP, BACnet®/IP, LonTalk® (optional), and Modbus®.

The Trane IntelliPak 2 has the technology and flexibility to bring total comfort to every building space.

**Note:** AHRI certifies up to 63 Ton units, all air-cooled units over 63 tons are tested in accordance with the code.

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## Revision History

- Updated correct dimensions for filters in General data (all dimensions in inches) table.
- Updated digit 14 to add standard CFM instead of high for D, E, F, and G option in Model Number Description chapter.
- Updated electrical service sizing data table in Electric Data chapter.



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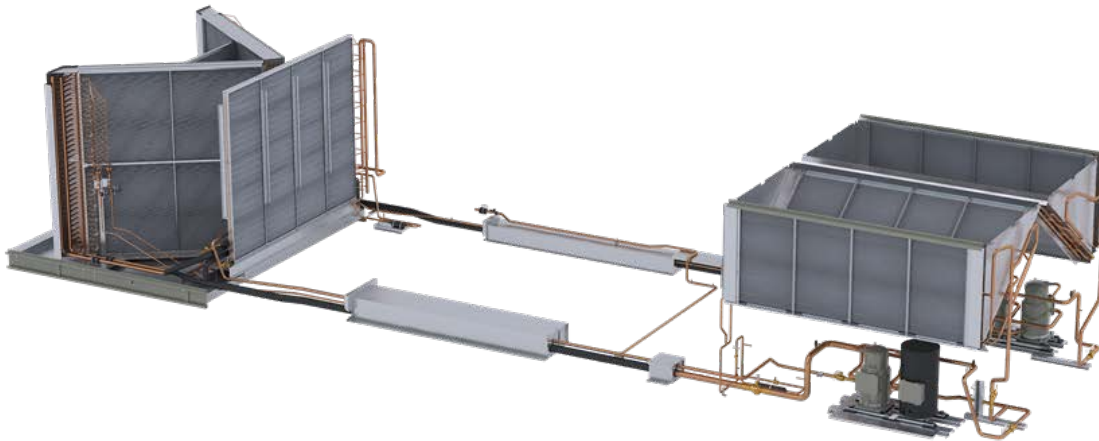
# Features and Benefits

## Cabinet



Features		Benefits
Standard	Salt spray testing IAC w ASTM B117 standard	Durable enough to withstand a minimum of 672 hours consecutive salt spray to handle corrosive environments
	Double Wall Construction	Foam injected R8 insulation throughout the air handler section, enabling industry leading efficiency and reliability
	Pitched roof over air handler section	Prevents water leakage in cabinet, pooling water on top of cabinet
	Single point latching / hinged access doors on control panel, filter, supply, and relief/return fan section as well as gas heat section	Provide easy and fast access to critical sections of the unit
	Double sloped stainless-steel drain pans	Prevents standing water under the evaporator coil
Optional	Single or two piece construction	Installation flexibility to facilitate lifting and rigging of the unit
	Extended casing	Versatility for heating and cooling applications
	Flexible downflow and horizontal discharge/return paths	Ability to mix and match airflow paths allows usage on varying installations
	Blank Sections <ul style="list-style-type: none"> <li>• 4ft blank section</li> <li>• 8ft blank section</li> </ul>	Versatility for heating and cooling applications
	Burglar bars on select configured units	Prevents building entry via the HVAC duct

# Refrigeration



Features		Benefits
Standard	R-410a Refrigerant	HFC Refrigerant
	Microchannel condenser coil	Reduced refrigerant quantity enabling LEED EA Credit 4, decreased weight, and minimized galvanic corrosion
	Electronic expansion valve	More accurate superheat reading and control. Provides consistent superheat setting that improves efficiency and compressor reliability.
	Refrigeration pressures constantly monitored by transducers	Provides faster, more accurate readings that maximize efficiency of the refrigeration system Monitors compressors in real time to ensure performance within reliable limits Allows service technician to read system pressures at either the user interface or remotely through optional building automation system (BAS) Provides loss of charge protection
	Frostat™ coil frost protection	Prevents coil icing by using temperature and pressure sensors on each refrigeration circuit used to determine if the coil is approaching a freezing condition
	Drain pans	Stainless steel positively sloping evaporator coil drain pan
Optional	eFlex™ variable speed compressors	Capacity control delivers industry leading energy efficiency, as well as more precise leaving air temperature control (+/- 1°F)
	High capacity evaporator coils	Allows flexibility to match building load capacities
	Low ambient control	Provides refrigeration cooling in lower ambient temperatures to 0°F, improving the unit's operating range
	Suction Service Valve	Reduces service time if repairs are needed
	Replaceable core filter driers	Helps serviceability and allows for quicker replacement
	Modulating hot gas reheat	Effective humidity control w/o using additional energy to reheat cooled air
	Corrosion protected condenser coil	Coil tested to withstand ASTM B117 salt spray test for 6,000 hours and ASTM G85 A2 Cyclic Acidified Salt Fog test for 2,400 hours optimizing coil protection in more corrosive environments
Variable speed condenser fans	Minimizes fan cycling and maximizes part load efficiency	



## Features and Benefits

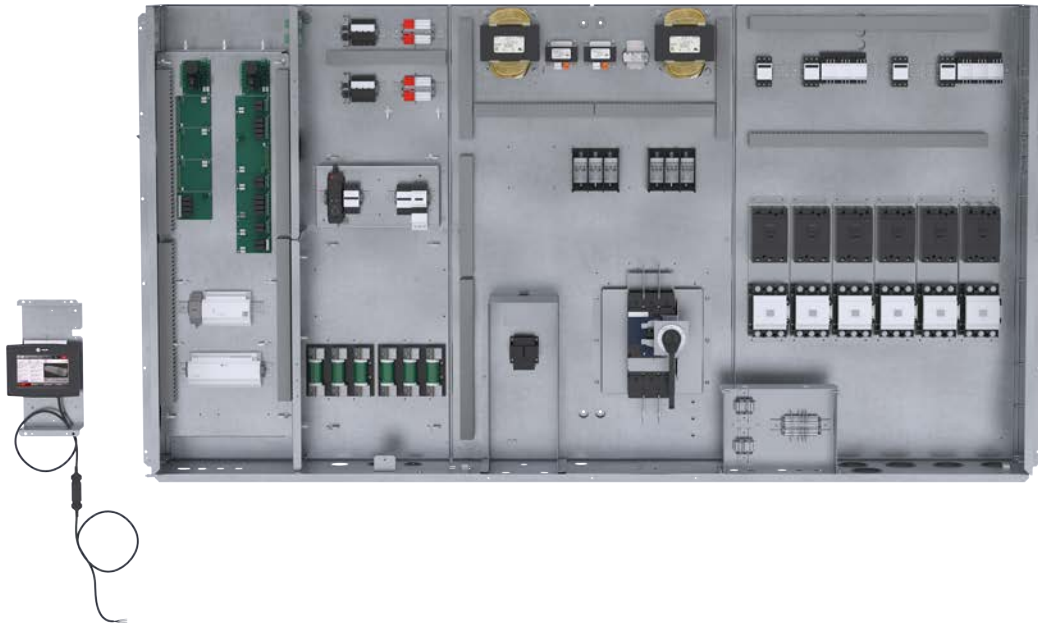
### Airflow

Features		Benefits
Standard	Variable speed supply fan with backward curved, airfoil-shaped blades	Variable speed technology enables precision adjustments to output and/or capacity according to the building space requirements Standard and low airflow options to achieve specific cfm requirements for the application
	Spring fan isolation	Reduces undesirable vibration and noise
	MERV 8 high efficiency throwaway filter	These filters have 90% efficiency in trapping particles at 3 to 10 micrometers in size
Optional	Trane Air Quality (Traq™) outside air measurement system	Traq controls the amount of outdoor air intake to accurately meet minimum fresh air requirements and energy-efficiency goals
	Statitrac™ direct space building pressurization control	Highly accurate and efficient method of maintaining building pressure control
	Ventilation override mode	Flexibility to temporarily override airflow management during non-standard situations
	Economizer operations	Enables use of outside air as an initial stage of cooling, reducing compressor runtime, resulting in lower energy consumption and longer unit lifespan
	Supply/Relief/Return Fan Piezometers	Measures airflow within 5% total accuracy when operating within the stable operating region of the fan curve
	Relief Fans	The Trane 100% modulating relief fan is an excellent choice for controlling building pressure
	Return Fans	Trane's 100% modulating return fan is an excellent choice for systems with high return static pressure losses
	Energy Recovery Wheel	Recycles energy from the normally relief building air to pre-condition incoming ventilation air
	Pre-evaporator and final filter rating up to MERV 17	Variety of options available to meet indoor air/filtration requirements
	Ultra-low leak damper leakage rate down to 3 CFM/ sq. ft. with fault detection and diagnostics	Energy efficiency and code compliance (ASHRAE 90.1, California Title 24)
Demand Control Ventilation	Minimizes energy consumption while meeting the ventilation requirements of ASHRAE Std 62.1.	



# Electrical

Figure 1. Control panel



Features		Benefits
Standard	Separation of H/L voltage in control box	Safer to service the control panel
	Compressor protection module	Protect compressors against reverse rotation
Optional	High Fault SCCR with unit interrupt rating of 65,000 amp (480V) and 25,000 amp (600V)	Meets needs of building systems with high available fault current requirements
	Voltage Options	460/60/3 XL 575/60/3 XL 380/50/3XL
	Through the door non-fused disconnect with external handle	Safe and Convenient way to quickly shut off power to the unit
	Convenience Outlet	Allows technicians to plug tools or equipment directly into the unit / no need for extension cords
	LED Marine Lights in service compartments	Convenient way to maintain and service the unit



## Features and Benefits

### Gas Heat - Option

Features		Benefits
Standard	Drum and tube heat exchangers with forced draft burners tested under UL 795	Meets product safety regulations
	Flue to exhaust above the unit	Removes hot air away from the unit and prevents recirculation with the combustion intake
	81% steady state efficiency	All gas heaters meet the 2023 Department of Energy efficiency code
	Air rise capability up to 60° F	Range of capacity to meet discharge air temperature
Optional	Staged and modulating offerings for each MBH	Assortment of option combinations provides the best solution for a variety of applications, along with the ability to achieve turndown up to 20:1 10:1 modulating gas heat 850 MBh 20:1 modulating gas heat 1100, 1800, and 2500 MBh
	Low   Medium   High heat offerings	

### Electric Heat - Option

Features		Benefits
Standard	Full-faced element coil	Creates a more consistent heat profile
	<ul style="list-style-type: none"> <li>• High grade element wire</li> <li>• Low watt density heater coils</li> </ul>	Allows for increased reliability
	90 to 300 kW range	Provides best solution for the application
	Air rise capability up to 50°F	Range of capacity meets discharge air temperature requirements



# Symbio™ 800 Controls

The Symbio™ 800 controller is a factory-installed, application specific and programmable controller designed to control chillers and large packaged HVAC equipment. A 7-inch user interface features a touch-sensitive color screen that provides facility managers at-a-glance operating status, performance monitoring, scheduling changes, and operating adjustments. Other advanced features include automated controller back-up, and optional features such as secure remote connectivity, wireless building communications, mobile device connectivity, and custom programming with expandable I/O.

## Features and Benefits

Symbio™ 800 Feature	Benefits
Multiple, open standard protocol support <ul style="list-style-type: none"> <li>Air-Fi® Wireless (BACnet®/AirFi, optional)</li> <li>BACnet MS/TP</li> <li>BACnet/IP</li> <li>LON (Optional)</li> <li>Modbus</li> </ul>	Simplified, lower cost, and more flexible integration with all common open standard protocols using Trane or competitive BAS systems and controllers
Remote connection to building or equipment	Trane Connect™ provides an easy, secure option to connect remotely to a Tracer SC+ or directly to your Trane equipment
Common integration strategies and equipment specific points lists	Simplified, lower cost, and uncompromised integration
Application specific and configurable	Reduced project costs with superior reliability, comfort, performance - applications specific and configurable system ensures machine continues to run within operating envelope. Ability to upgrade firmware with a simple file transfer.
Smart Analytics	Smart analytics provide superior reliability through the life of the equipment with minimum downtime
Data logging	Standard, local or remote Intuitive review and analysis of equipment, zone, and building performance
Local scheduling	Capable of operating in stand-alone operation without a building automation system as a temporary back-up schedule for ongoing comfort and energy savings
Rugged, 7-inch color touch screen user interface	Easy, touch navigation for viewing data and making operational changes
Display preferences	Choose how to view dates, times, units (SI, IP), screen brightness, data format, and backlight timeout. 3 built-in languages are supported and selectable for all TD7 screens.
Intuitive navigation	Helps operators access data and alarms for quick and accurate response and resolution
At-a-glance status	Easily readable color display showing key operating parameters of major equipment components
Reports	Quickly summarizes data for clear understanding and interpretation to enable local monitoring of expected performance and operating efficiency
Graphs	Easily visualize trend data for local troubleshooting and fine-tuning
Multiple language support	Suitable for operation in multiple geographies
Adaptive Control™ Algorithms	Pre-empts potential equipment disruptions during rapidly changing conditions – providing consistent equipment performance and building comfort
SD card backup/restore	Faster, lower cost repairs with reduced downtime
Modbus device support	Capable of integrating optional Modbus devices for local or remote diagnostics — provides faster, lower cost troubleshooting and increased equipment performance



## Symbio™ 800 Controls

### Options

Symbio™ 800 Feature	Benefits
Remote connection to building or equipment	Trane Connect™ provides an easy, secure option to connect remotely to a Tracer SC+ or directly to your Trane equipment
Programmable	Equipment application flexibility and cost-reduced control of nearby equipment
Expandable I/O	Field or factory installed I/O for programmable feature - Reduced installation costs and increased installation flexibility
User security with audit trail support	Flexible and secure access for multiple users allows monitoring, overriding/releasing points, release of all overrides, custom report editing, and tracking changes by user
Wi-Fi Adapter	Enables the operation of wireless service tools for increased technician productivity and flexibility
LonTalk®	The LonTalk module provides an interface to a Tracer SC+ building automation system or other control system that supports LonTalk.
Air-Fi® Wireless (BACnet®, optional)	Air-Fi provides wireless communication to Air-Fi™ wireless sensors, service tools, equipment controls, and building controller.

### Specifications

Controller Specifications	
Input power	24 Vdc +/- 10%, 400mA max.
Storage temperature	-67°F to 185°F (-55°C to 85°C), Humidity: Between 5% to 100% (Condensing).
Operating temperature	-40°F to 158°F (-40°C to 70°C).
Environmental rating (enclosure)	IP3x.
Time clock	On-board real time clock with 10 year battery backup.
Mounting weight	Mounting surface must support 1.3 lb. (0.6 kg).
Overall dimensions	5.65 in. (143.5 mm) wide x 4.00 in. (101.6 mm) high x 2.38 in. (60.6 mm) deep.
Agency Compliance	
<ul style="list-style-type: none"> <li>• UL PAZX, Energy Management Equipment.</li> <li>• UL94-5V Flammability.</li> <li>• CE.</li> <li>• FCC CFR Title 47, Part 15.109: Class B Limit, (30 MHz—10 GHz).</li> <li>• BTL Listed—Advanced Application Profile (B-AAC).</li> </ul>	
User Interface Specifications	
Input power	24 Vdc +/- 10%, 400 mA max
Storage temperature	-67°F to 203°F (-55°C to 95°C), Humidity: Between 5% to 100% (Condensing).
Operating temperature	-40°F to 158°F (-40°C to 70°C), Humidity: Between 5% to 100% (Condensing).
Environmental rating (enclosure)	IP56 (dust and strong water jet protected) with optional sealed Ethernet cable (PN: X19070632020).
Mounting weight	Mounting surface must support 1.6 lb. (0.74 kg).
Overall dimensions	8.3 in. (211.6 mm) wide x 6.3 in. (158.8 mm) high x 2.1 in. (53.2 mm) deep [bezel depth 0.4 in. (11.3 mm)].
Agency Compliance	
<ul style="list-style-type: none"> <li>• UL PAZX, Energy Management Equipment.</li> <li>• UL94-5V, Flammability.</li> <li>• FCC CFR Title 47, Part 15.109: Class A Limit, (30 MHz—4 GHz).</li> <li>• CE EMC Directive 2004/108/EC.</li> </ul>	

## Variable Air Volume (VAV) Operation

### Supply Air Pressure Control

#### Variable Frequency Drive (VFD) Control

A pressure transducer measures duct static pressure, and the VFD is modulated to maintain the supply air static pressure within an adjustable user-defined range. The range is determined by the supply air pressure setpoint and supply air pressure deadband, which are set through the user interface or BAS/Network.

The variable frequency drives provide supply fan motor speed modulation. The drive will accelerate or decelerate as required to maintain the supply static pressure setpoint.

#### Supply Air Static Pressure Limit

The opening of VAV terminals, and the amount of supply air provided by the variable frequency drive are coordinated during startup and transition to/from Occupied/Unoccupied modes to prevent over pressurization of the supply air ductwork. However, if for any reason the supply air pressure exceeds the user-defined supply air static pressure limit that was set at the user interface, the supply fan and VFD are shut down. The unit is then allowed to restart three times. If the over pressurization condition occurs on the third restart, the unit is shut down and a manual reset diagnostic is set and displayed at the user interface and BAS/Network.

### Space Pressure Control - Statitrac

A pressure transducer is used to measure and report direct space (building) static pressure. The user-defined control parameters used in this control scheme are space static pressure setpoint, space pressure deadband and relief enable point. As the economizer opens, the building pressure rises and once above the relief enable point, enables the relief fan and dampers or relief VFD. The relief dampers or VFD then modulate to maintain space pressure within the deadband.

### Supply Air Temperature Controls

#### Cooling/Economizer

During Occupied cooling mode of operation, the economizer (if available) and mechanical cooling are used to control the supply air temperature. The supply air temperature setpoint and deadband are user-defined at the user interface. The supply air temperature setpoint may be user-defined from the BAS/Network. If the conditions of the outside air are appropriate to use "free cooling," the economizer will be used first in an attempt to satisfy the supply air setpoint; then, if required, the mechanical cooling will be staged on to maintain supply air temperature setpoint. Minimum On/Off timing of the mechanical cooling prevents rapid cycling.

On units with economizer, a call for cooling will modulate the outside air dampers open. The rate of economizer modulation is based on deviation of the supply air temperature from setpoint, i.e., the further away from setpoint, the faster the outside air damper will open. First stage of cooling will be allowed to start after the economizer reaches full open.

The economizer is only allowed to function freely if one of the following conditions is met:

- For dry bulb economizer control the ambient temperature must be below the dry bulb temperature control setting.
- For reference enthalpy economizer control, outdoor air enthalpy must be below the enthalpy control setting. At outdoor air conditions above the enthalpy control setting, mechanical cooling only is used and the outside air dampers remain at minimum position.
- For comparative enthalpy economizer control, outdoor air enthalpy must be below the enthalpy of the return air.
- For differential dry bulb economizer control, the ambient dry bulb temperature must be below the dry bulb temperature of the return air.

If the unit does not include an economizer, mechanical cooling only is used to satisfy cooling requirements. The outdoor air dampers may be set for a maximum of 25% outdoor air, through the unit mounted user interface or a signal from the BAS/network, if the rooftop is equipped with 0 to 25% motorized outside air dampers.

## Heating

### Gas Heating: Staged Heat

Up to two stages of gas heat will be sequenced based on zone demand. Status messages and diagnostics are communicated to the user interface. To prevent cycling, a three-minute delay shall be provided between first- and second- stage, gas valve operation on two-stage heaters.

### Modulating Gas

Upon a call for heating, the Symbio controller closes the heating contacts, beginning the firing sequence. First, the heat exchanger combustion blower begins operation. Upon positive proving of combustion airflow, a 30 second pre-purge cycle is executed. Then the ignition sequence takes place.

If ignition is not proven, the safety control locks out and must be manually reset. As long as there is a call for heat, the safety control can be reset, which starts another purge cycle and try for ignition. Once ignited, as additional heat is required, the combustion air increases the firing rate.

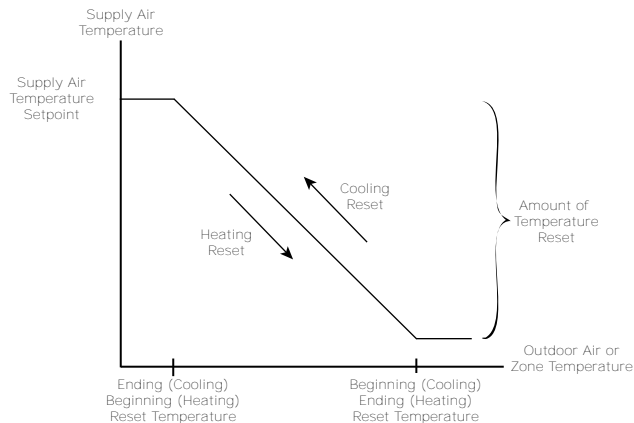
During heating operation, an electronic flame safety control provides continuous flame supervision. If combustion should become unstable for any reason, heating will automatically shut down and be locked out until reset at the unit mounted user interface panel. As the heating requirement is satisfied, the gas heat controller will modulate the combustion air and the firing rate will lower to maintain the desired outlet temperature. When the requirement is fully satisfied, the heating contacts are opened, de-energizing the heat. The specific sequence of operation of the gas heat will depend on the size of the heat exchanger.

### Electric Heating

The individual stages of electric heat will be sequenced on the zone demand. The number of available stages will depend on the unit size and heat capacity selected.

## Supply Air Setpoint Temperature Reset

**Figure 2. Supply air temperature reset**



Supply air setpoint reset can be used to adjust the supply air temperature setpoint on the basis of a zone temperature or on outdoor air temperature. Supply air setpoint reset adjustment is available from the user interface for supply air heating and supply air cooling control.

### Outdoor Air Cooling Reset

Outdoor air cooling reset is sometimes used in applications where the outdoor temperature has a large effect on building load. When the outside air temperature is low and the building cooling load is low, the supply air setpoint can be raised, thereby preventing sub-cooling of critical zones. This reset can lower usage of mechanical cooling, thus savings in compressor kW, but an increase in supply fan kW may occur.

### Outdoor Air Heating Reset

Outdoor air heating reset is the inverse of cooling, with the same principles applied. For both outdoor air cooling reset and heating reset, there are three user-defined parameters that are adjustable through the user interface:

- Beginning reset temperature
- Ending reset temperature
- Amount of temperature reset

#### **Zone Reset**

Zone reset is applied to the zone(s) in a building that tend to be overly cool or overly hot. The supply air temperature setpoint is adjusted based on the temperature of the critical zone(s). This can have the effect of improving comfort and/or lowering energy usage. The user-defined parameters are the same as for outdoor air reset.

## **Supply Air Tempering**

A feature that is used with modulating heat options, modulating gas, or hot water. Supply air tempering is enabled when the supply air temperature falls below the supply air temperature deadband low end. The heat valve is then modulated open to maintain the set minimum supply air temperature.

## **Zone Temperature Control**

### **Unoccupied Zone Heating and Cooling**

During Unoccupied mode, the unit is operated as a constant volume unit. VFDs operate at 100% and VAV boxes are driven full open. The unit controls zone temperature to the Unoccupied zone cooling and heating (heating units only) setpoints.

### **Morning Warmup Options (Not applicable to SZVAV)**

This feature may be enabled on all types of factory installed heat units as well as cooling only units configured as “External Heat” (for example, VAV boxes with reheat). At the conclusion of Unoccupied mode, while the economizer (if supplied) is kept closed, the selected zone is heated to the user-defined Morning Warmup setpoint (see descriptions below). The unit is then released to Occupied mode.

#### **Cycling Capacity Morning Warmup (MWU)**

Cycling capacity Morning Warmup provides a more gradual heating of the zone. Normal zone temperature control with varying capacity is used to raise the zone temperature to the MWU zone temperature setpoint. This method of warmup is used to overcome the “building sink” effect. Cycling capacity MWU will operate until the MWU setpoint is reached or for 60 minutes, then the unit switches to Occupied mode. A control algorithm is used to increase or decrease the amount of heat in order to achieve the MWU zone temperature setpoint.

**Note:** *When using the Morning Warmup option in a VAV heating/cooling rooftop, airflow must be maintained through the rooftop unit. This can be accomplished by electrically tying the VAV boxes to the VAV box output relay contacts on the Symbio™ 800 Controls or by using changeover thermostats. Either of these methods will assure adequate airflow through the unit and satisfactory heating of the building.*

### **Daytime Warmup**

This feature is available on all types of heating units. During Occupied mode, if the zone temperature falls to a preset, user-defined zone low limit temperature setpoint, the unit is put into Unoccupied mode and Daytime Warmup is initiated. The system changes over to constant volume heating (full unit airflow), the VAV boxes are fully opened and full heating capacity is provided until the Daytime Warmup setpoint is reached. The unit is then returned to normal Occupied mode.



## Single Zone Variable Air Volume (SZVAV) Operation

The IntelliPak® controls platform will support Single Zone VAV as an optional unit control type in order to meet ASHRAE 90.1. The basic control will be a hybrid variable air volume/constant volume configured unit that provides discharge temperature control to a varying discharge air temperature target setpoint based on the space temperature and/or humidity conditions. Concurrently, the unit will control and optimize the supply fan speed to maintain the zone temperature to a zone temperature setpoint.

### VFD Control

The VFD will modulate the supply fan motor speed, accelerating or decelerating as required to maintain the zone temperature to the zone temperature setpoint.

When subjected to high ambient return conditions the VFD will reduce its output frequency to maintain operation.

### Supply Fan Output Control

Units configured for Single Zone VAV control will utilize the same supply fan output control scheme as on traditional VAV units except the VFD signal will be based on zone heating and cooling demand instead of the supply air pressure.

### Space Pressure Control – Statitrac™

For units configured with Space Pressure Control with or without Statitrac, the new schemes implemented for economizer minimum position handling require changes to the existing Space Pressure Control scheme in order to prevent over/under pressurization. The overall scheme will remain very similar to VAV units with Space Pressure Control with the exception of the dynamic Relief Enable Setpoint.

For SZVAV, a Relief Enable Setpoint must be selected during the 100% Fan Speed Command. Once selected, the difference between the Relief Enable Setpoint and Design OA Damper Minimum Position at 100% Fan Speed Command will be calculated. The difference calculated will be used as an offset and added to the Active Building Design OA Minimum Position Target in order to calculate the dynamic Relief Enable Target, which will be used throughout the Supply Fan Speed/OA Damper Position range.

The Relief Enable Target could be above or below the Active Building Design OA Minimum Position Target Setpoint, based on the Active Relief Enable Setpoint being set above or below the Building Design Minimum Position at 100% Fan Speed Command. Note that an Relief Enable Setpoint of 0% will result in the same effect on Relief Fan control as on VAV applications with and without Statitrac.

### Occupied Cooling Operation

For normal cooling operation, cooling capacity will be staged or modulated in order to meet the calculated discharge air target setpoint. If the current active cooling capacity is controlling the discharge air within the deadband, no additional cooling capacity change will be requested. As the Discharge Air Temperature rises above the deadband, the algorithm will request additional capacity as required (additional compressors or economizer). As the Discharge Air Temperature falls below the deadband, the algorithm will request a reduction in active capacity.

### Default Economizer Operation

By default, the unit will be set up to optimize the minimum supply fan speed capability during Economizer Only operation. If the economizer is able to meet the demand alone, due to desirable ambient conditions, the supply fan speed will be allowed to increase above the minimum prior to utilizing mechanical cooling if discharge air setpoint falls below the discharge air Lower Limit (Cooling) setpoint.

### Occupied Heating Operation

Occupied heating operation will utilize two separate control methodologies based on heating configurations. For all “Staged” Heating types, the unit will utilize full airflow during all active heating periods exactly like traditional Constant Volume units. For “Modulating” Heating types the unit will have the ability to utilize SZVAV Heating, much like Active Cooling, in order to maintain the Zone Temperature to the Zone Heating setpoint. Also, on units configured with a Modulating Heat type, the customer will have the ability to select between SZVAV Heating control, or to utilize traditional Constant Volume, full airflow heating based on the associated unit setup.



## Unoccupied Mode

In Unoccupied periods the unit will utilize setback setpoints, 0% Minimum OA Damper position, and Auto Fan Mode operation as on normal Constant Volume units. The Supply Fan speed will be forced to 100% to operate in a constant volume mode for all active heating and cooling requests.

## Cooling Sequence

If the controller determines that there is a need for compressor stages in order to meet the calculated discharge air target setpoint, once supply fan proving has been made, the unit will begin to stage compressors accordingly.

**Note:** *The compressor staging order will be based on unit configuration and compressor lead/lag status.* Once the discharge air target setpoint calculation has reached the user defined Minimum Setpoint and compressors are being utilized to meet the demand, if the cooling demand increases, the discharge air target setpoint value will continue to lower past the minimum setpoint and begin to ramp the supply fan speed upward toward 100%.

Once the discharge air target setpoint calculation has reached the Minimum Setpoint and compressors are being utilized to meet the demand, as the discharge air target setpoint value continues to calculate lower the algorithm will begin to ramp the supply fan speed up toward 100%. Note that the supply fan speed will remain at the compressor stage's associated minimum value (as described below) until the discharge air target setpoint value is calculated below the discharge air temperature Minimum Setpoint (limited discharge air target setpoint).

As the cooling load in the zone decreases the zone cooling algorithm will reduce the speed of the fan down to minimum per compressor stage and control the compressors accordingly. As the compressors begin to de-energize, the supply fan speed will fall back to the Cooling Stage's associated minimum fan speed, but not below. As the load in the zone continues to drop, cooling capacity will be reduced in order to maintain the discharge air within the  $\pm\frac{1}{2}$  discharge air target deadband.

## Heating

### Gas Heating: Staged Heat

Up to two stages of gas heat will be sequenced based on zone demand. Status messages and diagnostics are communicated to the user interface.

### Modulating Gas

Modulating gas heat will consist of one modulating valve for precise heating control. The output will be modulated as the demand in the zone changes. Status messages and diagnostics are communicated to the user interface.

### Electric Heating

The individual stages of electric heat will be sequenced on the zone demand. The number of available stages will depend on the unit size and heat capacity selected.



## SZVAV and VAV Operation

*Note: SZVAV exceptions are noted in parenthesis.*

### Outside Air Control

#### Outside Air Measurement

Trane air quality (Traq™) outside air measurement system utilizes velocity pressure sensing rings. Based on unit design CFM, the Symbio™ 800 monitors and controls the quantity of outside air entering the unit. The outside airflow can be calibrated to compensate for altitude.

An optional CO<sub>2</sub> sensor may be connected to control outside air based on CO<sub>2</sub> Demand Control Ventilation (DCV).

#### Outside Airflow Compensation

As the supply fan modulates, this function proportionally adjusts the economizer minimum position to compensate for the change in total airflow, in order to maintain a constant percent of outside air. The modified economizer minimum position is computed as a linear function – based on VFD position – given the two endpoints:

- Minimum Position with VFD @ 0%
- Minimum Position with VFD @ 100%

Both are user adjustable at the user interface.

### Unit Feedback – Supply and Relief Fan Speed Setpoints

Controls VAV Unit Feedback Setpoints BACnet® network points are available to allow for communication of the Supply and Relief Fan Speed Setpoints to the BAS. These points are only available for multi-zone VAV units. These setpoints will be overridden by equipment protection functionality, when applicable.

### Emergency Override

When a LonTalk® communication protocol or BACnet® control network is installed, the user can initiate from the Tracer® Ensemble™ building automation system (BAS), Tracer® SC+ or third party BAS one of five predefined, not available to configure, Emergency Override sequences. All compressors, condenser fans and the Humidification output are de-energized for any Emergency Override sequence. Each Emergency Override sequence commands the unit operation as follows:

<p><b>PRESSURIZE_EMERG:</b></p> <ul style="list-style-type: none"> <li>• Supply Fan - On</li> <li>• Supply Fan VFD - Max</li> <li>• Relief Fan - Off; Relief Dampers - Closed (if so equipped)</li> <li>• OA Dampers - Open; Return Damper - Closed</li> <li>• Heat - All heat stages off; Mod Heat output at 0 VDC</li> <li>• Occupied/Unoccupied/VAV box output - Energized</li> <li>• VOM Relay - Energized (if so equipped)</li> <li>• Preheat Output - Off</li> <li>• Return Fan - Off; Relief Dampers - Closed (if so equipped)</li> <li>• Return VFD - Min (if so equipped)</li> </ul>	<p><b>EMERG_DEPRESSURIZE:</b></p> <ul style="list-style-type: none"> <li>• Supply Fan - Off</li> <li>• Supply Fan VFD - Min</li> <li>• Relief Fan - On; Relief Dampers - Open/Max (if so equipped)</li> <li>• OA Dampers - Closed; Return Damper - Open</li> <li>• Heat - All heat stages off; Mod Heat output at 0 VDC</li> <li>• Occupied/Unoccupied/VAV box output - Energized</li> <li>• VOM Relay - Energized (if so equipped)</li> <li>• Preheat Output - Off</li> <li>• Return Fan - On; Relief Dampers - Open (if so equipped)</li> <li>• Return VFD - Max (if so equipped)</li> </ul>
<p><b>EMERG_PURGE:</b></p> <ul style="list-style-type: none"> <li>• Supply Fan - On</li> <li>• Supply Fan VFD - Max</li> <li>• Relief Fan - On; Relief Dampers Open (if so equipped)</li> <li>• OA Dampers - Open; Return Damper - Closed</li> <li>• Heat - All heat stages off; Mod Heat output at 0 VDC</li> <li>• Occupied/Unoccupied/VAV box output - Energized</li> <li>• VOM Relay - Energized (if so equipped)</li> <li>• Preheat Output - Off</li> <li>• Return Fan - On; Relief Dampers - Open (if so equipped)</li> <li>• Return VFD - Max (if so equipped)</li> </ul>	<p><b>EMERG_SHUTDOWN:</b></p> <ul style="list-style-type: none"> <li>• Supply Fan - Off</li> <li>• Supply Fan VFD - Min</li> <li>• Relief Fan - Off; Relief Dampers - Closed (if so equipped)</li> <li>• OA Dampers - Closed; Return Damper - Open</li> <li>• Heat - All heat stages off; Mod Heat output at 0 VDC</li> <li>• Occupied/Unoccupied/VAV box output - Energized</li> <li>• VOM Relay - Energized (if so equipped)</li> <li>• Preheat Output - Off</li> <li>• Return Fan - Off; Relief Dampers - Closed (if so equipped)</li> <li>• Return VFD - Min (if so equipped)</li> </ul>
<p><b>EMERG_FIRE - Input from fire pull box/system:</b></p> <ul style="list-style-type: none"> <li>• Supply Fan - Off</li> <li>• Supply Fan VFD - Min</li> <li>• Relief Fan - Off; Relief Dampers - Closed (if so equipped)</li> <li>• OA Dampers - Closed; Return Damper - Open</li> <li>• Heat - All heat stages off; Mod Heat output at 0 VDC</li> <li>• Occupied/Unoccupied/VAV box output - Energized</li> <li>• VOM Relay - Energized (if so equipped)</li> <li>• Preheat Output - Off</li> <li>• Return Fan - Off; Relief Dampers - Closed (if so equipped)</li> <li>• Return VFD - Min (if so equipped)</li> </ul>	

## Ventilation Override Module (VOM)

The user can customize up to five different override sequences for purposes of ventilation override control. If more than one VOM sequence is being requested, the sequence with the highest priority is initiated first. Sequence hierarchy is the sequence "A" (UNIT OFF) is first, with sequence "E" (PURGE with Duct Pressure Control) last. A ventilation override mode can be initiated by closing any of the five corresponding binary inputs on the VOM module. A binary output is provided on the VOM module to provide remote indication of an active VOM mode. All compressors, condenser fans and the Humidification output are de-energized for any VOM sequence. The factory default definitions for each mode are as follows:



## Symbio™ 800 Controls

<p><b>UNIT OFF sequence “A”</b> When complete system shutdown is required the following sequence can be used.</p> <ul style="list-style-type: none"> <li>• Supply Fan - Off</li> <li>• Supply Fan VFD - Min</li> <li>• Relief Fan - Off; Relief Dampers - Closed (if so equipped)</li> <li>• OA Dampers - Closed; Return Damper - Open</li> <li>• Heat - All heat stages off; Mod Heat output at 0 VDC</li> <li>• Occupied/Unoccupied/VAV box output - Deenergized</li> <li>• VOM Relay - Energized</li> <li>• Preheat Output - Off</li> <li>• Return Fan - Off; Relief Dampers - Closed (if so equipped)</li> <li>• Return VFD - Min (if so equipped)</li> <li>• OA Bypass Dampers - Open (if so equipped)</li> <li>• Relief Bypass Dampers - Open (if so equipped)</li> </ul>	<p><b>PRESSURIZE sequence “B”</b> Perhaps a positively pressurized space is desired instead of a negatively pressurized space. In this case, the supply fan should be turned on with VFD at 100% speed and exhaust fan should be turned off.</p> <ul style="list-style-type: none"> <li>• Supply Fan - On</li> <li>• Supply Fan VFD - Max</li> <li>• Relief Fan - Off; Relief Dampers - Closed (if so equipped)</li> <li>• OA Dampers - Open; Return Damper - Closed</li> <li>• Heat - All heat stages off; Mod Heat output at 0 VDC</li> <li>• Occupied/Unoccupied/VAV box output - Energized</li> <li>• VOM Relay - Energized</li> <li>• Preheat Output - Off</li> <li>• Return Fan - Off; Relief Dampers - Closed (if so equipped)</li> <li>• Return VFD - Min (if so equipped)</li> <li>• OA Bypass Dampers - Open (if so equipped)</li> <li>• Relief Bypass Dampers - Open (if so equipped)</li> </ul>
<p><b>EXHAUST sequence “C”</b> With only the exhaust fans running (supply fan off), the space that is conditioned by the rooftop would become negatively pressurized. This is desirable for clearing the area of smoke from the now-extinguished fire, possibly keeping smoke out of areas that were not damaged.</p> <ul style="list-style-type: none"> <li>• Supply Fan - Off</li> <li>• Supply Fan VFD - Min</li> <li>• Relief Fan - On; Relief Dampers Open (if so equipped)</li> <li>• OA Dampers - Closed; Return Damper - Open</li> <li>• Heat - All heat stages off; Mod Heat output at 0 VDC</li> <li>• Occupied/Unoccupied/VAV box output - Deenergized</li> <li>• VOM Relay - Energized</li> <li>• Preheat Output - Off</li> <li>• Return Fan - On; Relief Dampers - Open (if so equipped)</li> <li>• Return VFD - Max (if so equipped)</li> <li>• OA Bypass Dampers - Open (if so equipped)</li> <li>• Relief Bypass Dampers - Open (if so equipped)</li> </ul>	<p><b>PURGE sequence “D”</b> Possibly this sequence could be used for purging the air out of a building before coming out of Unoccupied mode of operation on VAV units or for the purging of smoke or stale air if required after a fire.</p> <ul style="list-style-type: none"> <li>• Supply Fan - On</li> <li>• Supply Fan VFD - Max</li> <li>• Relief Fan - On; Relief Dampers Open (if so equipped)</li> <li>• OA Dampers - Open; Return Damper - Closed</li> <li>• Heat - All heat stages off; Mod Heat output at 0 VDC</li> <li>• Occupied/Unoccupied/VAV box output - Energized</li> <li>• VOM Relay - Energized</li> <li>• Preheat Output - Off</li> <li>• Return Fan - On; Relief Dampers - Open (if so equipped)</li> <li>• Return VFD - Max (if so equipped)</li> <li>• OA Bypass Dampers - Open (if so equipped)</li> <li>• Relief Bypass Dampers - Open (if so equipped)</li> </ul>
<p><b>PURGE with duct pressure control sequence “E”</b> This sequence can be used when supply air control is required for smoke control.</p> <ul style="list-style-type: none"> <li>• Supply Fan - On</li> <li>• Supply Fan VFD - Controlled by Supply Air Pressure Control function; Supply Air Pressure High Limit disabled</li> <li>• Relief Fan - On; Relief Dampers Open (if so equipped)</li> <li>• OA Dampers - Open; Return Damper - Closed</li> <li>• Heat - All heat stages off; Mod Heat output at 0 VDC</li> <li>• Occupied/Unoccupied/VAV box output - Energized</li> <li>• VOM Relay - Energized</li> <li>• Preheat Output - Off</li> <li>• Return Fan - On; Relief Dampers - Open (if so equipped)</li> <li>• Return VFD - Max (if so equipped)</li> <li>• OA Bypass Dampers - Open (if so equipped)</li> <li>• Relief Bypass Dampers - Open (if so equipped)</li> </ul>	

## User Interface (UI)

A 7 inch user interface features a touch-sensitive color screen that provides operating status, performance monitoring, and scheduling changes and operating adjustments.

## Frost Avoidance

### Evaporator Coil Frost Protection - Frostat™

Temperature and pressure readings on each evaporator circuit are used to determine if the coil is getting close to a freezing condition. The Frostat™ system reduces the need for hot gas bypass and sheds cooling when coil frosting conditions occur. The supply fans are not shut off and will de-ice the coil. Timers prevent the compressors from rapid cycling.

## Steam and Hot Water Coil - Freeze Avoidance

Freeze Avoidance is a feature which helps prevent freezing of steam or hot water heat coils during periods of unit inactivity and low ambient temperatures. Whenever the unit supply fan is off, the outdoor air temperature is monitored. If the temperature falls below a predetermined value, the heating valve is opened to a position selected on the user interface to allow a minimum amount of steam or hot water to flow through the coil and avoid freezing conditions.

## Occupied/Unoccupied Switching

There are two ways to switch between Occupied or Unoccupied:

- Field-supplied contact closure (hard wired binary input to Symbio™ 800 Controls) (SZVAV and VAV). This input accepts a field supplied switch or contacts closure, such as a time-of-day clock
- Tracer (or third party BAS)

## Trane Tracer® Ensemble™ or BAS System

The Tracer® Ensemble™ building management system or a third party BAS (with BACnet® or LON option) can control the Occupied/Unoccupied status of the rooftop.

### Timed Override Activation - ICS

This function is operational when the Zone Temperature Sensor is installed. When this function is initiated by the push of an override button on the ICS sensor, the Tracer Ensemble will switch the unit to the Occupied mode. Unit operation (Occupied mode) during timed override is terminated by a signal from Tracer.

### Timed Override Activation - Non-ICS

This function is active whenever the Zone Temperature Sensor is installed. When this function is initiated by the push of an override button on the zone sensor, the unit will switch to the Occupied mode. Automatic Cancellation of the Timed Override Mode occurs after three hours of operation.

## Economizer Controls

### Comparative Enthalpy Control of Economizer

An optional comparative enthalpy system is used to control the operation of the economizer, and measures the temperature and humidity of both return air and outside air to determine which source has lower enthalpy. This system allows true comparison of outdoor air and return air enthalpy by measurement of outdoor air and return air temperatures and humidities.

### Reference Enthalpy Control of Economizer

The optional reference enthalpy compares outdoor air temperature and humidity to the economizer enthalpy control setpoint. If outdoor air temperature and humidity are below the economizer enthalpy control setpoint, the economizer will operate freely. This system provides more sophisticated control where outdoor air humidity levels may not be acceptable for building comfort and indoor air quality.

### Dry Bulb Temperature Control of Economizer

The optional dry bulb system measures outdoor temperature comparing it to the economizer control temperature setpoint. If the outdoor temperature is below the economizer dry bulb temperature control setpoint, the economizer will operate freely. This system is best suited for arid regions where the humidity levels of outside air would not be detrimental to building comfort and indoor air quality.

### Differential Dry Bulb Temperature Control of Economizer

The optional differential dry bulb system measures outdoor temperature comparing it to the return air temperature. If the outdoor temperature is below the return air dry bulb temperature minus the economizer dry bulb enable offset the economizer will operate freely. This system is best suited for arid regions where the humidity levels of outside air would not be detrimental to building comfort and indoor air quality.



## Balanced Starts

Balanced starts is a user-selectable feature through the User Interface available on all units without the eFlex™ variable speed option. After each request for compressor operation, the lead refrigeration circuit switches, thereby causing a more equitable or balanced run time among compressors.

## Emergency Stop Input

A binary input is provided for installation of field provided switch or contacts for immediate shutdown of all unit functions.

## Anti-Short Cycle Protection

A standard feature provided to prevent excessive cycling and premature wear of the compressors, contactors and related components.

## High Duct Temperature Sensor

Two temperature sensors, Discharge Air and Return Air (if installed) are used to determine if duct temperatures are excessively high. If the discharge air temperature exceeds 200°F or if the return air temperature exceeds 135°F, the unit will be placed into Emergency Stop Mode.

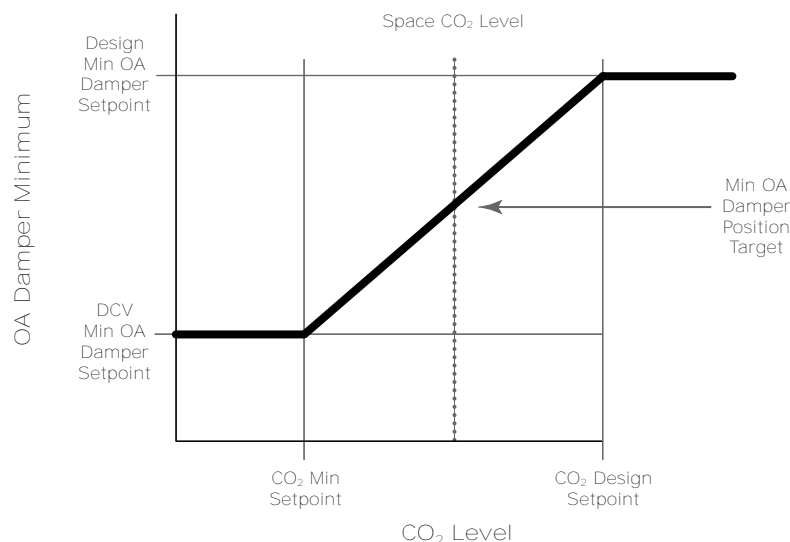
## CO<sub>2</sub> Control - Demand Control Ventilation (DCV)

A ventilation reset function that provides the necessary ventilation for occupants and reduces energy consumption by minimizing the outdoor air damper position (or the OA flow setpoint with Traq) below the Building Design Minimum, while still meeting the ASHRAE Std 62.1 ventilation requirements.

- If the space CO<sub>2</sub> level is greater than or equal to the CO<sub>2</sub> Design Setpoint, the outdoor air damper will open to the Design Min Outdoor Air Damper (or OA Flow) Setpoint. If there is a call for economizer cooling, the outdoor air damper may be opened further to satisfy the cooling request.
- If the space CO<sub>2</sub> level is less than or equal to the CO<sub>2</sub> Minimum Setpoint, the outdoor air damper will close to the DCV Minimum Outdoor Air Damper (or OA Flow) Setpoint. If there is a call for economizer cooling, the outdoor air damper may be opened further to satisfy the cooling request.
- If the space CO<sub>2</sub> level is greater than the CO<sub>2</sub> Minimum Setpoint and less than the CO<sub>2</sub> Design Setpoint, the outdoor air damper position is (or OA flow) modulated proportionally to the Space CO<sub>2</sub> level relative to a point between the CO<sub>2</sub> Min Setpoint and the CO<sub>2</sub> Design Setpoint. If there is a call for economizer cooling, the outdoor air damper may be opened further to satisfy the cooling request.

**Note:** CO<sub>2</sub> sensor used with Demand Control Ventilation must be powered from an external power source or separate 24 VAC transformer.

Figure 3. CO<sub>2</sub> control



## Low Charge Protection

A refrigerant charge estimate is calculated using a combination of measured temperatures, calculated saturated temperatures, refrigerant mass flow and the expansion valve opening. At the touch screen interface, a warning diagnostic is displayed when a low charge has been detected on the circuit, but is not critical enough to force a circuit shutdown. When a critical low charge has been detected on the circuit, a circuit shut down is triggered, and a shutdown diagnostic is displayed at the touch screen interface. Other diagnostic messages include the following:

- A diagnostic message displayed at the user interface, warning of a low charge situation when the unit is just slightly undercharged. The unit will be allowed to run.
- A diagnostic message displayed at the user interface, , warning of a low charge situation when the unit is undercharged. The undercharged circuit will be locked out to protect the compressors.

## Condenser Fan Control

The Symbio™ 800 controller cycles or modulates condenser fans based on ambient temperature and saturated condensing temperature to ensure the optimum operating conditions for the unit.

## LonTalk® Building Automation System

The LonTalk® communication protocol for the Symbio™ 800 controller expands communications from the unit UCM network to a Tracer® Ensemble™ building automation system or third party building automation system. Utilizing LonTalk®, the BAS allows external setpoint and configuration adjustment and monitoring of status and diagnostics. The Symbio™ 800 utilizes an FTT-10A free topology transceiver, which supports non-polarity sensitive, free topology wiring—which in turn allows the system installer to utilize star, bus, and loop architectures. This controller works in standalone mode, peer-to-peer with one or more other units, or when connected to a Tracer® Ensemble™ or a third party building automation system that supports LonTalk®. The LON controller is available as a factory or field-installed kit.

## BACnet® Building Automation Control Network

The BACnet® control network for Symbio™ 800 expands communications from the unit UCM network to the Tracer® Ensemble™ building automation system or third party building automation system. Utilizing BACnet, the BAS allows external setpoint and configuration adjustment and monitoring of status and diagnostics. The Symbio™ 800 utilizes the BACnet defined MS/TP protocol as defined in ASHRAE standard 135-2004. This controller works in standalone mode, with Tracer® Ensemble™ or when connected to a third party building automation system that supports BACnet.

## AirFi® Wireless Communication Interface

Trane AirFi® Wireless Comm replaces the BACnet communication link and sensor wire on Tracer® building automation systems for faster, easier, lower-risk installation and life-cycle savings.

## Modulating Hot Gas Reheat

When space conditions allow, the modulating hot gas reheat function activates the reheat mode. The reheat valve and cooling valve are modulated to control the discharge air temperature to the discharge air temperature reheat setpoint (default 70 °F).

In reheat mode, the reheat valve is commanded (15 to 85%) to control to the discharge air reheat setpoint and the cooling valve mirrors the reheat valve position (85 to 15%).

## Low Ambient Compressor Start Lockout

This function will lock out the compressor if the outdoor air temperature is below the low ambient compressor lock out temperature setpoint. The factory setpoint is 50°F on standard units and 0°F on low ambient units. This setpoint is adjustable at the user interface. Compressors will be locked out when outdoor air temperatures fall below the selected temperature and will be allowed to start again when temperatures rise 5°F above the setpoint.



## Symbio™ 800 Controls

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### Isolation Damper Control

The Symbio™ 800 supports field installed discharge and/or return isolation dampers including damper parameter setup, damper command, position status and associated alarms.





# Application Considerations

## High Capacity Evaporator

Rooftops are popular because of their “packaged” nature. Everything needed is contained in one box; mix-matching is neither necessary nor available. With this convenience comes some disadvantages, among them correctly matching cooling capacity to building load. For example, a 105 ton rooftop would need to be used on an application that is 91 tons, simply because the ton rooftop does not meet capacity. Matching the rooftop’s capacity to the building load is critical, which is why the IntelliPak line offers a high capacity coil option on its rooftops.

Capacity tables for both standard and high capacity units are available in the cooling data section of this catalog. Use the pressure drops associated with the high capacity coil option by adding them to the total static pressure used to size the supply fan motor. eFlex™, variable speed compressors also help units match the load needed by varying the compressor capacity down to 15% of full load.

## eFlex™ Variable Speed

A state of the art Trane eFlex™ variable speed compressor is combined with fixed capacity compressors to provide a superior part load efficiency (IEER) option. Compressor designs are optimized and selected to maximize part load performance. Continuous capacity from 15-100% means that discharge air temperature is controlled within +/-1°F. This eliminates discharge air temperature swings caused by cycling fixed capacity compressors, improves humidity control, and leads to increased comfort in the space.

## Relief/Return Fan Options

The Trane 100% modulating relief system with Statitrac is an excellent choice for controlling building pressure. With a relief fan system, the supply fan motor and drives must be sized to overcome the total system static pressure, including return losses, and pull return air back to the unit during non-economizer operation.

For systems with high return static pressure losses, Trane’s 100% modulating return fan system is recommended. In a return fan system, the return fan works in series with the supply fan, and operates continuously whenever the supply fan is operating to maintain return air volume. The return fan motor and drives are sized to pull the return CFM back to the unit based on return duct static. Therefore, with a return fan system, the supply fan ordinarily requires less horsepower than a system with a relief fan.

Either return or relief fan systems with Statitrac may be used on any rooftop application that has an outdoor air economizer.

## Relief/Return Fan Systems

Reasons for selecting either return or relief fan systems include economy, building pressure control, code requirements, and generally accepted engineering practices.

- 100% modulating relief with Statitrac direct space sensing building pressurization control
- 100% modulating plenum return airfoil fan with Statitrac direct space sensing building pressurization control with variable frequency drive

## 100% Modulating relief with Statitrac™ Control, and Variable Air Volume (VAV) Units

For VAV rooftops, the 100% modulating relief discharge dampers (or VFD) are modulated in response to building pressure. A differential pressure control system, Statitrac, uses a differential pressure transducer to compare indoor building pressure to atmospheric pressure. The FC relief fan is turned on when required to lower building static pressure to setpoint. The Statitrac control system then modulates the discharge dampers (or VFD) to control the building pressure to within the adjustable, specified deadband that is set at the user interface. Economizer and return air dampers are modulated independent of the relief dampers (or VFD) based on ventilation control and economizer cooling requests.



## Application Considerations

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### Advantages:

- The relief fan runs only when needed to lower building static pressure.
- Statitrac compensates for pressure variations within the building from remote relief fans and makeup air units.
- The relief fan discharges in a single direction resulting in more efficient fan operation compared to return fan systems.
- When discharge dampers are utilized to modulate the relief airflow, the relief fan may be running unloaded whenever the economizer dampers are less than 100% open.

The Trane 100% modulating relief system with Statitrac provides efficient control of building pressure in most applications simply because 100 percent modulating relief discharge dampers and VFD are controlled directly from building pressure, rather than from an indirect indicator of building pressure, such as outdoor air damper position.

### 100% Modulating Relief with Statitrac Control, SZVAV Units

The overall scheme will remain very similar to non-Single Zone VAV units with Space Pressure Control with the exception of the dynamic Relief Enable Setpoint.

For SZVAV the user will select an Relief Enable Setpoint during the 100% Fan Speed Command. Once selected, the difference between the Relief Enable Setpoint and Design OA Damper Minimum Position at 100% Fan Speed Command will be calculated. The difference calculated will be used as an offset to be added to the Active Building Design OA Minimum Position Target to calculate the dynamic Relief Enable Target to be used throughout the Supply Fan Speed/OA Damper Position range.

### Advantages

- The relief fan runs only when the economizer reaches the desired relief enable point.
- Relief dampers are modulated based on the economizer position.
- The relief fan discharges in a single direction resulting in more efficient fan operation compared to return fan systems.
- When discharge dampers are utilized to modulate the relief airflow, the relief fan may be running unloaded whenever the economizer dampers are less than 100% open.

The Trane 100% modulating relief system provides excellent linear control of building relief in most applications where maintaining building pressure is not important.

### 100% Modulating Return Fan Systems with Statitrac Control and Variable Air Volume (VAV) Units

The IntelliPak rooftop offers 100% modulating return fan systems. A differential pressure control system, Statitrac, uses a differential pressure transducer to compare indoor building pressure to atmospheric pressure.

The return fan relief dampers are modulated, based on space pressure, to control the building pressure to within the adjustable, specified deadband that is set at the user interface. A VFD modulates the return fan speed based on return duct static pressure.

Economizer and return air dampers are modulated independent of the relief dampers based on ventilation control and economizer cooling requests.

### Advantages:

- The return fan operates independently of the supply fan to provide proper balance throughout the airflow envelope.
- Statitrac compensates for pressure variations within the building from remote relief fans and makeup air units.
- The return fan acts as both relief and return fan based on operation requirements.

The Trane 100% modulating return system with Statitrac provides efficient control of building pressure in applications with higher return duct static pressure and applications requiring duct returns. Relief

discharge dampers are controlled directly from building pressure, return fan VFD is controlled from return static pressure, and return/economizer dampers are controlled based on ventilation control and economizer cooling requests.

## Other Cooling Options

### Cooling, Rapid Restart Units Only

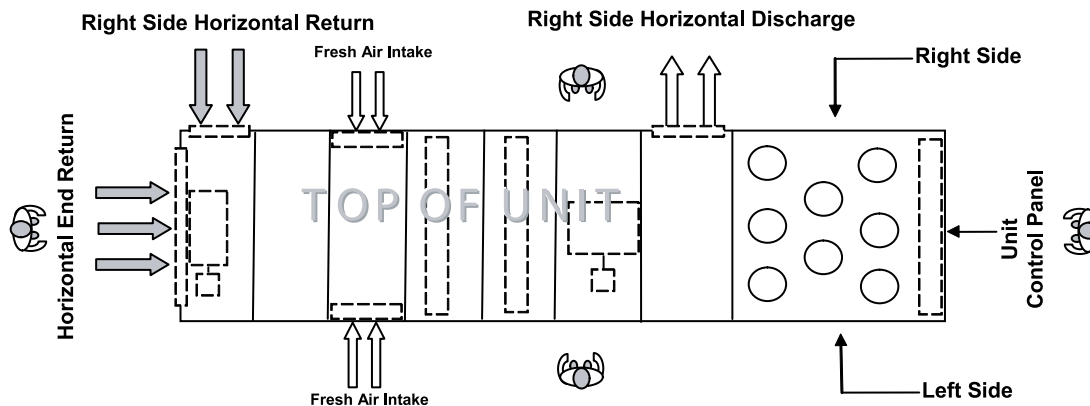
This is for applications where the space has a high heat load with critical temperature control requirements. A typical application is a computer room that has a large number of routers and servers. If the cooling capacity is lost due to a power interruption, the temperature in the room can rise as much as 3-4°F per minute. Once power is restored (e.g., backup generator has started), the cooling capacity needs to be maximized as soon as possible to help get the space under control. Once cooling capacity has been maximized, the unit can then manage the load using its normal capacity control algorithms.

### Supply and Return Airflow Configurations

The typical rooftop installation has both the supply and return air paths routed through the roof curb and building roof. However, many rooftop installations require horizontal supply and/or return from the rooftop because of a building's unique design or for acoustic considerations.

There are several ways to accomplish horizontal supply, see and/or .

**Figure 4. Left/right unit orientation and horizontal airflow**



**Table 1. Supply airflow configuration**

Cabinet Configuration	Supply Airflow Discharge Direction	Type	Acceptable Application	With Bag Final Filters	With Cartridge Final Filters	With HEPA Final Filters
Standard Length	Downflow - Standard Option	Cooling Only	Yes	No	No	No
Standard Length	Horizontal - Right Side - Standard Option	Cooling Only	Yes	No	No	No
Standard Length	Horizontal - Left Side - Field Convertible	Cooling Only	Field Convert	No	No	No
Standard Length	Downflow - Standard Option	Gas, Electric, Steam, Hot Water Heat	Yes	No	No	No
Standard Length	Horizontal - Right Side - Standard Option	Gas, Electric, Steam, Hot Water Heat	Yes	No	No	No
Standard Length	Horizontal - Left Side - Field Convertible	Gas, Electric, Steam, Hot Water Heat	No	No	No	No
4 ft Blank Section	Downflow - Standard Option	Cooling Only	Yes	Yes	Yes	Yes
4 ft Blank Section	Horizontal - Right Side - Standard Option	Cooling Only	Yes	Yes	Yes	Yes



## Application Considerations

**Table 1. Supply airflow configuration (continued)**

Cabinet Configuration	Supply Airflow Discharge Direction	Type	Acceptable Application	With Bag Final Filters	With Cartridge Final Filters	With HEPA Final Filters
4 ft Blank Section	Horizontal - Left Side - Field Convertible	Cooling Only	Field Convert	Yes	Yes	Yes
4 ft Blank Section	Downflow - Standard Option	Gas, Electric, Steam, Hot Water Heat	No	No	No	No
4 ft Blank Section	Horizontal - Right Side - Standard Option	Gas, Electric, Steam, Hot Water Heat	No	No	No	No
4 ft Blank Section	Horizontal - Left Side - Field Convertible	Gas, Electric, Steam, Hot Water Heat	No	No	No	No
8 ft Blank Section	Downflow - Standard Option	Cooling Only, Steam Heat, Hot Water Heat	Yes	Yes	Yes	Yes
8 ft Blank Section	Horizontal - Right Side - Standard Option	Cooling Only, Steam Heat, Hot Water Heat	Yes	Yes	Yes	Yes
8 ft Blank Section	Horizontal - Left Side - Field Convertible	Cooling Only, Steam Heat, Hot Water Heat	Field Convert	Yes	Yes	Yes
8 ft Blank Section	Downflow - Standard Option	Gas <sup>(a)</sup> or Electric <sup>(b)</sup>	Yes	No	High Temp	High Temp
8 ft Blank Section	Horizontal - Right Side - Standard Option	Gas <sup>(a)</sup> or Electric <sup>(b)</sup>	Yes	No	High Temp	High Temp
8 ft Blank Section	Horizontal - Left Side - Field Convertible	Gas <sup>(a)</sup> or Electric <sup>(b)</sup>	Field Convert	No	High Temp	High Temp

<sup>(a)</sup> Not available with 2.5M MBh heater

<sup>(b)</sup> Multi-piece units with electric heat and eight foot blank section are not field convertible from right side horizontal to left side horizontal configuration.

**Note:** For left/right unit orientation, see [Figure 4, p. 27](#).

**Table 2. Return airflow configuration**

Airflow Config	Relief Fan VFD	Relief Fan No VFD	Return Fan VFD	Return Fan No VFD
Vertical	Yes	Yes	Yes	Yes
Horizontal - Right	Yes	Yes	Yes	Yes
Horizontal - Left	No	Field Convert	No	No
Horizontal - End	Yes	Yes	No	No

**Note:** For left/right unit orientation, see [Figure 4, p. 27](#).

When using an IntelliPak 2 Rooftop for horizontal supply and/or return, an additional pressure drop must be added to the supply external static to account for the 90 degree turn the air is making. This additional pressure drop depends on airflow and rooftop size, but a range of 0.10 inches to 0.30 inches can be expected. The openings on the rooftop all have a one inch lip around the perimeter to facilitate ductwork attachment.

## Corrosive Atmospheres

Trane's IntelliPak™ Rooftops are designed and built to industrial standards and will perform to those standards for an extended period depending on the hours of use, the quality of maintenance performed, and the regularity of that maintenance.

One factor that can have an adverse effect on unit life is operation in a corrosive environment. Since the Microchannel condenser coil is an all-aluminum design, it provides a high level of corrosion protection on its own. Uncoated, it withstands a salt spray test in accordance with ASTM B117 for 1,000 hours. When rooftops are operated in highly corrosive environments, Trane recommends the corrosion protected condenser coil option.

This corrosion protection option meets the most stringent testing in the industry, including ASTM B117 Salt Spray test for 6,000 hours and ASTM G85 A2 Cyclic Acidified Salt Fog test for 2,400 hours. The acid fog test is the most stringent available today. This coating is added after coil construction covering all tubes, headers, fins and edges. The design provides superior protection from any corrosive agent. For evaporator coils, epoxy coating can be utilized as a design special.

IntelliPak paint innately handles harsh weather, including most coastal and salt environments and direct sun. The unit paint was salt spray tested in accordance with ASTM B117 and UV weathering resistance tested in accordance with ASTM G155 Test cycle 1 for 2000 hours. For further detail on the paint testing, refer to PROD-SLB034\*-EN

*Note: Field coating is not allowed on Microchannel coils.*

## Ventilation Override Sequences

One of the benefits of using a relief fan rather than a return fan, in addition to the benefits of lower energy usage is that the rooftop can be used as part of a ventilation override system. Several types of sequences can be easily done when relief fans are a part of the rooftop system. One of the benefits of using a relief fan rather than a return fan, in addition to the benefits of lower energy usage is that the rooftop can be used as part of a ventilation override system. Several types of sequences can be easily done when relief fans are a part of the rooftop system.

Typically, a manual switch is used and located near the fire protection control panel. This enables the fire department access to the control for use during or after a fire. It is also possible to initiate the sequence from a field-installed automatic smoke detector. In either case, a contact closure begins the ventilation override control sequence.

The user can customize up to five (5) different override sequences for purposes such as smoke control. The following parameters within the unit can be defined for each of the five sequences:

- Supply Fan - on/off
- Variable Frequency Drives - on (60 Hz)/off (0 Hz)/controlling
- Relief/Return Fan - on/off
- Relief Dampers - open/closed
- Economizer Dampers - open/closed
- Heat - off/controlling (output for) VAV Boxes - open/controlling

Compressors and condenser fans are shut down for any Ventilation Override sequence. Factory preset sequences include unit Off, Relief, Purge, Purge with duct pressure control, and Pressurization. Any of the user-defined Ventilation Override sequences can be initiated by closing a field supplied switch or contacts connected to an input on the Ventilation Override Module. If more than one ventilation override sequence is being requested, the sequence with the highest priority is initiated. Refer to the Ventilation Override Mode (VOM) information in the Control section of this catalog for more details on each override sequence.

## Natural Gas Heating Considerations

Trane uses 304L stainless steel throughout the construction of its IntelliPak™ natural gas drum and tube heat exchangers.

These heat exchangers can be applied with confidence, particularly with full modulation control, when mixed air temperatures are below 50°F, and low ambient temperatures can cause condensation to form on the heat exchanger. The natural gas heat exchangers are not recommended for applications with mixed air conditions entering the heat exchanger below 30°F to ensure adequate leaving air heating temperature. For airflow limitations and temperature rise across the heat exchanger information, see Natural Gas Heating Capacities table in Performance Data.

## Acoustic Considerations

The best time to make provisions to reduce sound transmission to the occupied space is during the project design phase. Proper placement of rooftop equipment is critical to reducing sound transmitted into the building. The most economical means of avoiding an acoustical problem is to locate rooftop equipment away from acoustically-sensitive areas. If possible, locate rooftop equipment above corridors, utility rooms, restrooms, or other areas where higher sound levels are acceptable.

It is not possible to totally quantify the effect of the building structure on sound transmission, since this depends on the response of the roof and building members to the sound and vibration of the unit components. However, the following guidelines have been proven through experience to help reduce sound transmission through the building structure:

- Never cantilever the condensing section of the rooftop unit; a structural cross member must support this end of the unit.
- Locate the unit's center of gravity close to (or over) a column or main support beam to minimize roof deflection and vibration-related noise.
- If the roof structure is very light, roof joists should be replaced by a structural shape in the critical areas described above.



## Application Considerations

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- If several units are to be placed on one span, they should be staggered to reduce deflection over that span.

For more information:

- ASHRAE. 2015. *ASHRAE Handbook – HVAC Applications* (Chapter 48: Noise and Vibration Control). Atlanta, GA: ASHRAE.
- ASHRAE. 2011. *Practical Guide to Noise and Vibration Control for HVAC Systems*. Atlanta, GA: ASHRAE.
- Guckelberger, D. 2000. "Controlling Noise From Large Rooftop Units," *ASHRAE Journal* (May): pp. 55-62.
- Trane. Guckelberger, D. and Bradley, B. 2006. *Acoustics in Air Conditioning*, ISS-APM001-EN. La Crosse, WI: Inland Printing Company.
- Trane. Murphy, J. and Harshaw, J. 2012. *Rooftop VAV Systems*, SYS-APM007-EN. La Crosse, WI: Inland Printing Company.

In addition, the Trane Acoustics Program™ (TAP) allows for modeling of various sound paths to predict sound levels in the occupied space. The software models airborne sound from supply- and return-air paths, as well as duct breakout and roof transmission sound, so that the designer can identify potential sound problems and make design alterations before equipment installation. TAP is also capable of modeling the effect of outdoor sound on adjacent properties. This program is available at [www.trane.com](http://www.trane.com). Ask your local Trane representative for additional information.

## High Entering Return Temperature Applications

Some applications may have high entering return temperatures. It is recommended that the dry bulb temperatures in any application not exceed 95°F for extended periods of time. If this is a requirement, please work with the Applications or Product Support group in developing a specific assessment. Other factors, such as wet bulb and ambient temperatures, will also affect the system's reaction.

## Clearance Requirements

The recommended clearances identified in [Figure 21, p. 112](#) and should be maintained to assure adequate service capability, maximum capacity and peak operating efficiency. A reduction in unit clearance could result in condenser coil starvation or warm condenser air recirculation. If the clearances shown are not possible on a particular job, consider the following:

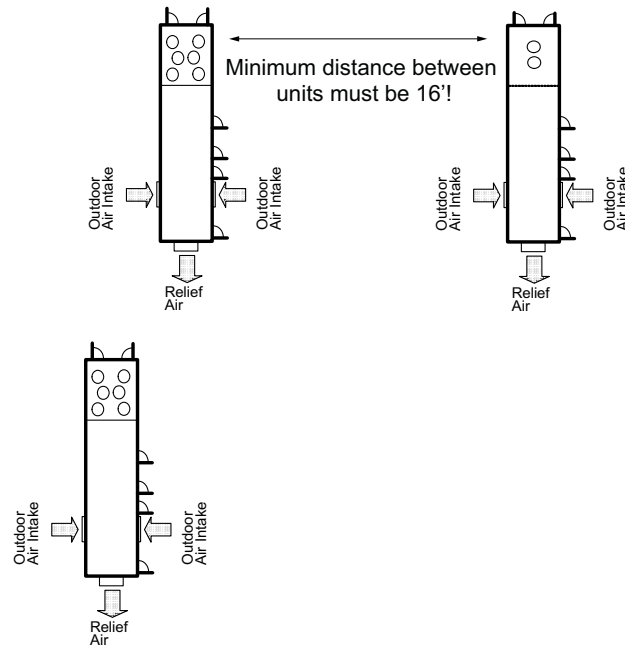
- Do the clearances available allow for major service work such as changing compressors or coils?
- Do the clearances available allow for proper outside air intake, relief air removal, and condenser airflow?
- If screening around the unit is being used, is there a possibility of air recirculation from the relief to the outside air intake, or from condenser exhaust to condenser intake?
- Do clearances meet all applicable codes?

Actual clearances which appear inadequate should be reviewed with a local Trane sales engineer.

When two or more units are to be placed side by side, the distance between the units should be increased to 150 percent of the recommended single unit clearance. The units should also be staggered for the following reasons:

- To reduce span deflection if more than one unit is placed on a single span. Reducing deflection discourages sound transmission.
- To assure proper diffusion of relief air before contact with the outside air intake of adjacent unit.

Figure 5. Unit placement



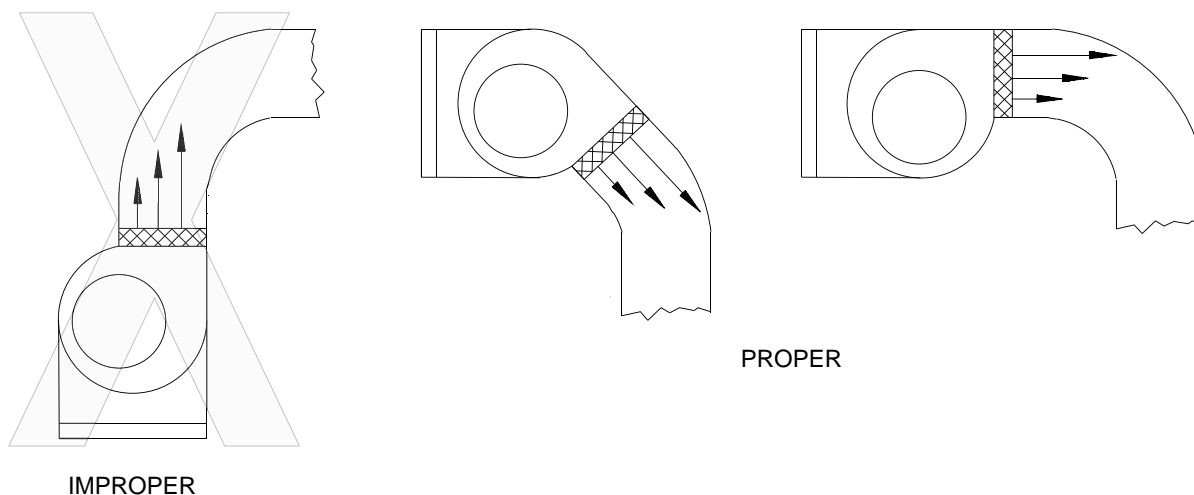
## Duct Design

It is important to note that the rated capacities of the rooftop can be met only if the rooftop is properly installed in the field. A well-designed duct system is essential in meeting these capacities.

The satisfactory distribution of air throughout the system requires that there be an unrestricted and uniform airflow from the rooftop discharge duct. This discharge section should be straight for at least several duct diameters to allow the conversion of fan energy from velocity pressure to static pressure.

However, when job conditions dictate elbows be installed near the rooftop outlet, the loss of capacity and static pressure may be reduced through the use of guide vanes and proper direction of the bend in the elbow. The high velocity side of the rooftop outlet should be directed at the outside radius of the elbow rather than the inside as illustrated in .

Figure 6. Duct design





## Application Considerations

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### Energy Recovery Wheel

For applications where the air streams within the rooftop must be isolated, consider using alternative technologies that guarantee separation of the air streams.

**Important:** *Do not use energy wheels in applications where the relief air is contaminated with harmful toxins or biohazards or where even a minor mixing of the air streams presents a health risk. See Installation Operation Maintenance (RT-SVX073\*-EN) for more information.*

The energy recovery option was designed as a partial flow outside air system, where the required outside air is less than 100 percent. IntelliPak 2 monitors outside air, return air, and zone conditions. It compares them with setpoints (set in the rooftop user interface) and checks for suitable energy recovery system operation. Energy recovery can be activated when both supply and relief fans are in operation. Heat can be recovered when the return air dry bulb temperature is greater than the outside air dry bulb temperature.

Energy recovery is disabled when economizer cooling operation is requested. Economizer cooling in energy recovery wheel equipped units requires the relief air and outside air bypass dampers to be open and the recovery wheel motor to be off. The energy recovery wheel can provide free cooling when outside air enthalpy is greater than return air enthalpy. In general, energy recovery works well in applications where a high outside airflow minimum is required, often because of high occupancy.

### Modulating Hot Gas Reheat

Often supply fan VAV modulation, staged compressor control, or the addition of an eFlex™ variable speed compressor are sufficient in handling building humidity in a wide range of indoor load conditions. Applications where non-peak load conditions can be dominated by latent loads are candidates for the Hot Gas Reheat option. This includes many applications subject to ASHRAE Standard 62 requirements.

When a Hot Gas Reheat coil is energized, it increases the air temperature after exiting the evaporator coil. While this provides dehumidification, this is not a dehumidifier. The main function of the Packaged RTU is to provide zone temperature control. For times when dehumidification is needed, the hot gas reheat will be energized.

Applications which should be investigated before using the standard modulating hot gas reheat option, and will require additional investigation include the following:

- Process applications
- Units utilized as a make-up air or 100% outside air units
- Zones with dramatically varying load conditions (sanctuaries, locker rooms, gymnasiums, etc.)





# Selection Procedure

This section outlines a step-by-step procedure that may be used to select a Trane air-cooled single-zone air conditioner. Air-cooled models should be selected based on dry bulb (DB) conditions. For specific model selection, utilize TSA or contact the local Trane Sales Office. This sample selection is based on the following conditions:

**Note:** When calculating capacities for evaporative condensers, use ambient wet bulb (WB).

<b>Summer Design</b>	
Summer outdoor design conditions	95 DB/76 WB ambient temperature
Summer room design conditions	78 DB/65 WB
Total cooling load	980 MBh (81.6 tons)
Sensible cooling load	735 MBh (61.25 tons)
Outdoor air ventilation load	154.0 MBh (12.8 tons)
Return air temperature	78 DB/65 WB
<b>Winter design:</b>	
Winter outdoor design conditions	0°F
Return air temperature	70°F
Total heating load	720 MBh
Winter outdoor air ventilation load	288.6 MBh
Total winter heating load	1008.6 MBh
<b>Air delivery data:</b>	
Supply fan CFM	36,000 CFM
External duct static pressure	1.86 in wg
Minimum outdoor air ventilation	3,600 CFM
fan CFM	36,000 CFM
Return air duct negative static pressure	0.3 in wg
<b>Electrical characteristics:</b>	
Voltage/cycle/phase	460/60/3
Unit Accessories	<ul style="list-style-type: none"> <li>• Gas fired heat exchanger - high heat</li> <li>• Downflow supply and upflow return</li> <li>• High efficiency throwaway filters</li> <li>• Economizer</li> <li>• Modulating 100% relief</li> </ul>

## Cooling Capacity Selection

### 1. Nominal Unit Size Selection

A summation of the peak cooling load and the outside air ventilation load shows: 980 MBh + 154.0 MBh = 1134.0 MBh required unit capacity. From , a 105 ton unit with standard capacity evaporator coil at 80 DB / 65 WB, 95°F outdoor air temperature and 36,000 total supply CFM is 1,237 MBh total and 1,037 MBh sensible. Thus, a nominal 105 ton unit with standard capacity evaporator coil is selected.

### 2. Evaporator Coil Entering Conditions

*Mixed air dry bulb temperature determination:*

Using the minimum percent of OA (3,600 CFM ÷ 36,000 CFM = 10%), determine the mixture dry

bulb to the evaporator.

$$RADB + \% OA (OADB - RADB) = 78 + (0.10) (95 - 78) = 78 + 1.5 = 79.5^{\circ}\text{F}$$

*Approximate wet bulb mixture temperature:*

$$RAWB + \% OA (OAWB - RAWB) = 65 + (0.10) (76 - 65) = 65 + 1.1 = 66.1^{\circ}\text{F}$$

### 3. Determine Supply Fan Motor Heat Gain

Having selected a nominal 105 ton unit, the supply fan bhp can be calculated. The supply fan motor heat gain must be considered in final determination of unit capacity.

**Table 3. Determine unit total static pressure at design supply CFM:**

Supply Duct Static Pressure	2.2 inches
Evaporator Coil ( )	0.64 inches
Return Duct Negative Static Pressure	0.30
Heat Exchanger ( )	0.03
Throwaway Filter ( )	0.26
Economizer Damper <sup>(a)</sup> ( )	0.57
Unit Total Static Pressure	4.0

<sup>(a)</sup> Add either the economizer damper value or return damper value, depending on which static pressure is greater. (Do not use both.)

Using total of 36,000 CFM and total static pressure of 4.0 inches, enter 40.4 bhp with 1,097 rpm required for the 36" supply fan. Supply fan motor heat gain = 109.0 MBh, or  $109.0 \text{ MBh} \div 36000 \text{ CFM} \times 1.085 = 2.8^{\circ}\text{F}$  supply fan motor heat. See supply fan graph in [Figure 12, p. 86](#).

### 4. Determine Total Required Cooling Capacity

Required capacity = Total peak load + OA load + supply air fan motor heat

$$\text{Required capacity} = 980.0 + 154.0 + 109.0 = 1243.0 \text{ MBh (103.6 tons)}$$

### 5. Determine Unit Capacity

From , unit total capacity at 79.5 DB/66.1 WB entering the evaporator, 36,000 supply air CFM, 95°F outdoor ambient is 1,251 MBh (104.2 tons) with 996 MBh (83 tons) sensible capacity.

### 6. Determine Leaving Air Temperature

Unit sensible heat capacity corrected for supply air fan motor heat = 996 MBh sensible - 109.0 MBh motor heat = 887 MBh.

Supply air dry bulb temperature difference =

$$\frac{\text{Sensible Btu}}{1.085 \times \text{Supply CFM}} =$$

$$\text{Sensible Btu} = 887 \text{ MBh} / (1.085 \times 36,000 \text{ CFM}) = 23.0$$

$$\text{Supply air dry bulb} = 79.5 \text{ DB} - 23.0 = 56.5 \text{ leaving evaporator coil}$$

$$\frac{\text{Total Btu}}{4.5 \times \text{Supply CFM}} =$$

$$\text{Unit enthalpy difference} = 1,251 \text{ MBh} \div (4.5 \times 36,000 \text{ CFM}) = 7.72 \text{ Btu/lb.}$$

Leaving enthalpy = h (ent WB) - h (diff). From [Table 7, p. 47](#), h (ent WB) = 30.9 Btu/lb.

$$\text{Leaving enthalpy} = 30.9 \text{ Btu/lb.} - 7.72 \text{ Btu/lb.} = 23.18 \text{ Btu/lb.}$$

Supply air wet bulb = 54.9 leaving evaporator coil.

Leaving air temperature = 56.5 DB/54.9 WB

## Heating Capacity Selection

1. **Determine air temperature entering heating module**

Mixed air temperature = RADB + % OA (OADB - RADB) = 70 + (0.10) (0 - 70) = 63°F

Supply air fan motor heat temperature rise = 109000 Btu ÷ (1.085 x 36000 CFM) = 2.8°F

Air temperature entering heating module = 63.0 + 2.8 = 65.8°F

2. **Determine total winter heating load**

Total winter heating load = peak heating load + ventilation load - supply fan motor heat = 720 + 288.6 - 109.0 = 899.6 MBh

a. **Electric heating system**

Unit operating on 460/60/3 power supply.

From Table 47, p. 90, kW may be selected for a nominal 105 ton unit operating 460-volt power. The 265 kW heat module (904.4 MBh) will satisfy the winter heating load of 899.6 MBh.

Table 47, p. 90 shows an air temperature rise of 23.2°F for 36,000 CFM through the 265 kW heat module.

Unit supply temperature at design heating conditions = mixed air temperature + air temperature rise = 65.8°F + 23.2°F = 89.0°F.

b. **Gas heating system (natural gas)**

From select the high heat module (1,458 MBh output) to satisfy winter heating load of 899.6 MBh at unit CFM.

Table also shows an air temperature rise of 37.3°F for **36,000 CFM** through the heating module.

Unit supply temperature at design heating conditions = mixed air temperature + air temperature rise = 65.8°F + 37.3°F = 103.1°F.

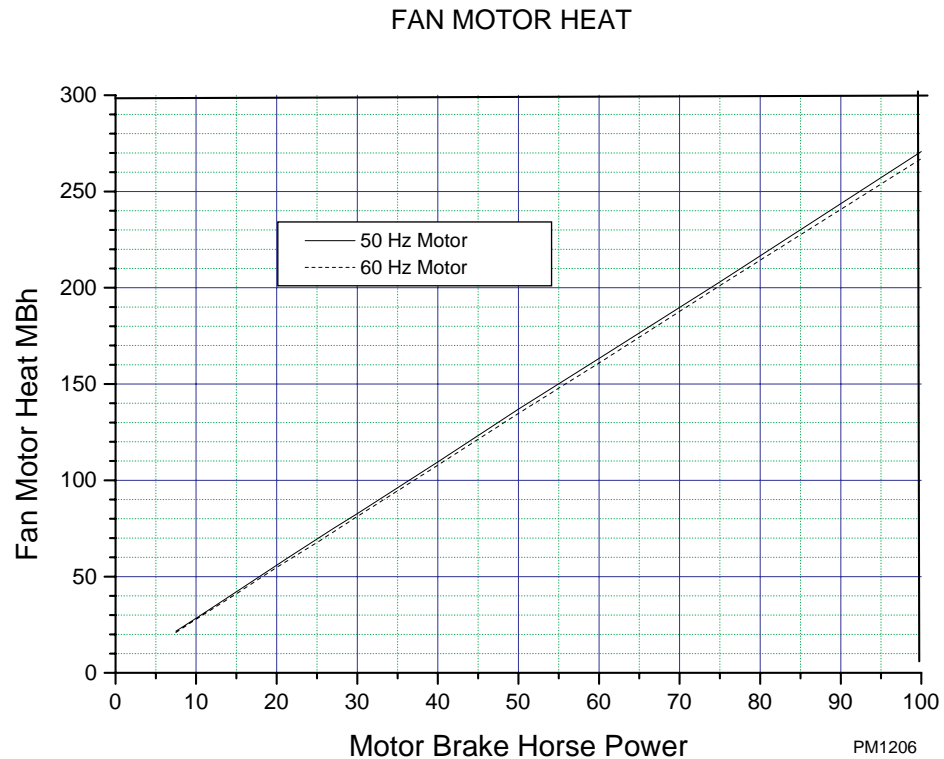
c. **Hot water heating system**

Assume a hot water supply temperature of 190°F and an entering coil temperature of 65.8°F.

Subtract the mixed air temperature from the hot water temperature to determine the ITD (initial temperature difference).

ITD = 190°F - 65.0°F = 125°F. Divide the winter heating load by ITD = 1008.6 MBh ÷ 125°F = 8.0 Q/ITD.

From , select the low heat module. By interpolation, a Q/ITD of 8.0 can be obtained at a gpm of 40.0. Water pressure drop at 40.0 gpm is 0.33 ft. of water.

**Figure 7. Fan motor heat**


Heat module temperature rise is determined by:

$$\frac{\text{Total Btu}}{1.085 \times \text{Supply CFM}} = \Delta T$$

$$\frac{1008600}{1.085 \times 36000} = 25.8$$

Unit supply air temperature = mixed air temperature + air temperature rise = 65.4 + 25.8 = 91.2° F.

**d. Steam heating system**

Assume a 15 psig steam supply.

From , the saturated temperature steam is 250°F. Subtract mixed air temperature from the steam temperature to determine ITD.

$$\text{ITD} = 250^\circ\text{F} - 65.0^\circ\text{F} = 185^\circ\text{F}.$$

Divide winter heating load by ITD = 1008.6 MBh ÷ 185°F = 5.45 Q/ITD.

From , select the low heat module. The low heat module at 36,000 CFM has a Q/ITD = 7.45.

$$\text{Heat module capacity, Q} = \text{ITD} \times \text{Q/ITD} = 185^\circ\text{F} \times 7.45 \text{ Q/ITD} = 1378 \text{ MBh}$$

Heat module air temperature rise is determined by:

$$\frac{\text{Total Btu}}{1.085 \times \text{Supply CFM}} = \Delta T$$

$$\frac{1378000}{1.085 \times 36000} = 35.3$$

Unit supply temperature at design conditions = mixed air temperature + air temperature rise =  $65.4^{\circ}\text{F} + 35.3^{\circ}\text{F} = 100.7^{\circ}\text{F}$ .

**e. Air delivery procedure**

Supply fan performance tables include internal resistance of rooftop. For total static pressure determination, system external static must be added to appropriate component static pressure drop (evaporator coil, filters, optional economizer, optional relief fan, optional heating system, optional cooling only extended casing).

**f. Supply fan motor sizing**

The supply fan motor selected in the cooling capacity determination was 40.4 bhp and 1,097 rpm. Thus, a 40 hp supply fan motor is selected.

Enter to select the proper drive. For a 105 ton rooftop with 40 hp motor, a drive letter A - 1,100 rpm is selected.

**g. Relief fan motor sizing**

The relief/return fan is selected based on total return system negative static pressure and relief fan CFM. Return system negative static includes return duct static, and any other job site applicable static pressure drop.

Return duct static pressure = 0.30 inches.

Total return system negative static pressure = 0.30 inches.

Exhaust fan CFM = 36,000 CFM

From the relief fan curve ([Figure 15, p. 88](#)), the required bhp is estimated at 21 bhp at 400 rpm. Thus, the relief fan motor selected is 25 hp.

To select a drive, enter for a 25 hp motor for a 105 ton unit. Drive selection number 4 - 400 rpm.

**h. Return fan motor sizing**

Return fan drive selection is shown on . The same static pressure and CFM considerations must be taken for return fan size, horsepower, and drive selection as are required for relief fan sizing. However, since the return fan runs continuously the sensible heat generated by the return fan motor must be included in the entering evaporator coil mixed air temperature equation.

In this selection, if the return motor bhp is equal to the relief motor bhp,  $21.44 \text{ bhp} = 58.1 \text{ MBh} \div (1.085 \times 36,000 \text{ Return CFM}) = 1.5^{\circ}\text{F}$  added to the return air temperature.

Where altitudes are significantly above sea level, use [Table 8, p. 48](#) and [Figure 8, p. 47](#) for applicable correction factors.

**i. Unit Electrical Requirements**

Selection procedures for electrical requirements for wire sizing amps, maximum fuse sizing, and dual element fuses are given in the electrical service section of this catalog.

**j. Altitude Corrections**

The rooftop performance tables and curves of this catalog are based on standard air (.075 lbs/ft). If the rooftop airflow requirements are at other than standard conditions (sea level), an air density correction is needed to project accurate unit performance.

[Figure 8, p. 47](#) shows the air density ratio at various temperatures and elevations. Trane rooftops are designed to operate between  $40^{\circ}$  and  $90^{\circ}\text{F}$  leaving air temperature. The procedure to use when selecting a supply or relief/return fan on a rooftop for elevations and temperatures other than standard is as follows:

- Determine the air density ratio using [Figure 8, p. 47](#).
- Divide the static pressure at the nonstandard condition by the air density ratio to obtain the corrected static pressure.
- Use the actual CFM and the corrected static pressure to determine the fan rpm and bhp from the rooftop performance tables or curves.

- The fan rpm is correct as selected.
- Bhp must be multiplied by the air density ratio to obtain the actual operating bhp.

In order to better illustrate this procedure, the following example is used: Consider a 90 ton rooftop unit that is to deliver 32,000 actual CFM at 3-inches total static pressure (tsp), 55°F leaving air temperature, at an elevation of 5,000 ft.

- From [Figure 8, p. 47](#), the air density ratio is 0.86.
- $Tsp = 3.0\text{-inches} / 0.86 = 3.49\text{ inches tsp}$ .
- From the supply fan curve [Figure 10, p. 85](#) a 90 ton rooftop will deliver 32,000 CFM at 3.49 inches TSP at 997 rpm and an estimated 30 bhp.
- $Bhp = 30 \times 0.86 = 25.8\text{ bhp actual}$ .
- The rpm is correct as selected - 997 rpm.

Compressor MBh, SHR, and kW should be calculated at standard and then converted to actual using the correction factors in [Table 8, p. 48](#). Apply these factors to the capacities selected at standard CFM so as to correct for the reduced mass flow rate across the condenser. Heat selections other than gas heat will not be affected by altitude. Nominal gas capacity (output) should be multiplied by the factors given in [Table 9, p. 48](#) before calculating the heating supply air temperature.

## Total Energy Recovery Wheel

Utilize Trane Select Assist (TSA) or contact the local Trane sales office to calculate required return air preheat temperature for the given minimum outdoor air temperature and return air relative humidity.

To calculate the supply and relief air conditions leaving the wheel, you must know the wheel effectiveness. Refer to for total effectiveness measurements.

**Note:** *The effectiveness numbers shown assume equal supply and relief airflows. If the airflows are unbalanced, the effectiveness changes. Use TSA to determine effectiveness values for these conditions.*

## Calculate Wheel Performance

Use the following equations to calculate supply air conditions. Use TSA to calculate relief air conditions and to obtain actual dry bulb temperature and enthalpy values for coil and equipment sizing.

1. Dry bulb temperature:

$$\text{Cooling: } T_{sa} = T_{oa} - (E \times (T_{oa} - T_{ra}))$$

$$\text{Heating: } T_{sa} = T_{oa} + (E \times (T_{ra} - T_{oa}))$$

where:

$T_{sa}$  = Dry bulb temperature of supply air (°F)

$T_{oa}$  = Dry bulb temperature of outside air (°F)

$T_{ra}$  = Dry bulb temperature of return air (°F)

E = Sensible Effectiveness

2. Enthalpy:

$$\text{Cooling: } H_{sa} = H_{oa} - (E \times (H_{oa} - H_{ra}))$$

$$\text{Heating: } H_{sa} = H_{oa} + (E \times (H_{ra} - H_{oa}))$$

where:

$H_{sa}$  = Enthalpy of supply air (Btu/ lb)

$H_{oa}$  = Enthalpy of outside air (Btu/ lb)

$H_{ra}$  = Enthalpy of return air (Btu/lb)

E = Total Effectiveness

After calculating these two points, use a psychrometric chart to obtain the supply air wet bulb temperature and/or grains moisture.

### 3. Energy wheel application example

In this example, a wheel sized for nominal 10,500 CFM will be used for the initial evaluation. The air pressure drop is 1.07 in. wg and the total effectiveness is 73% (see ). The total and latent effectiveness values are close to equal for Trane energy wheels. For this example, total effectiveness is assumed to be 73% in cooling mode and 75% in heating mode. TSA could be used to obtain the exact values.

#### a. Supply air conditions, cooling mode:

$$T_{sa} = T_{oa} - (E \times (T_{oa} - T_{ra})) = 95^{\circ}\text{F} - (.73 \times (95^{\circ}\text{F} - 75^{\circ}\text{F})) = 81^{\circ}\text{F}$$

$$H_{sa} = H_{oa} - (E \times (H_{oa} - H_{ra})) = 38.4 \text{ Btu/lb} - (.73 \times (38.4 \text{ Btu/lb} - 26.0 \text{ Btu/lb})) = 29.3 \text{ Btu/lb}$$

According to a psychrometric chart, the supply air wet bulb temperature is 64.4°F, 64 grains/lbm.

$$T_{sa} = T_{oa} + (E \times (T_{ra} - T_{oa})) = 10^{\circ}\text{F} + (.75 \times (70^{\circ}\text{F} - 10^{\circ}\text{F})) = 55^{\circ}\text{F}$$

$$H_{sa} = H_{oa} + (E \times (H_{ra} - H_{oa})) = 3.2 \text{ Btu/lb} + (.75 \times (22.7 \text{ Btu/lb} - 3.2 \text{ Btu/lb})) = 17.8 \text{ Btu/lb}$$

According to a psychrometric chart, the supply air wet bulb temperature is 45.5°F, 30 grains/lbm.

When designing the remainder of the air-handling system, remember to account for the air pressure drop imposed by the energy wheel.

## Hot Gas Reheat Selection

The hot gas reheat coil is designed to deliver maximum reheat temperatures. Contact the local Trane Sales Office or refer to the IntelliPak™ Trane Select Assist (TSA) program to determine leaving air temperature, latent capacity, reheat sensible capacity, leaving unit dew point, and moisture removal when the unit is in reheat operation. If the reheat setpoint is not obtainable at the provided conditions the customer will be required to make adjustments to the conditions or change the reheat setpoint value. Please note that reheat operation will not be allowed when there is a call for heating.



# Model Number Description

## DIGIT 1: Unit Type

**S** = Self-Contained (Packaged Rooftop)

## Digit 2 — Unit Function

**E** = DX Cooling, Electric Heat  
**F** = DX Cooling, Natural Gas Heat  
**L** = DX Cooling, Hot Water Heat  
**S** = DX Cooling, Steam Heat  
**X** = DX Cooling, No Heat, Extended Casing

## Digit 3 — System Type

**E** = DX Cooling, Electric Heat

## Digit 4 — Development Sequence

**E** = DX Cooling, Electric Heat

## Digit 5, 6, 7 — Nominal Capacity

**090** = 90 Ton Air-Cooled  
**105** = 105 Ton Air-Cooled  
**120** = 120 Ton Air-Cooled  
**130** = 130 Ton Air-Cooled  
**150** = 150 Ton Air-Cooled

## Digit 8 — Voltage Selection

**4** = 460/60/3  
**5** = 575/60/3  
**C** = 380/50/3

## Digit 9 — Heating Capacity Selection

**0** = No Heat  
**1** = Electric heat 90/56 kW 60/50 Hz  
**2** = Electric heat 140/88 kW 60/50 Hz  
**3** = Electric heat 265/166 kW 60/50 Hz  
**4** = Electric Heat 300/188 kW 60/50 Hz  
**A** = Low Gas Heat — 2-stage  
**B** = Medium Gas Heat — 2-stage  
**C** = High Gas Heat — 2-stage  
**D** = Low Gas Heat — Modulating  
**E** = Medium Gas Heat — Modulating  
**F** = High Gas Heat — Modulating  
**G** = Low Heat - 1.0" (25mm) Valve  
**H** = Low Heat - 1.25" (32mm) Valve  
**J** = Low Heat - 1.5" (38mm) Valve  
**K** = Low Heat - 2.0" (50mm) Valve  
**L** = Low Heat - 2.50" (64mm) Valve  
**M** = Low Heat - 3.0" (76mm) Valve  
**N** = High Heat - 1.0" (25mm) Valve  
**P** = High Heat - 1.25" (32mm) Valve  
**Q** = High Heat - 1.5" (38mm) Valve  
**R** = High Heat - 2.0" (50mm) Valve  
**T** = High Heat - 2.50" (64mm) Valve  
**U** = High Heat - 3.0" (76mm) Valve

## DIGIT 10, 11 — Design Sequence

## DIGIT 12 — Unit Configuration Selection

**1** = One-Piece Unit w/o Blank Section  
**2** = One-Piece Unit w/4' Blank Section  
**3** = One-Piece Unit w/8' Blank Section  
**4** = Two-Piece Unit w/o Blank Section  
**5** = Two-Piece Unit w/4' Blank Section  
**6** = Two-Piece Unit w/8' Blank Section

## DIGIT 13 — Supply/Return Airflow Direction

**1** = Downflow Supply/Upflow Return  
**2** = Downflow Supply/Horiz End Return  
**3** = Downflow Supply/Horiz Right Return  
**4** = Right Side Horiz Supply/Upflow Return  
**5** = Right Side Horiz Supply/Horizontal End Return  
**6** = Right Side Horiz Supply/Horizontal Right Return

## DIGIT 14 — Supply Fan Options

**1** = Standard CFM Supply Fan Motor(s)  
**3** = Standard CFM Supply Fan - TEFC High EFF Motor(s)  
**4** = Low CFM Supply Fan Motor(s)  
**6** = Low CFM Supply Fan - TEFC High EFF Motor (s)  
**7** = Standard CFM Supply Fan - w/ Internal Shaft Grounding  
**9** = Standard CFM Supply Fan - TEFC Motor and internal SGR  
**A** = Low CFM Supply Fan - w/ Internal Shaft Grounding  
**C** = Low CFM Supply Fan - TEFC Motor and internal SGR  
**D** = Standard CFM Fan Motor(s) and Piezometer  
**E** = Standard CFM Fan - TEFC Motor(s) and Piezometer  
**F** = Standard CFM Fan - ODP with SGR Motor(s) and Piezometer  
**G** = Standard CFM Fan - TEFC with SGR Motor(s) and Piezometer  
**H** = Low CFM Fan Motor(s) and Piezometer  
**J** = Low CFM Fan - TEFC Motor(s) and Piezometer  
**L** = Low CFM Fan - ODP with SGR Motor(s) and Piezometer  
**M** = Low CFM Fan - TEFC with SGR Motor(s) and Piezometer

## DIGIT 15 — Supply Fan Motor Selection

**F** = 15 hp  
**G** = 20 Hp  
**H** = 25 Hp  
**J** = 30 Hp  
**K** = 40 Hp  
**L** = 50 Hp  
**M** = 60 Hp  
**N** = 75 Hp  
**P** = 100 Hp

## DIGIT 16 — Supply Fan RPM Selection

**7** = 700  
**8** = 800  
**9** = 900  
**A** = 1000  
**B** = 1100  
**C** = 1200  
**D** = 1300  
**E** = 1400  
**F** = 1500  
**G** = 1600  
**H** = 1700  
**J** = 1800  
**K** = 1900  
**L** = 2000

## DIGIT 17 — Relief/Return Fan Options

**0** = None  
**5** = Std CFM Exhaust w/ VFD w/Bypass  
**6** = Low CFM Exhaust w/ VFD w/Bypass  
**7** = Std CFM Exhaust w/ VFD w/o Bypass  
**8** = Low CFM Exhaust w/ VFD w/o Bypass  
**C** = Std CFM Return w/ VFD w/ Bypass  
**D** = Low CFM Return w/ VFD w/ Bypass  
**E** = Std CFM Return w/ VFD w/o Bypass  
**F** = Low CFM Return w/ VFD w/o Bypass  
**G** = Std CFM Exhaust w/ VFD w/Bypass and Piezometer  
**H** = Low CFM Exhaust w/ VFD w/Bypass and Piezometer  
**J** = Std CFM Exhaust w/ VFD w/o Bypass and Piezometer  
**K** = Low CFM Exhaust w/ VFD w/o Bypass and Piezometer  
**L** = Std CFM Return w/ VFD w/ Bypass and Piezometer  
**M** = Low CFM Return w/ VFD w/ Bypass and Piezometer  
**N** = Std CFM Return w/ VFD w/o Bypass and Piezometer  
**P** = Low CFM Return w/ VFD w/o Bypass and Piezometer



### DIGIT 18 — Relief/Return Fan Motor Selection

0 = None  
 D = 7.5 Hp  
 E = 10 Hp  
 F = 15 Hp  
 G = 20 Hp  
 H = 25 Hp  
 J = 30 Hp  
 K = 40 Hp  
 L = 50 Hp  
 M = 60 Hp

### DIGIT 19 — Relief/Return RPM Selection

0 = None  
 3 = 300  
 4 = 400  
 5 = 500  
 6 = 600  
 7 = 700  
 8 = 800  
 9 = 900  
 A = 1000  
 B = 1100  
 C = 1200  
 D = 1300  
 E = 1400

### DIGIT 20 — System Control Selection

4 = VAV (Discharge Temp Control) w/ VFD Supply  
 5 = VAV(Discharge Temp Control) w/ VFD Supply w/ Bypass  
 6 = VAV ( Single Zone) w/VFD Supply  
 7 = VAV( Single Zone) w/VFD w/ Bypass

### DIGIT 21 — Fresh Air Options/Controls

A = 0-25% Motorized Damper  
 B = Economizer w/ Dry Bulb  
 C = Economizer w/ Reference Enthalpy  
 D = Economizer w/ Comparative Enthalpy  
 E = Econ w/ Fresh Air Measure/Dry Bulb  
 F = Econ w/ Fresh Air Measure/Ref Enthalpy  
 G = Econ w/ Fresh Air Measure/Comp Enthalpy  
 H = Econ w/ DCV/Dry Bulb<sup>(a)</sup>  
 J = Econ w/ DCV/Ref Enthalpy<sup>(a)</sup>  
 K = Econ w/ DCV/Comp Enthalpy<sup>(a)</sup>  
 L = Econ w/ Differential Dry Bulb  
 M = Econ w/ DVC/Differentail Dry Bulb<sup>(a)</sup>  
 N = Econ w/ Fresh Air Measure/DVC/Differerentail Dry Bulb<sup>(a)</sup>

### DIGIT 22 — Damper Option

0 = Standard  
 1 = Low Leak Damper(s)-AMCA Class 2, 10cfm/ft<sup>2</sup>  
 2 = Ultra Low Leak Damper(s)-AMCA Class 1, 4cfm/ft<sup>2</sup>  
 3 = Ultra Low Leak, AMCA 1A, Title 24

### DIGIT 23— Pre-Evaporator Coil Filter Selection

0 = Pre-Evap Filters-MERV 8, High Eff Filters  
 1 = Pre-Evap Filters-2" Rack/Less Filters  
 2 = Pre-Evap Filters-MERV 15 Bag Filters w/ Prefilters  
 3 = Pre-Evap Filters - Bag Filter Rack/Less Filters  
 4 = Pre-Evap Filters - MERV 14 Cartridge Filters w/ Prefilters  
 5 = Pre-Evap Filters - Cartridge Rack/Less Filters  
 6 = Pre-Evap Filters - MERV 14 Low PD Cartridge w/Prefilters  
 7 = Pre-Evap Filters - Low PD Cartridge Rack/Less Filters

### DIGIT 24 — Blank Section Application

#### Options

0 = None  
 A = Final MERV 15 Bag Filters w/ Prefilters  
 B = Final MERV 14 Low PD Cartridge Filters w/ Prefilters  
 C = Final MERV 14 , Cartridge Filters w/ Prefilters  
 D = Final MERV 14 High Temp Cartridge Filters w/ Prefilters  
 E = Final MERV 17 HEPA Filters w/ Prefilters  
 F = Final MERV 17 High Temp HEPA Filters w/ Prefilters

### DIGIT 25 — Energy Recovery Wheel

0 = None  
 1 = Low CFM ERW w/ Bypass Defrost  
 2 = Standard CFM ERW w/ Bypass Defrost

### DIGIT 26 — Unit Mounted Power Connection Selection

A = Terminal Block  
 B = Non-Fused Disconnect  
 C = Non-Fused Disconnect w/ Powered Convenience Outlet  
 D = Unit Disconnect Switch w/ high fault SCCR  
 E = Unit Disconnect Switch w/ high fault SCCR/ Powered Convenience Outlet

### DIGIT 27 — Condenser Coil Selection

0 =All Aluminum Air-Cooled Condenser Coil  
 J = Corrosion Protected Condenser Coil

### DIGIT 28 — Efficiency, Capacity, and Drain Pan Option

A = Standard Evap Coil w/ Stainless Steel Drain Pan  
 C = High Cap Evap Coil w/ Stainless Steel Drain Pan  
 W = eFlex™ w/ Std evap coil w/ SS drain pan  
 Z = eFlex™ w/ Hi cap evap coil w/ SS drain pan

### DIGIT 29 — Refrigeration System A

0 = Standard  
 A = Suction Service Valves  
 B = Replaceable Core Liquid Filter Driers  
 C = Suction Service Valves and Replaceable Core Liquid Filter Driers

### DIGIT 30 — Refrigeration System B

0 = Standard  
 1 = Modulating Hot Gas Reheat  
 2 = Hot Gas Bypass  
 3 = Modulating Hot Gas Reheat /Hot Gas By-Pass

### DIGIT 31 — Ambient Control Option

0 = Standard Ambient  
 1 = Low Ambient

### DIGIT 32 — Controls

0 = None  
 1 = Expansion Module  
 2 = Power Meter  
 3 = Expansion Module w/ Power Meter

### DIGIT 33 — Controls (continued)

0 = None  
 3 = Rapid Restart  
 4 = Filter Monitoring  
 5 = Rapid Restart w/ Filter Monitoring

<sup>(a)</sup> Requires CO<sub>2</sub> Sensor(s)



## Model Number Description

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### DIGIT 34 — Module Options

- 0 = None
- 1 = Modbus®
- 2 = Modbus® and Ventilation Override
- 3 = Air-Fi
- 4 = Air-Fi and Ventilation Override
- D = Ventilation Override
- F = LonTalk®
- L = LonTalk® and Ventilation Override
- M = BACnet®
- N = BACnet® and Ventilation Override
- W = BACnet® with Air-Fi
- Z = BACnet® Interface and Ventilation Override

### DIGIT 35 — Zone Sensor Option

- 0 = No Accessory Panel
- A = BAYSENS108 - Dual Setpoint w/Man/Auto Changover
- C = BAYSENS073 - Room Sensor w/ Timed Override and Cancel
- D = BAYSENS074 - Room Snsr w/ TO & Cancel and Local Stpt Adj
- M = BAYSENS800 - Programmable Zone Sensor

### DIGIT 36 — Agency Approval Option

- 0 = None
- 1 = cULus

### DIGIT 37 — Service Enhancements

- 0 = Single Side Access Door
- A = Dual Side Access Door
- B = Single Side Access Doors/ Marine Lights
- C = Dual Side Access Doors/ Marine Lights

### DIGIT 38 — Miscellaneous Options

- 0 = None
- 1 = Belt Guards
- 2 = Burglar Bars
- 3 = Belt Guards/Burglar Bars
- 4 = Isolation Damper Control
- 5 = Belt Guards/Isolation Damper Control
- 6 = Burglar Bars/Isolation Damper Control
- 7 = Belt Guards/Burglar Bars/Isolation Damper Control



# General Data

**Table 4. General data (all dimensions in inches)**

	90 Tons	105 Tons	120 Tons	130 Tons	150 Tons
<b>Compressor Data - Fixed Speed</b>					
Number/Size (Nominal)	4/20.8T	6/15.3T	2/20.8T,4/15.3T	6/20T	6/20.8T
Type	Scroll	Scroll	Scroll	Scroll	Scroll
Unit Capacity Steps	100/75/50/25	100/83/67/50/33/17	100/80/65/50/33/17	100/83/67/50/35/15	100/83/67/50/33/17
RPM	3450	3450	3450	3450	3450
No. of Circuits	2	2	2	2	2
<b>Compressor Data - eFlex™ Variable Speed (Air-Cooled Only)</b>					
Number/Size (Nominal)	1/6-25T,4/15.3T	1/6-25T,1/20.8T,3/15.3T	1/6-25T,1/26.2T,1/20.8T,2/15.3T	1/6-25T,1/32.2T,3/15.3T	1/6-25T,1/15.3T,1/20.8T,2/32.2T
Type	Scroll	Scroll	Scroll	Scroll	Scroll
Unit Capacity Steps	15-100	15-100	15-100	15-100	15-100
No. of Circuits	2	2	2	2	2
<b>Evaporator Coil - Standard</b>					
Dimensions	118x90	118x90	170x90	170x90	170x90
Size (ft <sup>2</sup> )	73.75	73.75	106.25	106.25	106.25
Rows/Fin Series	3/168	4/168	4/168	4/168	6/168
Tube Diameter	1/2	1/2	1/2	1/2	1/2
Surface	Enhanced	Enhanced	Enhanced	Enhanced	Enhanced
<b>Evaporator Coil - High Capacity</b>					
Dimensions	118x90	118x90	170x90	170x90	N/A
Size (ft <sup>2</sup> )	73.75	73.75	106.25	106.25	N/A
Rows/Fin Series	5/168	6/168	6/168	6/168	N/A
Tube Diameter	1/2	1/2	1/2	1/2	N/A
Surface	Enhanced	Enhanced	Enhanced	Enhanced	N/A
<b>Air-Cooled - Condenser Fans</b>					
Number/Size/Type	6/30/Prop	6/30/Prop	8/30/Prop	8/30/Prop	8/30/Prop
Hp (each)	1.5	1.5	1.5	1.5	1.5
<b>Air-Cooled - Condenser Coil</b>					
Size (ft <sup>2</sup> )	134	161	161	161	161
Rows/Fin Series	2/252	2/252	2/252	2/252	2/252
Type	Microchannel	Microchannel	Microchannel	Microchannel	Microchannel
<b>Supply Fans Standard CFM</b>					
Number/Size/Type	1/36/DW AF	1/36/DW AF	1/40/DW AF	1/40/DW AF	1/40/DW AF
Number of Motors	1	1	1	1	1
HP Range	15-60	20-75	20-75	20-100	20-100
CFM Range	20000-40000	23000-45000	27000-54000	29000-58000	29000-58000
Total SP Range-(In. WG)	7.5	7.5	7.5	7.5	7.5
<b>Supply Fans Low CFM</b>					
Number/Size/Type	1/25/DW AF <sup>(a)</sup>	1/32/DW AF	1/32/DW AF	1/32/DW AF	1/32/DW AF
Number of Motors	1	1	1	1	1
hp Range	15-50	15-60	15-60	20-60	20-60
CFM Range	16000-31000	19000-36000	21000-42000	23000-45000	23000-45000
ESP Range-(In. WG)	7.5	7.5	7.5	7.5	7.5
<b>Exhaust Fans Standard CFM</b>					
Number/Size/Type	1/28/DW AF	1/32/DW AF	1/32/DW AF	1/32/DW AF	1/32/DW AF
Number of Motors	1	1	1	1	1
hp Range	10-50	15-50	15-60	15-60	15-60
CFM Range	20000-36000	23000-40000	27000-48000	29000-52000	29000-52000
ESP Range-(In. WG)	2.5	2.5	2.5	2.5	2.5
<b>Exhaust Fans Low CFM</b>					
Number/Size/Type	1/25/DW FC	1/28/DW FC	1/28/DW FC	1/28/DW FC	1/28/DW FC
Number of Motors	1	1	1	1	1
hp Range	7.5-25	7.5-25	7.5-30	7.5-50	7.5-50
CFM Range	10000-28000	12000-33000	14000-37000	15000-41000	15000-41000
ESP Range-(In. WG)	2.5	2.5	2.5	2.5	2.5
<b>Return Fans Standard CFM</b>					
Number/Size/Type	1/40/Plenum AF	1/40/Plenum AF	1/44/Plenum AF	1/44/Plenum AF	1/44/Plenum AF
Number of Motors	1	1	1	1	1
hp Range	10-30	15-40	15-40	20-50	20-50
CFM Range	20000-40000	24000-44000	27000-51000	29000-54000	29000-54000



## General Data

**Table 4. General data (all dimensions in inches) (continued)**

	90 Tons	105 Tons	120 Tons	130 Tons	150 Tons
ESP Range-(In. WG)	2.5	2.5	2.5	2.5	2.5
<b>Return Fans Low CFM</b>					
Number/Size/Type	1/36.5/Plenum	1/36.5/Plenum	1/36.5/Plenum	1/36.5/Plenum	1/36.5/Plenum
Number of Motors	1	1	1	1	1
hp Range	7.5-20	10-25	10-40	15-40	15-40
CFM Range	16000-28000	19000-33000	21000-36000	23000-36000	23000-36000
ESP Range-(In. WG)	2.5	2.5	2.5	2.5	2.5
<b>Energy Recovery Standard CFM</b>					
Cassette Dimensions (LxWxH)	104x104x10	108x108x14	115x115x14	115x115x14	115x115x14
Wheel Segments	16	16	16	16	16
Motor (V/ph/Hz)	460/3/60 575/5/60	460/3/60 575/5/60	460/3/60 575/5/60	460/3/60 575/5/60	460/3/60 575/5/60
hp	0.33	0.33	0.33	0.33	0.33
Galv. Steel RA Filters - Number/Size	10/24x24x1	10/24x24x1	10/24x24x1	10/24x24x1	10/24x24x1
Galv. Steel FA Filters - Number/Size	8/24x24x1	8/24x24x1	8/24x24x1	8/24x24x1	8/24x24x1
CFM Range	8500-18000	9000-21000	10000-24000	13000-29000	13000-29000
<b>Energy Recovery Low CFM</b>					
Cassette Dimensions (LxWxH)	85x85x7.07	85x85x7.07	91x91x10	96x96x10	96x96x10
Wheel Segments	8	8	8	16	16
Motor (V/ph/Hz)	460/3/60 575/5/60	460/3/60 575/5/60	460/3/60 575/5/60	460/3/60 575/5/60	460/3/60 575/5/60
hp	0.25	0.25	0.25	0.25	0.25
Galv. Steel RA Filters - Number/Size	10/24x24x1	10/24x24x1	10/24x24x1	10/24x24x1	10/24x24x1
Galv. Steel FA Filters - Number/Size	8/24x24x1	8/24x24x1	6/24x24x1 2/12x24x1	6/24x24x1 2/12x24x1	6/24x24x1 2/12x24x1
CFM Range	8500-14000	9000-14000	9000-15000	9000-16000	9000-16000
<b>Electric Heat (60 Hz)</b>					
kW	90-265	90-265	140-300	140-300	140-300
Circuit Capacity Steps	30-37.5 kW	30-37.5 kW	35-37.5 kW	35-37.5 kW	35-37.5 kW
<b>Electric Heat (50 Hz)</b>					
kW	56-166	56-166	88-188	88-188	88-188
Circuit Capacity Steps	18-23.5 kW	18-23.5 kW	21.9-23.5 kW	21.9-23.5 kW	21.9-23.5 kW
<b>Natural Gas Heat</b>					
Low Heat Input (mbh)	850	850	1100	1100	1100
Medium Heat Input (mbh)	1100	1100	1800	1800	1800
High Heat Input (mbh)	1800	1800	2500	2500	2500
Low/Medium/High Heat - No. of Stages	2	2	2	2	2
Low Heat Modulating Turndown	10:1	10:1	20:1	20:1	20:1
Medium Heat Modulating Turndown	20:1	20:1	20:1	20:1	20:1
High Heat Modulating Turndown	20:1	20:1	20:1	20:1	20:1
Heat Exchanger Material	Stainless Steel	Stainless Steel	Stainless Steel	Stainless Steel	Stainless Steel
Gas Heat Steady State Efficiency% <sup>(b)</sup>	81	81	81	81	81
<b>Hot Water Coil</b>					
Size	33 x 88 x 2 rows	33 x 88 x 2 rows	33 x110 x 2 rows	33 x110 x 2 rows	33 x110 x 2 rows
Quantity	2	2	2	2	2
Type	5W, PrimaFlo	5W, PrimaFlo	5W, PrimaFlo	5W, PrimaFlo	5W, PrimaFlo
High Heat (fins/ft)	122	122	122	122	122
Low Heat (fins/ft)	80	80	80	80	80
<b>Steam Coil</b>					
Size	33 x 88 x 1 rows	33 x 88 x 1 rows	33 x110 x 1 rows	33 x110 x 1 rows	33 x110 x 1 rows
Quantity	2	2	2	2	2
Type	NS, SigmaFlo	NS, SigmaFlo	NS, SigmaFlo	NS, SigmaFlo	NS, SigmaFlo
High Heat (fins/ft)	112	112	112	112	112
Low Heat (fins/ft)	62	62	62	62	62
<b>Pre-Evap Filters</b>					
<b>Standard 2" High Efficiency Throwaway Filters</b>					
Number/Size	21-20 x 24 x 2 5-12 x 24 x 2	21-20 x 24 x 2 5-12 x 24 x 2	21-20 x 24 x 2 5-12 x 24 x 2	21-20 x 24 x 2 5-12 x 24 x 2	21-20 x 24 x 2 5-12 x 24 x 2
Face area (ft <sup>2</sup> )	80	80	93	93	93
<b>90-95% Bag Filters w/Perfilters</b>					
Number/Size	21-20 x 24 x 19 5-12 x 24 x 19	21-20 x 24 x 19 5-12 x 24 x 19	21-20 x 24 x 19 5-12 x 24 x 19	21-20 x 24 x 19 5-12 x 24 x 19	21-20 x 24 x 19 5-12 x 24 x 19
Face area(ft <sup>2</sup> )	80	80	80	80	80

**Table 4. General data (all dimensions in inches) (continued)**

	90 Tons	105 Tons	120 Tons	130 Tons	150 Tons
Number/Size (Prefilters)	21-20 x 24 x 2 5-12 x 24 x 2	21-20 x 24 x 2 5-12 x 24 x 2	21-20 x 24 x 2 5-12 x 24 x 2	21-20 x 24 x 2 5-12 x 24 x 2	21-20 x 24 x 2 5-12 x 24 x 2
<b>90-95% Cartridge Filters w/Perfilters</b>					
Number/Size	21-20 x 24 x 12 5-12 x 24 x 12	21-20 x 24 x 12 5-12 x 24 x 12	21-20 x 24 x 12 5-12 x 24 x 12	21-20 x 24 x 12 5-12 x 24 x 12	21-20 x 24 x 12 5-12 x 24 x 12
Face area (ft <sup>2</sup> )	80	80	80	80	80
Number/Size (Prefilters)	21-20 x 24 x 2 5-12 x 24 x 2	21-20 x 24 x 2 5-12 x 24 x 2	21-20 x 24 x 2 5-12 x 24 x 2	21-20 x 24 x 2 5-12 x 24 x 2	21-20 x 24 x 2 5-12 x 24 x 2
<b>90-95% Low Pressure Cartridge Filters w/Perfilters</b>					
Number/Size	21-20 x 24 x 12 5-12 x 24 x 12	21-20 x 24 x 12 5-12 x 24 x 12	21-20 x 24 x 12 5-12 x 24 x 12	21-20 x 24 x 12 5-12 x 24 x 12	21-20 x 24 x 12 5-12 x 24 x 12
Face area (ft <sup>2</sup> )	80	80	80	80	80
Number/Size (Prefilters)	21-20 x 24 x 2 5-12 x 24 x 2	21-20 x 24 x 2 5-12 x 24 x 2	21-20 x 24 x 2 5-12 x 24 x 2	21-20 x 24 x 2 5-12 x 24 x 2	21-20 x 24 x 2 5-12 x 24 x 2
<b>Post-Evap Filters</b>					
<b>90-95% Low Pressure Cartridge Filters w/Perfilters (c)</b>					
Number/Size	15-24 x 24 x 12 7-12 x 24 x 12	15-24 x 24 x 12 7-12 x 24 x 12	15-24 x 24 x 12 7-12 x 24 x 12	15-24 x 24 x 12 7-12 x 24 x 12	15-24 x 24 x 12 7-12 x 24 x 12
Face area (ft <sup>2</sup> )	74	74	74	74	74
Number/Size (Prefilters)	15-24 x 24 x 4 7-12 x 24 x 4	15-24 x 24 x 4 7-12 x 24 x 4	15-24 x 24 x 4 7-12 x 24 x 4	15-24 x 24 x 4 7-12 x 24 x 4	15-24 x 24 x 4 7-12 x 24 x 4
<b>90-95% Bag Filters w/Perfilter (d)</b>					
Number/Size	15-24 x 24 x 19 7-12 x 24 x 19	15-24 x 24 x 19 7-12 x 24 x 19	15-24 x 24 x 19 7-12 x 24 x 19	15-24 x 24 x 19 7-12 x 24 x 19	15-24 x 24 x 19 7-12 x 24 x 19
Face area (ft <sup>2</sup> )	74	74	74	74	74
Number/Size (Prefilters)	15-24 x 24 x 2 7-12 x 24 x 2	15-24 x 24 x 2 7-12 x 24 x 2	15-24 x 24 x 2 7-12 x 24 x 2	15-24 x 24 x 2 7-12 x 24 x 2	15-24 x 24 x 2 7-12 x 24 x 2
<b>90-95% Cartridge Filters (d)</b>					
Number/Size	15-24 x 24 x 12 7-12 x 24 x 12	15-24 x 24 x 12 7-12 x 24 x 12	15-24 x 24 x 12 7-12 x 24 x 12	15-24 x 24 x 12 7-12 x 24 x 12	15-24 x 24 x 12 7-12 x 24 x 12
Face area (ft <sup>2</sup> )	74	74	74	74	74
Number/Size (Prefilters)	15-24 x 24 x 2 7-12 x 24 x 2	15-24 x 24 x 2 7-12 x 24 x 2	15-24 x 24 x 2 7-12 x 24 x 2	15-24 x 24 x 2 7-12 x 24 x 2	15-24 x 24 x 2 7-12 x 24 x 2
<b>90-95% High Temp Cartridge Filters (e)</b>					
Number/Size	15-24 x 24 x 12 7-12 x 24 x 12	15-24 x 24 x 12 7-12 x 24 x 12	15-24 x 24 x 12 7-12 x 24 x 12	15-24 x 24 x 12 7-12 x 24 x 12	15-24 x 24 x 12 7-12 x 24 x 12
Face area (ft <sup>2</sup> )	74	74	74	74	74
Number/Size (Prefilters)	15-24 x 24 x 2 7-12 x 24 x 2	15-24 x 24 x 2 7-12 x 24 x 2	15-24 x 24 x 2 7-12 x 24 x 2	15-24 x 24 x 2 7-12 x 24 x 2	15-24 x 24 x 2 7-12 x 24 x 2
<b>HEPA Filters w/Perfilter (d)</b>					
Number/Size	15-24 x 24 x 12 7-12 x 24 x 12	15-24 x 24 x 12 7-12 x 24 x 12	15-24 x 24 x 12 7-12 x 24 x 12	15-24 x 24 x 12 7-12 x 24 x 12	15-24 x 24 x 12 7-12 x 24 x 12
Face area (ft <sup>2</sup> )	74	74	74	74	74
Number/Size (Prefilters)	15-24 x 24 x 2 7-12 x 24 x 2	15-24 x 24 x 2 7-12 x 24 x 2	15-24 x 24 x 2 7-12 x 24 x 2	15-24 x 24 x 2 7-12 x 24 x 2	15-24 x 24 x 2 7-12 x 24 x 2
<b>High Temp HEPA Cartridge Filters w/Perfilter (e)</b>					
Number/Size	15-24 x 24 x 12 7-12 x 24 x 12	15-24 x 24 x 12 7-12 x 24 x 12	15-24 x 24 x 12 7-12 x 24 x 12	15-24 x 24 x 12 7-12 x 24 x 12	15-24 x 24 x 12 7-12 x 24 x 12
Face area (ft <sup>2</sup> )	74	74	74	74	74
Number/Size (Prefilters)	15-24 x 24 x 2 7-12 x 24 x 2	15-24 x 24 x 2 7-12 x 24 x 2	15-24 x 24 x 2 7-12 x 24 x 2	15-24 x 24 x 2 7-12 x 24 x 2	15-24 x 24 x 2 7-12 x 24 x 2

(a) 90T unit with Gas Heat requires 32-inch supply fan for low CFM option

(b) Heating Performance is AHRI and DOE certified.

(c) Standard airflow application of cooling only units require High Efficiency Throwaway Prefilters with the 90-95% Low PD Cartridge Filter Options.

(d) Standard airflow application of cooling only units include 2-inch High Efficiency Throwaway Prefilters with the 90-95% Bag and HEPA Filter Options.

(e) Gas/Electric units require 2-inch High Efficiency High Temperature Rated Throwaway Prefilters with High Temperature Rated 90-95% Cartridge and HEPA filter options.

**Table 5. Gas heat inputs/input ranges/inlet sizes**

Two-Stage Gas Heat				Gas Heat Inlet Sizes (in.)
Standard Gas Heat Input (MBh)	Low Gas Heat Inputs (MBh)	High Fire Heat Input (MBh)	Modulating Gas Heat Range (MBh)	
850	425	850	85-850	1 1/4
1100	550	1100	55-1100	1 1/4



**General Data**

**Table 5. Gas heat inputs/input ranges/inlet sizes (continued)**

Two-Stage Gas Heat				
Standard Gas Heat Input (MBh)	Low Gas Heat Inputs (MBh)	High Fire Heat Input (MBh)	Modulating Gas Heat Range (MBh)	Gas Heat Inlet Sizes (in.)
1800	900	1800	90-1800	2
2500	1250	2500	125-2500	2

**Table 6. Economizer outdoor air damper leakage (at rated airflow)<sup>1</sup>**

Damper	Leakage Rate/CFM/ft <sup>2</sup>
Standard	20
Optional "Low Leak"	10 (Class 2 AMCA 511-99)
Optional "Ultra Low Leak"	4 (Class 1 AMCA 511-99)
Title 24 Ultra Low Leak	3 (Class 1A AMCA 511-99)

<sup>1</sup> Leakage/ft<sup>2</sup> at 1.0 in WC pressure difference



# Performance Adjustment Factors

Figure 8. Air density ratios

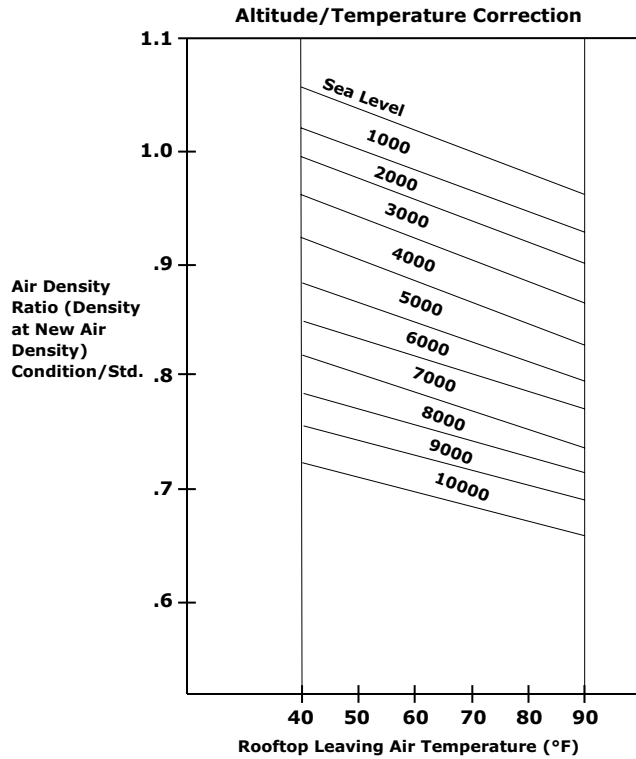


Table 7. Enthalpy of saturated air

Wet Bulb Temperature	Btu per Pound
41	15.70
43	16.66
42	16.17
43	16.66
44	17.15
45	17.65
46	18.16
47	18.68
48	19.21
49	19.75
50	20.30
51	20.86
52	21.44
53	22.02
54	22.62
55	23.22
56	23.84



## Performance Adjustment Factors

**Table 7. Enthalpy of saturated air (continued)**

Wet Bulb Temperature	Btu per Pound
57	24.48
58	25.12
59	25.78
60	26.46
61	27.15
62	27.85
63	28.57
64	29.31
65	30.06
66	30.83
67	31.62
68	32.42
69	33.25
70	34.09
71	34.95
72	35.83
73	36.74
74	37.66

**Table 8. Cooling capacity altitude correction factors**

	Altitude (ft.)							
	Sea Level	1000	2000	3000	4000	5000	6000	7000
Cooling Capacity Multiplier	1.00	0.99	0.99	0.98	0.97	0.96	0.95	0.94
KW Correction Multiplier (Compressors)	1.00	1.01	1.02	1.03	1.04	1.05	1.06	1.07
Sensible Heat Ratio Correction Multiplier	1.00	.98	.95	.93	.91	.89	.87	.85
Maximum Condenser Ambient	115°F	114°F	113°F	112°F	111°F	110°F	109°F	108°F

**Table 9. Gas heating capacity altitude correction factors**

	Sea Level to 2000	2001 to 2500	2501 to 3500	3501 to 4500	4501 to 5500	5501 to 6500	6501 to 7500
Capacity Multiplier	1.00	.92	.88	.84	.80	.76	.72

*Note: Correction factors are per ANSI Z223.1/NFPA 54. Local codes may supersede.*





# Performance Data

## Gross Cooling Capacities

### Air-Cooled, 60Hz, Standard and High Capacity Evaporator Coils

**Table 10. Gross cooling capacities – 90 tons – standard evaporator coil, 60Hz**

CFM	Ent DB (°F)	Ambient Temperature (°F)																													
		85						95						105						115											
		Entering Wet Bulb (°F)			73			67			61			73			67			61			73			67			61		
		CAP	SHC	SHC	CAP	SHC	SHC	CAP	SHC	SHC	CAP	SHC	SHC	CAP	SHC	SHC	CAP	SHC	SHC	CAP	SHC	SHC	CAP	SHC	SHC	CAP	SHC	SHC			
16000	75	889	635	995	526	1108	411	850	613	950	503	1055	387	806	589	899	478	996	361	758	563	844	452	932	333	844	452	932	333		
	80	891	726	996	618	1108	503	852	704	951	595	1056	479	808	680	901	570	997	453	760	654	846	544	933	426	846	544	933	426		
	85	892	817	997	709	1108	595	854	795	953	687	1056	572	810	771	902	662	998	546	763	740	848	635	933	518	848	635	933	518		
20000	75	899	899	999	800	1109	687	862	862	954	778	1057	663	821	821	904	753	999	638	781	781	850	726	935	610	850	726	935	610		
	80	952	713	1059	574	1171	427	906	688	1007	549	1110	401	856	662	949	521	1041	373	801	634	886	493	967	343	886	493	967	343		
	85	954	827	1061	689	1171	543	909	802	1009	664	1110	517	858	776	951	636	1042	488	804	748	888	608	968	459	888	608	968	459		
25000	75	960	935	1063	803	1172	658	916	910	1011	778	1111	632	867	867	953	751	1043	604	815	815	891	722	970	574	891	722	970	574		
	80	981	981	1065	917	1174	773	945	945	1013	892	1113	747	903	903	956	865	1045	719	856	856	894	836	971	689	894	836	971	689		
	85	1006	803	1113	627	1220	442	954	776	1054	600	1150	414	897	748	988	571	1073	384	835	718	918	540	991	352	918	540	991	352		
30000	75	1010	938	1116	770	1220	586	959	910	1057	743	1151	558	903	881	991	714	1075	528	843	843	920	683	992	496	920	683	992	496		
	80	1026	1026	1119	913	1222	730	978	978	1059	886	1153	702	931	931	994	857	1077	672	877	877	923	826	994	640	923	826	994	640		
	85	1075	1075	1123	1056	1225	874	1030	1030	1065	1019	1155	846	978	978	1001	988	1079	816	921	921	932	932	996	784	932	932	996	784		
33000	75	1044	889	1150	677	1251	454	987	860	1085	648	1175	425	924	830	1013	617	1092	393	858	786	937	585	1004	360	937	585	1004	360		
	80	1053	1048	1153	849	1252	628	998	998	1088	820	1177	598	938	938	1016	789	1094	567	875	875	940	757	1005	533	940	757	1005	533		
	85	1089	1089	1156	1020	1254	800	1039	1039	1091	992	1179	771	983	983	1021	947	1096	739	921	921	945	912	1006	706	945	912	1006	706		
36000	75	1144	1144	1166	1166	1256	972	1091	1091	1103	1103	1181	943	1031	1031	1032	1032	1098	911	964	964	965	965	1008	877	965	965	1008	877		
	80	1061	939	1166	705	1264	461	1002	898	1098	676	1186	431	937	865	1024	644	1100	399	869	831	945	611	1008	365	945	611	1008	365		
	85	1075	1075	1169	895	1266	652	1018	1018	1101	865	1187	622	957	957	1027	833	1102	589	895	895	947	800	1010	555	947	800	1010	555		
40000	75	1121	1121	1173	1083	1268	842	1068	1068	1107	1039	1190	811	1007	1007	1033	1005	1103	779	941	941	955	955	1011	745	955	955	1011	745		
	80	1177	1177	1188	1188	1270	1031	1120	1120	1121	1121	1192	1001	1055	1055	1056	1056	1105	968	982	982	983	983	1012	934	983	983	1012	934		
	85	1076	976	1179	734	1275	468	1015	945	1109	704	1194	437	948	911	1032	671	1106	404	878	875	951	637	1012	370	951	637	1012	370		
40000	80	1094	1094	1183	940	1277	676	1037	1037	1112	910	1196	645	977	977	1035	878	1107	612	912	912	954	827	1013	578	954	827	1013	578		
	85	1149	1149	1189	1130	1279	883	1092	1092	1120	1098	1198	852	1027	1027	1044	1044	1109	819	957	957	963	963	1014	784	963	963	1014	784		
	90	1205	1205	1206	1206	1281	1089	1143	1143	1144	1144	1200	1058	1073	1073	1074	1074	1111	1025	995	995	996	996	1019	968	996	996	1019	968		
40000	75	1094	1038	1194	771	1287	477	1030	1006	1121	740	1203	445	961	961	1041	707	1111	412	888	888	956	672	1015	377	956	672	1015	377		
	80	1120	1120	1197	1000	1289	708	1063	1063	1124	969	1205	676	999	999	1044	936	1113	642	929	929	960	880	1017	608	960	880	1017	608		
	85	1180	1180	1206	1206	1291	938	1118	1118	1134	1134	1207	906	1049	1049	1056	1056	1114	872	973	973	973	973	1019	838	973	973	1019	838		
90	1236	1236	1237	1237	1293	1167	1169	1169	1170	1170	1209	1135	1093	1093	1094	1094	1118	1076	1008	1008	1008	1009	1009	1024	1024	1009	1009	1024	1024		



Performance Data

Table 11. Gross cooling capacities – 90 tons eFlex™ variable speed – standard evaporator coil, 60Hz

CFM	Ent DB (°F)	Ambient Temperature (°F)																							
		85						95						105						115					
		Entering Wet Bulb (°F)			Entering Wet Bulb (°F)			Entering Wet Bulb (°F)			Entering Wet Bulb (°F)			Entering Wet Bulb (°F)			Entering Wet Bulb (°F)			Entering Wet Bulb (°F)					
		61	67	73	61	67	73	61	67	73	61	67	73	61	67	73	61	67	73						
16000	75	881	630	985	521	1098	406	846	611	945	501	1051	386	809	591	903	481	1001	365	772	572	859	461	947	342
	80	883	721	986	612	1098	498	847	702	946	593	1052	478	811	682	904	573	1002	457	774	663	861	553	948	435
	85	884	809	988	704	1099	590	849	790	948	684	1052	570	813	770	906	664	1002	549	777	750	862	644	949	527
	90	891	878	989	795	1100	682	859	850	949	775	1054	662	827	826	908	755	1004	641	794	794	864	735	950	618
20000	75	942	706	1049	568	1159	422	902	686	1003	547	1105	400	860	665	954	525	1046	376	817	644	903	503	981	352
	80	944	820	1051	683	1160	537	904	800	1005	662	1105	515	862	779	957	640	1046	492	820	754	906	618	982	467
	85	950	921	1053	797	1161	652	911	889	1007	776	1107	630	871	857	959	754	1048	607	833	827	908	732	984	582
	90	975	975	1055	911	1163	767	940	940	1010	890	1108	745	906	906	962	864	1050	721	869	869	911	841	985	696
25000	75	995	796	1102	621	1205	435	950	774	1050	598	1142	411	903	752	995	575	1075	386	854	729	937	551	1003	360
	80	999	933	1105	764	1206	579	955	911	1053	742	1144	556	909	880	998	718	1076	531	862	845	940	694	1004	504
	85	1019	1019	1107	907	1208	723	978	978	1055	884	1145	699	936	936	1001	861	1078	674	893	893	943	831	1006	648
	90	1065	1065	1112	1044	1210	866	1026	1026	1061	1017	1147	842	984	984	1008	979	1080	817	938	938	951	933	1008	791
30000	75	1032	881	1137	669	1231	445	983	853	1080	646	1163	421	932	829	1021	622	1092	396	880	804	957	597	1016	369
	80	1039	1008	1140	841	1233	618	994	972	1083	818	1165	594	947	940	1024	794	1094	569	899	899	960	768	1018	542
	85	1077	1077	1143	1006	1235	791	1036	1036	1087	982	1167	766	990	990	1028	957	1096	741	941	941	960	909	1019	714
	90	1133	1133	1153	1119	1237	962	1087	1087	1101	1085	1168	938	1037	1037	1045	1045	1098	912	981	981	983	983	1021	886
33000	75	1049	924	1152	698	1242	451	998	901	1093	674	1173	427	946	876	1031	649	1100	401	892	851	965	623	1022	375
	80	1063	1049	1155	886	1244	641	1017	1017	1097	863	1174	617	968	968	1034	838	1102	592	916	916	968	805	1024	565
	85	1109	1109	1160	1067	1246	831	1064	1064	1102	1042	1177	806	1015	1015	1036	987	1104	781	961	961	974	948	1025	754
	90	1164	1164	1177	1171	1248	1020	1115	1115	1122	1122	1179	995	1060	1060	1061	1061	1106	970	997	997	997	997	1027	932
36000	75	1063	972	1164	725	1251	457	1011	948	1104	701	1181	433	958	920	1040	676	1106	407	902	873	971	650	1027	381
	80	1085	1085	1168	931	1253	665	1036	1036	1107	907	1183	640	986	986	1043	882	1108	615	933	933	974	846	1028	588
	85	1136	1136	1166	1098	1256	872	1088	1088	1114	1074	1185	847	1035	1035	1050	1018	1110	821	976	976	984	976	1030	794
	90	1190	1190	1197	1197	1259	1078	1137	1137	1138	1138	1188	1043	1077	1077	1078	1078	1112	1016	1010	1010	1011	1011	1032	987
40000	75	1080	1032	1177	762	1262	466	1026	987	1114	737	1190	441	971	948	1048	712	1112	415	914	906	977	685	1032	388
	80	1107	1107	1181	983	1265	696	1059	1059	1118	957	1192	671	1008	1008	1051	930	1114	645	952	952	980	902	1033	618
	85	1165	1165	1190	1159	1267	926	1113	1113	1128	1116	1194	901	1056	1056	1064	1064	1117	875	991	991	991	994	1034	848
	90	1218	1218	1206	1206	1270	1144	1159	1159	1160	1160	1197	1117	1095	1095	1095	1095	1120	1080	1024	1024	1024	1024	1039	1016

**Table 12. Gross cooling capacities – 105 tons – standard evaporator coil, 60Hz**

CFM	Ent DB (°F)	Ambient Temperature (°F)																							
		85						95						105						115					
		Entering Wet Bulb (°F)			Entering Wet Bulb (°F)			Entering Wet Bulb (°F)			Entering Wet Bulb (°F)			Entering Wet Bulb (°F)			Entering Wet Bulb (°F)			Entering Wet Bulb (°F)					
		61	67	73	61	67	73	61	67	73	61	67	73	61	67	73	61	67	73						
19000	75	1039	745	1161	615	1291	477	1226	448	935	688	1044	557	1155	418	878	658	979	526	1079	386				
	80	1041	853	1163	724	1292	587	1226	558	937	796	1046	666	1155	527	880	766	982	636	1080	496				
	85	1044	961	1165	833	1292	696	1228	668	943	900	1048	775	1157	637	887	869	984	744	1082	605				
	90	1056	1056	1166	941	1294	805	1229	777	968	968	1050	883	1159	746	921	921	987	853	1084	714				
23000	75	1098	821	1223	662	1348	492	1274	461	981	760	1090	599	1194	428	918	728	1018	567	1110	394				
	80	1101	952	1225	793	1348	624	1275	593	985	888	1093	731	1195	561	923	852	1021	699	1112	527				
	85	1110	1078	1227	925	1350	757	1277	726	999	999	1096	863	1197	693	943	943	1024	830	1114	659				
	90	1147	1147	1230	1056	1352	889	1279	858	1049	1049	1100	995	1200	825	994	994	1030	954	1115	791				
28000	75	1152	910	1275	714	1393	505	1312	472	1022	845	1129	648	1224	438	953	811	1050	613	1132	403				
	80	1158	1063	1278	874	1395	667	1313	634	1032	996	1132	808	1226	600	965	961	1053	774	1134	564				
	85	1179	1179	1281	1034	1397	828	1316	795	1070	1070	1136	969	1228	760	1009	1009	1057	924	1136	725				
	90	1240	1240	1288	1186	1399	988	1318	955	1125	1125	1146	1117	1230	921	1060	1060	1069	1069	1137	885				
33000	75	1190	996	1311	763	1423	516	1336	482	1052	918	1154	694	1242	447	978	880	1069	658	1145	411				
	80	1203	1174	1315	952	1425	707	1338	673	1069	1069	1157	883	1244	637	1001	1001	1073	847	1146	600				
	85	1248	1248	1319	1141	1427	897	1340	862	1124	1124	1164	1059	1246	826	1055	1055	1080	1020	1147	790				
	90	1311	1311	1332	1316	1429	1085	1342	1051	1179	1179	1181	1181	1247	1015	1104	1104	1105	1105	1148	978				
38000	75	1220	1068	1337	810	1444	527	1352	492	1074	994	1171	739	1254	456	997	955	1082	702	1153	419				
	80	1240	1240	1341	1028	1446	746	1354	711	1106	1106	1174	957	1255	675	1036	1036	1086	905	1153	637				
	85	1302	1302	1349	1231	1448	965	1356	929	1165	1165	1184	1155	1256	892	1088	1088	1097	1097	1155	855				
	90	1365	1365	1367	1367	1451	1182	1358	1147	1217	1217	1218	1218	1259	1092	1132	1132	1132	1132	1159	1052				
43000	75	1244	1146	1357	857	1459	538	1363	502	1092	1069	1183	784	1262	465	1012	1012	1091	746	1157	427				
	80	1277	1277	1361	1103	1461	786	1365	750	1138	1138	1188	1012	1262	712	1061	1061	1095	971	1159	675				
	85	1344	1344	1372	1329	1463	1033	1366	996	1195	1195	1201	1201	1264	959	1111	1111	1110	1110	1161	921				
	90	1406	1406	1408	1408	1467	1279	1371	1222	1243	1243	1243	1243	1271	1181	1102	1102	1123	1123	1167	1139				
45000	75	1253	1177	1363	875	1464	542	1367	506	1098	1098	1187	801	1264	469	1017	1017	1093	763	1159	431				
	80	1291	1291	1367	1133	1466	802	1369	765	1148	1148	1192	1039	1265	727	1069	1069	1098	997	1161	690				
	85	1358	1358	1380	1368	1468	1060	1370	1023	1204	1204	1207	1207	1268	986	1117	1117	1117	1117	1163	948				
	90	1420	1420	1421	1421	1474	1298	1377	1258	1250	1250	1251	1251	1275	1217	1158	1158	1159	1159	1169	1169				



Performance Data

Table 13. Gross cooling capacities – 105 tons eFlex™ variable speed – standard evaporator coil, 60Hz

CFM	Ent DB (°F)	Ambient Temperature (°F)																																																
		85						95						105						115																														
		Entering Wet Bulb (°F)			73			Entering Wet Bulb (°F)			67			73			Entering Wet Bulb (°F)			61			67			73																								
		CAP	SHC	SHC	CAP	SHC	SHC	CAP	SHC	SHC	CAP	SHC	SHC	CAP	SHC	SHC	CAP	SHC	SHC	CAP	SHC	SHC	CAP	SHC	SHC	CAP	SHC	SHC																						
19000	75	1033	741	1153	611	1280	473	986	715	1100	585	1218	446	937	689	1044	557	1153	417	887	662	986	529	1083	388	80	1035	849	1155	720	1280	583	988	823	1102	693	1219	555	939	797	1046	666	1154	527	890	770	988	638	1084	497
	85	1039	958	1157	828	1281	692	992	930	1104	802	1220	664	945	900	1048	775	1155	636	896	873	991	747	1086	606	90	1051	1051	1158	936	1283	800	1009	1009	1106	910	1222	773	969	969	1050	883	1157	745	927	927	993	855	1088	715
	75	1091	817	1213	657	1334	486	1038	789	1153	628	1265	457	983	760	1090	599	1191	427	927	731	1025	569	1113	395	80	1094	948	1215	789	1335	619	1041	920	1155	760	1266	590	987	891	1093	731	1192	559	932	859	1028	701	1114	528
23000	85	1103	1073	1217	920	1337	751	1052	1043	1158	891	1268	722	1000	1000	1095	862	1194	691	950	950	1030	832	1116	660	90	1140	1140	1220	1051	1338	883	1095	1095	1162	1023	1270	853	1049	1049	1100	993	1196	823	999	999	1036	956	1117	791
	75	1143	905	1264	709	1377	499	1084	875	1197	678	1300	468	1023	845	1128	647	1219	436	961	814	1055	615	1132	403	80	1150	1058	1267	869	1378	660	1092	1027	1200	839	1302	629	1032	995	1131	807	1221	597	972	963	1058	775	1134	564
	85	1173	1173	1269	1028	1381	821	1121	1121	1203	998	1304	790	1069	1069	1134	967	1222	758	1014	1014	1062	935	1135	724	90	1232	1232	1277	1179	1383	981	1179	1179	1212	1148	1306	950	1124	1124	1144	1116	1224	918	1064	1064	1073	1072	1136	884
33000	75	1181	991	1299	757	1405	510	1117	955	1227	726	1322	478	1052	917	1152	693	1235	445	985	883	1074	660	1144	410	80	1193	1168	1302	946	1407	700	1132	1127	1230	914	1324	668	1069	1069	1155	882	1237	634	1007	1007	1077	848	1146	600
	85	1239	1239	1306	1134	1409	889	1183	1183	1236	1091	1326	857	1123	1123	1161	1057	1239	823	1060	1060	1084	1021	1147	789	90	1300	1300	1315	1288	1411	1077	1241	1241	1250	1250	1328	1045	1176	1176	1180	1180	1241	1012	1106	1106	1107	1107	1150	978
	75	1210	1062	1323	804	1424	520	1143	1028	1247	771	1337	487	1074	993	1168	738	1247	453	1004	957	1086	703	1152	419	80	1230	1230	1327	1021	1426	739	1168	1168	1251	988	1339	706	1106	1106	1172	955	1249	672	1040	1040	1089	912	1154	637
38000	85	1291	1291	1334	1223	1429	957	1229	1229	1260	1189	1342	924	1162	1162	1181	1153	1251	890	1091	1091	1099	1099	1155	854	90	1352	1352	1354	1354	1432	1174	1285	1285	1286	1286	1345	1141	1212	1212	1213	1213	1254	1098	1131	1131	1132	1132	1158	1050
	75	1233	1140	1342	850	1439	531	1163	1104	1262	817	1349	498	1092	1068	1180	782	1255	463	1018	1018	1018	746	1158	427	80	1266	1266	1345	1096	1442	779	1203	1203	1266	1054	1352	745	1136	1136	1184	1010	1257	710	1065	1065	1098	971	1158	674
	85	1331	1331	1356	1321	1445	1025	1264	1264	1278	1273	1354	991	1191	1191	1191	1197	1197	1259	956	1111	1111	1111	1111	1160	920	90	1391	1391	1392	1392	1449	1262	1317	1317	1318	1318	1359	1216	1237	1237	1238	1238	1264	1178	1150	1150	1151	1151	1167
45000	75	1241	1171	1348	869	1445	536	1171	1135	1267	835	1353	502	1098	1091	1183	800	1258	467	1023	1023	1095	763	1159	431	80	1280	1280	1352	1118	1448	795	1215	1215	1271	1074	1356	760	1146	1146	1188	1036	1260	725	1073	1073	1100	997	1159	689
	85	1345	1345	1364	1352	1450	1053	1275	1275	1285	1285	1358	1018	1200	1200	1202	1202	1261	983	1117	1117	1117	1117	1162	947	90	1403	1403	1405	1405	1456	1290	1327	1327	1328	1328	1364	1252	1245	1245	1246	1246	1268	1213	1157	1157	1158	1158	1169	1167
	75	1403	1403	1405	1405	1456	1290	1327	1327	1327	1327	1328	1328	1364	1252	1245	1245	1246	1246	1268	1213	1157	1157	1158	1158	1169	1167																							

**Table 14. Gross cooling capacities – 120 tons – standard evaporator coil, 60Hz**

CFM	Ent DB (°F)	Ambient Temperature (°F)																							
		85						95						105						115					
		Entering Wet Bulb (°F)			Entering Wet Bulb (°F)			Entering Wet Bulb (°F)			Entering Wet Bulb (°F)			Entering Wet Bulb (°F)			Entering Wet Bulb (°F)			Entering Wet Bulb (°F)					
		61	67	73	61	67	73	61	67	73	61	67	73	61	67	73	61	67	73						
21000	75	1174	813	1323	674	1483	527	1112	775	1254	635	1406	487	1046	734	1181	593	1323	444	975	691	1103	551	1236	401
	80	1175	933	1324	795	1484	649	1114	895	1256	756	1407	609	1048	854	1183	714	1324	566	978	812	1105	672	1237	523
	85	1178	1053	1326	915	1485	770	1117	1015	1258	876	1408	730	1052	974	1185	835	1326	688	982	933	1108	792	1239	644
26000	75	1186	1171	1327	1035	1487	891	1128	1128	1260	996	1410	851	1069	1069	1187	955	1328	809	1012	1012	1110	913	1241	765
	80	1257	913	1410	737	1567	549	1188	871	1332	694	1480	506	1113	827	1249	650	1386	461	1034	782	1162	604	1288	414
	85	1261	1062	1413	886	1568	700	1192	1020	1335	844	1481	657	1117	977	1252	800	1387	612	1039	932	1166	754	1290	565
31000	75	1268	1207	1415	1035	1570	850	1201	1165	1338	993	1484	807	1129	1122	1255	949	1390	762	1056	1056	1169	904	1292	716
	80	1307	1307	1419	1184	1572	999	1249	1249	1342	1142	1486	956	1185	1185	1260	1098	1392	911	1119	1119	1175	1053	1295	865
	85	1317	1005	1471	792	1621	564	1241	961	1386	748	1526	519	1160	915	1296	701	1423	472	1075	868	1202	654	1318	424
36000	75	1324	1183	1475	971	1623	744	1249	1140	1390	926	1528	699	1169	1088	1300	880	1426	652	1086	1040	1206	832	1320	604
	80	1343	1343	1478	1148	1625	922	1274	1274	1394	1104	1530	877	1206	1206	1304	1058	1428	830	1133	1133	1211	1011	1322	782
	85	1414	1414	1486	1327	1627	1100	1348	1348	1403	1283	1533	1055	1276	1276	1314	1229	1431	1008	1200	1200	1222	1181	1325	960
41000	75	1363	1093	1515	844	1657	576	1282	1048	1425	798	1556	530	1195	1000	1328	749	1448	482	1105	952	1229	700	1336	433
	80	1375	1294	1519	1051	1659	785	1296	1247	1429	1005	1558	738	1211	1199	1332	956	1450	690	1125	1125	1233	907	1338	640
	85	1422	1422	1525	1257	1662	992	1351	1351	1435	1212	1561	945	1274	1274	1340	1164	1452	897	1194	1194	1241	1115	1340	847
46000	75	1501	1501	1538	1456	1664	1198	1426	1426	1450	1409	1563	1152	1346	1346	1357	1357	1455	1103	1261	1261	1262	1262	1342	1054
	80	1399	1180	1548	893	1683	588	1313	1132	1453	845	1577	540	1222	1078	1351	796	1464	491	1129	1022	1247	745	1348	441
	85	1419	1407	1552	1128	1685	825	1337	1337	1457	1081	1579	777	1251	1251	1356	1031	1465	727	1169	1169	1252	981	1349	677
51000	75	1489	1489	1561	1364	1688	1060	1412	1412	1467	1317	1581	1013	1329	1329	1367	1256	1467	963	1241	1241	1264	1204	1349	912
	80	1569	1569	1581	1581	1691	1295	1487	1487	1490	1490	1584	1248	1398	1398	1400	1400	1470	1198	1303	1303	1305	1305	1352	1146
	85	1429	1255	1573	941	1702	599	1340	1204	1474	892	1592	551	1245	1152	1368	841	1475	500	1148	1098	1260	790	1356	449
54000	75	1459	1459	1578	1205	1705	864	1380	1380	1478	1156	1593	815	1295	1295	1374	1106	1476	764	1206	1206	1266	1054	1355	713
	80	1544	1544	1590	1457	1707	1128	1461	1461	1492	1407	1595	1079	1370	1370	1388	1354	1476	1028	1276	1276	1283	1283	1354	976
	85	1622	1622	1624	1624	1711	1392	1533	1533	1535	1535	1599	1343	1436	1436	1437	1437	1481	1292	1332	1332	1333	1333	1358	1222
51000	75	1454	1335	1592	988	1718	611	1362	1283	1489	938	1603	561	1264	1229	1380	886	1483	510	1165	1165	1268	834	1361	458
	80	1504	1504	1598	1281	1719	904	1420	1420	1496	1231	1604	854	1329	1329	1367	1179	1483	802	1234	1234	1277	1110	1358	749
	85	1588	1588	1614	1558	1722	1197	1499	1499	1513	1506	1605	1146	1402	1402	1407	1407	1483	1094	1300	1300	1299	1299	1357	1041
54000	75	1609	1609	1665	1665	1731	1491	1568	1568	1569	1569	1611	1439	1462	1462	1446	1446	1489	1366	1350	1350	1350	1350	1361	1308
	80	1468	1382	1602	1016	1725	617	1374	1330	1497	965	1609	567	1275	1275	1386	913	1487	515	1174	1174	1272	860	1363	463
	85	1527	1527	1608	1326	1728	928	1440	1440	1504	1276	1609	877	1346	1346	1394	1207	1486	825	1248	1248	1282	1151	1359	771
54000	85	1610	1610	1627	1617	1731	1239	1518	1518	1525	1525	1610	1187	1418	1418	1417	1417	1486	1134	1312	1312	1313	1313	1358	1080
	90	1684	1684	1686	1686	1742	1551	1445	1445	1585	1585	1618	1477	1474	1474	1475	1475	1492	1419	1356	1356	1357	1357	1363	1360



Performance Data

Table 15. Gross cooling capacities – 120 tons eFlex™ variable speed – standard evaporator coil, 60Hz

CFM	Ent DB (°F)	Ambient Temperature (°F)																							
		85						95						105						115					
		Entering Wet Bulb (°F)			Entering Wet Bulb (°F)			Entering Wet Bulb (°F)			Entering Wet Bulb (°F)			Entering Wet Bulb (°F)			Entering Wet Bulb (°F)			Entering Wet Bulb (°F)					
		61	67	73	61	67	73	61	67	73	61	67	73	61	67	73	61	67	73						
21000	75	1141	795	1286	657	1443	512	1082	758	1220	620	1372	474	1020	720	1153	581	1297	435	958	682	1084	543	1219	396
	80	1143	915	1287	777	1444	633	1084	877	1222	740	1372	595	1022	839	1155	701	1298	556	961	802	1087	663	1220	517
	85	1145	1034	1289	897	1445	754	1087	997	1224	859	1374	716	1026	957	1158	821	1299	677	966	919	1089	783	1222	638
26000	75	1157	1137	1290	1016	1447	874	1103	1096	1226	979	1375	836	1048	1048	1160	941	1301	797	997	997	1092	902	1224	758
	80	1220	893	1369	718	1527	535	1153	853	1296	678	1446	495	1085	813	1221	638	1362	453	1016	772	1144	597	1274	411
	85	1223	1041	1371	867	1528	685	1157	1001	1299	827	1447	645	1089	961	1224	787	1363	603	1021	918	1147	746	1276	561
31000	75	1232	1188	1374	1015	1531	834	1168	1141	1302	975	1450	794	1105	1087	1227	935	1366	753	1042	1040	1151	894	1279	711
	80	1276	1276	1378	1163	1533	983	1220	1220	1306	1124	1453	943	1162	1162	1232	1084	1369	902	1103	1103	1157	1043	1282	859
	85	1277	984	1428	774	1582	552	1205	942	1348	732	1494	510	1131	900	1267	689	1402	466	1055	858	1183	646	1306	422
36000	75	1284	1159	1432	951	1584	730	1213	1117	1352	909	1496	688	1140	1074	1271	867	1405	645	1067	1028	1187	824	1309	601
	80	1311	1303	1435	1128	1587	908	1245	1245	1357	1086	1499	866	1182	1182	1276	1044	1408	823	1117	1117	1193	1001	1313	779
	85	1380	1380	1444	1302	1590	1085	1317	1317	1366	1260	1502	1043	1252	1252	1286	1217	1411	1000	1184	1184	1206	1169	1315	956
41000	75	1321	1072	1471	826	1620	565	1244	1028	1387	782	1526	522	1165	984	1300	738	1428	477	1085	936	1211	693	1327	432
	80	1334	1271	1476	1031	1623	773	1259	1224	1391	988	1529	729	1183	1163	1304	944	1431	684	1110	1105	1216	899	1330	639
	85	1386	1386	1482	1237	1626	979	1319	1319	1398	1194	1532	935	1249	1249	1313	1145	1435	891	1178	1178	1225	1100	1333	845
46000	75	1465	1465	1497	1439	1629	1184	1396	1396	1415	1371	1536	1141	1323	1323	1335	1314	1438	1096	1248	1248	1253	1253	1336	1050
	80	1355	1153	1504	875	1647	578	1275	1108	1415	830	1548	533	1192	1062	1323	784	1446	487	1109	1010	1230	738	1340	440
	85	1378	1355	1509	1109	1650	813	1304	1298	1420	1065	1551	768	1227	1227	1329	1019	1449	723	1152	1152	1236	973	1343	675
51000	75	1452	1452	1519	1339	1653	1048	1380	1380	1432	1294	1554	1003	1304	1304	1342	1243	1452	957	1226	1226	1250	1195	1344	910
	80	1534	1534	1545	1525	1657	1282	1458	1458	1465	1465	1559	1237	1379	1379	1381	1381	1456	1191	1294	1294	1296	1296	1349	1144
	85	1384	1235	1529	923	1667	589	1300	1189	1436	877	1564	543	1215	1135	1341	830	1458	497	1129	1086	1244	783	1349	449
54000	75	1423	1423	1535	1186	1670	853	1345	1345	1443	1140	1567	807	1269	1269	1348	1094	1461	760	1189	1189	1251	1040	1350	712
	80	1507	1507	1550	1438	1673	1116	1429	1429	1459	1390	1570	1070	1348	1348	1366	1331	1463	1023	1263	1263	1273	1255	1351	974
	85	1589	1589	1592	1592	1679	1379	1507	1507	1509	1509	1576	1333	1420	1420	1422	1422	1470	1278	1327	1327	1315	1315	1357	1228
51000	75	1409	1311	1549	971	1683	601	1323	1262	1453	923	1577	554	1234	1203	1354	875	1468	507	1146	1133	1253	827	1354	458
	80	1465	1465	1556	1262	1686	893	1386	1386	1461	1209	1579	846	1303	1303	1363	1160	1469	798	1219	1219	1263	1110	1354	749
	85	1553	1553	1576	1530	1689	1185	1470	1470	1483	1460	1582	1137	1383	1383	1390	1387	1472	1089	1292	1292	1294	1294	1356	1040
54000	75	1633	1633	1635	1635	1698	1469	1544	1544	1546	1546	1590	1419	1450	1450	1452	1452	1479	1361	1348	1348	1349	1349	1363	1307
	80	1422	1358	1559	999	1690	608	1335	1299	1461	951	1583	561	1246	1229	1361	902	1472	512	1158	1158	1258	853	1357	463
	85	1488	1488	1568	1301	1694	918	1406	1406	1470	1252	1585	870	1322	1322	1371	1202	1473	821	1234	1234	1269	1143	1356	771
54000	85	1576	1576	1591	1557	1698	1227	1490	1490	1499	1493	1588	1178	1400	1400	1403	1403	1475	1129	1305	1305	1304	1304	1358	1079
	90	1655	1655	1657	1657	1709	1527	1563	1563	1564	1564	1597	1467	1464	1464	1465	1465	1484	1414	1357	1357	1358	1358	1366	1347











**Table 20. Gross cooling capacities – 90 tons – high capacity evaporator coil, 60Hz**

CFM	Ent DB (°F)	Ambient Temperature (°F)																										
		85						95						105						115								
		61			67			73			61			67			73			61			67			73		
		CAP	SHC	SHC	CAP	SHC	SHC	CAP	SHC	SHC	CAP	SHC	SHC	CAP	SHC	SHC	CAP	SHC	SHC	CAP	SHC	SHC	CAP	SHC	SHC			
16000	75	960	671	1073	562	1188	443	917	647	1023	536	1130	417	868	619	967	508	1066	388	816	591	908	479	998	358			
	80	961	762	1074	654	1188	536	918	738	1024	628	1131	509	869	710	969	600	1067	481	817	682	909	571	999	451			
	85	963	854	1075	745	1188	628	920	829	1025	719	1132	601	872	802	970	691	1068	573	820	771	911	662	1000	543			
20000	75	968	943	1076	836	1189	719	926	818	1027	719	1133	693	877	877	971	782	1069	665	839	839	913	753	1001	635			
	80	1029	750	1141	609	1247	456	978	722	1084	581	1182	428	921	692	1020	551	1109	397	862	662	952	520	1033	366			
	85	1031	864	1143	724	1248	571	980	836	1086	696	1183	543	924	807	1022	665	1110	513	865	776	955	634	1034	482			
25000	75	1036	975	1144	838	1249	686	987	947	1087	810	1184	658	932	917	1024	780	1112	628	876	876	957	748	1035	596			
	80	1061	1061	1146	952	1250	801	1018	1018	1090	924	1185	773	971	971	1027	894	1113	742	920	920	960	863	1036	711			
	85	1087	840	1195	660	1290	467	1029	810	1131	630	1218	437	966	778	1060	598	1138	406	900	745	985	566	1055	374			
30000	75	1092	983	1197	803	1292	611	1035	948	1133	773	1219	581	973	915	1062	741	1139	550	908	881	988	709	1056	517			
	80	1107	1107	1199	946	1292	754	1057	1057	1135	916	1220	725	1003	1003	1065	884	1140	693	945	945	991	852	1056	660			
	85	1159	1159	1204	1089	1293	897	1109	1109	1141	1053	1221	868	1052	1052	1071	1020	1141	836	990	990	990	985	1056	803			
33000	75	1127	925	1229	707	1317	476	1064	894	1160	676	1239	446	996	854	1084	643	1155	414	925	818	1004	609	1068	381			
	80	1136	1089	1231	879	1317	649	1076	1057	1162	848	1240	618	1010	1010	1086	815	1155	586	945	945	1006	781	1066	553			
	85	1176	1176	1235	1050	1318	820	1120	1120	1166	1016	1240	790	1058	1058	1090	977	1154	757	992	992	1012	941	1065	724			
36000	75	1229	1229	1244	1212	1318	992	1170	1170	1177	1177	1241	961	1104	1104	1104	1104	1155	929	1032	1032	1033	1033	1065	895			
	80	1145	974	1244	735	1328	482	1080	943	1172	703	1248	452	1010	899	1093	670	1162	419	936	862	1012	635	1073	386			
	85	1158	1154	1246	923	1328	671	1096	1096	1174	892	1248	641	1033	1033	1096	858	1161	608	967	967	1014	824	1070	574			
40000	75	1208	1208	1251	1103	1328	860	1149	1149	1180	1070	1248	829	1083	1083	1102	1034	1160	796	1012	1012	1021	998	1068	762			
	80	1260	1260	1264	1264	1329	1048	1197	1197	1198	1198	1249	1018	1125	1125	1126	1126	1126	1160	984	1048	1048	1041	1068	937			
	85	1160	1015	1256	762	1337	488	1094	981	1182	730	1256	457	1021	944	1101	696	1167	424	946	907	1017	661	1076	391			
40000	75	1179	1179	1258	967	1336	694	1120	1120	1184	935	1254	663	1054	1054	1103	901	1165	629	984	984	1020	855	1072	595			
	80	1235	1235	1264	1161	1336	900	1172	1172	1191	1128	1253	868	1102	1102	1111	1091	1163	835	1026	1026	1029	1029	1069	801			
	85	1285	1285	1286	1286	1337	1105	1217	1217	1218	1218	1254	1074	1141	1141	1142	1142	1142	1164	1026	1058	1058	1059	1070	988			
40000	75	1178	1076	1268	798	1347	496	1109	1042	1192	765	1263	464	1034	1004	1109	731	1173	431	957	957	1022	695	1080	397			
	80	1209	1209	1270	1026	1345	725	1146	1146	1194	983	1261	693	1076	1076	1112	945	1169	659	1002	1002	1026	907	1073	624			
	85	1264	1264	1279	1239	1346	954	1196	1196	1204	1204	1259	921	1121	1121	1122	1122	1166	887	1041	1041	1041	1041	1070	852			
40000	75	1311	1311	1312	1312	1352	1170	1238	1238	1239	1239	1264	1134	1156	1156	1156	1156	1171	1096	1068	1068	1068	1068	1076	1058			



Performance Data

Table 21. Gross cooling capacities – 90 tons eFlex™ variable speed – high capacity evaporator coil, 60Hz

CFM	Ent DB (°F)	Ambient Temperature (°F)																							
		85						95						105						115					
		Entering Wet Bulb (°F)			73			Entering Wet Bulb (°F)			67			73			Entering Wet Bulb (°F)			67			73		
		CAP	SHC	SHC	CAP	SHC	SHC	CAP	SHC	SHC	CAP	SHC	SHC	CAP	SHC	SHC	CAP	SHC	SHC	CAP	SHC	SHC	CAP	SHC	SHC
16000	75	945	667	1056	557	1172	440	905	645	1011	535	1121	417	864	622	965	512	1067	393	822	600	917	489	1010	369
	80	946	758	1056	649	1172	533	906	735	1012	626	1121	509	865	713	965	603	1067	486	823	690	918	580	1010	461
	85	947	849	1056	740	1172	624	907	825	1012	718	1121	601	867	802	966	695	1067	578	826	780	919	672	1011	553
20000	75	955	926	1057	831	1173	716	919	899	1013	808	1122	693	882	871	967	785	1068	669	846	845	920	762	1011	644
	80	1013	746	1125	606	1234	455	968	723	1074	582	1176	430	921	698	1020	557	1115	405	874	674	764	532	1049	379
	85	1014	860	1126	720	1234	570	969	836	1075	696	1176	546	923	810	1021	671	1115	520	877	786	967	646	1050	494
25000	75	1019	971	1127	834	1235	685	977	936	1076	810	1177	660	935	906	1023	785	1116	635	892	874	968	760	1050	609
	80	1047	1047	1128	948	1235	799	1010	1010	1078	924	1178	775	971	971	1025	897	1116	749	931	931	971	872	1051	723
	85	1071	837	1182	659	1278	466	1021	812	1125	634	1214	441	969	787	1065	608	1146	415	917	759	1004	582	1074	388
30000	75	1076	977	1183	802	1278	610	1026	952	1126	777	1214	585	976	925	1067	751	1146	559	926	885	1005	724	1074	532
	80	1098	1082	1184	944	1278	753	1052	1051	1128	919	1215	728	1007	1007	1069	891	1147	702	961	961	1008	864	1074	675
	85	1148	1148	1189	1084	1278	896	1103	1103	1134	1059	1215	871	1057	1057	1077	1018	1147	845	1007	1007	1020	981	1074	817
33000	75	1112	921	1217	708	1303	476	1058	895	1157	682	1235	451	1003	868	1094	656	1164	425	947	841	1028	629	1089	398
	80	1124	1071	1219	879	1304	649	1073	1035	1158	853	1235	623	1021	999	1095	827	1164	597	968	963	1029	800	1088	569
	85	1165	1165	1222	1046	1304	820	1118	1118	1162	1020	1235	795	1067	1067	1100	993	1164	768	1014	1014	1035	966	1087	741
36000	75	1219	1219	1235	1185	1304	991	1168	1168	1179	1146	1235	966	1114	1114	1119	1108	1164	940	1055	1055	1056	1056	1088	907
	80	1132	971	1233	736	1316	483	1076	944	1171	710	1246	457	1019	917	1106	684	1173	431	961	890	1038	656	1096	404
	85	1151	1118	1234	924	1316	672	1099	1083	1172	898	1246	646	1045	1045	1107	868	1172	620	991	991	1040	840	1094	592
40000	75	1199	1199	1239	1108	1316	861	1148	1148	1178	1081	1245	835	1095	1095	1114	1052	1171	808	1037	1037	1048	1000	1093	781
	80	1250	1250	1258	1235	1316	1049	1196	1196	1188	1187	1246	1018	1137	1137	1138	1138	1172	991	1072	1072	1073	1073	1093	962
	85	1149	1020	1245	764	1327	489	1092	993	1182	738	1255	463	1033	962	1115	711	1180	437	974	924	1046	683	1101	410
40000	75	1175	1165	1247	969	1326	696	1121	1121	1183	939	1254	670	1067	1067	1117	911	1178	643	1012	1012	1048	883	1099	615
	80	1227	1227	1253	1168	1325	901	1173	1173	1191	1127	1253	875	1116	1116	1128	1079	1177	849	1055	1055	1061	1036	1097	821
	85	1275	1275	1277	1277	1326	1101	1217	1217	1218	1218	1254	1074	1154	1154	1153	1153	1178	1046	1084	1084	1085	1085	1098	1017
40000	75	1168	1082	1258	801	1338	498	1110	1048	1193	775	1264	472	1051	1004	1125	748	1188	445	991	961	1054	720	1107	418
	80	1202	1202	1260	1023	1336	727	1149	1149	1196	996	1262	701	1093	1093	1128	968	1185	674	1033	1033	1057	939	1104	646
	85	1256	1256	1270	1209	1335	955	1199	1199	1208	1170	1260	929	1138	1138	1143	1129	1183	902	1071	1071	1072	1072	1102	867
90	1300	1300	1300	1300	1336	1176	1237	1237	1237	1237	1238	1238	1148	1171	1171	1172	1172	1185	1120	1096	1096	1097	1097	1103	1058

**Table 22. Gross cooling capacities – 105 tons – high capacity evaporator coil, 60Hz**

CFM	Ent DB (°F)	Ambient Temperature (°F)																							
		85						95						105						115					
		61		67		73		61		67		73		61		67		73		61		67		73	
		CAP	SHC	CAP	SHC	CAP	SHC	CAP	SHC	CAP	SHC	CAP	SHC	CAP	SHC	CAP	SHC	CAP	SHC	CAP	SHC	CAP	SHC	CAP	SHC
19000	75	1081	766	1207	636	1338	496	1028	736	1148	606	1271	466	971	705	1084	575	1199	435	912	674	1019	543	1125	403
	80	1082	874	1209	745	1339	606	1030	845	1150	715	1272	576	974	814	1086	684	1200	544	915	782	1021	652	1126	512
	85	1086	982	1210	853	1340	715	1034	963	1152	823	1273	685	978	919	1088	792	1202	654	921	888	1023	761	1127	622
23000	75	1094	989	1212	961	1341	824	1049	1049	1154	932	1275	794	1004	1004	1091	900	1203	762	956	956	1026	869	1129	731
	80	1143	842	1271	682	1394	509	1084	811	1205	650	1320	477	1021	778	1134	617	1240	444	957	745	1061	584	1158	411
	85	1146	973	1273	814	1395	642	1088	942	1207	782	1321	610	1026	910	1137	749	1242	577	961	872	1064	716	1160	544
28000	75	1153	1101	1275	945	1396	774	1097	1070	1209	913	1322	742	1037	1036	1139	880	1243	709	982	982	1067	847	1162	676
	80	1191	1191	1278	1076	1398	905	1142	1142	1213	1045	1324	874	1089	1089	1143	1012	1245	841	1034	1034	1072	974	1163	807
	85	1199	932	1324	734	1438	521	1134	898	1252	700	1357	488	1064	864	1174	666	1271	454	994	829	1095	631	1183	420
33000	75	1206	1087	1327	894	1439	682	1141	1053	1255	861	1358	649	1073	1017	1177	826	1272	615	1004	981	1098	791	1184	581
	80	1227	1227	1330	1054	1440	843	1173	1173	1258	1021	1359	810	1113	1113	1181	986	1273	775	1052	1052	1103	945	1185	741
	85	1290	1290	1337	1208	1442	1002	1233	1233	1265	1174	1361	969	1171	1171	1190	1138	1274	935	1106	1106	1113	1102	1186	901
38000	75	1240	1017	1360	782	1466	531	1170	983	1283	747	1380	498	1095	939	1201	711	1289	463	1020	901	1117	676	1198	428
	80	1252	1199	1363	970	1467	721	1184	1163	1286	936	1381	687	1113	1113	1204	900	1290	652	1046	1046	1120	864	1197	617
	85	1300	1300	1368	1159	1468	909	1239	1239	1291	1117	1381	876	1172	1172	1210	1080	1290	840	1103	1103	1127	1042	1196	805
43000	75	1363	1363	1379	1338	1469	1098	1298	1298	1304	1302	1383	1064	1227	1227	1229	1229	1291	1029	1153	1153	1154	1154	1197	993
	80	1271	1093	1386	828	1486	541	1197	1055	1304	793	1396	507	1119	1016	1218	756	1302	472	1041	976	1131	720	1207	437
	85	1291	1291	1389	1045	1486	759	1225	1225	1307	1010	1395	724	1156	1156	1222	973	1300	689	1084	1084	1135	926	1204	653
45000	75	1355	1355	1396	1251	1489	977	1288	1288	1316	1215	1395	941	1215	1215	1231	1176	1299	905	1139	1139	1145	1137	1202	870
	80	1416	1416	1418	1418	1493	1195	1344	1344	1345	1345	1399	1159	1265	1265	1266	1266	1303	1110	1182	1182	1183	1183	1206	1071
	85	1295	1170	1404	874	1501	552	1219	1132	1319	838	1408	517	1138	1091	1230	800	1311	481	1057	1051	1140	763	1214	446
45000	75	1332	1332	1408	1119	1504	799	1263	1263	1323	1072	1406	763	1189	1189	1235	1032	1307	726	1112	1112	1145	992	1208	690
	80	1397	1397	1418	1349	1506	1045	1324	1324	1335	1311	1408	1009	1245	1245	1248	1248	1308	972	1162	1162	1163	1163	1209	936
	85	1455	1455	1456	1456	1512	1278	1376	1376	1377	1377	1414	1239	1289	1289	1290	1290	1314	1198	1201	1201	1202	1202	1213	1158
45000	75	1304	1201	1410	892	1507	556	1226	1162	1324	856	1411	521	1145	1121	1234	818	1314	485	1064	1064	1143	780	1216	449
	80	1347	1347	1414	1138	1509	815	1276	1276	1329	1099	1411	778	1200	1200	1239	1059	1310	741	1121	1121	1148	1018	1210	705
	85	1411	1411	1425	1388	1512	1073	1336	1336	1342	1342	1413	1036	1255	1255	1255	1255	1311	999	1170	1170	1170	1170	1211	944
90	1468	1468	1469	1469	1518	1315	1386	1386	1387	1387	1387	1419	1275	1298	1298	1299	1299	1317	1234	1208	1208	1208	1208	1215	1192



Performance Data

Table 23. Gross cooling capacities – 105 tons eFlex™ variable speed – high capacity evaporator coil, 60Hz

CFM	Ent DB (°F)	Ambient Temperature (°F)																							
		85						95						105						115					
		Entering Wet Bulb (°F)						Entering Wet Bulb (°F)						Entering Wet Bulb (°F)						Entering Wet Bulb (°F)					
		61	67	73	79	85	91	61	67	73	79	85	91	61	67	73	79	85	91	61	67	73	79	85	91
19000	75	1074	762	1198	632	1326	491	1025	734	1143	603	1263	463	973	706	1085	575	1198	434	922	678	1027	547	1129	405
	80	1076	870	1200	740	1326	601	1026	842	1144	712	1264	573	976	814	1087	684	1199	544	924	786	1029	655	1130	514
	85	1079	978	1201	848	1327	710	1030	951	1146	820	1265	682	980	921	1089	792	1200	653	930	892	1031	763	1131	623
23000	75	1089	1078	1203	956	1328	818	1046	1046	1148	928	1267	790	1004	1004	1091	900	1202	761	962	962	1033	872	1133	732
	80	1135	838	1260	677	1379	503	1080	808	1198	647	1310	474	1023	778	1134	617	1237	444	965	749	1067	586	1161	412
	85	1138	969	1262	808	1380	636	1083	939	1200	779	1311	606	1027	910	1136	748	1239	576	970	878	1070	718	1162	545
28000	75	1145	1096	1264	939	1381	767	1092	1067	1203	910	1312	738	1039	1028	1139	880	1240	708	988	988	1073	849	1164	676
	80	1183	1183	1267	1070	1382	899	1137	1137	1206	1041	1314	869	1089	1089	1143	1011	1242	839	1039	1039	1078	978	1165	808
	85	1189	926	1312	728	1420	514	1128	895	1244	697	1344	484	1065	863	1173	665	1266	453	1002	832	1101	633	1184	420
33000	75	1196	1082	1314	888	1421	675	1135	1049	1246	857	1346	644	1074	1017	1176	825	1267	613	1012	984	1104	793	1184	581
	80	1219	1219	1317	1047	1422	835	1167	1167	1250	1016	1347	804	1113	1113	1180	985	1268	773	1057	1057	1108	949	1185	740
	85	1280	1280	1324	1201	1423	994	1226	1226	1257	1169	1348	964	1169	1169	1189	1136	1269	932	1109	1109	1118	1103	1185	900
38000	75	1229	1012	1346	775	1446	524	1163	976	1274	743	1366	493	1095	938	1199	710	1284	461	1028	904	1121	677	1197	428
	80	1241	1192	1348	963	1448	714	1177	1159	1276	931	1367	682	1114	1108	1202	899	1283	649	1052	1052	1124	865	1196	616
	85	1289	1289	1353	1148	1450	902	1232	1232	1282	1112	1368	870	1171	1171	1208	1078	1284	838	1107	1107	1131	1042	1196	804
43000	75	1350	1350	1364	1330	1452	1090	1289	1289	1295	1283	1370	1058	1225	1225	1226	1226	1286	1026	1155	1155	1156	1156	1198	993
	80	1259	1086	1370	821	1467	535	1190	1051	1294	788	1382	502	1119	1015	1216	755	1295	470	1047	978	1134	720	1201	435
	85	1281	1277	1373	1038	1469	753	1217	1217	1297	1005	1383	720	1155	1155	1219	972	1295	687	1089	1089	1138	931	1204	653
45000	75	1343	1343	1380	1243	1471	970	1279	1279	1305	1209	1384	937	1212	1212	1228	1173	1295	903	1141	1141	1147	1135	1204	869
	80	1400	1400	1402	1402	1476	1188	1333	1333	1334	1334	1388	1148	1260	1260	1261	1261	1298	1107	1181	1181	1182	1182	1206	1069
	85	1283	1164	1387	867	1483	546	1211	1127	1309	833	1395	513	1138	1090	1227	799	1305	479	1063	1051	1143	764	1205	443
45000	75	1320	1320	1390	1106	1486	793	1255	1255	1312	1066	1395	758	1187	1187	1231	1030	1303	724	1116	1116	1147	992	1207	689
	80	1383	1383	1400	1341	1488	1039	1314	1314	1323	1304	1396	1004	1241	1241	1244	1244	1303	969	1163	1163	1164	1164	1208	934
	85	1438	1438	1440	1440	1494	1271	1364	1364	1365	1365	1402	1233	1285	1285	1286	1286	1308	1195	1200	1200	1201	1201	1213	1156
45000	75	1291	1194	1393	885	1489	550	1218	1157	1313	851	1399	517	1144	1120	1231	816	1308	483	1070	1068	1145	781	1205	446
	80	1334	1334	1397	1130	1492	809	1267	1267	1317	1094	1399	774	1198	1198	1235	1056	1306	739	1124	1124	1150	1018	1209	704
	85	1396	1396	1407	1379	1494	1066	1325	1325	1330	1325	1401	1031	1250	1250	1251	1251	1306	996	1170	1170	1170	1170	1210	952
90	1453	1453	1454	1454	1501	1307	1375	1375	1376	1376	1407	1269	1294	1294	1295	1295	1313	1231	1207	1207	1208	1208	1215	1191	

**Table 24. Gross cooling capacities – 120 tons – high capacity evaporator coil, 60Hz**

CFM	Ent DB (°F)	Ambient Temperature (°F)																							
		85						95						105						115					
		61		67		73		61		67		73		61		67		73		61		67		73	
		CAP	SHC	CAP	SHC	CAP	SHC	CAP	SHC	CAP	SHC	CAP	SHC	CAP	SHC	CAP	SHC	CAP	SHC	CAP	SHC	CAP	SHC	CAP	SHC
21000	75	1209	830	1364	692	1524	541	1446	500	1076	747	1217	608	1361	457	1003	703	1137	564	1273	413				
	80	1211	950	1365	812	1525	663	1447	622	1078	867	1219	728	1362	579	1005	823	1139	685	1275	535				
	85	1213	1070	1367	932	1526	784	1449	1029	1296	892	1449	743	1364	700	1008	943	1141	805	1276	656				
	90	1217	1188	1368	1052	1527	905	1450	1298	1011	1450	864	1222	969	1366	821	1037	1037	1143	925	1278	777			
26000	75	1298	931	1455	754	1603	568	1226	888	1375	710	1517	516	1148	664	1066	795	1200	618	1327	427				
	80	1301	1080	1458	904	1604	709	1229	1036	1378	860	1518	667	1151	991	1070	944	1204	768	1329	577				
	85	1306	1228	1460	1052	1606	859	1235	1183	1380	1009	1520	817	1159	1137	1084	1084	1206	917	1331	727				
	90	1343	1343	1463	1201	1607	1008	1283	1283	1384	1157	1522	966	1218	1218	1298	1112	1150	1210	1066	1333	876			
31000	75	1362	1024	1517	808	1651	570	1283	978	1430	763	1559	527	1198	931	1337	716	1460	482	1242	667				
	80	1367	1202	1520	986	1653	749	1289	1156	1434	941	1560	706	1205	1105	1341	894	1461	661	1246	846				
	85	1382	1377	1523	1163	1654	927	1313	1313	1437	1119	1562	884	1242	1242	1345	1071	1462	838	1250	1024				
	90	1455	1455	1527	1341	1655	1105	1387	1387	1443	1296	1563	1061	1313	1313	1352	1245	1464	1016	1236	1236				
36000	75	1410	1113	1559	858	1684	581	1325	1065	1468	812	1587	537	1235	1016	1370	763	1483	491	1142	966				
	80	1420	1315	1561	1064	1685	788	1336	1266	1471	1018	1587	743	1248	1216	1374	970	1483	697	1160	1160				
	85	1465	1465	1566	1270	1687	995	1392	1392	1476	1224	1587	949	1314	1314	1380	1176	1483	903	1232	1232				
	90	1540	1540	1574	1470	1690	1201	1466	1466	1486	1423	1588	1155	1384	1384	1392	1374	1484	1108	1299	1299				
41000	75	1447	1198	1589	905	1710	593	1358	1149	1494	858	1606	547	1263	1092	1393	809	1499	500	1167	1039				
	80	1463	1427	1592	1139	1713	829	1378	1378	1498	1093	1605	781	1293	1293	1397	1044	1496	733	1208	1208				
	85	1532	1532	1597	1374	1720	1062	1454	1454	1504	1321	1604	1015	1369	1369	1405	1270	1495	967	1281	1281				
	90	1604	1604	1611	1599	1719	1300	1523	1523	1525	1525	1606	1249	1434	1434	1436	1436	1436	1436	1201	1341	1341			
46000	75	1477	1275	1611	951	1732	606	1385	1224	1513	903	1621	557	1286	1170	1409	853	1511	509	1187	1115				
	80	1506	1506	1614	1214	1734	870	1425	1425	1517	1167	1617	818	1338	1338	1413	1117	1505	770	1247	1247				
	85	1584	1584	1622	1468	1737	1134	1500	1500	1526	1419	1618	1081	1409	1409	1424	1367	1503	1032	1316	1316				
	90	1652	1652	1654	1654	1743	1399	1564	1564	1565	1565	1622	1345	1468	1468	1469	1469	1505	1284	1367	1367				
51000	75	1501	1354	1627	996	1754	618	1407	1302	1527	948	1633	567	1306	1247	1420	897	1520	519	1204	1191				
	80	1549	1549	1632	1288	1752	911	1464	1464	1532	1240	1629	857	1372	1372	1425	1179	1511	807	1277	1277				
	85	1624	1624	1643	1566	1755	1205	1535	1535	1544	1516	1631	1150	1439	1439	1441	1441	1509	1097	1340	1340				
	90	1700	1700	1697	1697	1763	1498	1593	1593	1595	1595	1639	1430	1490	1490	1491	1491	1514	1373	1382	1382				
54000	75	1514	1401	1636	1024	1758	625	1418	1349	1534	975	1639	574	1317	1293	1425	924	1524	525	1215	1215				
	80	1571	1571	1640	1332	1761	936	1483	1483	1540	1273	1635	881	1389	1389	1431	1219	1514	829	1291	1291				
	85	1644	1644	1654	1625	1765	1247	1552	1552	1554	1554	1638	1191	1453	1453	1454	1454	1512	1137	1350	1350				
	90	1718	1718	1720	1720	1774	1545	1611	1611	1612	1612	1647	1486	1504	1504	1505	1505	1520	1428	1387	1387				









### Air-Cooled, 50Hz, Standard and High Capacity Evaporator Coils

**Table 28. Gross cooling capacities – 90 tons – standard evaporator coil, 50Hz**

CFM	Ent DB (°F)	Ambient Temperature (°F)																																																																																																		
		85						95						105						115																																																																																
		Entering Wet Bulb (°F)			73			67			61			73			67			61			73			67			61																																																																							
		CAP	SHC	SHC	CAP	SHC	SHC	CAP	SHC	SHC	CAP	SHC	SHC	CAP	SHC	SHC	CAP	SHC	SHC	CAP	SHC	SHC	CAP	SHC	SHC	CAP	SHC	SHC	CAP	SHC	SHC																																																																					
16000	75	796	586	888	476	982	359	758	566	844	455	930	336	715	543	794	431	871	311	669	519	741	406	808	285	80	798	678	889	568	982	451	760	657	845	546	930	429	717	634	796	523	872	404	671	610	743	498	809	378	85	801	764	891	659	983	543	763	743	847	638	931	521	722	720	798	615	873	496	677	677	745	590	810	470	90	813	813	892	751	984	635	782	782	849	729	933	613	747	747	800	706	875	588	708	708	747	681	811	562
	75	845	660	936	520	1025	371	801	637	886	496	966	346	752	613	829	471	899	320	700	587	769	444	828	292	80	848	774	939	635	1026	486	804	752	888	611	966	462	756	720	832	586	900	436	705	693	771	559	829	408	85	858	858	941	749	1027	602	816	816	890	726	968	577	773	773	834	700	902	551	729	729	773	673	830	523	90	895	895	943	863	1029	716	857	857	893	832	970	692	814	814	838	805	904	665	765	765	779	777	832	637
	75	886	747	975	570	1057	383	837	722	918	544	991	357	782	691	856	517	918	329	724	658	789	489	840	300	80	893	880	978	713	1058	527	845	845	921	688	992	501	793	793	858	661	920	473	737	737	791	632	841	444	85	923	923	980	856	1060	671	879	879	924	831	994	645	830	830	862	792	921	617	776	776	795	762	842	588	90	969	969	988	987	1062	814	923	923	933	933	996	788	869	869	872	872	922	760	810	810	811	811	843	730
	75	914	820	1000	617	1077	393	861	792	939	591	1006	367	803	763	871	562	929	338	741	732	800	532	847	308	80	929	929	1003	789	1078	567	879	879	941	762	1007	540	826	826	874	734	930	511	769	769	802	690	846	480	85	975	975	1008	947	1080	739	924	924	947	919	1009	712	868	868	880	880	930	683	805	805	809	809	847	652	90	1021	1021	1022	1022	1081	911	966	966	967	967	1010	884	904	904	905	905	932	854	834	834	835	835	850	805
75	928	866	1011	645	1085	400	873	838	947	618	1012	372	812	808	878	589	933	343	749	749	804	558	848	313	80	950	950	1014	834	1087	590	899	899	950	807	1013	563	843	843	880	763	933	533	782	782	807	729	849	502	85	999	999	1021	1006	1088	780	945	945	958	958	1015	752	884	884	888	888	934	722	817	817	816	816	850	692	90	1044	1044	1045	1045	1090	969	985	985	986	986	1017	923	918	918	919	919	936	890	843	843	844	844	854	854	
75	940	912	1020	673	1092	406	883	883	954	645	1017	378	820	820	883	615	936	349	755	755	807	584	850	318	80	970	970	1023	879	1093	614	917	917	957	843	1018	586	857	857	886	803	936	555	793	793	810	768	851	525	85	1019	1019	1032	1032	1095	820	961	961	967	967	1019	792	897	897	897	897	936	762	825	825	825	825	852	732	90	1063	1063	1064	1064	1097	1007	1000	1000	1001	1001	1021	976	928	928	929	929	941	941	852	852	852	852	858	858	
75	953	953	1030	709	1099	415	894	894	962	681	1022	366	830	830	887	650	938	356	763	763	809	619	851	325	80	992	992	1033	920	1100	645	935	935	965	889	1022	616	872	872	891	856	938	586	803	803	813	813	852	555	85	1040	1040	1045	1045	1101	875	979	979	978	978	1023	846	909	909	910	910	940	816	832	832	833	833	855	759	90	1083	1083	1084	1084	1104	1079	1015	1015	1015	1015	1028	1028	940	940	941	941	946	946	863	863	863	863	863	863	863

Table 29. Gross cooling capacities – 90 tons eFlex™ variable speed – standard evaporator coil, 50Hz

CFM	Ent DB (°F)	Ambient Temperature (°F)																							
		85				95				105				115											
		Entering Wet Bulb (°F)				Entering Wet Bulb (°F)				Entering Wet Bulb (°F)				Entering Wet Bulb (°F)											
		61	67	73	73	61	67	73	73	61	67	73	73	61	67	73	73								
16000	75	819	597	916	488	1019	373	785	579	877	470	973	354	749	561	836	451	923	333	712	542	793	431	869	311
	80	821	688	917	580	1019	465	787	670	879	562	974	446	751	652	838	542	924	426	714	633	794	523	869	404
	85	823	777	919	671	1020	557	790	759	880	653	974	538	755	740	839	634	925	518	719	710	796	614	870	496
	90	835	835	921	762	1021	649	805	805	882	744	976	630	774	774	841	725	926	609	745	745	798	705	870	587
20000	75	872	672	970	533	1067	386	833	652	926	514	1014	365	793	633	879	493	956	343	751	613	829	472	892	319
	80	874	786	972	648	1068	501	836	763	928	628	1015	480	796	743	881	608	957	458	755	719	831	586	893	434
	85	883	875	975	762	1070	616	847	846	931	742	1017	595	811	811	883	722	959	573	773	773	833	700	895	549
	90	917	917	977	876	1071	731	885	885	933	856	1018	710	851	851	887	831	960	687	813	813	838	809	897	663
25000	75	917	759	1014	584	1102	397	874	739	964	563	1042	375	829	718	911	541	978	352	782	696	855	518	911	328
	80	923	893	1017	727	1103	541	881	863	967	706	1043	519	838	831	914	684	980	496	793	793	857	661	913	472
	85	949	949	1019	869	1105	685	913	913	970	844	1045	663	873	873	917	821	982	640	831	831	861	797	914	616
	90	998	998	1026	997	1106	828	960	960	978	963	1046	806	917	917	927	919	984	783	869	869	873	873	916	759
30000	75	948	837	1042	631	1122	407	902	816	988	610	1060	385	854	788	931	587	993	362	804	764	870	563	922	338
	80	961	961	1045	803	1124	580	919	919	991	781	1062	558	874	874	934	758	995	535	828	828	872	734	924	510
	85	1006	1006	1049	967	1127	752	964	964	996	939	1064	730	918	918	939	914	997	707	868	868	877	859	925	682
	90	1056	1056	1064	1064	1129	924	1010	1010	1011	1011	1066	902	958	958	959	959	999	879	900	900	901	901	927	845
33000	75	962	885	1054	659	1132	413	915	857	998	637	1068	391	866	833	939	614	1000	368	814	800	875	589	927	343
	80	983	983	1057	847	1134	604	938	938	1001	825	1069	581	892	892	941	795	1002	558	845	845	877	769	928	533
	85	1032	1032	1063	1020	1137	793	987	987	1003	969	1072	771	938	938	948	934	1004	747	882	882	885	885	929	722
	90	1081	1081	1082	1082	1139	982	1031	1031	1032	1032	1075	951	975	975	975	975	1006	926	914	914	915	915	931	889
36000	75	975	926	1063	686	1140	419	926	900	1006	664	1074	397	876	864	945	640	1005	374	823	823	879	615	930	349
	80	1001	1001	1066	892	1142	627	958	958	1009	869	1076	605	910	910	948	837	1007	581	858	858	882	811	931	556
	85	1054	1054	1074	1058	1144	834	1006	1006	1017	1007	1079	811	953	953	958	958	1009	788	893	893	895	895	932	762
	90	1101	1101	1102	1102	1147	1030	1047	1047	1048	1048	1082	1007	989	989	990	990	1012	971	925	925	925	925	936	928
40000	75	989	971	1073	722	1148	428	939	935	1014	700	1081	405	887	887	951	676	1010	382	834	834	883	650	934	357
	80	1026	1026	1076	942	1151	658	979	979	1017	918	1084	636	928	928	954	883	1012	612	872	872	888	855	934	587
	85	1077	1077	1087	1087	1153	888	1026	1026	1031	1031	1086	865	968	968	969	969	1013	841	906	906	907	907	935	816
	90	1123	1123	1123	1123	1157	1105	1066	1066	1067	1067	1090	1063	1005	1005	1006	1006	1018	1016	936	936	936	937	940	940

**Table 30. Gross cooling capacities – 105 tons – standard evaporator coil, 50Hz**

CFM	Ent DB (°F)	Ambient Temperature (°F)																							
		85						95						105						115					
		Entering Wet Bulb (°F)			Entering Wet Bulb (°F)			Entering Wet Bulb (°F)			Entering Wet Bulb (°F)			Entering Wet Bulb (°F)			Entering Wet Bulb (°F)			Entering Wet Bulb (°F)					
		61	67	73	61	67	73	61	67	73	61	67	73	61	67	73	61	67	73						
19000	75	925	686	1030	555	1135	414	877	661	976	528	1072	387	825	633	917	501	1002	358	771	606	855	472	929	328
	80	927	794	1032	664	1136	523	880	769	978	638	1072	496	828	742	919	610	1003	468	775	709	857	581	930	438
	85	934	899	1034	772	1137	633	888	873	980	746	1074	606	838	838	921	718	1005	577	789	789	859	690	932	547
23000	75	961	961	1036	880	1139	742	922	922	983	854	1076	715	878	878	924	827	1007	686	831	831	863	792	933	656
	80	971	758	1075	597	1173	424	917	731	1014	569	1102	396	860	702	949	540	1026	366	800	673	881	510	946	335
	85	976	884	1077	729	1174	557	923	856	1017	701	1104	528	867	826	952	672	1027	498	809	796	883	641	947	467
28000	75	990	990	1080	860	1175	689	944	944	1019	832	1105	661	896	896	954	803	1029	630	844	844	886	765	948	599
	80	1040	1040	1085	985	1177	821	993	993	1025	956	1107	792	942	942	961	925	1030	762	886	886	894	894	948	730
	85	1011	844	1112	646	1201	435	952	815	1045	616	1125	405	890	776	974	586	1043	374	826	744	900	554	957	342
33000	75	1021	995	1115	806	1203	596	964	964	1048	777	1126	567	904	904	977	746	1044	535	846	846	902	714	957	502
	80	1060	1060	1118	966	1204	757	1008	1008	1053	927	1128	727	951	951	982	895	1044	695	890	890	908	861	956	662
	85	1113	1113	1128	1115	1206	917	1058	1058	1064	1064	1129	887	996	996	997	997	1045	855	928	928	929	929	957	822
38000	75	1040	917	1137	693	1219	445	978	886	1066	662	1139	415	912	852	990	630	1052	382	844	818	911	597	963	350
	80	1058	1058	1140	881	1221	635	1002	1002	1068	851	1140	604	942	942	992	819	1052	572	879	879	914	772	962	538
	85	1113	1113	1146	1057	1222	824	1054	1054	1076	1024	1140	793	989	989	1001	990	1052	760	919	919	922	922	962	727
43000	75	1164	1164	1166	1166	1223	1013	1101	1101	1102	1102	1142	982	1029	1029	1030	1030	1054	932	949	949	949	949	965	896
	80	1063	995	1154	739	1232	455	998	962	1079	707	1148	424	928	927	1000	674	1058	391	857	857	917	640	965	358
	85	1097	1097	1157	956	1233	674	1036	1036	1083	910	1148	642	970	970	1003	874	1057	608	900	900	921	837	965	575
45000	75	1152	1152	1167	1154	1233	891	1087	1087	1093	1093	1148	859	1015	1015	1015	1015	1058	826	936	936	937	937	965	793
	80	1200	1200	1201	1201	1236	1090	1128	1128	1129	1129	1152	1056	1048	1048	1048	1048	1063	1020	965	965	965	965	971	971
	85	1081	1071	1167	784	1241	466	1013	1013	1089	752	1154	434	942	942	1006	718	1062	400	872	872	921	683	968	367
45000	75	1127	1127	1171	1012	1241	712	1062	1062	1093	977	1153	680	991	991	1011	940	1062	647	915	915	925	901	967	613
	80	1181	1181	1184	1184	1243	959	1110	1110	1109	1109	1155	927	1031	1031	1031	1031	1064	871	946	946	946	946	969	833
	85	1225	1225	1226	1226	1250	1181	1147	1147	1148	1148	1162	1146	1064	1064	1064	1064	1071	1071	977	977	977	977	977	977
45000	75	1088	1088	1171	802	1244	470	1019	1019	1092	770	1157	438	947	947	1008	735	1063	404	877	877	922	701	969	370
	80	1137	1137	1175	1040	1244	728	1070	1070	1097	1004	1156	695	997	997	1013	966	1063	662	919	919	926	926	967	628
	85	1190	1190	1191	1191	1247	986	1117	1117	1117	1117	1158	954	1036	1036	1036	1036	1065	895	950	950	950	950	970	856
45000	75	1233	1233	1234	1234	1254	1218	1155	1155	1156	1156	1166	1166	1070	1070	1071	1071	1074	1074	981	981	981	981	979	979



Performance Data

Table 31. Gross cooling capacities – 105 tons eFlex™ variable speed – standard evaporator coil, 50Hz

CFM	Ent DB (°F)	Ambient Temperature (°F)																									
		85				95				105				115													
		Entering Wet Bulb (°F)				Entering Wet Bulb (°F)				Entering Wet Bulb (°F)				Entering Wet Bulb (°F)													
		61	67	73	73	61	67	73	73	61	67	73	73	61	67	73	73										
19000	75	955	701	1066	571	1180	432	1180	432	910	676	1015	546	1121	406	862	651	960	520	1057	379	813	626	904	493	989	351
	80	957	809	1068	679	1180	541	1180	541	912	785	1017	654	1121	516	865	759	963	629	1058	489	816	732	907	602	990	461
	85	963	913	1070	788	1182	650	1182	650	919	888	1019	763	1123	625	873	863	965	737	1060	598	827	825	909	711	992	570
	90	985	985	1071	896	1183	759	1183	759	948	948	1021	871	1125	734	908	908	968	845	1061	707	867	867	912	816	993	679
23000	75	1004	774	1116	614	1223	443	1223	443	954	748	1058	588	1157	416	900	721	998	560	1086	388	846	694	936	532	1010	358
	80	1008	906	1118	746	1224	576	1224	576	958	873	1061	719	1158	549	907	845	1001	692	1087	520	853	817	938	664	1011	490
	85	1022	1022	1120	877	1226	708	1226	708	975	975	1064	850	1160	681	930	930	1004	823	1089	652	884	884	941	795	1013	622
	90	1069	1069	1125	1005	1228	839	1228	839	1026	1026	1069	978	1162	812	979	979	1010	946	1091	783	930	930	948	917	1014	753
28000	75	1048	861	1158	664	1256	455	1256	455	992	833	1095	636	1184	426	934	801	1029	607	1106	396	875	771	960	577	1025	365
	80	1058	1012	1161	825	1258	616	1258	616	1003	984	1098	796	1185	587	947	945	1032	767	1108	557	891	891	962	737	1026	526
	85	1093	1093	1164	984	1260	776	1260	776	1045	1045	1102	952	1187	748	993	993	1036	917	1109	718	938	938	967	885	1028	687
	90	1149	1149	1174	1134	1261	936	1261	936	1098	1098	1113	1102	1188	907	1043	1043	1048	1048	1111	877	982	982	982	982	1029	846
33000	75	1080	936	1186	712	1277	465	1277	465	1021	905	1119	683	1200	436	960	874	1048	652	1119	405	896	842	974	621	1034	374
	80	1097	1097	1189	901	1280	655	1280	655	1041	1041	1122	871	1203	626	986	986	1051	841	1121	595	928	928	976	803	1035	563
	85	1151	1151	1195	1077	1282	844	1282	844	1097	1097	1129	1046	1205	815	1038	1038	1058	1013	1123	784	974	974	984	972	1036	752
	90	1207	1207	1212	1212	1285	1033	1285	1033	1148	1148	1149	1149	1207	1003	1083	1083	1084	1084	1126	965	1012	1012	1012	1012	1039	923
38000	75	1106	1014	1206	758	1294	476	1294	476	1043	982	1135	728	1213	446	979	949	1060	696	1129	414	912	907	982	664	1040	382
	80	1135	1135	1209	975	1297	695	1297	695	1079	1079	1138	938	1216	664	1019	1019	1064	898	1130	632	955	955	986	863	1041	600
	85	1195	1195	1219	1175	1299	913	1299	913	1135	1135	1148	1138	1217	882	1069	1069	1074	1074	1132	850	996	996	997	997	1042	817
	90	1248	1248	1249	1249	1303	1122	1303	1122	1182	1182	1183	1183	1221	1081	1111	1111	1111	1111	1136	1046	1033	1033	1033	1033	1047	1010
43000	75	1126	1091	1221	804	1307	487	1307	487	1061	1054	1146	773	1223	456	994	994	1069	740	1135	424	925	925	987	707	1044	391
	80	1170	1170	1225	1033	1310	735	1310	735	1109	1109	1151	1000	1225	703	1044	1044	1073	965	1136	670	973	973	991	927	1044	637
	85	1228	1228	1237	1237	1312	981	1312	981	1162	1162	1164	1164	1226	949	1089	1089	1089	1089	1138	917	1012	1012	1012	1013	1046	871
	90	1280	1280	1282	1282	1319	1205	1319	1205	1209	1209	1210	1210	1234	1171	1132	1132	1132	1132	1146	1128	1048	1048	1048	1049	1053	1049
45000	75	1133	1121	1225	822	1311	492	1311	492	1067	1067	1150	791	1226	460	999	999	1071	758	1137	428	931	931	988	724	1045	394
	80	1181	1181	1230	1061	1314	750	1314	750	1119	1119	1155	1027	1227	718	1051	1051	1076	991	1138	686	979	979	993	953	1045	652
	85	1239	1239	1244	1244	1316	1008	1316	1008	1170	1170	1171	1171	1230	976	1096	1096	1097	1097	1141	932	1017	1017	1017	1017	1048	884
	90	1292	1292	1293	1293	1325	1242	1325	1242	1218	1218	1218	1218	1239	1207	1139	1139	1140	1140	1148	1148	1053	1053	1053	1053	1055	1055

**Table 32. Gross cooling capacities – 120 tons – standard evaporator coil, 50Hz**

CFM	Ent DB (°F)	Ambient Temperature (°F)																			
		85				95				105				115							
		Entering Wet Bulb (°F)				Entering Wet Bulb (°F)				Entering Wet Bulb (°F)				Entering Wet Bulb (°F)							
		61	67	73	73	61	67	73	73	61	67	73	73	61	67	73	73				
21000	75	1046	748	1308	454	988	712	1234	417	925	674	1040	531	1154	377	858	635	967	491	1071	337
	80	1049	868	1178	727	990	832	1235	539	927	794	1043	652	1156	499	862	756	969	612	1072	458
	85	1053	988	1180	848	1096	949	1237	660	934	911	1045	772	1157	620	871	762	972	733	1074	580
	90	1076	1076	1182	968	1027	1027	1239	781	974	974	1048	893	1159	741	918	819	975	853	1076	700
26000	75	1111	841	1242	663	1045	803	1281	429	975	763	1090	583	1192	388	902	722	1008	541	1100	345
	80	1116	991	1244	812	1050	952	1282	580	981	907	1093	732	1194	538	910	865	1012	690	1102	495
	85	1130	1130	1247	961	1069	1069	1284	729	1010	1010	1096	881	1196	688	948	948	1015	840	1103	645
	90	1189	1189	1252	1110	1131	1131	1286	878	1069	1069	1103	1025	1197	837	1003	1003	1023	982	1105	794
31000	75	1157	930	1285	714	1086	890	1308	439	1010	847	1121	630	1214	396	932	798	1034	587	1117	363
	80	1167	1102	1288	892	1097	1061	1310	618	1023	1018	1124	808	1215	575	948	948	1037	765	1117	531
	85	1209	1209	1292	1069	1146	1146	1311	796	1079	1079	1130	986	1216	752	1008	1008	1043	935	1117	708
	90	1274	1274	1302	1240	1209	1209	1312	973	1137	1137	1143	1143	1217	930	1061	1061	1063	1063	1118	885
36000	75	1192	1016	1314	762	1116	974	1326	448	1036	921	1142	676	1227	405	954	875	1050	631	1126	360
	80	1210	1210	1318	968	1138	1138	1326	655	1067	1067	1145	882	1227	611	992	992	1054	837	1123	565
	85	1273	1273	1324	1175	1204	1204	1326	861	1129	1129	1154	1078	1227	817	1050	1050	1063	1031	1122	771
	90	1337	1337	1341	1341	1263	1263	1328	1067	1183	1183	1184	1184	1228	1022	1096	1096	1076	1076	1124	965
41000	75	1220	1090	1336	808	1141	1045	1338	458	1057	998	1155	720	1236	413	972	950	1060	674	1131	368
	80	1253	1253	1340	1043	1182	1182	1337	692	1105	1105	1159	955	1233	647	1025	1025	1065	897	1126	601
	85	1322	1322	1349	1266	1246	1246	1336	926	1164	1164	1171	1171	1232	881	1077	1077	1077	1077	1124	835
	90	1382	1382	1384	1384	1301	1301	1338	1161	1211	1211	1212	1212	1234	1100	1114	1114	1115	1115	1124	1049
46000	75	1243	1169	1352	854	1161	1122	1347	467	1075	1074	1164	764	1242	422	987	987	1066	717	1134	376
	80	1293	1293	1356	1118	1216	1216	1344	729	1134	1134	1170	1013	1237	683	1048	1048	1071	963	1127	636
	85	1359	1359	1369	1364	1444	1444	1343	992	1189	1189	1187	1187	1235	946	1095	1095	1095	1095	1123	899
	90	1415	1415	1416	1416	1326	1326	1345	1236	1228	1228	1229	1229	1237	1186	1122	1122	1122	1122	1125	1125
51000	75	1262	1247	1363	900	1178	1178	1354	477	1090	1090	1170	808	1246	431	1006	1006	1069	760	1136	385
	80	1324	1324	1369	1177	1243	1243	1348	767	1155	1155	1178	1080	1239	721	1063	1063	1076	1028	1126	673
	85	1387	1387	1387	1387	1300	1300	1347	1059	1206	1206	1206	1206	1237	1012	1105	1105	1105	1105	1123	941
	90	1438	1438	1439	1439	1342	1342	1354	1326	1240	1240	1240	1240	1243	1243	1131	1131	1131	1131	1129	1129
54000	75	1273	1273	1369	927	1188	1188	1357	484	1103	1103	1173	834	1248	437	1015	1015	1070	786	1137	390
	80	1339	1339	1376	1219	1256	1256	1351	790	1165	1165	1181	1120	1240	743	1071	1071	1078	1067	1125	695
	85	1401	1401	1402	1402	1311	1311	1350	1098	1213	1213	1213	1213	1238	1029	1108	1108	1108	1108	1122	977
	90	1452	1452	1439	1439	1352	1352	1361	1361	1248	1248	1248	1248	1247	1247	1136	1136	1137	1137	1137	1137













**Table 38. Gross cooling capacities – 90 tons – high capacity evaporator coil, 50Hz**

CFM	Ent DB (°F)	Ambient Temperature (°F)																							
		85						95						105						115					
		Entering Wet Bulb (°F)			Entering Wet Bulb (°F)			Entering Wet Bulb (°F)			Entering Wet Bulb (°F)			Entering Wet Bulb (°F)			Entering Wet Bulb (°F)			Entering Wet Bulb (°F)					
		61	67	73	61	67	73	61	67	73	61	67	73	61	67	73	61	67	73						
16000	75	852	614	946	501	1036	379	891	590	898	478	981	355	763	565	845	452	920	329	713	539	789	426	856	302
	80	853	705	947	593	1036	471	811	682	900	569	982	447	764	656	847	544	921	422	715	631	790	517	857	395
	85	856	796	948	684	1037	563	815	770	901	661	983	539	769	745	848	635	922	514	721	718	792	609	858	487
	90	870	870	950	775	1038	655	835	835	903	752	984	631	797	797	850	726	923	605	755	755	794	700	859	578
20000	75	903	687	994	543	1074	388	855	662	940	518	1013	363	802	635	880	491	946	336	746	607	818	463	876	309
	80	906	801	995	657	1075	503	858	772	942	632	1014	478	806	745	882	605	947	451	751	716	820	577	876	423
	85	915	912	997	771	1075	618	871	871	943	746	1015	593	826	826	884	719	947	566	778	778	822	691	876	538
	90	955	955	1000	886	1076	732	913	913	947	856	1015	707	866	866	888	828	948	680	816	816	827	799	876	652
25000	75	945	772	1030	590	1101	397	891	746	971	564	1035	371	833	712	906	536	963	344	772	681	838	507	889	316
	80	952	909	1031	733	1101	541	900	882	972	707	1035	515	844	844	907	678	962	487	789	789	839	649	887	458
	85	984	984	1034	876	1101	683	937	937	975	844	1035	657	884	884	911	814	962	629	827	827	843	783	885	601
	90	1028	1028	1041	1011	1101	826	978	978	983	983	1035	800	921	921	922	922	962	772	859	859	860	860	885	743
30000	75	973	847	1052	636	1118	407	916	818	989	608	1049	380	854	787	920	579	974	352	790	755	848	549	896	324
	80	988	988	1053	807	1116	578	937	937	990	760	1046	551	881	881	922	750	970	523	821	821	850	710	890	493
	85	1034	1034	1058	968	1115	749	980	980	996	940	1045	722	920	920	927	908	968	693	855	855	856	856	887	664
	90	1075	1075	1076	1076	1115	920	1017	1017	1018	1018	1045	888	951	951	952	952	968	852	879	879	879	879	888	820
33000	75	986	893	1061	662	1125	412	927	864	996	635	1055	386	864	832	925	605	978	357	798	798	852	575	899	329
	80	1011	1011	1063	851	1122	600	958	958	998	814	1051	573	898	898	928	782	972	544	834	834	854	749	891	515
	85	1056	1056	1069	1026	1122	789	999	999	1005	997	1048	761	934	934	935	935	970	732	865	865	866	866	888	703
	90	1094	1094	1095	1095	1126	967	1032	1032	1032	1032	1052	936	961	961	961	961	973	905	886	886	886	886	892	872
36000	75	997	939	1069	689	1131	418	937	909	1002	661	1059	392	872	872	930	631	981	363	806	806	855	600	901	334
	80	1030	1030	1071	884	1127	623	974	974	1004	854	1054	596	911	911	932	821	974	567	844	844	857	788	891	537
	85	1073	1073	1078	1078	1129	830	1013	1013	1013	1013	1053	801	945	945	945	945	973	772	872	872	872	872	891	725
	90	1108	1108	1109	1109	1135	1022	1042	1042	1042	1042	1059	991	970	970	970	971	978	958	895	895	895	895	896	896
40000	75	1010	999	1076	725	1138	427	949	949	1008	696	1064	399	883	883	934	666	985	370	818	818	857	635	903	341
	80	1051	1051	1079	938	1136	655	991	991	1011	907	1057	626	924	924	936	874	976	596	854	854	859	839	892	566
	85	1091	1091	1091	1091	1138	885	1027	1027	1027	1027	1060	856	954	954	955	955	978	807	876	876	877	877	893	772
	90	1129	1129	1130	1130	1146	1094	1060	1060	1061	1061	1068	1062	984	984	985	985	985	985	985	985	985	985	985	985



Performance Data

Table 39. Gross cooling capacities – 90 tons eFlex™ variable speed – high capacity evaporator coil, 50Hz

Table with columns for CFM, Ent DB (°F), and Ambient Temperature (°F) with sub-columns for 85, 95, 105, and 115. Each sub-column contains three columns for Entering Wet Bulb (61, 67, 73) and three for Entering Wet Bulb (CAP, SHC, SHC).

**Table 40. Gross cooling capacities – 105 tons – high capacity evaporator coil, 50Hz**

CFM	Ent DB (°F)	Ambient Temperature (°F)																										
		85						95						105						115								
		61		67		73		61		67		73		61		67		73		61		67		73				
		CAP	SHC	CAP	SHC	CAP	SHC	CAP	SHC	CAP	SHC	CAP	SHC	CAP	SHC	CAP	SHC	CAP	SHC	CAP	SHC	CAP	SHC	CAP	SHC			
19000	75	959	702	1067	570	1168	426	1105	399	856	648	950	514	1037	371	801	619	888	486	967	342	804	725	890	595	968	452	
	80	962	811	1069	679	1169	536	1106	509	859	756	952	623	1038	480	804	725	890	595	968	452	819	819	893	703	969	560	
	85	967	916	1070	787	1170	645	1107	618	867	861	954	732	1040	589	819	819	893	703	969	560	862	862	896	808	970	669	
23000	75	1007	775	1111	611	1204	435	1135	407	892	716	984	553	1062	378	832	686	916	523	987	349	839	812	919	655	987	480	
	80	1011	903	1113	743	1205	568	1136	539	898	843	986	685	1063	510	839	812	919	655	987	480	877	877	922	786	987	612	
	85	1025	1025	1116	874	1206	699	1137	671	929	929	989	816	1063	642	877	877	922	786	987	612	921	921	929	910	987	743	
28000	75	1048	860	1147	659	1231	445	1158	416	923	793	1010	599	1080	387	858	760	937	568	1000	357	881	881	940	728	998	516	
	80	1058	1014	1149	819	1231	605	1158	577	938	938	1012	759	1079	546	881	881	940	728	998	516	927	927	945	878	997	675	
	85	1099	1099	1153	979	1231	765	1158	736	987	987	1017	911	1078	706	927	927	945	878	997	675	966	966	967	967	997	826	
33000	75	1078	936	1171	705	1249	455	1172	426	946	869	1025	643	1091	395	878	835	949	611	1009	365	916	916	952	789	1003	551	
	80	1097	1097	1173	893	1248	643	1170	613	979	979	1028	831	1087	582	916	916	952	789	1003	551	1027	1027	1035	960	1000	739	
	85	1151	1151	1179	1072	1247	831	1169	801	1027	1027	1064	1064	1085	770	959	959	960	960	1000	739	1064	1064	1065	1065	990	990	
38000	75	1100	1013	1187	750	1262	465	1182	435	964	944	1036	687	1099	404	894	894	957	654	1014	374	1009	1009	1039	889	1005	588	
	80	1137	1137	1190	957	1260	681	1178	651	1009	1009	1039	889	1092	619	940	940	960	854	1005	588	1052	1052	1053	1053	978	978	
	85	1188	1188	1198	1168	1261	899	1178	868	1052	1052	1083	1083	1084	1084	977	977	978	978	1004	788	1083	1083	1084	1084	1002	1002	
43000	75	1119	1089	1198	795	1272	476	1190	445	980	980	1042	730	1105	414	912	912	961	697	1018	383	1046	1046	1046	955	1096	625	
	80	1166	1166	1202	1025	1271	721	1185	689	1030	1030	1046	955	1096	657	956	956	966	918	1008	625	1067	1067	1068	1068	987	987	
	85	1215	1215	1215	1215	1272	967	1186	919	1067	1067	1068	1068	1068	1068	1013	1013	1013	1013	1014	1014	1099	1099	1100	1100	1014	1014	
45000	75	1259	1259	1260	1260	1278	1193	1191	1158	1099	1099	1099	1099	1100	1100	1106	1106	1106	1106	1014	1014	1014	1044	1044	1044	981	1008	640
	80	1225	1119	1202	813	1275	480	1193	449	1057	1057	1125	781	1193	449	988	988	1044	748	1020	387	1036	1036	1049	981	1008	640	
	85	1223	1223	1224	1224	1276	979	1188	944	1072	1072	1072	1072	1072	1072	1105	1105	1105	1105	1016	1016	1016	1072	1072	1072	990	1006	869
90	1268	1268	1269	1269	1283	1229	1189	1189	1189	1189	1189	1190	1190	1190	1190	1106	1106	1106	1106	1016	1016	1016	1072	1072	1072	990	1006	869



Performance Data

Table 41. Gross cooling capacities – 105 tons eFlex™ variable speed – high capacity evaporator coil, 50Hz

CFM	Ent DB (°F)	Ambient Temperature (°F)																							
		85						95						105						115					
		61		67		73		61		67		73		61		67		73		61		67		73	
CAP	SHC	CAP	SHC	CAP	SHC	CAP	SHC	CAP	SHC	CAP	SHC	CAP	SHC	CAP	SHC	CAP	SHC	CAP	SHC	CAP	SHC	CAP	SHC		
19000	75	991	718	1105	588	1217	446	944	692	1052	561	1157	420	894	666	996	534	1095	393	843	639	938	507	1028	365
	80	993	827	1107	696	1217	555	946	801	1054	670	1158	529	897	774	998	643	1096	503	847	748	941	616	1029	475
	85	998	932	1108	804	1218	664	951	906	1055	778	1160	638	903	879	1000	751	1097	612	857	846	943	724	1031	584
	90	1020	1020	1110	912	1220	773	981	981	1058	886	1161	747	941	941	1003	860	1099	720	898	898	946	833	1032	692
23000	75	1042	792	1155	630	1257	456	989	764	1097	603	1193	429	935	736	1036	575	1125	401	879	708	972	546	1052	373
	80	1047	923	1158	762	1258	588	994	893	1099	734	1194	561	940	863	1038	706	1126	533	886	834	975	678	1053	504
	85	1058	1049	1160	893	1260	720	1011	1011	1102	865	1195	693	964	964	1041	837	1127	665	917	917	978	809	1054	636
	90	1108	1108	1164	1024	1261	851	1063	1063	1106	995	1196	824	1016	1016	1046	964	1128	796	965	965	984	934	1054	767
28000	75	1088	878	1197	679	1289	466	1030	849	1133	651	1219	438	970	817	1067	622	1146	410	910	784	998	592	1069	380
	80	1097	1033	1199	839	1291	627	1041	1003	1136	811	1220	598	982	970	1070	781	1146	570	926	926	1001	751	1068	540
	85	1134	1134	1203	999	1292	787	1085	1085	1140	967	1221	758	1032	1032	1074	938	1147	729	976	976	1006	903	1068	699
	90	1190	1190	1210	1151	1294	947	1138	1138	1149	1122	1222	918	1082	1082	1086	1075	1148	889	1022	1022	1023	1023	1070	859
33000	75	1121	956	1224	726	1312	477	1060	924	1157	696	1237	448	997	892	1087	666	1160	419	932	859	1014	635	1079	388
	80	1137	1134	1226	914	1314	666	1082	1082	1159	884	1238	637	1026	1026	1090	854	1160	607	967	967	1017	819	1078	576
	85	1193	1193	1232	1093	1315	854	1138	1138	1166	1062	1239	825	1079	1079	1096	1031	1160	795	1016	1016	1024	997	1077	764
	90	1246	1246	1248	1248	1318	1043	1187	1187	1188	1188	1241	1013	1123	1123	1124	1124	1162	977	1053	1053	1054	1054	1079	939
38000	75	1147	1033	1242	771	1329	488	1083	1001	1172	741	1251	458	1017	967	1099	710	1170	428	949	933	1023	678	1086	397
	80	1180	1180	1245	983	1330	705	1122	1122	1175	948	1250	675	1061	1061	1103	915	1168	644	997	997	1027	880	1083	613
	85	1236	1236	1253	1190	1333	923	1175	1175	1184	1159	1251	892	1110	1110	1113	1102	1168	861	1040	1040	1040	1040	1083	822
	90	1287	1287	1288	1288	1339	1128	1221	1221	1222	1222	1257	1095	1150	1150	1151	1151	1173	1061	1074	1074	1075	1075	1086	1026
43000	75	1167	1110	1255	816	1342	499	1101	1077	1183	785	1261	468	1033	1029	1108	754	1178	438	966	966	1029	722	1092	406
	80	1213	1213	1259	1048	1345	745	1151	1151	1187	1015	1260	713	1086	1086	1112	981	1174	682	1017	1017	1033	945	1086	650
	85	1267	1267	1271	1268	1348	991	1201	1201	1202	1202	1262	959	1130	1130	1131	1131	1176	919	1055	1055	1056	1056	1086	875
	90	1321	1321	1322	1322	1355	1220	1248	1248	1250	1250	1270	1185	1172	1172	1173	1173	1182	1149	1089	1089	1090	1090	1092	1080
45000	75	1174	1141	1260	834	1347	503	1108	1100	1187	803	1264	473	1041	1041	1110	772	1180	442	974	974	1031	739	1093	410
	80	1225	1225	1264	1075	1350	761	1161	1161	1191	1042	1263	729	1094	1094	1115	1007	1176	697	1023	1023	1035	971	1088	665
	85	1278	1278	1280	1280	1353	1019	1210	1210	1211	1211	1266	978	1138	1138	1139	1139	1178	936	1060	1060	1061	1061	1088	899
	90	1334	1334	1335	1335	1361	1256	1259	1259	1260	1260	1274	1221	1180	1180	1181	1181	1186	1169	1094	1094	1094	1094	1095	1095







Performance Data

Table 43. Gross cooling capacities – 120 tons eFlex™ variable speed – high capacity evaporator coil, 50Hz

Table with columns for CFM, Ent DB (°F), Ambient Temperature (°F), and three sets of columns for 85, 95, 105, and 115 degrees Fahrenheit. Each set includes CAP, SHC, and SHC values for 61, 67, and 73 sub-columns.





# Supply Fan

Figure 9. Supply fan performance LOW CFM (25")

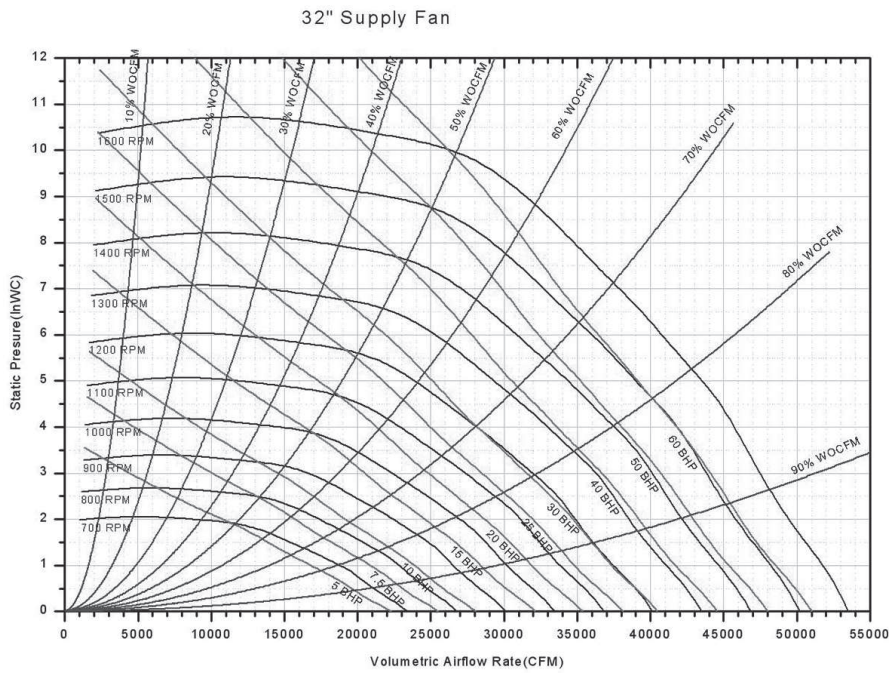
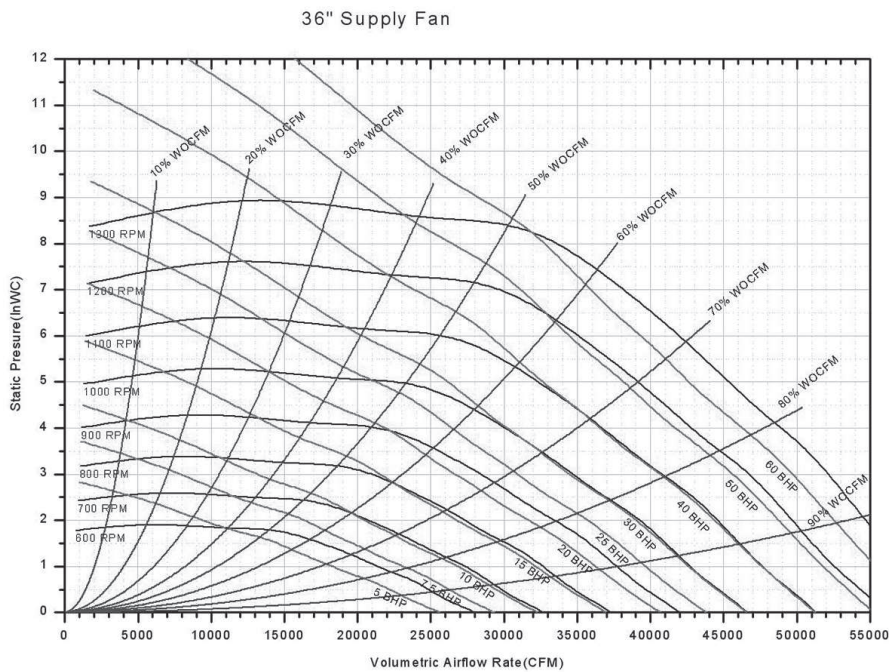


Figure 10. Supply fan performance STANDARD CFM (36")- 90-105 tons





# Performance Data

Figure 11. Supply fan performance LOW CFM (32")

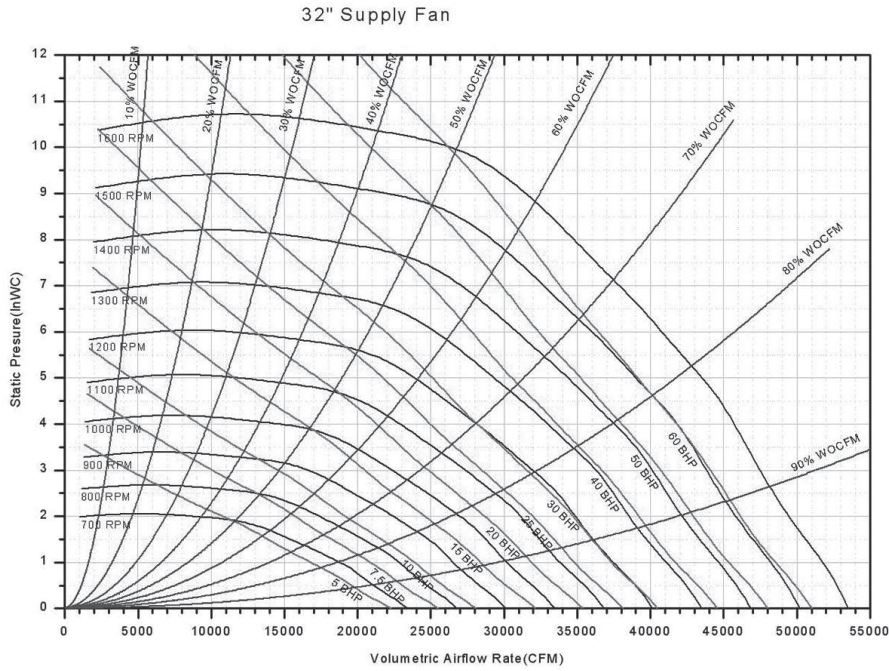
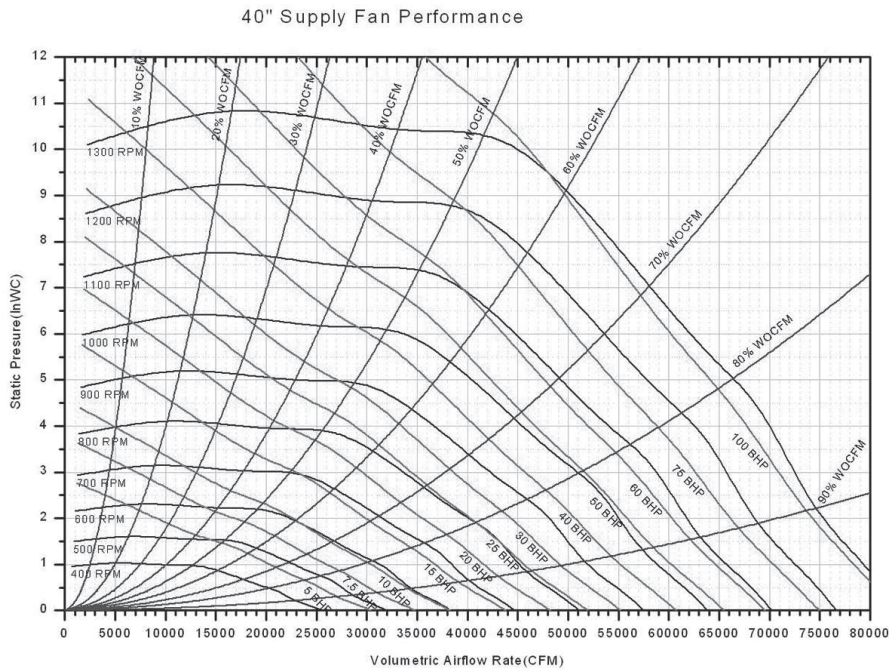


Figure 12. Supply fan performance STANDARD CFM - 120-150 tons (40")



# Relief Fan

Figure 13. Relief fan performance LOW CFM - 90 tons (25" Fan)

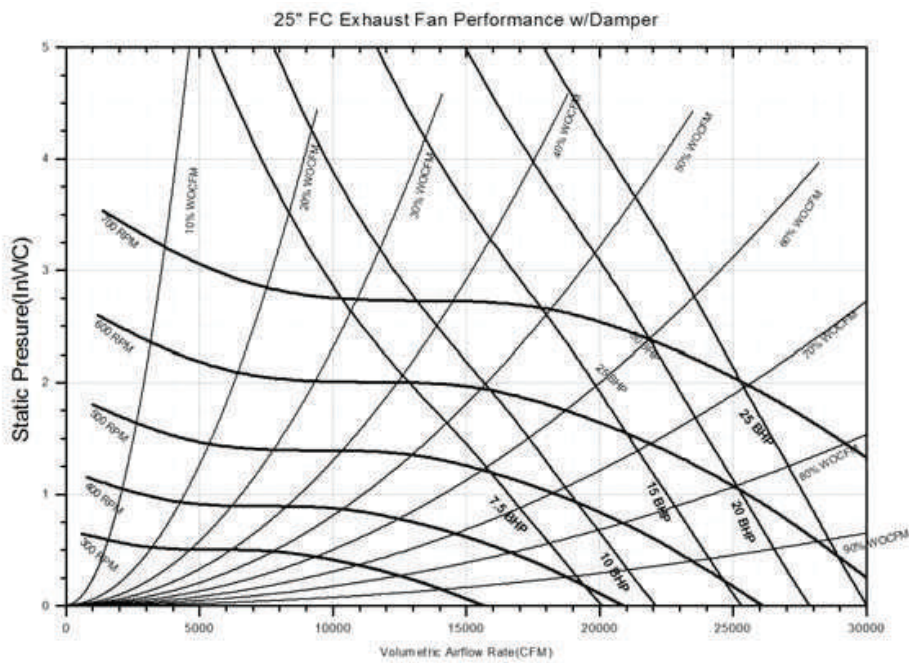
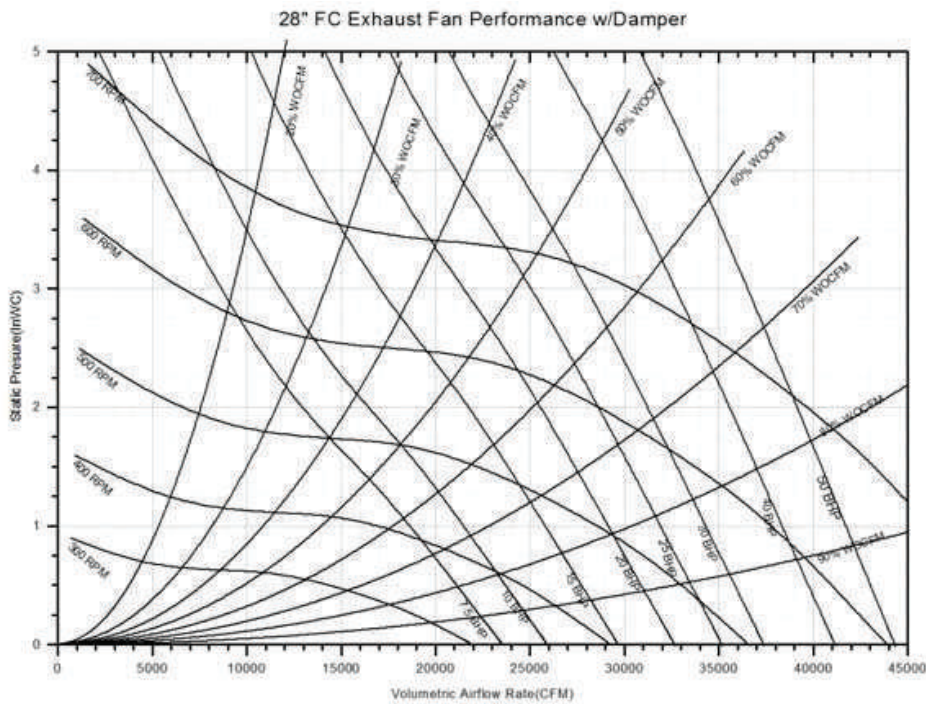


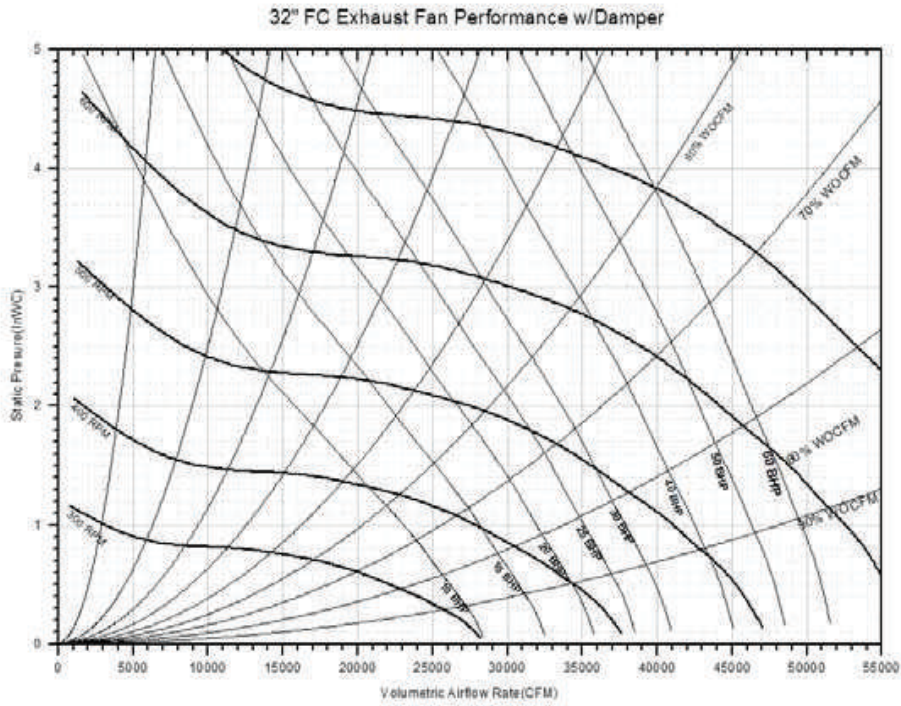
Figure 14. Relief fan performance STANDARD CFM—90 tons; LOW CFM—105-150 tons (28")





## Performance Data

Figure 15. Relief fan performance standard CFM —105-150 tons (32")



## Return Fan

Figure 16. Return fan performance LOW CFM 90-150 tons (36.5")

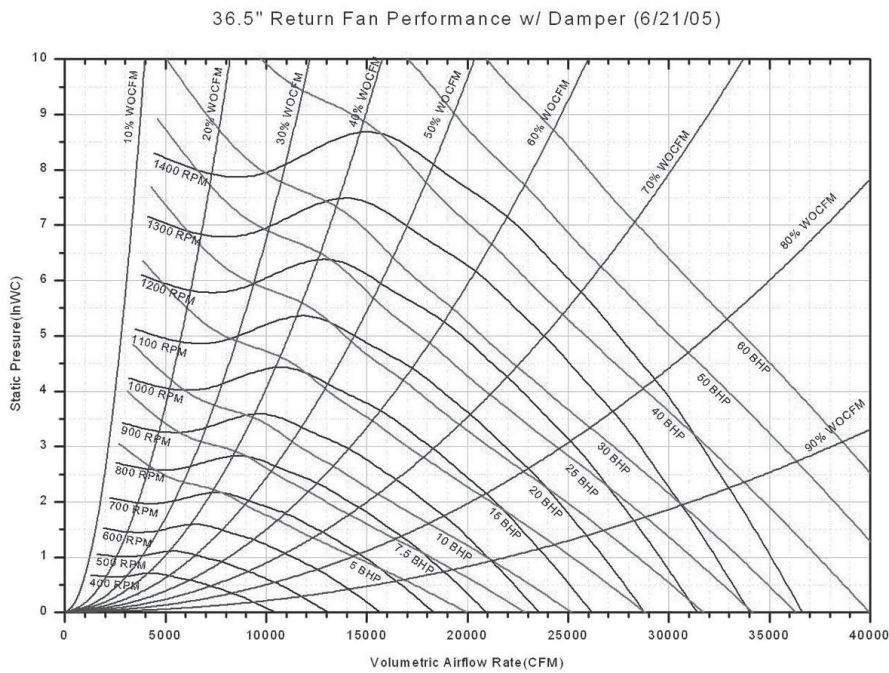




Figure 17. Return fan performance STANDARD CFM - 90-105 tons (40")

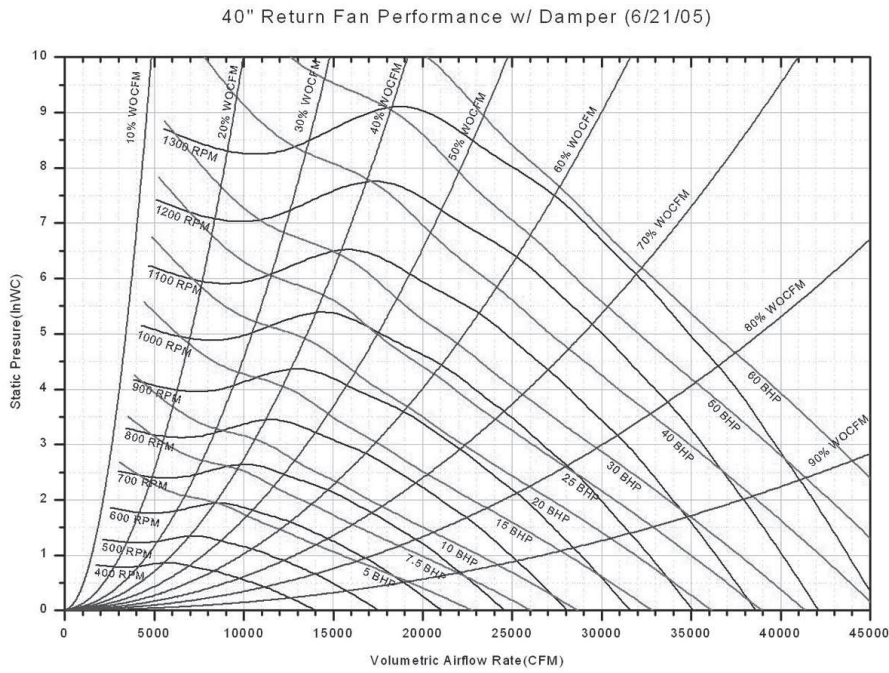
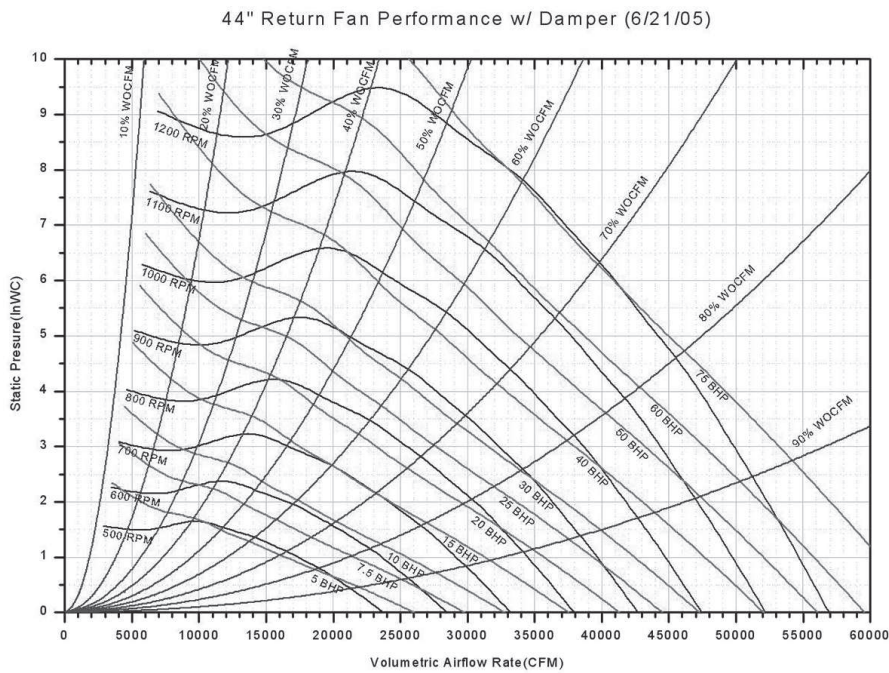


Figure 18. Return fan performance STANDARD CFM—120-150 tons (44")





**Performance Data**

# Heating Capacities

**Table 46. Natural gas heating capacities**

Nominal Tons	Heat Module	MBh (Input)	MBh (Output)	Air Temperature Rise <sup>(a)</sup> vs. Unit CFM											
				18500	20000	23500	25000	27000	31500	34000	38000	42000	46000	54000	58000
90-105	LOW	850	688.5	34.3	31.7	27.0	25.4	23.5	20.1	18.7	16.7	15.1	13.8	11.8	10.9
	MEDIUM	1100	891	44.4	41.1	34.9	32.8	30.4	26.1	24.2	21.6	19.6	17.9	15.2	14.2
	HIGH	1800	1458	-	-	-	53.8	49.8	42.7	39.5	35.4	32.0	29.2	24.9	23.2
120-150	LOW	1100	891	-	-	34.9	32.8	30.4	26.1	24.2	21.6	19.6	17.9	15.2	14.2
	MEDIUM	1800	1458	-	-	-	-	49.8	42.7	39.5	35.4	32.0	29.2	24.9	23.2
	HIGH	2500	2025	-	-	-	-	-	59.2	54.9	49.1	44.4	40.6	34.6	32.2

**Notes:**

1. Actual limits may be + or - the values shown; to accurately calculate capacities, contact the local Trane Sales Office or utilize TSA.
2. Follow the supply CFM ranges posted in the General Data for each case size.
3. All heaters are 81% efficient.
4. CFM values below the minimum and above the maximum shown in this table are not cULus approved.

<sup>(a)</sup> Air temperature rise (at sea level) = heat output (Btu) ÷ (CFM x 1.085).

**Table 47. Electric heat air temperature rise (60 Hz)**

Nominal Tons	KW Input (60 Hz)	Total (MBh)	CFM									
			20000	22000	26000	30000	34000	38000	42000	46000	54000	58000
90	90	307.2	14.2	12.9	10.9	9.4	8.3	7.5	6.7	—	—	—
	265	904.4	—	37.9	32.1	27.8	24.5	21.9	19.8	—	—	—
105	90	307.2	14.2	12.9	10.9	9.4	8.3	7.5	6.7	—	—	—
	265	904.4	41.6	37.9	32.1	27.8	24.5	21.9	19.8	—	—	—
120	140	477.8	—	20	16.9	14.7	13	11.6	10.5	9.6	8.2	7.6
	300	1023.9	—	42.9	36.3	31.5	27.8	24.8	22.5	20.5	17.5	16.3

**Notes:**

1. Actual limits may be + or - the values shown; to accurately calculate capacities, contact the local Trane Sales Office or utilize TOPSS.
2. Follow the supply CFM ranges posted in the General Data for each case size.

**Table 48. Electric heat air temperature rise (50 Hz)**

Nominal Tons	KW Input (50 Hz)	Total (MBh)	CFM									
			20000	22000	26000	30000	34000	38000	42000	46000	54000	58000
90	56	191.1	8.8	8	6.8	5.9	5.2	4.6	4.2	—	—	—
	166	566.6	—	23.7	20.1	17.4	15.4	13.7	12.4	—	—	—
105	56	191.1	8.8	8	6.8	5.9	5.2	4.6	4.2	—	—	—
	166	566.6	26.1	23.7	20.1	17.4	15.4	13.7	12.4	—	—	—
120	88	300.3	—	12.6	10.6	9.2	8.1	7.3	6.6	6	5.3	4.8
	188	641.6	—	26.9	22.7	19.7	17.4	15.6	14.1	12.9	11.4	10.2

**Notes:**

1. Actual limits may be + or - the values shown; to accurately calculate capacities, contact the local Trane Sales Office or utilize TSA.
2. Follow the supply CFM ranges posted in the General Data for each case size.

**Table 49. Electric heat kW ranges**

Nominal Tons	Nominal Voltage		
	460	575	380
90	90-265	90-265	56-166
105	90-265	90-265	56-166
120	140-300	140-300	88-188

**Table 49. Electric heat kW ranges (continued)**

Nominal Tons	Nominal Voltage		
	460	575	380
130-150	140-300	140-300	88-188

**Notes:**

1. Actual limits may be + or - the values shown; to accurately calculate capacities, contact the local Trane Sales Office or utilize TSA.
2. Follow the supply CFM ranges posted in the General Data for each case size.

**Table 50. Hot water coil heating capacities (Q/ITD)**

Nom Tons	Airflow (CFM)	High Capacity					Low Capacity				
		40	80	120	160	200	30	60	100	140	175
		0.3	1	2.1	3.7	5.6	0.2	0.6	1.5	2.8	4.3
90	16000	7.57	9.02	9.59	9.9	10.1	5.5	6.54	7.05	7.29	7.42
	20000	8.26	10.08	10.84	11.25	11.52	6.02	7.34	8.01	8.33	8.5
	25000	8.9	11.15	12.12	12.66	13.01	6.52	8.15	9	9.42	9.65
	30000	9.4	12.02	13.18	13.84	14.27	6.91	8.81	9.84	10.35	10.62
	33000	9.65	12.46	13.74	14.47	14.94	7.11	9.15	10.28	10.84	11.14
	36000	9.86	12.86	14.25	15.04	15.56	7.28	9.46	10.68	11.29	11.63
	40000	10.12	13.35	14.86	15.73	16.31	7.48	9.83	11.16	11.84	12.21
105	19000	8.1	9.83	10.55	10.94	11.18	5.9	7.15	7.78	8.09	8.25
	23000	8.67	10.75	11.64	12.13	12.44	6.34	7.85	8.63	9.01	9.21
	28000	9.21	11.69	12.78	13.39	13.79	6.77	8.56	9.52	9.99	10.25
	33000	9.65	12.46	13.74	14.47	14.94	7.11	9.15	10.28	10.84	11.14
	38000	10	13.11	14.56	15.4	15.94	7.38	9.65	10.93	11.58	11.93
	43000	10.29	13.67	15.28	16.21	16.83	7.61	10.08	11.5	12.22	12.62
	45000	10.39	13.87	15.54	16.51	17.15	7.69	10.23	11.71	12.46	12.88
120	21000	9.19	11.27	12.12	12.58	12.88	6.67	8.17	8.93	9.29	9.48
	26000	9.89	12.46	13.55	14.16	14.55	7.21	9.07	10.04	10.51	10.76
	31000	0	13.43	14.75	15.5	15.98	7.64	9.81	10.98	11.55	11.86
	36000	0	14.24	15.78	16.66	17.22	0	10.43	11.78	12.46	12.83
	41000	0	14.94	16.67	17.67	18.32	0	10.96	12.49	13.27	13.69
	46000	0	15.54	17.45	18.57	19.3	0	11.42	13.12	13.99	14.46
	51000	0	16.06	18.15	19.37	20.18	0	11.83	13.68	14.63	15.15
	54000	0	16.35	18.53	19.82	20.67	0	12.05	13.98	14.99	15.54
130	23000	9.49	11.77	12.73	13.25	13.58	6.91	8.55	9.39	9.8	10.01
	26000	9.89	12.46	13.55	14.16	14.55	7.21	9.07	10.04	10.51	10.76
	30000	10.33	13.25	14.53	15.25	15.71	7.56	9.67	10.8	11.35	11.65
	35000	0	14.09	15.59	16.44	16.99	0	10.31	11.63	12.29	12.64
	40000	0	14.81	16.5	17.48	18.11	0	10.86	12.36	13.11	13.52
	45000	0	15.42	17.3	18.4	19.11	0	11.34	13	13.85	14.31
	50000	0	15.96	18.02	19.22	20.01	0	11.75	13.57	14.51	15.02
	55000	0	16.44	18.65	19.96	20.82	0	12.12	14.08	15.1	15.67
150	23000	9.49	11.77	12.73	13.25	13.58	6.91	8.55	9.39	9.8	10.01
	26000	9.89	12.46	13.55	14.16	14.55	7.21	9.07	10.04	10.51	10.76
	30000	10.33	13.25	14.53	15.25	15.71	7.56	9.67	10.8	11.35	11.65
	35000	0	14.09	15.59	16.44	16.99	0	10.31	11.63	12.29	12.64
	40000	0	14.81	16.5	17.48	18.11	0	10.86	12.36	13.11	13.52
	45000	0	15.42	17.3	18.4	19.11	0	11.34	13	13.85	14.31
	50000	0	15.96	18.02	19.22	20.01	0	11.75	13.57	14.51	15.02
	55000	0	16.44	18.65	19.96	20.82	0	12.12	14.08	15.1	15.67



## Performance Data

**Table 50. Hot water coil heating capacities (Q/ITD) (continued)**

Nom Tons	Airflow (CFM)	High Capacity					Low Capacity				
		40	80	120	160	200	30	60	100	140	175
		0.3	1	2.1	3.7	5.6	0.2	0.6	1.5	2.8	4.3

**Notes:**

1. Nominal capacity is in tons
2. WPD is waterside pressure drop in feet of water
3. Hot water capacity is at 180°F entering water temperature and 65°F entering air temperature
4. Maximum entering water temperature is 200°F.

**Table 51. Steam coil heating capacities (Q/ITD)**

Nominal Tons	Airflow	High Cap	Low Cap
90	16000	7.33	4.99
	20000	8.17	5.67
	25000	9.06	6.35
	30000	9.84	6.91
	33000	10.26	7.19
	36000	10.66	7.44
	40000	11.16	7.74
105	19000	7.97	5.51
	23000	8.73	6.1
	28000	9.55	6.71
	33000	10.27	7.2
	38000	10.92	7.61
	43000	11.52	7.95
	45000	11.74	8.07
120	21000	9.4	6.43
	26000	10.41	7.24
	31000	11.29	7.92
	36000	12.08	8.49
	41000	12.8	8.97
	46000	13.45	9.39
	51000	14.06	9.75
	54000	14.4	9.95
130	23000	9.82	6.78
	26000	10.41	7.24
	30000	11.12	7.79
	35000	11.93	8.38
	40000	12.66	8.88
	45000	13.32	9.31
	50000	13.94	9.68
	55000	14.52	10.01
	58000	14.84	10.18

**Table 51. Steam coil heating capacities (Q/ITD) (continued)**

Nominal Tons	Airflow	High Cap	Low Cap
150	23000	9.82	6.78
	26000	10.41	7.24
	30000	11.12	7.79
	35000	11.93	8.38
	40000	12.66	8.88
	45000	13.32	9.31
	50000	13.94	9.68
	55000	14.52	10.01
	58000	14.84	10.18

**Notes:**

- Nominal capacity is in tons.
- Steam coil capacity is at 15 psig and 65°F entering air temperature.
- Capacities are expressed as mbh (Q) per degree (°F) of initial temperature difference (ITD) between the entering steam temperature (°F) and the entering (return) air temperature (°F) to the coil.
- The maximum recommended steam pressure is 35 psig.

**Table 52. Properties of steam**

Steam Pressure (psig)	2	5	10	15	20	25	30	40	50
Temperature of Steam (°F)	219	227	239	250	259	267	274	287	298

## Component Static Pressure Drops

**Table 53. Component static pressure drops (in. H<sub>2</sub>O)**

Nom Tons	CFM	Evaporator Coil					(Dampers wide open)		
		Standard		High Capacity		Reheat Coil	Return Damper	Outside Air <sup>(a)</sup>	
		Dry	Wet	Dry	Wet	Dry		Econo Damper	Traq Damper
90	16000	0.1	0.13	0.17	0.22	0.04	0.06	0.11	0.19
	20000	0.15	0.19	0.24	0.31	0.06	0.1	0.17	0.29
	25000	0.21	0.27	0.35	0.45	0.08	0.16	0.27	0.45
	30000	0.28	0.36	0.47	0.6	0.11	0.23	0.39	0.65
	33000	0.33	0.42	0.55	0.7	0.13	0.28	0.47	0.79
	36000	0.38	0.48	0.63	0.8	0.15	0.34	0.57	0.94
	40000	0.45	0.57	0.75	0.95	0.18	0.42	0.7	1.16
105	19000	0.18	0.23	0.27	0.32	0.05	0.09	0.15	0.26
	23000	0.2	0.31	0.37	0.47	0.07	0.13	0.23	0.38
	28000	0.34	0.43	0.51	0.64	0.1	0.2	0.34	0.57
	33000	0.44	0.56	0.66	0.84	0.13	0.28	0.47	0.79
	38000	0.55	0.7	0.83	1.05	0.16	0.38	0.63	1.05
	43000	0.67	0.85	1.01	1.28	0.2	0.49	0.81	1.34
45000	0.73	0.92	1.09	1.38	0.21	0.53	0.89	1.47	
120	21000	0.11	0.14	0.18	0.23	0.04	0.05	0.1	0.17
	26000	0.17	0.22	0.25	0.32	0.06	0.09	0.15	0.26
	31000	0.23	0.29	0.34	0.43	0.08	0.12	0.22	0.36
	36000	0.29	0.38	0.43	0.55	0.1	0.17	0.3	0.49
	41000	0.36	0.45	0.53	0.67	0.12	0.22	0.39	0.64
	46000	0.44	0.55	0.64	0.81	0.15	0.28	0.49	0.8
	51000	0.51	0.64	0.75	0.95	0.18	0.35	0.61	0.99
	54000	0.55	0.69	0.83	1.05	0.2	0.39	0.68	1.11



## Performance Data

**Table 53. Component static pressure drops (in. H<sub>2</sub>O) (continued)**

Nom Tons	CFM	Evaporator Coil					(Dampers wide open)			
		Standard		High Capacity		Reheat Coil	Return Damper	Outside Air <sup>(a)</sup>		
		Dry	Wet	Dry	Wet	Dry		Econo Damper	Traq Damper	
130	23000	0.14	0.18	0.21	0.27	0.05	0.07	0.12	0.2	
	26000	0.17	0.22	0.25	0.32	0.06	0.09	0.15	0.26	
	30000	0.21	0.27	0.32	0.41	0.07	0.12	0.21	0.34	
	35000	0.27	0.35	0.41	0.52	0.1	0.16	0.28	0.46	
	40000	0.34	0.43	0.51	0.65	0.12	0.21	0.37	0.61	
	45000	0.41	0.52	0.61	0.78	0.15	0.27	0.47	0.77	
	50000	0.49	0.62	0.73	0.93	0.17	0.33	0.59	0.95	
	58000	0.57	0.72	0.85	1.08	0.2	0.4	0.71	1.15	
150	23000	0.21	0.27	-	-	0.05	0.07	0.12	0.2	
	26000	0.25	0.32	-	-	0.06	0.09	0.15	0.26	
	30000	0.32	0.41	-	-	0.07	0.12	0.21	0.34	
	35000	0.41	0.52	-	-	0.1	0.16	0.28	0.46	
	40000	0.51	0.65	-	-	0.12	0.21	0.37	0.61	
	45000	0.61	0.78	-	-	0.15	0.27	0.47	0.77	
	50000	0.73	0.93	-	-	0.17	0.33	0.59	0.95	
	58000	0.85	1.08	-	-	0.2	0.4	0.71	1.15	
		0.93	1.18	-	-	0.22	0.45	0.79	1.28	

**Note:** Actual Supply Fan CFM Range: 90 Ton 16000-40000; 105 Ton 19000-45000; 120 Ton 21000-54000; 130-150 Ton 23000-58000

<sup>(a)</sup> Use only 1 value. Select Traq value if option is selected.

**Table 54. Component static pressure drops (in. H<sub>2</sub>O)**

Nom Tons	CFM	Electric Heating (Hz) All kW's	Gas Heating						Hydronic Heating Coil Data			
			Low Heat		Medium Heat		High Heat		Hot Water Coil		Steam Coil	
			DF	Hz	DF	Hz	DF	Hz	High	Low	High	Low
90	16000	0.01	0.01	0.02	0.01	0.04	0.03	0.07	0.13	0.08	0.12	0.08
	20000	0.02	0.01	0.04	0.01	0.07	0.04	0.12	0.19	0.12	0.17	0.12
	25000	0.03	0.02	0.05	0.02	0.11	0.07	0.18	0.27	0.17	0.26	0.18
	30000	0.05	0.03	0.06	0.03	0.15	0.10	0.26	0.36	0.24	0.35	0.25
	33000	0.06	0.04	0.07	0.04	0.18	0.12	0.32	0.42	0.28	0.41	0.3
	36000	0.07	0.04	0.10	0.04	0.22	0.14	0.38	0.49	0.33	0.48	0.35
	40000	0.08	0.06	0.12	0.06	0.27	0.18	0.47	0.58	0.39	0.57	0.43
105	19000	0.02	0.01	0.03	0.01	0.06	0.04	0.11	0.17	0.11	0.16	0.11
	23000	0.03	0.02	0.04	0.02	0.09	0.06	0.15	0.23	0.15	0.22	0.16
	28000	0.04	0.03	0.06	0.03	0.13	0.09	0.23	0.32	0.21	0.31	0.22
	33000	0.06	0.04	0.07	0.04	0.18	0.12	0.32	0.42	0.28	0.41	0.3
	38000	0.07	0.05	0.10	0.05	0.24	0.16	0.42	0.53	0.36	0.52	0.39
	43000	0.1	0.06	0.14	0.06	0.31	0.20	0.54	0.65	0.45	0.65	0.49
	45000	0.1	0.07	0.15	0.07	0.34	0.22	0.59	0.71	0.49	0.7	0.53
120	21000	0.02	0.02	0.07	0.05	0.13	0.08	0.18	0.14	0.09	0.13	0.09
	26000	0.03	0.02	0.11	0.07	0.20	0.13	0.28	0.2	0.13	0.19	0.13
	31000	0.05	0.03	0.16	0.11	0.28	0.18	0.40	0.26	0.17	0.25	0.18
	36000	0.07	0.04	0.22	0.14	0.38	0.24	0.54	0.33	0.22	0.33	0.24
	41000	0.09	0.06	0.28	0.19	0.49	0.31	0.70	0.42	0.28	0.41	0.3
	46000	0.11	0.07	0.36	0.23	0.62	0.39	0.88	0.5	0.34	0.5	0.37
	51000	0.13	0.09	0.44	0.29	0.76	0.48	1.08	0.6	0.41	0.59	0.44
	54000	0.15	0.10	0.49	0.32	0.85	0.54	1.21	0.66	0.45	0.65	0.49
130	23000	0.03	0.02	0.09	0.06	0.15	0.10	0.22	0.16	0.1	0.15	0.1
	26000	0.03	0.02	0.11	0.07	0.20	0.13	0.28	0.2	0.13	0.19	0.13
	30000	0.05	0.03	0.15	0.10	0.26	0.17	0.37	0.25	0.16	0.24	0.17
	35000	0.06	0.04	0.21	0.14	0.36	0.23	0.51	0.32	0.21	0.31	0.22
	40000	0.08	0.06	0.27	0.18	0.47	0.30	0.66	0.4	0.27	0.39	0.28
	45000	0.1	0.07	0.34	0.22	0.59	0.38	0.84	0.49	0.33	0.48	0.35
	50000	0.13	0.09	0.42	0.28	0.73	0.46	1.03	0.58	0.39	0.57	0.43
	55000	0.16	0.10	0.51	0.33	0.88	0.56	1.25	0.68	0.47	0.67	0.51
	58000	0.17	0.12	0.57	0.37	0.98	0.63	1.39	0.75	0.51	0.74	0.56
150	23000	0.03	0.02	0.09	0.06	0.15	0.10	0.22	0.16	0.1	0.15	0.1
	26000	0.03	0.02	0.11	0.07	0.20	0.13	0.28	0.2	0.13	0.19	0.13
	30000	0.05	0.03	0.15	0.10	0.26	0.17	0.37	0.25	0.16	0.24	0.17
	35000	0.06	0.04	0.21	0.14	0.36	0.23	0.51	0.32	0.21	0.31	0.22
	40000	0.08	0.06	0.27	0.18	0.47	0.30	0.66	0.4	0.27	0.39	0.28
	45000	0.1	0.07	0.34	0.22	0.59	0.38	0.84	0.49	0.33	0.48	0.35
	50000	0.13	0.09	0.42	0.28	0.73	0.46	1.03	0.58	0.39	0.57	0.43
	55000	0.16	0.10	0.51	0.33	0.88	0.56	1.25	0.68	0.47	0.67	0.51
	58000	0.17	0.12	0.57	0.37	0.98	0.63	1.39	0.75	0.51	0.74	0.56

**Note:** There is no pressure drop with electric heat DF configuration



**Performance Data**

**Table 55. Component static pressure drops (in. H<sub>2</sub>O) — filters**

Nom Tons	CFM	Standard Filter Section (Pre Evap)					Final Filter Section (Post Evap)					
		Std 2" High Eff Throw Away Filters	90-95% Low PD Cartridge Filters w/ 2" Prefilter	90-95% Low PD Cartridge Filters w/ 4" Prefilter	90-95% Cartridge Filters w/ 2" Prefilter (a)	90-95% Bag Filters w/ 2" Prefilter (a)	90-95% Std Temp Low PD Cartridge Filters w/4" Prefilter (b)	90-95% Std Temp Bag Filters w/ 2" Prefilter (c)	90-95% Std Temp Cartridge Filters w/ 2" Prefilter (c)	90-95% Hi Temp Cartridge Filters w/ 2" Hi Temp Prefilter (c)	90-95% Hi Temp HEPA w/ 2" Hi Temp Prefilter (d)	90-95% Std Temp HEPA Filters w/ 2" Hi Temp Prefilter (d)
90	16000	0.08	0.24	—	0.27	0.34	0.23	0.36	0.29	0.35	0.54	0.48
	20000	0.11	0.31	—	0.33	0.41	0.31	0.43	0.36	0.44	0.69	0.61
	25000	0.15	0.42	—	0.42	0.5	0.43	0.54	0.47	0.58	0.89	0.78
	30000	0.2	0.53	—	0.54	0.6	0.56	0.65	0.6	0.74	1.1	0.95
	33000	0.23	0.61	—	0.61	0.67	0.65	0.73	0.69	0.86	1.22	1.06
	36000	0.26	0.69	—	0.7	0.73	0.74	0.8	0.79	0.98	1.36	1.16
	40000	0.3	0.8	—	0.82	0.83	0.88	0.91	0.93	1.15	—	—
105	19000	0.1	0.27	—	0.3	0.37	0.27	0.4	0.32	0.4	0.62	0.55
	23000	0.11	0.29	—	0.32	0.39	0.29	0.42	0.34	0.42	0.66	0.58
	28000	0.18	0.49	—	0.49	0.56	0.51	0.61	0.54	0.68	1.01	0.88
	33000	0.23	0.61	—	0.61	0.67	0.65	0.73	0.69	0.86	1.22	1.06
	38000	0.28	0.74	—	0.76	0.78	0.81	0.86	0.86	1.06	—	—
	43000	0.33	0.89	—	0.92	0.91	0.98	1	1.05	1.3	—	—
	45000	0.36	0.95	—	0.99	0.96	1.05	1.06	1.13	1.4	—	—
120	21000	0.1	—	0.3	0.35	0.42	0.34	0.45	0.38	0.47	0.73	0.64
	26000	0.13	—	0.41	0.44	0.52	0.46	0.56	0.49	0.61	0.93	0.81
	31000	0.17	—	0.53	0.56	0.62	0.59	0.68	0.63	0.78	1.14	0.99
	36000	0.2	—	0.66	0.7	0.73	0.74	0.8	0.79	0.98	1.36	1.16
	41000	0.25	—	0.81	0.85	0.86	0.91	0.94	0.97	1.2	—	—
	46000	0.29	—	0.96	1.03	0.99	1.09	1.09	1.17	1.45	—	—
	51000	0.34	—	1.14	—	—	1.29	—	—	—	—	—
	54000	0.37	—	1.25	—	—	1.42	—	—	—	—	—
130	23000	0.1	—	0.32	0.37	0.44	0.36	0.47	0.4	0.49	0.77	0.68
	26000	0.14	—	0.43	0.47	0.54	0.48	0.58	0.52	0.64	0.97	0.85
	30000	0.17	—	0.55	0.59	0.64	0.62	0.7	0.66	0.82	1.18	1.02
	35000	0.21	—	0.69	0.73	0.76	0.78	0.83	0.82	1.02	1.4	1.2
	40000	0.26	—	0.84	0.89	0.88	0.94	0.97	1.01	1.25	—	—
	45000	0.3	—	1	1.07	1.02	1.13	1.12	1.22	1.51	—	—
	50000	0.35	—	1.17	1.27	1.16	1.33	—	—	—	—	—
	55000	0.41	—	1.36	—	—	1.55	—	—	—	—	—
58000	0.44	—	1.48	—	—	—	—	—	—	—	—	
150	23000	0.1	—	0.32	0.37	0.44	0.36	0.47	0.4	0.49	0.77	0.68
	26000	0.14	—	0.43	0.47	0.54	0.48	0.58	0.52	0.64	0.97	0.85
	30000	0.17	—	0.55	0.59	0.64	0.62	0.7	0.66	0.82	1.18	1.02
	35000	0.21	—	0.69	0.73	0.76	0.78	0.83	0.82	1.02	1.4	1.2
	40000	0.26	—	0.84	0.89	0.88	0.94	0.97	1.01	1.25	—	—
	45000	0.3	—	1	1.07	1.02	1.13	1.12	1.22	1.51	—	—
	50000	0.35	—	1.17	1.27	1.16	1.33	—	—	—	—	—
	55000	0.41	—	1.36	—	—	1.55	—	—	—	—	—
58000	0.44	—	1.48	—	—	—	—	—	—	—	—	

(a) 120-150 Ton Max CFM 50000  
 (b) 130-150 Ton Max CFM 55500  
 (c) 120-150 Ton Max CFM 46250  
 (d) 90-150 Ton Max CFM 37000



**Table 56. Energy recovery wheel component static pressure drops — low CFM**

Nom Tons	CFM	Outside Air Bypass Damper Open	Outside Air Bypass Damper Closed	Relief Air Bypass Damper Open	Relief Air Bypass Damper Closed
<b>Low CFM Energy Recovery Wheel</b>					
90	8000	0.07	0.78	0.09	0.66
	9000	0.09	0.88	0.11	0.79
	10000	0.12	0.99	0.14	0.92
	12000	0.16	1.20	0.19	1.16
	14000	0.21	1.42	0.24	1.41
	16000	0.27	—	0.29	—
	20000	0.40	—	0.42	—
	25000	0.59	—	0.60	—
	30000	0.80	—	0.80	—
	33000	0.94	—	0.94	—
	36000	1.08	—	1.07	—
	40000	1.30	—	1.27	—
105	9000	0.09	0.88	0.11	0.79
	12000	0.16	1.20	0.19	1.16
	14000	0.21	1.42	0.24	1.41
	16000	0.27	—	0.29	—
	19000	0.36	—	0.39	—
	23000	0.51	—	0.52	—
	28000	0.71	—	0.72	—
	33000	0.94	—	0.94	—
	38000	1.19	—	1.18	—
	43000	1.46	—	1.41	—
45000	1.58	—	1.52	—	
120	9000	0.09	0.78	0.11	0.69
	12000	0.16	1.06	0.18	1.02
	15000	0.23	1.36	0.26	1.36
	18000	0.31	—	0.34	—
	21000	0.41	—	0.44	—
	26000	0.59	—	0.62	—
	31000	0.79	—	0.82	—
	36000	1.01	—	1.04	—
	41000	1.25	—	1.28	—
	46000	1.51	—	1.52	—
	51000	1.79	—	1.79	—
	54000	1.96	—	1.95	—
130	9000	0.09	0.71	0.10	0.62
	12000	0.15	0.97	0.18	0.92
	16000	0.25	1.34	0.28	1.33
	20000	0.36	—	0.40	—
	23000	0.46	—	0.49	—
	26000	0.57	—	0.60	—
	30000	0.72	—	0.75	—
	35000	0.93	—	0.97	—
	40000	1.16	—	1.20	—
	45000	1.40	—	1.43	—
	50000	1.67	—	1.69	—
	55000	1.95	—	1.96	—
	58000	2.12	—	2.12	—



**Performance Data**

**Table 56. Energy recovery wheel component static pressure drops — low CFM (continued)**

Nom Tons	CFM	Outside Air Bypass Damper Open	Outside Air Bypass Damper Closed	Relief Air Bypass Damper Open	Relief Air Bypass Damper Closed
<b>Low CFM Energy Recovery Wheel</b>					
150	9000	0.09	0.71	0.10	0.62
	12000	0.15	0.97	0.18	0.92
	16000	0.25	1.34	0.28	1.33
	20000	0.36	—	0.40	—
	23000	0.46	—	0.49	—
	26000	0.57	—	0.60	—
	30000	0.72	—	0.75	—
	35000	0.93	—	0.97	—
	40000	1.16	—	1.20	—
	45000	1.40	—	1.43	—
	50000	1.67	—	1.69	—
	55000	1.95	—	1.96	—
	58000	2.12	—	2.12	—

**Table 57. Energy recovery wheel component static pressure drops — standard CFM**

Nom Tons	CFM	Outside Air Bypass Damper Open	Outside Air Bypass Damper Closed	Relief Air Bypass Damper Open	Relief Air Bypass Damper Closed
<b>Standard CFM Energy Recovery Wheel</b>					
90	8000	0.06	0.54	0.07	0.44
	9000	0.08	0.61	0.10	0.53
	10000	0.10	0.68	0.12	0.62
	12000	0.15	0.83	0.17	0.77
	14000	0.19	0.99	0.22	0.94
	16000	0.24	1.16	0.26	1.12
	18000	0.30	1.32	0.31	1.29
	20000	0.35	-	0.37	-
	25000	0.52	-	0.54	-
	30000	0.70	-	0.73	-
	33000	0.82	-	0.84	-
	36000	0.95	-	0.97	-
	40000	1.12	-	1.14	-
105	9000	0.08	0.57	0.09	0.47
	12000	0.14	0.77	0.16	0.65
	14000	0.19	0.93	0.21	0.78
	16000	0.24	1.08	0.26	0.91
	19000	0.32	1.33	0.34	1.11
	21000	0.37	1.49	0.40	1.25
	23000	0.44	-	0.46	-
	28000	0.61	-	0.64	-
	33000	0.80	-	0.82	-
	38000	1.00	-	1.03	-
	43000	1.23	-	1.25	-
45000	1.33	-	1.34	-	

**Table 57. Energy recovery wheel component static pressure drops — standard CFM (continued)**

Nom Tons	CFM	Outside Air Bypass Damper Open	Outside Air Bypass Damper Closed	Relief Air Bypass Damper Open	Relief Air Bypass Damper Closed
<b>Standard CFM Energy Recovery Wheel</b>					
120	10000	0.10	0.56	0.11	0.50
	12000	0.14	0.69	0.16	0.63
	15000	0.20	0.89	0.23	0.85
	18000	0.27	1.10	0.29	1.05
	21000	0.35	1.33	0.38	1.28
	24000	0.43	1.57	0.47	1.51
	26000	0.50	-	0.54	-
	31000	0.66	-	0.72	-
	36000	0.84	-	0.91	-
	41000	1.04	-	1.11	-
	46000	1.26	-	1.34	-
	51000	1.49	-	1.56	-
54000	1.63	-	1.71	-	
130-150	13000	0.16	0.59	0.17	0.53
	15000	0.20	0.69	0.22	0.63
	18000	0.26	0.86	0.28	0.79
	21000	0.33	1.04	0.36	0.96
	23000	0.38	1.16	0.42	1.06
	26000	0.45	1.36	0.50	1.24
	29000	0.54	1.57	0.60	1.42
	30000	0.57	-	0.63	-
	35000	0.72	-	0.80	-
	40000	0.89	-	0.98	-
	45000	1.08	-	1.17	-
	50000	1.28	-	1.38	-
	55000	1.50	-	1.60	-
	58000	1.63	-	1.74	-

**Table 58. Energy recovery wheel component static pressure drops — dampers**

Tons	CFM	Return Damper, ERW only	Econo Damper, ERW only
90	16000	0.14	0.15
	20000	0.2	0.24
	25000	0.29	0.39
	30000	0.42	0.56
	33000	0.51	0.69
	36000	0.61	0.82
	40000	0.75	1.01
105	19000	0.19	0.22
	23000	0.25	0.33
	28000	0.37	0.49
	33000	0.51	0.69
	38000	0.68	0.91
	43000	0.87	1.17
120	45000	0.96	1.29
	21000	0.22	0.18
	26000	0.32	0.27
	31000	0.45	0.39
	36000	0.61	0.53
	41000	0.79	0.69
	46000	1	0.87
	51000	1.24	1.07
54000	1.4	1.2	



**Performance Data**

**Table 58. Energy recovery wheel component static pressure drops — dampers (continued)**

Tons	CFM	Return Damper, ERW only	Econo Damper, ERW only
130-150	23000	0.25	0.21
	26000	0.32	0.27
	30000	0.42	0.36
	35000	0.57	0.5
	40000	0.75	0.65
	45000	0.96	0.83
	50000	1.19	1.02
	55000	1.45	1.24
	58000	1.63	1.38

**Table 59. Energy recovery wheel pressure loss  $\Delta P$  (in. wg) and total effectiveness**

Actual Airflow CFM	90-105 Tons Low		120 Tons Low		130-150 Tons Low		90 Tons Standard		105 Tons Standard		120 Tons Standard		130-150 Tons Standard	
	$\Delta P$	Eff	$\Delta P$	Eff	$\Delta P$	Eff	$\Delta P$	Eff	$\Delta P$	Eff	$\Delta P$	Eff	$\Delta P$	Eff
8000	0.73	77.50	0.64	79.00	0.58	80.00	0.49	81.60	—	—	—	—	—	—
9000	0.82	75.90	0.72	77.60	0.65	78.70	0.55	80.60	0.51	81.30	—	—	—	—
10000	0.91	74.30	0.80	76.20	0.73	77.50	0.61	79.50	0.56	80.30	0.49	81.60	—	—
11000	1.00	72.70	0.88	74.80	0.80	76.20	0.67	78.50	0.62	79.40	0.54	80.70	—	—
12000	1.09	71.10	0.96	73.40	0.87	75.00	0.73	77.40	0.67	78.40	0.59	79.80	—	—
13000	1.18	69.50	1.04	72.00	0.94	73.70	0.79	76.40	0.73	77.40	0.64	79.00	0.48	74.70
14000	—	—	1.12	70.60	1.02	72.40	0.85	75.30	0.79	76.50	0.69	78.10	0.51	72.90
15000	—	—	1.20	69.20	1.09	71.10	0.91	74.30	0.84	75.50	0.74	77.30	0.55	71.90
16000	—	—	—	—	1.16	69.80	0.97	73.20	0.90	74.50	0.79	76.40	0.58	71.00
17000	—	—	—	—	1.24	68.50	1.03	72.10	0.95	73.50	0.83	75.60	0.61	70.00
18000	—	—	—	—	—	—	1.09	71.10	1.01	72.50	0.88	74.70	0.64	69.00
19000	—	—	—	—	—	—	1.15	70.00	1.07	71.50	0.93	73.90	0.67	68.10
20000	—	—	—	—	—	—	1.22	68.90	1.12	70.50	0.98	73.00	0.71	67.10
21000	—	—	—	—	—	—	—	—	1.18	69.50	1.03	72.10	0.74	66.10
22000	—	—	—	—	—	—	—	—	1.23	68.50	1.08	71.30	0.77	65.10
23000	—	—	—	—	—	—	—	—	—	—	1.13	70.40	0.80	64.20
24000	—	—	—	—	—	—	—	—	—	—	1.18	69.50	0.84	63.20
25000	—	—	—	—	—	—	—	—	—	—	1.23	68.70	0.87	62.20
26000	—	—	—	—	—	—	—	—	—	—	—	—	0.90	61.20
27000	—	—	—	—	—	—	—	—	—	—	—	—	0.93	60.30
28000	—	—	—	—	—	—	—	—	—	—	—	—	0.97	59.30
29000	—	—	—	—	—	—	—	—	—	—	—	—	1.00	58.30

## Fan Drive Selections

**Table 60. Supply air fan drive selections**

		Horse Power (hp)									
Nom Tons	Low/Std	RPM	15 hp	20 hp	25 hp	30 hp	40 hp	50 hp	60 hp	75 hp	100 hp
			Drive/No.								
90	Low	2000						L			
	Low	1900					K				
	Low	1800					J				
	Low	1700				H					
	Low	1600			G						
	Low	1500		F							
	Low	1400	E	E							
90-105	Std	1300							D	D	
	Std	1200						C	C		
	Std	1100					B	B			
	Std	1000				A	A				
	Std	900		9	9	9					
	Std	800	8	8	8						
105-150	Low	1500							F		
	Low	1400						E	E		
	Low	1300					D	D			
	Low	1200				C	C				
	Low	1100			B	B					
	Low	1000		A	A						
	Low	900	9	9							
120-150	Std	1200									C
	Std	1100							B	B	B
	Std	1000						A	A	A	A
	Std	900					9	9	9	9	
	Std	800			8	8	8	8			
	Std	700		7	7	7	7				

**Table 61. Relief air fan drive selections**

		Horse Power (hp)									
Nom Tons	Low/Std	RPM	15 hp	20 hp	25 hp	30 hp	40 hp	50 hp	60 hp	75 hp	100 hp
			Drive/No.								
90	Low	700				7	7				
	Low	600	6	6	6	6	6				
	Low	500	5	5	5	5					
	Low	400	4	4	4						
	Std	600				6	6				
	Std	500			5	5	5				
	Std	400		4	4	4	4				
	Std	300		3	3						
105-150	Low	600				6	6	6	6	6	
	Low	500			5	5	5	5	5	5	
	Low	400	4	4	4	4	4	4	4		
	Low	300	3	3	3						
	Std	600								6	6
	Std	500			5	5	5	5	5		
	Std	400			4	4	4				



## Performance Data

**Table 62. Return air fan drive selections**

Nom Tons	Low/Std	RPM	Horse Power (hp)							
			7.5 hp	10 hp	15 hp	20 hp	25 hp	30 hp	40 hp	50 hp
			Drive/No.							
All	Low	1400							E	
	Low	1300						D		
	Low	1200					C	C		
	Low	1100				B				
	Low	1000			A	A				
	Low	900			9					
	Low	800	8	8						
	Low	700	7							
90-105	Std	1200							C	
	Std	1100						B	B	
	Std	1000					A	A		
	Std	900				9				
	Std	800			8					
	Std	700		7						
120-150	Std	1100								B
	Std	1000							A	A
	Std	900						9	9	
	Std	800				8	8			
	Std	700			7					
	Std	600			6					



# Electrical Data

## Electrical Service Sizing

To correctly size electrical service wiring for a unit, find the appropriate calculations listed below. Each type of unit has its own set of calculations for MCA (Minimum Circuit Ampacity) and MOP (Maximum Overcurrent Protection). Read the load definitions that follow and then find the appropriate set of calculations based on unit type.

**Note:** Set 1 is for cooling only and cooling with gas heat units, and set 2 is for cooling with electric heat units.

Load Definitions: (To determine load values, see the Electrical Service Sizing Data Tables on the following page.)

LOAD1 = Current of the largest motor (compressor or fan motor)

LOAD2 = Sum of the currents of all remaining motors

LOAD3 = Current of electric heaters

LOAD4 = Any other load rated at 1 AMP or more

### Set 1: Cooling Only Rooftop Units and Cooling with Gas Heat Rooftop Units

$$\text{MCA} = (1.25 \times \text{LOAD1}) + \text{LOAD2} + \text{LOAD4}$$

$$\text{MOP} = (2.25 \times \text{LOAD1}) + \text{LOAD2} + \text{LOAD4}$$

Select a fuse rating equal to the MOP value. If the MOP value does not equal a standard fuse size as listed in NEC 240-6, select the next lower standard fuse rating.

**Note:** If selected MOP is less than the MCA, then select the lowest standard maximum fuse size which is equal to or larger than the MCA, provided the selected fuse size does not exceed 800 amps.

### Set 2: Rooftop units with Electric Heat

To arrive at the correct MCA and MOP values for these units, two sets of calculations must be performed. First calculate the MCA and MOP values as if the unit was in cooling mode (use the equations given in Set 1). Then calculate the MCA and MOP values as if the unit were in heating mode as follows. (Keep in mind when determining LOADS that the compressors don't run while the unit is in heating mode).

$$\text{MCA} = 1.25 \times (\text{LOAD1} + \text{LOAD2} + \text{LOAD4}) + \text{LOAD3}$$

The nameplate MCA value will be the larger of the cooling mode MCA value or the heating mode MCA value calculated above.

$$\text{MOP} = (2.25 \times \text{LOAD1}) + \text{LOAD2} + \text{LOAD3} + \text{LOAD4}$$

The selection MOP value will be the larger of the cooling mode MOP value or the heating mode MOP value calculated above.

Select a fuse rating equal to the MOP value. If the MOP value does not equal a standard fuse size as listed in NEC 240-6, select the next lower standard fuse rating.

**Notes:**

- If selected MOP is less than the MCA, then select the lowest standard maximum fuse size which is equal to or larger than the MCA, provided the selected fuse size does not exceed 800 amps.
- On 90 to 150 ton rooftops, the selected MOP value is stamped in the MOP field on the unit nameplate.



**Electrical Data**

**Service Sizing Data**

**Table 63. Electrical service sizing data**

Fixed Capacity Compressors								
Nom Tons	Compressor		Nominal Voltage					
	Size	No per Unit	460 V		575 V		380 V	
			RLA (ea.)	LRA (ea.)	RLA (ea.)	LRA (ea.)	RLA (ea.)	LRA (ea.)
90	250	4	38.1	215	30.4	175	38.4	215
105	184	6	28.9	160	23.1	135	29.1	160
120	184	4	28.9	160	23.1	135	29.1	160
	250	2	38.1	215	30.4	175	38.4	215
130	240	6	36	215	28.8	175	36.3	215
150	250	6	38.1	215	30.4	175	38.4	215

**Table 64. Electrical service sizing data**

Fixed Capacity Compressors								
Nom Tons	Compressor		Nominal Voltage					
	Size	No per Unit	460 V		575 V		380 V	
			RLA (ea.)	LRA (ea.)	RLA (ea.)	LRA (ea.)	RLA (ea.)	LRA (ea.)
90	170	1	44.6	N/A	35.7	N/A	54	N/A
	169	4	26.2	160	20.9	135	26.4	160
105	170	1	44.6	N/A	35.7	N/A	54	N/A
	169	3	26.2	160	20.9	135	26.4	160
	227	1	36.1	215	28.9	175	36.4	215
120	170	1	44.6	N/A	35.7	N/A	54	N/A
	169	2	26.2	160	20.9	135	26.4	160
	227	1	36.1	160	28.9	175	36.4	215
	285	1	47.5	260	38	210	48	260
130	170	1	44.6	N/A	35.7	N/A	54	N/A
	227	3	36.1	215	28.9	175	36.4	215
	346	1	57.1	235	45.6	187	57.6	235
150	170	1	44.6	N/A	35.7	N/A	54	N/A
	169	1	26.2	160	20.9	135	26.4	160
	227	1	36.1	215	28.9	175	36.4	215
	346	2	57.1	235	45.6	187	57.6	235



**Table 65. Electrical service sizing data—motors — air-cooled and evaporative condensing**

Nominal Tonnage	No of Fans	Fixed Speed						Variable Speed		
		Standard Ambient			Low Ambient			Standard or Low Ambient		
		Voltage								
		460	575	380	460	575	380	460	575	380
90, 105	6	16.2	13.2	15	15	12.4	14.8	12.5	10.8	14.3
120, 130, 150	8	21.6	17.6	20	20.4	16.8	19.8	16.6	14.4	19.1

**Table 66. Electrical service sizing data—supply, relief/return fan motors — air-cooled and evaporative condensing**

Motor HP	460 V	575 V	380 V
	FLA	FLA	FLA
<b>Supply Fan Motors</b>			
15	18.5	15.0	22.0
20	24.7	19.6	28.0
25	31.0	25.0	36.0
30	36.6	29.0	43.5
40	49.0	39.0	54.0
50	59.0	47.2	68.0
60	71.5	57.2	81.0
75	90.0	72.0	103.0
100	115.0	91.3	N/A
<b>Relief/Return Fan Motors</b>			
7.5	9.8	7.8	12.1
10	12.6	10.1	15.2
15	18.5	15.0	22.0
20	24.7	19.6	28.0
25	31.0	25.0	36.0
30	36.6	29.0	43.5
40	49.0	39.0	54.0
50	59.0	47.2	68.0
60	71.5	57.2	81.0

**Table 67. Electrical service sizing data—electric heat module (electric heat units only)**

Module kW	Voltage		
	460	575	380
	FLA	FLA	FLA
90 / 56	108.3	86.6	85.1
140 / 88	168.4	134.7	133.3
265 / 166	318.8	255.0	252.3
300 / 188	360.8	288.7	285.7

**Note:** Electric heat FLA are determined at 480, 600, 380 volts.



## Electrical Data

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**Table 68. Transformer 1 and 2 primary amps**

Nom Tons	Voltage		
	460	575	380
90-150	9	7	11

**Table 69. Voltage utilization range**

Unit Voltage	Range
460/60/3	414-506
575/60/3	517-633
380/50/3	342-418

**Table 70. Electrical service sizing data—energy recovery wheel motor**

Nom Tons	Unit Function	Voltage	
		460	575
		FLA	FLA
90-120	1 (Low CFM ERW)	1.1	0.90
130-150	1 (Low CFM ERW)	1.8	1.4
All	2 (High. CFM ERW)	2.6	2.5

# Dimensional Data

Figure 19. Unit top/left view

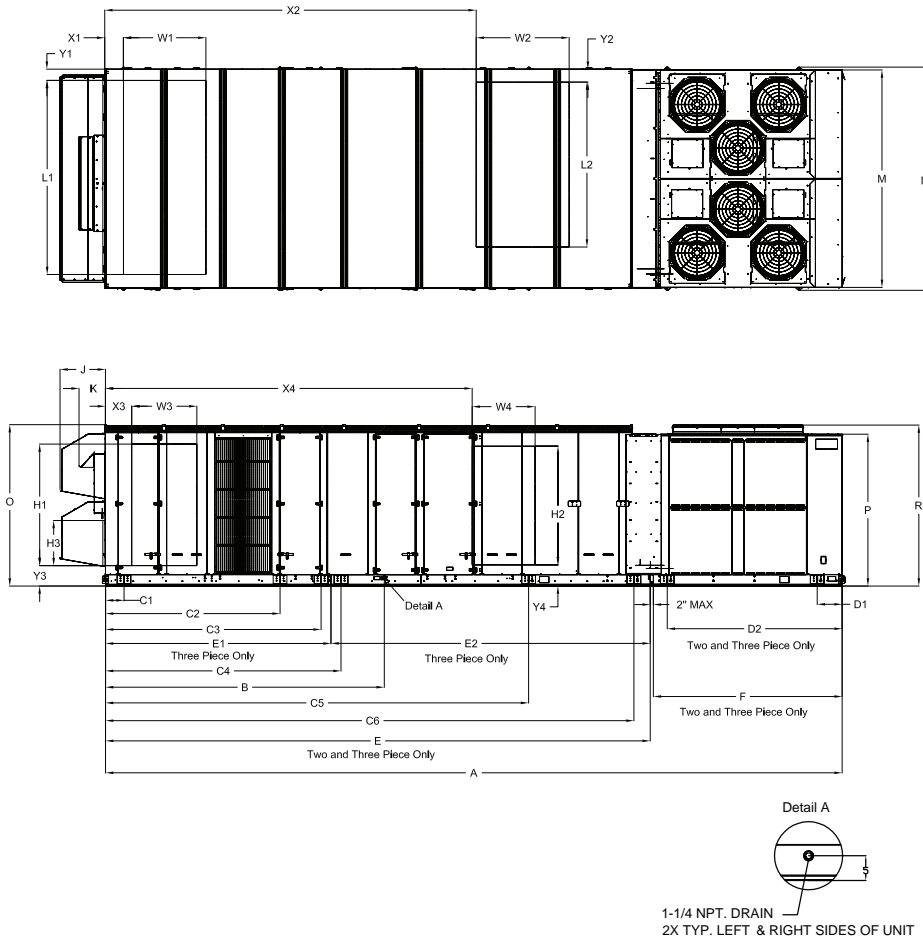


Table 71. Unit dimensions (in.)—ONE-PIECE unit —WITHOUT energy recovery wheel

Tons	Blank Section	Lifting Lug Locations						Unit Width		Unit Height			Return Fan	Exhaust Fan
		Unit Dimensions		Air Handler Side			Condenser Side	M	N	O	P	R	J	K
		A	B	C1	C2	C3	D1							
90	None	437 3/16	159 15/16	66	252 14/16	N/A	27 11/16	139 13/16	143 8/16	103 12/16	97 9/16	103 7/16	29 3/16	17
	4 ft	485 6/16	159 15/16	66	252 14/16	N/A	54 2/16	139 13/16	143 8/16					
	8 ft	533 9/16	159 15/16	66	252 14/16	N/A	54 2/16	139 13/16	143 8/16					
105	None	455 3/16	159 15/16	66	252 14/16	N/A	27 11/16	139 13/16	143 8/16	103 12/16	97 9/16	103 7/16	29 3/16	17
	4 ft	503 6/16	159 15/16	66	252 14/16	N/A	54 2/16	139 13/16	143 8/16					
	8 ft	551 9/16	159 15/16	66	252 14/16	N/A	54 2/16	139 13/16	143 8/16					
120-150 (a)	None	528 15/16	197 1/16	66	269 6/16	N/A	63 2/16	139 13/16	143 8/16	—	—	—	—	—



## Dimensional Data

**Table 71. Unit dimensions (in.)—ONE-PIECE unit —WITHOUT energy recovery wheel (continued)**

Tons	Blank Section	Unit Dimensions		Lifting Lug Locations				Unit Width		Unit Height			Return Fan	Exhaust Fan
				Air Handler Side			Condenser Side	M	N	O	P	R	J	K
		A	B	C1	C2	C3	D1							
120-150 (a)	4 ft	577 2/16	197 1/16	66	269 6/16	N/A	63 2/16	139 13/16	143 8/16	—	—	—	—	—
120-150 (b)	None	540 15/16	197 1/16	66	269 6/16	N/A	63 2/16	139 13/16	143 8/16	—	—	—	—	—

(a) All units except high heat gas models

(b) High heat gas models only

**Table 72. Unit dimensions (in.)—ONE-PIECE unit —WITH energy recovery wheel**

Tons	Blank Section	Unit Dimensions		Lifting Lug Locations				Unit Width		Unit Height		
		A	B	Air Handler Side			Condenser Side	M	N	O	P	R
				C1	C2	C3	D1					
90	None	533 9/16	256 5/16	66	201 1/16	349 4/16	27 11/16	139 13/16	143 8/16	103 12/16	97 9/16	103 7/16
90	4 ft	581 13/16	256 5/16	66	201 1/16	349 4/16	54 2/16	139 13/16	143 8/16	103 12/16	97 9/16	103 7/16
105	None	551 9/16	256 5/16	66	201 1/16	349 4/16	27 11/16	139 13/16	143 8/16	103 12/16	97 9/16	103 7/16
105	4 ft	599 13/16	256 5/16	66	201 1/16	349 4/16	54 2/16	139 13/16	143 8/16	103 12/16	97 9/16	103 7/16
Tons	Blank Section	Return Fan	Exhaust Fan									
		J	K									
90	None	N/A	17									
90	4 ft	N/A	17									
105	None	N/A	17									
105	4 ft	N/A	17									

**Table 73. Unit dimensions (in.)—TWO-PIECE unit —WITHOUT energy recovery wheel**

Tons	Blank Section	Unit Dimensions				Lifting Lug Locations				Lug Locations	
		A	B	E	F	Air Handler Side				Condenser Side	
						C1	C2	C3	C4	D1	D2
90	None	454 4/16	159 15/16	330 14/16	121 6/16	66	252 14/16	N/A	N/A	16	112 7/16
	4 ft	502 7/16	159 15/16	379 1/16	121 6/16	66	252 14/16	368 6/16	N/A	16	112 7/16
	8 ft	550 11/16	159 15/16	427 4/16	121 6/16	66	252 14/16	416 10/16	N/A	16	112 7/16
105	None	472 4/16	159 15/16	330 14/16	139 6/16	66	252 14/16	N/A	N/A	16	130 7/16
	4 ft	520 7/16	159 15/16	379 1/16	139 6/16	66	252 14/16	368 6/16	N/A	16	130 7/16
	8 ft	568 11/16	159 15/16	427 4/16	139 6/16	66	252 14/16	416 10/16	N/A	16	130 7/16
120-150 (a)	None	546	197 1/16	395 10/16	148 6/16	66	269 6/16	384 15/16	N/A	16	139 7/16
120-150 (a)	4 ft	594 4/16	197 1/16	443 13/16	148 6/16	66	269 6/16	433 2/16	N/A	16	139 7/16
120-150 (a)	8 ft	642 7/16	197 1/16	492 1/16	148 6/16	66	269 6/16	481 6/16	N/A	16	139 7/16
120-150 (a)	None	558	197 1/16	407 10/16	148 6/16	66	269 6/16	396 15/16	N/A	16	139 7/16

**Table 73. Unit dimensions (in.)—TWO-PIECE unit —WITHOUT energy recovery wheel (continued)**

Tons	Blank Section	Unit Width		Unit Height			Return Fan	Exhaust Fan
		M	N	O	P	R	J	K
90	None	139 13/16	143 8/16	103 12/16	97 9/16	103 7/16	29 3/16	17
	4 ft	139 13/16	143 8/16	103 12/16	97 9/16	103 7/16	29 3/16	17
	8 ft	139 13/16	143 8/16	103 12/16	97 9/16	103 7/16	29 3/16	17
105	None	139 13/16	143 8/16	103 12/16	97 9/16	103 7/16	29 3/16	17
	4 ft	139 13/16	143 8/16	103 12/16	97 9/16	103 7/16	29 3/16	17
	8 ft	139 13/16	143 8/16	103 12/16	97 9/16	103 7/16	29 3/16	17
120-150 (a)	None	139 13/16	143 8/16	103 12/16	97 9/16	103 7/16	29 3/16	17
120-150 (a)	4 ft	139 13/16	143 8/16	103 12/16	97 9/16	103 7/16	29 3/16	17
120-150 (a)	8 ft	139 13/16	143 8/16	103 12/16	97 9/16	103 7/16	29 3/16	17
120-150 (b)	None	139 13/16	143 8/16	103 12/16	97 9/16	103 7/16	29 3/16	17

(a) High Heat Gas Models Only

(b) High Heat Gas Models Only

**Table 74. Unit dimensions (in.)—TWO-PIECE unit —WITH energy recovery wheel**

Tons	Blank Section	Unit Dimensions				Lifting Lug Locations				Lug Locations	
		A	B	E	F	Air Handler Side				Condenser Side	
						C1	C2	C3	C4	D1	D2
90	None	550 11/16	256 5/16	427 5/16	121 6/16	66	201 1/16	349 4/16	N/A	16	112 7/16
	4 ft	598 14/16	256 5/16	475 8/16	121 6/16	66	201 1/16	349 4/16	464 13/16	16	112 7/16
	8 ft	647 2/16	256 5/16	523 12/16	121 6/16	66	201 1/16	349 4/16	513	16	112 7/16
105	None	568 11/16	256 5/16	427 5/16	139 6/16	66	201 1/16	349 4/16	N/A	16	130 7/16
	4 ft	616 14/16	256 5/16	475 8/16	139 6/16	66	201 1/16	349 4/16	464 13/16	16	130 7/16
	8 ft	665 2/16	256 5/16	523 12/16	139 6/16	66	201 1/16	349 4/16	513	16	130 7/16
120-150(a)	None	642 7/16	293 8/16	492 1/16	148 6/16	66	238 5/16	365 5/16	480 14/16	16	139 7/16
120-150(a)	4 ft	690 10/16	293 8/16	540 4/16	148 6/16	66	238 5/16	365 5/16	529 2/16	16	139 7/16
120-150(a)	8 ft	738 14/16	293 8/16	588 8/16	148 6/16	66	238 5/16	365 5/16	577 5/16	16	139 7/16
120-150(a)	None	654 7/16	293 8/16	504 1/16	148 6/16	66	238 5/16	365 5/16	492 14/16	16	139 7/16

Tons	Blank Section	Unit Width		Unit Height			Return Fan	Exhaust Fan
		M	N	O	P	R	J	K
90	None	139 13/16	143 8/16	103 12/16	97 9/16	103 7/16	N/A	17
	4 ft	139 13/16	143 8/16	103 12/16	97 9/16	103 7/16	N/A	17
	8 ft	139 13/16	143 8/16	103 12/16	97 9/16	103 7/16	N/A	17
105	None	139 13/16	143 8/16	103 12/16	97 9/16	103 7/16	N/A	17
	4 ft	139 13/16	143 8/16	103 12/16	97 9/16	103 7/16	N/A	17
	8 ft	139 13/16	143 8/16	103 12/16	97 9/16	103 7/16	N/A	17
120-150(a)	None	139 13/16	143 8/16	103 12/16	97 9/16	103 7/16	N/A	17
120-150(a)	4 ft	139 13/16	143 8/16	103 12/16	97 9/16	103 7/16	N/A	17
120-150(a)	8 ft	139 13/16	143 8/16	103 12/16	97 9/16	103 7/16	N/A	17
120-150(b)	None	139 13/16	143 8/16	103 12/16	97 9/16	103 7/16	N/A	17

(a) High Heat Gas Models Only

(b) High Heat Gas Models Only



**Dimensional Data**

**Table 75. Downflow/horizontal airflow configuration dimensions (in.) without energy recovery wheel (ERW)**

Tonnage	Blank Section	Gas Heat	DOWNFLOW Opening Dimensions							
			Return Opening-with or without Relief Fan				Return Opening-with Return Fan			
			X1	Y1	W1	L1	X1	Y1	W1	L1
90-105	None	None	14 13/16	8 14/16	48 3/16	121 15/16	14 13/16	42 14/16	48 3/16	53 14/16
	4 ft	None	14 13/16	8 14/16	48 3/16	121 15/16	14 13/16	42 14/16	48 3/16	53 14/16
	8 ft	None	14 13/16	8 14/16	48 3/16	121 15/16	14 13/16	42 14/16	48 3/16	53 14/16
120-150	None	None	14 13/16	8 14/16	48 3/16	121 15/16	14 13/16	42 14/16	48 3/16	53 14/16
	4 ft	None	14 13/16	8 14/16	48 3/16	121 15/16	14 13/16	42 14/16	48 3/16	53 14/16
	8 ft	None	14 13/16	8 14/16	48 3/16	121 15/16	14 13/16	42 14/16	48 3/16	53 14/16
90-105	None	Low/Med/High	14 13/16	8 14/16	48 3/16	121 15/16	14 13/16	42 14/16	48 3/16	53 14/16
	8 ft	Low/Med/High	14 13/16	8 14/16	48 3/16	121 15/16	14 13/16	42 14/16	48 3/16	53 14/16
120-150	None	Low/Med	14 13/16	8 14/16	48 3/16	121 15/16	14 13/16	42 14/16	48 3/16	53 14/16
	8 ft	Low/Med	14 13/16	8 14/16	48 3/16	121 15/16	14 13/16	42 14/16	48 3/16	53 14/16
	None	High	14 13/16	8 14/16	48 3/16	121 15/16	14 13/16	42 14/16	48 3/16	53 14/16
Tonnage	Blank Section	Gas Heat	DOWNFLOW Opening Dimensions				HORIZONTAL Opening Dimensions			
			Supply Opening				Return Side Opening			
			X2	Y2	W2	L2	X3	Y3	W3	H1
90-105	None	None	256 1/16	13	47 14/16	102 8/16	9 5/16	10 10/16	54 12/16	84 15/16
	4 ft	None	304 4/16	13	47 14/16	102 8/16	9 5/16	10 10/16	54 12/16	84 15/16
	8 ft	None	352 8/16	13	47 14/16	102 8/16	9 5/16	10 10/16	54 12/16	84 15/16
120-150	None	None	320 13/16	13	47 14/16	102 8/16	—	—	—	—
	4 ft	None	369	13	47 14/16	102 8/16	—	—	—	—
	8 ft	None	417 3/16	13	47 14/16	102 8/16	9 5/16	10 10/16	54 12/16	84 15/16
90-105	None	Low/Med/High	256 1/16	13	47 14/16	102 8/16	9 5/16	10 10/16	54 12/16	84 15/16
	8 ft	Low/Med/High	352 8/16	13	47 14/16	102 8/16	9 5/16	10 10/16	54 12/16	84 15/16
120-150	None	Low/Med	320 13/16	13	47 14/16	102 8/16	9 5/16	10 10/16	54 12/16	84 15/16
	8 ft	Low/Med	417 3/16	13	47 14/16	102 8/16	9 5/16	10 10/16	54 12/16	84 15/16
	None	High	320 13/16	13	59 14/16	102 8/16	9 5/16	10 10/16	54 12/16	84 15/16
Tonnage	Blank Section	Gas Heat	HORIZONTAL Opening Dimensions							
			Return End Opening				Supply Opening			
			Y1	Y3	H3	L1	X4	Y4	W4	H2
90-105	None	None	6 5/16	8 3/16	35 3/16	127 2/16	254 12/16	10 10/16	54 12/16	84 15/16
	4 ft	None	6 5/16	8 3/16	35 3/16	127 2/16	302 15/16	10 10/16	54 12/16	84 15/16
	8 ft	None	6 5/16	8 3/16	35 3/16	127 2/16	351 2/16	10 10/16	54 12/16	84 15/16
120-150	None	None	—	—	—	—	319 8/16	10 10/16	54 12/16	84 15/16
	4 ft	None	—	—	—	—	367 11/16	10 10/16	54 12/16	84 15/16
	8 ft	None	6 5/16	8 3/16	35 3/16	127 2/16	415 15/16	10 10/16	54 12/16	84 15/16
90-105	None	Low/Med/High	6 5/16	8 3/16	35 3/16	127 2/16	254 12/16	10 10/16	54 12/16	66 11/16
	8 ft	Low/Med/High	6 5/16	8 3/16	35 3/16	127 2/16	351 2/16	10 10/16	54 12/16	84 15/16
120-150	None	Low/Med	6 5/16	8 3/16	35 3/16	127 2/16	319 8/16	10 10/16	54 12/16	66 11/16
	8 ft	Low/Med	6 5/16	8 3/16	35 3/16	127 2/16	415 15/16	10 10/16	54 12/16	84 15/16
	None	High	6 5/16	8 3/16	35 3/16	127 2/16	319 8/16	10 10/16	66 12/16	66 11/16

**Table 76. Downflow/horizontal airflow configuration dimensions (in.) with energy recovery wheel**

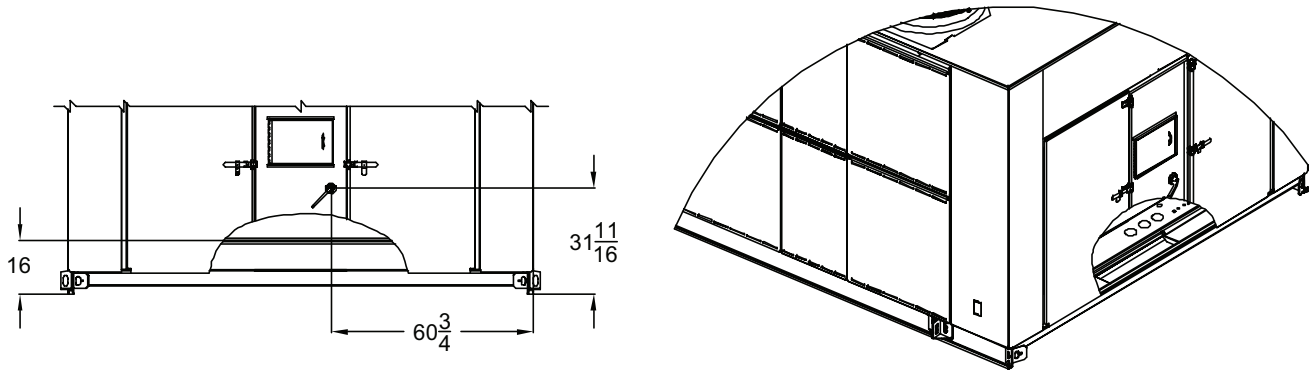
Tonnage	Blank Section	Gas Heat	DOWNFLOW Opening Dimensions											
			Return Opening-with or without Relief Fan				Return Opening-with Return Fan				Supply Opening			
			X1	Y1	W1	L1	X1	Y1	W1	L1	X2	Y2	W2	L2
90-105	None	None	82 3/16	8 14/16	49 10/16	121 15/16	N/A	N/A	N/A	N/A	352 8/16	13	47 14/16	102 8/16
	4 ft	None	82 3/16	8 14/16	49 10/16	121 15/16	N/A	N/A	N/A	N/A	400 11/16	13	47 14/16	102 8/16
	8 ft	None	82 3/16	8 14/16	49 10/16	121 15/16	N/A	N/A	N/A	N/A	448 15/16	13	47 14/16	102 8/16
120-150	None	None	82 3/16	8 14/16	49 10/16	121 15/16	N/A	N/A	N/A	N/A	417 4/16	13	47 14/16	102 8/16
	4 ft	None	82 3/16	8 14/16	49 10/16	121 15/16	N/A	N/A	N/A	N/A	465 7/16	13	47 14/16	102 8/16
	8 ft	None	82 3/16	8 14/16	49 10/16	121 15/16	N/A	N/A	N/A	N/A	513 10/16	13	47 14/16	102 8/16
90-105	None	Low/Med/High	82 3/16	8 14/16	49 10/16	121 15/16	N/A	N/A	N/A	N/A	352 8/16	13	47 14/16	102 8/16
	8 ft	Low/Med/High	82 3/16	8 14/16	49 10/16	121 15/16	N/A	N/A	N/A	N/A	448 15/16	13	47 14/16	102 8/16
120-150	None	Low/Med	82 3/16	8 14/16	49 10/16	121 15/16	N/A	N/A	N/A	N/A	417 4/16	13	47 14/16	102 8/16
	8 ft	Low/Med	82 3/16	8 14/16	49 10/16	121 15/16	N/A	N/A	N/A	N/A	513 10/16	13	47 14/16	102 8/16
	None	High	82 3/16	8 14/16	49 10/16	121 15/16	N/A	N/A	N/A	N/A	417 4/16	13	59 14/16	102 8/16
Tonnage	Blank Section	Gas Heat	HORIZONTAL Opening Dimensions											
			Return Side Opening				Supply Opening							
			X3	Y3	W3	H1	X4	Y4	W4	H2				
90-105	None	None	71 8/16	10 10/16	54 12/16	43 6/16	351 3/16	10 10/16	54 12/16	84 15/16				
	4 ft	None	71 8/16	10 10/16	54 12/16	43 6/16	399 6/16	10 10/16	54 12/16	84 15/16				
	8 ft	None	71 8/16	10 10/16	54 12/16	43 6/16	447 10/16	10 10/16	54 12/16	84 15/16				
120-150	None	None	71 8/16	10 10/16	54 12/16	43 6/16	415 15/16	10 10/16	54 12/16	84 15/16				
	4 ft	None	71 8/16	10 10/16	54 12/16	43 6/16	464 2/16	10 10/16	54 12/16	84 15/16				
	8 ft	None	71 8/16	10 10/16	54 12/16	43 6/16	512 6/16	10 10/16	54 12/16	84 15/16				
90-105	None	Low/Med/High	71 8/16	10 10/16	54 12/16	43 6/16	351 3/16	10 10/16	54 12/16	66 11/16				
	8 ft	Low/Med/High	71 8/16	10 10/16	54 12/16	43 6/16	447 10/16	10 10/16	54 12/16	84 15/16				
120-150	None	Low/Med	71 8/16	10 10/16	54 12/16	43 6/16	415 15/16	10 10/16	54 12/16	66 11/16				
	8 ft	Low/Med	71 8/16	10 10/16	54 12/16	43 6/16	512 6/16	10 10/16	54 12/16	84 15/16				
	None	High	71 8/16	10 10/16	54 12/16	43 6/16	415 15/16	10 10/16	66 12/16	66 11/16				

**Notes:**

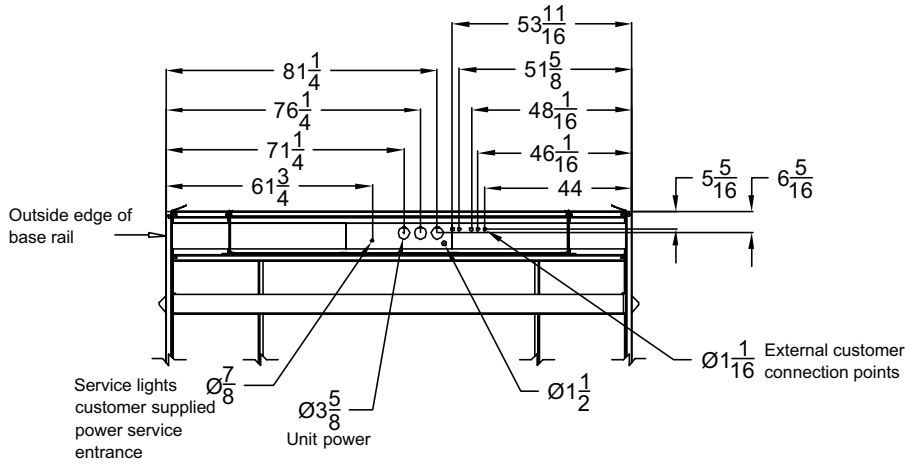
1. On horizontal return with ERW units, the return end opening can be on the front, rear, or both sides of the unit and must be specified.
2. ERW is not allowed w/ end return

# Electrical Entry Details

Figure 20. Electrical entry details/bottom view

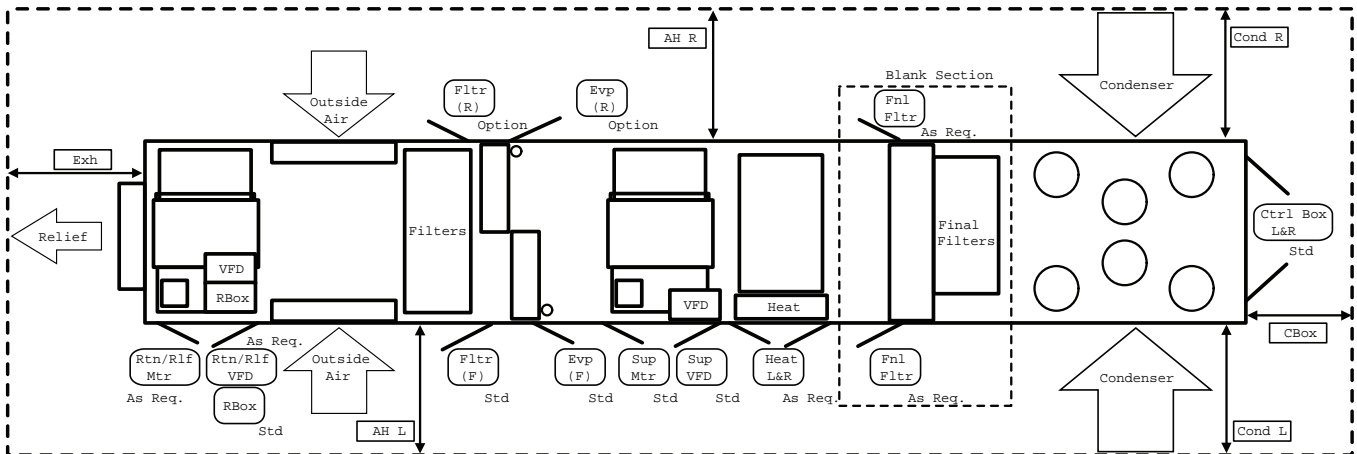


Bottom View



# Minimum Required Clearance

Figure 21. Minimum required clearance



**Note:** Unit drawing is representative only and may not accurately depict all models.



Table 77. Minimum required clearance

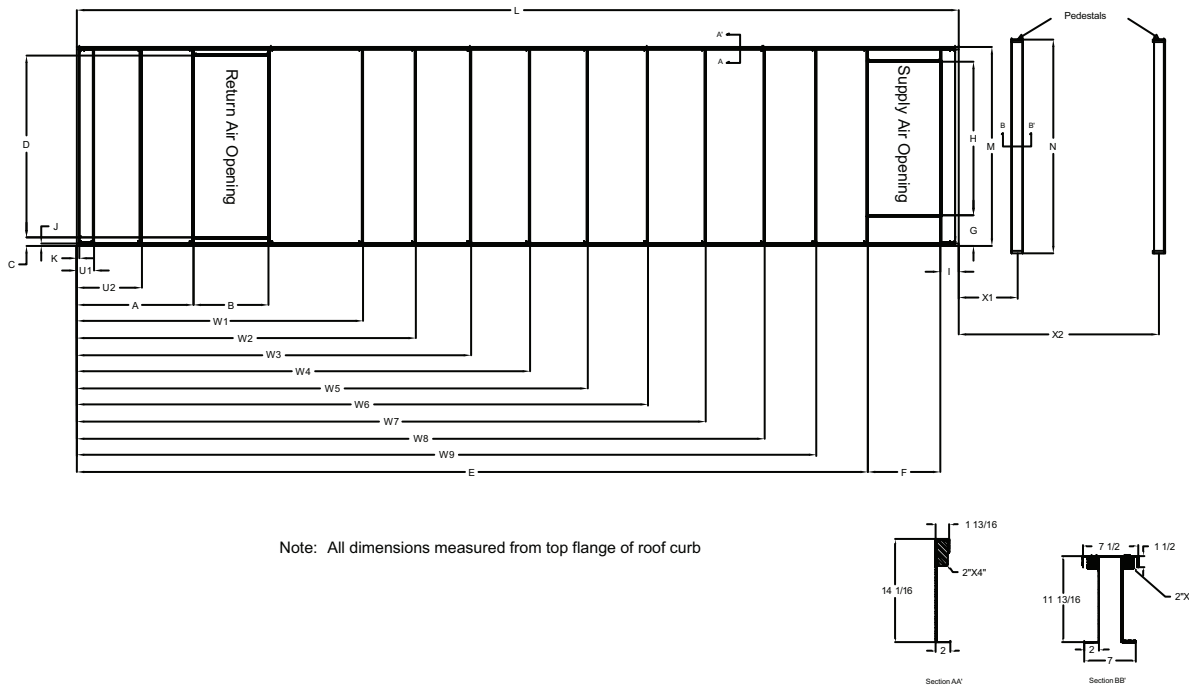
Door Location	Availability	Unit Option Selection (Door Swing Ft. and In.)									
		Standard		VFD		Heat	Reheat	Two-side Access		Final Filter	Energy Recovery
		90-105	120-150	Return/Relief	Supply			Electric/Hot Water/Steam	90-105		
Relief/Ret Motor	Std	2' 2"	2' 2"	*	*	*	*	*	*	*	
Relief/Ret VFD and Return Control Panel	As Req.	*	*	2' 2"	*	*	*	*	*	*	
ERW Filtr (L & R) (F)	Option	*	*	*	*	*	*	*	*	*	2' 2"
ERW Filtr(a) (L & R) (R)	Option	*	*	*	*	*	*	*	*	*	2' 2"
Filter (Front)	Std	2' 8"	2' 8"	*	*	*	*	*	*	*	
Filter (Rear)	Option	*	*	*	*	*	*	2' 2"	2' 8"	*	
Evap (Front)	Std	2' 2"	2' 2"	*	*	*	*	*	*	*	
Evap (Rear)	Std	2' 8"	*	*	*	*	*	*	*	*	
or Evap (Rear)	Option	*	*	*	*	*	2' 2"	*	2' 2"	*	
Supply Motor	Std	2' 8"	2' 8"	*	*	*	*	*	*	*	
Supply VFD	As Req.	*	*	*	2' 2"	*	*	*	*	*	
Heat (Left & Right)	As Req.	*	*	*	*	2' 2"	*	*	*	*	
Final Filter (Front)	As Req.	*	*	*	*	*	*	*	*	2' 2"	
Final Filter (Rear)	As Req.	*	*	*	*	*	*	*	*	2' 2"	
Control Box (L & R)	Std	3' 2"	3' 2"	*	*	*	*	*	*	*	

Minimum Required Clearance (Ft.)	AH_L	AH_R	Exh	Cond_L	Cond_R	Control Box
	8'	8'	8'	8'	8'	6'

Note: See Unit Dimensions for Energy Recovery Wheel location.

## Optional Roof Curb

Figure 22. Optional roof curb (downflow)



Note: All dimensions measured from top flange of roof curb



## Dimensional Data

**Table 78. Roof curb dimensions, ONE or TWO-piece unit without energy recovery wheel (in.)**

Tons	Blank Section	Dimensions									
		A	B	C	D	E	F	G	H	I	J
90-105	None	11 15/16	49 8/16	5 15/16	123	253 2/16	49 8/16	20 15/16	104	11 15/16	1 13/16
90-105	4 ft	11 15/16	49 8/16	5 15/16	123	301 5/16	49 8/16	20 15/16	104	11 15/16	1 13/16
90-105	8 ft	11 15/16	49 8/16	5 15/16	123	349 9/16	49 8/16	20 15/16	104	11 15/16	1 13/16
120-150 <sup>(a)</sup>	None	11 15/16	49 8/16	5 15/16	123	317 14/16	49 8/16	20 15/16	104	11 15/16	1 13/16
120-150	4 ft	11 15/16	49 8/16	5 15/16	123	366 2/16	49 8/16	20 15/16	104	11 15/16	1 13/16
120-150	8 ft	11 15/16	49 8/16	5 15/16	123	414 5/16	49 8/16	20 15/16	104	11 15/16	1 13/16
120-150 <sup>(b)</sup>	None	11 15/16	49 8/16	5 15/16	123	317 14/16	49 8/16	20 15/16	104	11 15/16	1 13/16

Tons	Blank Section	Dimensions		
		K	L	M
90-105	None	1 13/16	314 9/16	134 14/16
90-105	4 ft	1 13/16	362 12/16	134 14/16
90-105	8 ft	1 13/16	411	134 14/16
120-150 <sup>(c)</sup>	None	1 13/16	379 5/16	134 14/16
120-150	4 ft	1 13/16	427 8/16	134 14/16
120-150	8 ft	1 13/16	475 12/16	134 14/16
120-150 <sup>(d)</sup>	None	1 13/16	391 5/16	134 14/16

- (a) Except High Heat Gas Models
- (b) High Heat Gas Models Only
- (c) Except High Heat Gas Models
- (d) High Heat Gas Models Only

**Table 79. Roof curb cross member dimensions, ONE or TWO-piece unit without energy recovery wheel (in.)**

Tons	Blank Section	Cross Member Locations							
		W1	W2	W3	W4	W5	W6	W7	W8
90-105	None	103 6/16	145 11/16	183 6/16	218 4/16	N/A	N/A	N/A	N/A
90-105	4 ft	103 6/16	145 11/16	187 15/16	231 10/16	266 8/16	N/A	N/A	N/A
90-105	8 ft	103 6/16	145 11/16	189 15/16	234 3/16	279 13/16	314 11/16	N/A	N/A
120-150 <sup>(a)</sup>	None	103 6/16	145 11/16	179 6/16	213 1/16	248 2/16	289	N/A	N/A
120-150	4 ft	103 6/16	145 11/16	181 11/16	217 12/16	255 3/16	296 6/16	331 4/16	N/A
120-150	8 ft	103 6/16	145 11/16	185 4/16	224 13/16	265 12/16	304 7/16	344 9/16	379 7/16
120-150 <sup>(b)</sup>	None	103 6/16	145 11/16	179 5/16	213 1/16	248 2/16	289	N/A	N/A

- (a) Except High Heat Gas Models
- (b) High Heat Gas Models Only

**Table 80. Roof curb dimensions, ONE or TWO-piece unit with energy recovery wheel (in.)**

Tons	Blank Section	Dimensions									
		A	B	C	D	E	F	G	H	I	J
90-105	None	79 5/16	50 12/16	5 15/16	123	349 9/16	49 8/16	20 15/16	104	11 15/16	1 13/16
90-105	4 ft	79 5/16	50 12/16	5 15/16	123	397 12/16	49 8/16	20 15/16	104	11 15/16	1 13/16
90-105	8 ft	79 5/16	50 12/16	5 15/16	123	446	49 8/16	20 15/16	104	11 15/16	1 13/16
120-150 <sup>(a)</sup>	None	79 5/16	50 12/16	5 15/16	123	414 5/16	49 8/16	20 15/16	104	11 15/16	1 13/16
120-150	4 ft	79 5/16	50 12/16	5 15/16	123	462 8/16	49 8/16	20 15/16	104	11 15/16	1 13/16
120-150	8 ft	79 5/16	50 12/16	5 15/16	123	510 12/16	49 8/16	20 15/16	104	11 15/16	1 13/16
120-150 <sup>(b)</sup>	None	79 5/16	50 12/16	5 15/16	123	414 5/16	49 8/16	20 15/16	104	11 15/16	1 13/16

Tons	Blank Section	Dimensions		
		K	L	M
90-105	None	1 13/16	411	134 14/16
90-105	4 ft	1 13/16	459 3/16	134 14/16
90-105	8 ft	1 13/16	507 6/16	134 14/16
120-150 <sup>(c)</sup>	None	1 13/16	476 1/16	134 14/16
120-150	4 ft	1 13/16	524 4/16	134 14/16

**Table 80. Roof curb dimensions, ONE or TWO-piece unit with energy recovery wheel (in.) (continued)**

Tons	Blank Section	Dimensions		
		K	L	M
120-150	8 ft	1 13/16	572 8/16	134 14/16
120-150 <sup>(d)</sup>	None	1 13/16	488 1/16	134 14/16

- <sup>(a)</sup> Except High Heat Gas Models
- <sup>(b)</sup> High Heat Gas Models Only
- <sup>(c)</sup> Except High Heat Gas Models
- <sup>(d)</sup> High Heat Gas Models Only

**Table 81. Roof curb cross member dimensions, ONE or TWO-piece unit with energy recovery wheel (in.)**

Tons	Blank Section	Cross Member Locations										
		U1	U2	W1	W2	W3	W4	W5	W6	W7	W8	W9
90-105	None	11 15/16	43 15/16	168 10/16	204 11/16	242 1/16	279 13/16	314 11/16	N/A	N/A	N/A	N/A
90-105	4 ft	11 15/16	43 15/16	168 10/16	204 11/16	242 1/16	284 6/16	328	362 14/16	N/A	N/A	N/A
90-105	8 ft	11 15/16	43 15/16	168 10/16	204 11/16	242 1/16	286 5/16	330 9/16	376 4/16	411 2/16	N/A	N/A
120-150 <sup>(a)</sup>	None	11 15/16	43 15/16	168 10/16	204 11/16	242 1/16	275 12/16	309 8/16	344 9/16	385 7/16	N/A	N/A
120-150	4 ft	11 15/16	43 15/16	168 10/16	204 11/16	242 1/16	278 2/16	314 3/16	351 9/16	392 12/16	427 10/16	N/A
120-150	8 ft	11 15/16	43 15/16	168 10/16	204 11/16	242 1/16	281 10/16	321 3/16	362 3/16	400 14/16	441	475 14/16
120-150 <sup>(b)</sup>	None	11 15/16	43 15/16	168 10/16	204 11/16	242 1/16	275 12/16	309 8/16	344 9/16	385 7/16	N/A	N/A

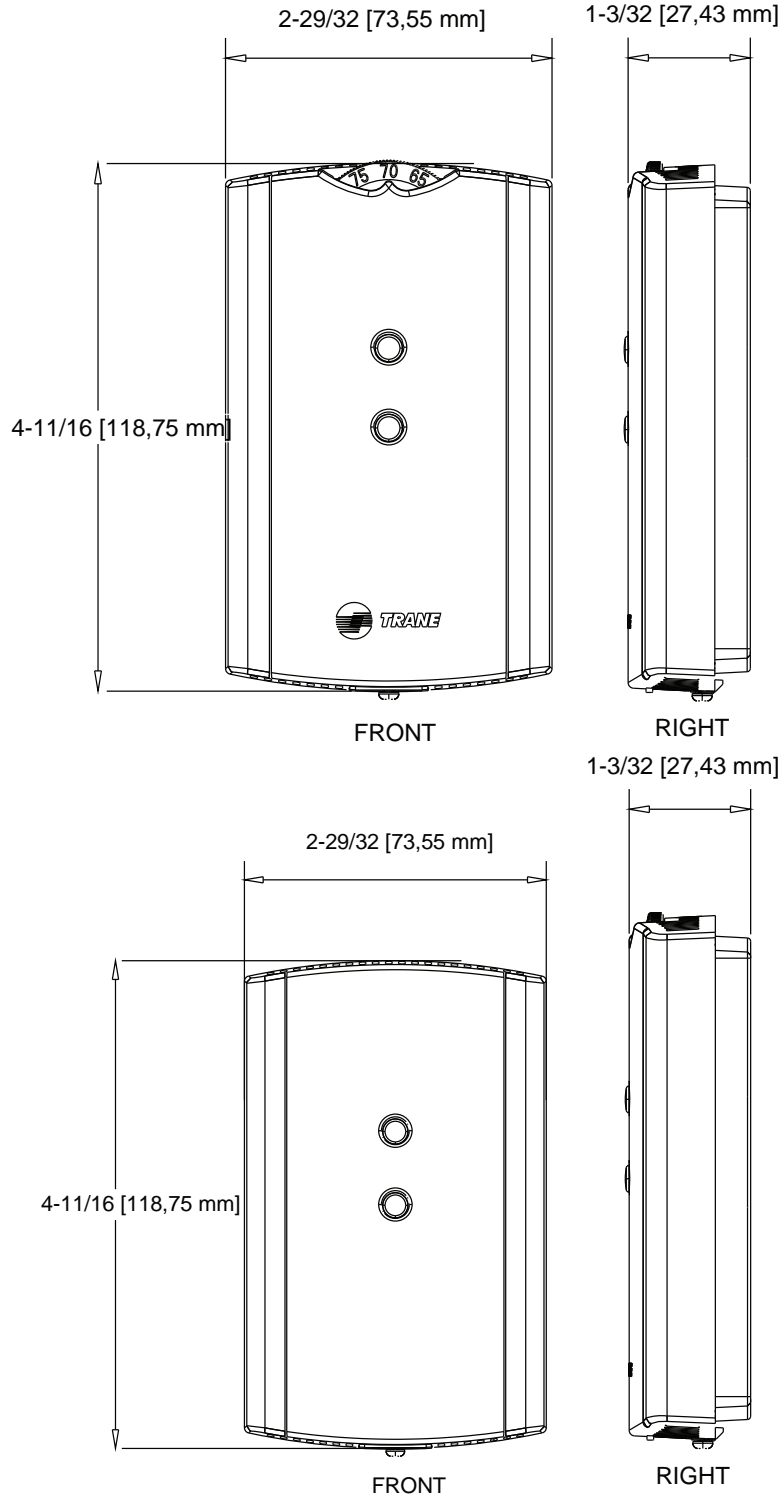
- <sup>(a)</sup> Except High Heat Gas Models
- <sup>(b)</sup> High Heat Gas Models Only

**Table 82. Pedestal dimensions**

Tons	One-, Two-Piece Unit	Pedestal Dimensions		
		N	X1	X2
90	1	145.25	N/A	93 1/16
90	2	145.25	36 3/16	111 3/16
105	1	145.25	N/A	111 1/16
105	2	145.25	36 3/16	129 3/16
120-150	1	145.25	N/A	117 1/16
120-150	2	145.25	40 3/16	136 3/16

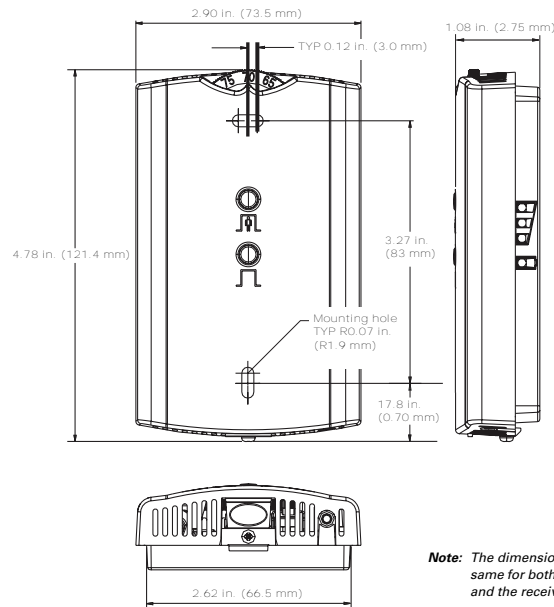
# Sensors

**Figure 23. Field installed zone sensor—with timed override button and local setpoint adjustment (BAYSENS074\*), with timed override only (BAYSENS073\*), sensor only (BAYSENS077\*)**



**Note:** Remote sensors are available for use with all zone sensors to provide remote sensing capabilities.

**Figure 24. Field installed zone sensor—wireless**



**Note:** The dimensions are the same for both the sensor and the receiver.



# Weights

**Table 83. Approximate operating weights (lbs.)**

Air-Cooled Units		
Nominal Tons	Unit (Minimum)	Roof Curb (Minimum)
90	14973	907
105	16411	907
120	18447	1040
130	18467	1040
150	19176	1040

**Notes:**

- Weights shown include the following features: No heat, standard evap capacity coils, fixed speed compressors, 0-25% outside air, 2" throwaway filters, low CFM supply fan, minimum supply motor sizes, no return or exhaust fan.
- Weights shown represent approximate minimum operating weights. To calculate weight for a specific unit configuration, utilize TOPSS or contact the local Trane sales representative. Weight outputs have a + 10% accuracy. ACTUAL WEIGHTS ARE STAMPED ON THE UNIT NAMEPLATE.

**Table 84. Component weights**

	90		105		120		130		150	
	Size	Weight	Size	Weight	Size	Weight	Size	Weight	Size	Weight
Refrigeration										
Compressor Assy. - Fixed capacity compressors	-	1126	-	1630	-	1642	-	1666	-	1666
Compressor Assy. - eFlex™ Variable speed	-	1479	-	1503	-	1626	-	1524	-	1786
Air-Cooled Condensing Coil (AI)	-	1173	-	1421	-	1485	-	1485	-	1485
Evap Coil - Std. Cap	-	1034	-	1300	-	1892	-	1892	-	2564
Evap Coil - Hi. Cap.	-	1382	-	1462	-	2564	-	2564	-	
Reheat Coil & Tubing	-	292	-	294	-	367	-	367	-	367
Replaceable Core Filter Driers	-	26	-	25	-	35	-	35	-	35
HGBP	-	46	-	49	-	53	-	53	-	53
Supply Fan Assembly										
Supply Fan & Fan Board Assy. - Low CFM	25"	1159	32"	1361	32"	1361	32"	1361	32"	1361
Supply Fan & Fan Board Assy. - Std. CFM	36"	1490	36"	1490	40"	1653	40"	1653	40"	1653
Belt Guard	-	116	-	116	-	116	-	116	-	116
Supply VFD (50 hp and below)	-	233	-	233	-	233	-	233	-	233
Supply VFD (60-100 hp)	-	284	-	284	-	284	-	284	-	284
Supply Fan Motor - 15 hp	-	181	-	181	-	181	-	181	-	181
Supply Fan Motor - 20 hp	-	206	-	206	-	206	-	206	-	206
Supply Fan Motor - 25 hp	-	358	-	358	-	358	-	358	-	358
Supply Fan Motor - 30 hp	-	413	-	413	-	413	-	413	-	413
Supply Fan Motor - 40 hp	-	495	-	495	-	495	-	495	-	495
Supply Fan Motor - 50 hp	-	604	-	604	-	604	-	604	-	604
Supply Fan Motor - 60 hp	-	776	-	776	-	776	-	776	-	776
Supply Fan Motor - 75 hp	-	879	-	879	-	879	-	879	-	879
Supply Fan Motor - 100 hp	-	1102	-	1102	-	1102	-	1102	-	1102
Return/Relief Fan Assembly										
Return Fan & Dampers - Low CFM	36"	2294	36"	2294	36"	2294	36"	2294	36"	2294
Return Fan & Dampers - Std. CFM	40"	2343	40"	2343	44"	2445	44"	2445	44"	2445
Exhaust Fan & Dampers - Low CFM	25"	889	28"	979	28"	979	28"	979	28"	979
Exhaust Fan & Dampers - Std. CFM	28"	979	32"	1429	32"	1429	32"	1429	32"	1429
Belt Guard	-	119	-	119	-	119	-	119	-	119
Exhaust / Return VFD (50 hp and below)	-	244	-	244	-	244	-	244	-	244

**Table 84. Component weights (continued)**

	90		105		120		130		150	
	Size	Weight	Size	Weight	Size	Weight	Size	Weight	Size	Weight
Exhaust / Return VFD (60-100 hp)	-	295	-	295	-	295	-	295	-	295
Exh / Rtn Fan Motor - 7.5 hp	-	160	-	160	-	160	-	160	-	160
Exh / Rtn Fan Motor - 10 hp	-	181	-	181	-	181	-	181	-	181
Exh / Rtn Fan Motor - 15 hp	-	206	-	206	-	206	-	206	-	206
Exh / Rtn Fan Motor - 20 hp	-	206	-	206	-	206	-	206	-	206
Exh / Rtn Fan Motor - 25 hp	-	358	-	358	-	358	-	358	-	358
Exh / Rtn Fan Motor - 30 hp	-	413	-	413	-	413	-	413	-	413
Exh / Rtn Fan Motor - 40 hp	-	495	-	495	-	495	-	495	-	495
Exh / Rtn Fan Motor - 50 hp	-	604	-	604	-	604	-	604	-	604
Exh Fan Motor - 60 hp	-	776	-	776	-	776	-	776	-	776
Heat										
Gas Heat Low	0.85M	690	0.85M	690	1.1M	840	1.1M	840	1.1M	840
Gas Heat Med	1.1M	840	1.1M	840	1.8M	1150	1.8M	1150	1.8M	1150
Gas Heat High	1.8M	1150	1.8M	1150	2.5M	1398 <sup>(a)</sup>	2.5M	1398	2.5M	1398
Electric Heat	-	485	-	485	-	485	-	485	-	485
Steam Heat Low	-	753	-	753	-	802	-	802	-	802
Steam Heat High	-	821	-	821	-	886	-	886	-	886
Hot Water Heat Low	-	773	-	773	-	841	-	841	-	841
Hot Water Heat High	-	818	-	818	-	897	-	897	-	897
Filters										
Filter Rack - Throwaway Filters	-	181	-	181	-	191	-	191	-	191
Filter Rack - Bag Filters	-	395	-	395	-	395	-	395	-	395
Filter Rack - Cartridge Filters	-	662	-	662	-	662	-	662	-	662
Final Filters - Bag Filters	-	392	-	392	-	392	-	392	-	392
Final Filters - Cartridge Filters w/ 2" pre-filter	-	607	-	607	-	607	-	607	-	607
Final Filters - Cartridge Filters w/ 4" pre-filter	-	638	-	638	-	638	-	638	-	638
Final Filters - High Temp. Cartridge	-	669	-	669	-	669	-	669	-	669
Final Filters - HEPA	-	1777	-	1777	-	1777	-	1777	-	1777
Final Filters - HEPA High Temp.	-	1839	-	1839	-	1839	-	1839	-	1839
Outside Air										
0-25% Damper	-	637	-	637	-	699	-	699	-	699
Econ	-	760	-	760	-	865	-	865	-	865
Econ w/ Air Measure	-	724	-	724	-	807	-	807	-	807
ERW, Low CFM w/ Econ <sup>(b)</sup>	-	3307	-	3307	-	3518	-	3681	-	3681
ERW, High CFM w/ Econ <sup>(b)</sup>	-	3545	-	3514	-	3756	-	3756	-	3756
ERW, Low CFM w/ Econ & Air Measure <sup>(b)</sup>	-	3487	-	3487	-	3727	-	3890	-	3890
ERW, High CFM w/ Econ & Air Measure <sup>(b)</sup>	-	3725	-	3694	-	3965	-	3965	-	3965
Cabinet										
Cabinet	-	8097	-	8315	-	9473	-	9473	-	9473
Cabinet - 4' Blank Section	-	935	-	935	-	901	-	901	-	901
Cabinet - 8' Blank Section	-	1709	-	1709	-	1682	-	1682	-	1682
Electrical Panels										
Control Box - Main	-	519	-	519	-	519	-	519	-	519
Convenience Outlet	-	36	-	36	-	36	-	36	-	36
Return Box	-	80	-	80	-	80	-	80	-	80
Junction Box	-	60	-	60	-	60	-	60	-	60
2-Piece Unit Adder										
2-Piece Adder	-	406	-	406	-	406	-	406	-	406

<sup>(a)</sup> 2.5M includes weight associated with 12" of cabinet length

<sup>(b)</sup> Energy Recovery includes weight associated w/ 96" of cabinet length.



## Weights

**Table 85. Roof curb weights**

Tonnage	Energy Recovery Wheel	Blank Section	One-Piece Unit	Two-Piece Unit
90-105	No	None	907	1055
90-105	No	4 ft	988	1136
90-105	No	8 ft	1069	1217
90-105	Yes	None	1093	1240
90-105	Yes	4 ft	1174	1321
90-105	Yes	8 ft	N/A	1401
120-150 (All Units Except High Heat Gas models)	No	None	1040	1194
120-150 (All Units Except High Heat Gas models)	No	4 ft	1122	1275
120-150 (All Units Except High Heat Gas models)	No	8 ft	N/A	1357
120-150 (High Heat Gas Models Only)	No	None	1055	1209
120-150 (All Units Except High Heat Gas models)	Yes	None	N/A	1378
120-150 (All Units Except High Heat Gas models)	Yes	4 ft	N/A	1459
120-150 (All Units Except High Heat Gas models)	Yes	8 ft	N/A	1540
120-150 (High Heat Gas Models Only)	Yes	None	N/A	1393

**Table 86. Pre-engineered options**

Component	Options
Cabinet	4' or 8' blank in Pre DX or Return Position
Electrical	Dual Power
Energy Recovery	Energy recovery with Horizontal Return
Fans	Beltless Direct Drive Plenum Supply Fan
	Propeller Relief Fan
Heat	LP Gas Heat Field Kit





# Mechanical Specifications

## General

Units shall be specifically designed for outdoor rooftop installation on a roof curb and be completely factory assembled and tested, piped, internally wired, fully charged with compressor oil and shipped in one, two or three-pieces for field reassembly into a single unit. Single piece units shall be fully charged.

Units shall be available for direct expansion cooling only, or direct expansion cooling with natural gas, electric, hot water or steam heating. Filters, outside air system, relief air system, optional non-fused disconnect switches and all operating and safety controls shall be furnished factory installed.

All units shall be cULus approved and factory run tested. Select configurations shall also be compliant with IBC Seismic requirements. In select configurations, cooling capacity shall be tested in accordance with AHRI Standard 360. All units shall have decals and tags to aid in service and indicate caution areas. Electrical diagrams shall be printed on long life water resistant material and shall ship attached to control panel doors.

## Casing

Exterior panels shall be zinc coated galvanized steel, phosphatized and painted with a slate grey air-dry finish durable enough to withstand a minimum of 672 hours consecutive salt spray application in accordance with standard ASTM B117. Screws shall be magnigard coated.

Refrigeration components and compressor shall be accessible through removable louvered panels as standard. Unit air handling section shall be laminated double-wall construction with polyurethane foam core injected between sheet metal panels and liners. Insulation value shall be R8. All interior surfaces shall be suitable for cleaning per ASHRAE 62. All access doors and panels shall have neoprene gaskets. Unit base shall be watertight with heavy gauge formed load bearing members and curb overhang. Unit lifting lugs shall accept chains or cables for rigging. Lifting lugs shall also serve as unit tie down points.

## Access Doors

Access doors shall be hinged with a single, exterior mounted, height and tension adjustable, handle to provide positive latching at three points. Access doors shall provide a door stop mechanism to latch the door in the open position to prevent unsafe door closure by wind.

Doors of laminated double wall construction with a polyurethane foam core between the exterior sheet metal pane and the interior liner, with an insulating value of R8 shall be provided on the air handlers serviceable compartments such as return/relief fan, filters, evaporator coil, and blank sections. Two single wall doors shall be provided for access to the control panel.

## Blank Sections

Blank section shall be [four][eight] foot length of laminated double wall construction with a polyurethane foam core between the exterior sheet metal panel and the interior liner, with an insulating value of R8. Hinged access doors of similar construction shall be provided on on either side.

## Two-Piece Construction

Two-piece construction shall facilitate lifting and rigging of the unit. The condenser section shall contain the associated valving and electrical box for recoupling of refrigeration, power and control systems. Transition panels shall be provided for the integrity on the recoupled unit.

**Note:** *Multi-piece units are shipped with nitrogen and must be field charged with R-410A.*

## Airflow Path

Unit shall have [downflow][horizontal] discharge conditioned air path. Return airflow path shall be either upflow or horizontal through the side or the end.



## Burglar Bars

A grate system shall be installed in supply and return air duct connection areas on non-horizontal airflow path units to minimize unwanted intrusion into duct systems.

## Belt Guard

Supply and relief fans shall have a universal size belt guard to accommodate any applicable drive configuration. The guard shall completely enclose the drive system and is provided with a two-piece removable front panel for servicing. Return fan guards shall be individually sized with a single piece removable panel for servicing.

## Refrigeration System

### Compressors

Compressors shall be direct-drive, hermetic, scroll-type compressors with centrifugal-type oil pumps. Each compressor has a crankcase heater to minimize the amount of liquid refrigerant present in the oil sump during off cycles. Discharge line service valves shall be standard on each refrigerant circuit, as well as liquid moisture indicator/sight glass.

### eFlex™ Variable Speed Compressors

The Trane eFlex™ variable speed compressor shall be capable of speed modulation from 25 Hz to a maximum of 100 Hz. The minimum unit capacity shall be 15% of full load or less. The compressor motor shall be a permanent magnet type. Each compressor shall have a crankcase heater installed, properly sized to minimize the amount of liquid refrigerant present in the oil sump during off cycles. Compressors shall be equipped with a bearing oil injection system that optimizes scroll set lubrication, sealing, and controls the oil circulation rate.

Optimal bearing lubrication shall be provided by a gerotor oil pump. Each variable speed compressor shall be matched with a specially designed variable frequency drive which modulates the speed of the compressor motor and provides several compressor protection functions. Control of the variable speed compressor and inverter control shall be integrated with the IntelliPak unit controller to ensure optimal equipment reliability and efficiency.

### Supply Fan

[Standard][Low] airflow supply fan shall have a single fan assembly with double width, double inlet, airfoil fan, motor and fixed pitch sheave drive. All fans shall be statically and dynamically balanced for the operating envelop. It shall be tested in the factory. Supply fans shall be test run in unit as part of the unit test. Fan operating envelop rpm shall be below first critical speed. Fan shafts shall be mounted on two grease lubricated ball bearings designed for 200,000 hours average life.

Extended grease lines shall allow greasing of bearings from section base rail. Fan motor and fan assembly shall be mounted on common base to allow consistent belt tension with no relative motion between fan and motor shafts. Entire assemblies shall be completely isolated from unit by two-inch deflection spring isolators.

### Evaporator Coil

Internally enhanced copper tubing of ½-inch O.D. shall be mechanically bonded to heavy-duty aluminum fins of configured design. All coils shall be equipped with electronic expansion valves, and are factory pressure and leak tested. A double sloped stainless steel drain pan shall be provided to drain condensate to both sides of the unit.

### Stainless Steel Drain Pans

Drain pan shall be stainless steel, double sloped, and located under the evaporator coil in order to promote runoff of standing water from condensation inside the unit as well as provide protection in corrosive environments. Two drain pipes shall be installed through the base channel on each side of the unit.

## Hot Gas Bypass

The hot gas bypass option shall consist of valves, piping and controls that are all included on circuit 1 to allow operation at low airflow, avoiding coil frosting and damage to the compressor. When saturated suction temperature falls below controls adjustable setpoint, the valve shall modulate hot gas to the inlet of the evaporator.

## Filter Drier

Removable core filter driers shall be optionally available and installed on each refrigeration circuit. For easy access, the filter driers are conveniently located in the condenser section close to the periphery of the unit.

## Suction Service Valves

Each compressor shall be optionally equipped with a suction service valve in order to facilitate compressor servicing.

## Air-Cooled Condensing

### Air-Cooled Condenser Coil

Condenser coils shall have all-aluminum, Microchannel coils. All coils shall be leak tested at the factory to ensure pressure integrity. The condenser coil shall be pressure tested to 650 psig. Subcooling circuit (s) shall be provided as standard.

### Air-Cooled Condenser Fans and Motors

All condenser fans shall be vertical discharge, direct drive fans, statically balanced, with steel blades and zinc plated steel hubs. Condenser fan motors shall be totally enclosed three-phase motors with permanently lubricated ball bearings, built-in current and thermal overload protection and weather tight slingers over motor bearings.

### Corrosion Protected Condenser Coil

All aluminum Microchannel condenser coil protection shall consist of a corrosion resistant coating that shall withstand ASTM B117 Salt Spray test for 6,000 hours and ASTM G85 A2 Cyclic Acidified Salt Fog test for 2,400 hours. This coating shall be added after coil construction covering all tubes, headers and fin edges, therefore providing optimum protection in more corrosive environments.

## Electrical

Unit shall be completely factory wired with necessary control and contactor pressure lugs or terminal block for power wiring. Units shall provide an internal location for a non-fused disconnect with external handle for safety.

### Symbio™ 800 Controller

The Symbio 800 controller is an application-specific, programmable controller that is factory installed and designed to control packaged HVAC equipment. A 7-inch user interface features a touch-sensitive color screen that provides facility managers with at-a-glance operating status, performance monitoring, scheduling changes, and operating adjustments. Other advanced features include automated controller backup and optional features such as secure remote connectivity, wireless building communications, mobile device connectivity, and custom programming with expandable I/O.

## Control Options

### Modbus Communication Protocol

The Symbio™ 800 controller shall support standard Modbus® RTU communication protocol through an RS485, two-wire communication link.



## Mechanical Specifications

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### **Trane LonTalk® Communication Interface Module**

The LonTalk module provides an interface to a Tracer Summit™ building automation system or other control system that supports LonTalk and shall be factory installed, allowing for control and monitoring of the unit through a RS485, two-wire communication link. Requires an additional LonTalk Communication Kit be installed.

### **BACnet® Communication**

The Symbio™ 800 controller supports BACnet® and shall be factory or field installed, allowing for control and monitoring of the unit through a RS485, two-wire communication link or BACnet/IP.

### **AirFi® Wireless Communication Interface Module (WCI) (Field Installed)**

Trane's Air-Fi Wireless Communication interface provides wireless communication between the Tracer SC+, Tracer Unit Controllers, and Symbio® 800.

### **Power Monitor**

Factory installed power meter shall measure unit energy usage to 0.2% accuracy (ANSI C12.20) and communicate through the Symbio.

### **Ambient Control**

Variable speed condenser motors shall be provided to allow the unit to operate down to 0°F.

### **Controls Expansion Hardware**

Symbio™ 800 shall have field applied controls capability. Factory installed expansion hardware (XM70) shall have 19 inputs/outputs. Additional expansions may be added in the field.

### **Rapid Restart**

Option provides immediate startup upon power failure. A backup generator shall be required on site before unit startup. Rapid Restart shall begin immediately after recovery from a power loss and work by restarting the compressors and supply fan quickly to provide full cooling within three to four minutes.

## **System Control Options**

### **Variable Air Volume Supply Air Temperature control**

Option provides all the necessary controls to operate a VAV rooftop from the discharge air temperature, including discharge air microprocessor controller and discharge air sensor. The microprocessor controller coordinates the economizer control and the stages of cooling with zone or outdoor air reset capabilities and an adjustable control band to fine-tune the control to specific applications.

### **Multi Zone Variable Air Volume (Discharge Air Temperature)**

Option provides all necessary controls to operate a VAV rooftop from the discharge air temperature, including discharge air microprocessor controller and discharge air sensor.

### **Variable Frequency Drive (VFD) Bypass**

Supply fan bypass control provides airflow at 60Hz in the event of drive failure

### **Single Zone Variable Air Volume**

Single zone VAV option provides all necessary controls to operate a rooftop unit based on maintaining two temperature setpoints; the discharge air and zone. Option includes factory-installed variable frequency drive (VFD) to provide supply fan motor speed modulation. During Single Zone VAV cooling, the unit maintains zone cooling setpoint by modulating the supply fan speed more or less to meet zone load demand, and the unit maintains discharge temperature to the discharge cooling setpoint by modulating economizer if available and staging DX cooling.

## Electrical System

### Power Supply

Air-cooled rooftops shall be available with 460 or 575 voltage, 3 phase 60 hertz power supply and 380 voltage, 3 phase 50 hertz power supply.

### Convenience Outlet

A 15A, 115V Ground Fault Interrupter convenience outlet shall be factory installed and wired and powered from a factory mounted transformer. A unit mounted, non-fused disconnect with internal handle is furnished with the factory powered convenience outlet.

### Non-Fused Disconnect Switch

An external handle mounted on the control box door shall be provided to disconnect unit power with the control box door closed for safety.

### Compressor Protection

Compressor Protection Modules shall be included in the junction box to protect compressors against reverse rotation.

### Unit Interrupt Rating (Short Circuit Current Rating-SCCR)

An optional 65,000 Amp rating (480V) and 25,000 Amp rating (600V) shall be applied to the unit enclosure using a non-fused circuit breaker for disconnect switch purposes. . The unit shall be marked with approved cULus markings and will adhere to cULus regulations.

### Marine Lights (Customer Powered)

A customer-provided 120V service will supply power to a fused disconnect switch which feeds a transformer providing class 2, 24V power to the LED Marine Lights. The LED Marine Lights shall be placed in the Supply Section (2), Outside Air Section (1), Return Section (1), and Extended Casing Section (1) for units without heat.

### Supply/Relief/Return Motors

Supply, relief/return motors shall be either open drip-proof or totally enclosed fan cooled (TEFC). All 60 Hz motors meet the Energy Independence and Security Act of 2007 (EISA). All 50 Hz supply, relief/return motors shall meet the U.S. Energy Policy Act of 1992 (EPACT). Motors with internal Shaft grounding rings can be selected for use with VFD applications and shall provide a conductive discharge path away from the motor bearings to ground.

## Filters

### General

Filter options shall mount integral within the unit and be accessible by a hinged access door with a single point latching device.

### Pre-evaporator Coil Filter Options

#### ***No Filters (Two-inch Nominal Thickness Throwaway Filter Rack Only)***

Shall provide a galvanized steel filter rack (less filter media) with filter channels to handle a complete set of two-inch nominal thickness throwaway filters to accommodate applications which require field supplied filters.

#### ***No Filters (Bag or Cartridge Filter Rack with Throwaway Prefilter Rack Only)***

Shall provide a galvanized steel filter rack (less filter media) to handle a complete set of two-inch (depending on airflow) nominal thickness throwaway prefilters and 7/8" actual header thickness bag or cartridge filters to accommodate applications which require field supplied filters.

#### ***MERV 8 Throwaway Filters (Standard)***



## Mechanical Specifications

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Shall be provided as standard-U.L. Class 2, two-inch nominal thickness, high efficiency pleated media filters rated MERV 8 per ASHRAE 52.2. Filters shall be provided mounted in a galvanized steel filter rack.

### **MERV 15, 90-95 Percent Bag Filters Option**

Nineteen-inch deep bag filters shall be U.L. Class 2 and have synthetic media mounted to a 7/8" nominal thickness header frame. These bag filters shall have an efficiency rating of MERV 15 per ASHRAE 52.2. To ensure maximum bag filter life two-inch prefilters shall be included with the bag filters. Filters shall be mounted in a galvanized steel filter rack.

### **MERV 14, 90-95 Percent Cartridge Filters Option**

Twelve-inch deep cartridge filters shall be U.L. Class 1 and be mounted with a 7/8" nominal thickness header frame. These cartridge filters shall have an efficiency rating of MERV 14 per ASHRAE 52.2. To ensure maximum cartridge filter life, two-inch (or four-inch, depending on the application) prefilters shall be included with the cartridge filters. Filters shall be mounted in a galvanized steel filter rack.

### **MERV 14, 90-95 Percent, Low Pressure Drop, Totally Incinerable, Cartridge**

Twelve-inch deep cartridge filter shall be U.L. Class 2 and mounted with a rigid 7/8" nominal thickness header frame. These low pressure drop cartridge filters shall have an efficiency rating of MERV 14 per ASHRAE 52.2. To ensure maximum cartridge filter life two-inch or four-inch prefilters (depending on airflow) shall be included with the high-flow, cartridge filters. Filters shall be mounted in a galvanized steel filter rack.

## Final Filters Options (Available Only on Units with Blank Section)

Final filter section filter options shall mount integral within the blank section unit casing and be accessible by hinged access doors.

### **MERV 15, 90-95 Percent, Bag, Final Filter Option**

*Note: Available on cooling only units with four or eight-foot blank section, as well as steam and hot water units with eight-foot blank section, unit casing only.*

Nineteen-inch deep bag filters shall be U.L. Class 2 and have synthetic media mounted to a 7/8" nominal thickness header frame. These bag filters shall have an efficiency rating of MERV 15 per ASHRAE 52.2. To ensure maximum bag final filter life two-inch, MERV 8 prefilters shall be included with the bag filters. Filters shall be mounted in a galvanized steel filter frame bank.

### **MERV 14, 90-95 Percent, Cartridge, Final Filter Option**

*Note: Available on cooling only units with four or eight-foot blank section, as well as steam and hot water units with eight-foot blank section, unit casing only.*

Twelve-inch deep cartridge filters shall be U.L. Class 1 and be mounted with a 7/8" nominal thickness header frame. These cartridge filters shall have an efficiency rating of MERV 14 per ASHRAE 52.2. To ensure maximum cartridge filter life, two-inch, MERV 8 prefilters shall be included with the cartridge filters. Filters shall be mounted in a galvanized steel filter frame bank.

### **MERV 14, 90-95 Percent, Low Pressure Drop, Totally Incinerable, Cartridge**

*Note: Available on cooling only units with four or eight-foot blank section, as well as steam and hot water units with eight-foot blank section, unit casing only.*

Twelve-inch deep cartridge filter shall be U.L. Class 2 and mounted with a rigid 7/8" nominal thickness header frame. These cartridge filters shall have an efficiency rating of MERV 14 per ASHRAE 52.2. To ensure maximum cartridge final filter life four-inch, MERV 8 prefilters shall be included with these cartridge filters. Filters shall be mounted in a galvanized steel filter frame bank.

### **MERV 14, 90-95 Percent, High Temperature Rated, Cartridge, Final Filter Option**

*Note: Available on gas and electric heat units with eight-foot blank section casing only.*

Twelve-inch deep cartridge filters shall be U.L. Class 1 and be mounted in a galvanized steel casing with a 7/8" nominal thickness header frame. These cartridge filters shall have an efficiency rating of MERV 14 per ASHRAE 52.2. To ensure maximum cartridge final filter life high temperature rated two-inch, MERV 8 prefilters shall be included with the cartridge filters. Filters shall be mounted in a galvanized steel filter frame bank.

### **MERV 17, 99.97 Percent, Standard Temperature Rated, HEPA, Final Filter Option**

*Note: Available on cooling only units with four or eight-foot blank section, as well as steam and hot water units with eight-foot blank section, unit casing only.*

Twelve-inch deep HEPA filters shall be U.L. Class 1 and be mounted in a galvanized steel casing. These filters have an efficiency rating of MERV 17 per ASHRAE 52.2 and an efficiency of 99.97% on a 0.3 micron DOP particle size. To ensure maximum HEPA final filter life two-inch, MERV 8 prefilters shall be included with the HEPA final filters. Filters shall be mounted in a galvanized steel filter frame bank.

**MERV 17, 99.97 Percent, High Temperature Rated, HEPA, Final Filter Option**

*Note: Available on gas and electric heat units with eight-foot blank section casing only.*

Twelve-inch deep HEPA filters shall be U.L. Class 1 and be mounted in a galvanized steel casing. These filters have an efficiency rating of MERV 17 per ASHRAE 52.2 and an efficiency of 99.97% on a 0.3 micron DOP particle size. To ensure maximum HEPA final filter life high temperature rated two-inch, MERV 8 prefilters shall be included with the HEPA final filters. Filters shall be mounted in a galvanized steel filter frame bank.

## Relief Air

### General

Relief air options include no relief, 100 percent modulating relief fan and 100 percent modulating relief fan with direct space building pressurization control. Relief fans are either standard or low airflow

### No Relief (Standard)

Relief air opening is sealed with panel and made watertight.

### 100 Percent Modulating Relief Fan Option

Fan design is double width, double inlet forward-curved type. Fan is mounted on a shaft with fixed sheave drive. All fans are dynamically balanced and tested in factory before being installed in unit. It is test run in unit as part of unit test.

Fan operating envelop rpm is below first critical speed. Fan shaft is mounted on two grease lubricated ball or roller bearings as applicable designed for 200,000-hour average life. Extended grease lines are provided to allow greasing of bearings from section base rail. Fan motor and assembly is mounted on common base to allow consistent belt tension with no relative motion between fan and motor shafts. The entire assembly is completely isolated from unit with 2-inch spring isolation. Discharge dampers at unit outlet modulate relief airflow in response to OA damper position.

The fan operates when economizer damper is open greater than minimum position. Discharge dampers at fan outlet modulate in response to economizer damper position on Constant Volume (CV) rooftops.

### 100 Percent Modulating Relief Fan with Statitrac Control Option

Fan design is double width, double inlet forward-curved type. Fan is mounted on a shaft with fixed sheave drive. All fans are dynamically balanced and tested in factory before being installed in unit. Relief fan is test run as part of unit final run test.

Fan operating envelop rpm is below first critical speed. Fan shaft is mounted on two grease lubricated ball or roller bearings designed for 200,000-hour average life. Extended grease lines are provided to allow greasing of bearings from section base rail.

Fan motor and assembly is mounted on common base to allow consistent belt tension with no relative motion between fan and motor shafts. The entire assembly is completely isolated from unit with 2-inch spring isolators. For VAV rooftops, the 100 percent modulating relief discharge damper (or VFD) is modulated in response to building pressure. A differential pressure control system, (Statitrac), uses a differential pressure transducer to compare indoor building pressure to outdoor ambient atmospheric pressure. The FC relief fan is turned on when required to lower building static pressure setpoint.

The (Statitrac) control system then modulates the discharge dampers (or VFD) to control the building pressure to within the adjustable, specified deadband that shall be adjustable at the user interface. Optional bypass can be factory installed to provide full nominal airflow in the event of a drive failure.



## Return Air

### General

Return air options shall include 100 percent modulating return fan and 100 percent modulating return with direct space building pressurization control. Return fans shall be either standard or low airflow.

### 100 Percent Modulating Return Fan

A single width plenum fan with airfoil blade shall be mounted on a shaft with fixed sheave drive. The fan shall be dynamically balanced for the operating envelop and tested in factory before being installed in unit. The plenum fan shall be test run in unit as part of unit test. Fan operating envelop rpm shall be below first critical speed. Fan shaft shall be mounted on two grease lubricated ball or roller bearings designed for 200,000-hour average life. Extended grease lines shall be provided to allow greasing of bearings from section base rail.

Fan motor and assembly shall be mounted on common base to allow consistent belt tension with no relative motion between fan and motor shafts. The entire assembly shall be completely isolated from unit with 2-inch spring isolators. Discharge dampers at unit outlet shall modulate relief airflow in response to OA / return air damper position. The return fan VFD shall operate in conjunction with the supply fan.

### 100 Percent Modulating Return Fan with Statitrac Control Option

A single width plenum fan with airfoil blade shall be mounted on a shaft with fixed sheave drive. The fan shall be dynamically balanced for the operating envelop and tested in factory before being installed in unit. The plenum fan shall be test run as part of unit final run test. Fan operating envelop rpm shall be below first critical speed. Fan shaft shall be mounted on two grease lubricated ball or roller bearings designed for 200,000-hour average life. Extended grease lines shall be provided to allow greasing of bearings from section base rail.

Fan motor and assembly shall be mounted on common base to allow consistent belt tension with no relative motion between fan and motor shafts. The entire assembly shall be completely isolated from unit with 2-inch spring isolators. The 100 percent modulating relief damper shall be modulated in response to building pressure. A differential pressure control system, (Statitrac), shall use a differential pressure transducer to compare indoor building pressure to outdoor ambient atmospheric pressure.

The Statitrac control system shall modulate the discharge dampers to control the building pressure to within the adjustable, specified deadband that shall be adjustable at the user interface. The return fan VFD shall modulate in response to return duct static pressure. Optional bypass can be factory installed to provide full nominal airflow in the event of a drive failure.

## Outside Air

### General

Three outside air options: 0 to 25 percent motorized controlled outside air, 0-100 percent fully modulating economizer, and 0-100 percent fully modulating economizer with outside air measurement.

### 0-25 Percent Motorized Outside Air Damper Option

0-25 percent motorized outside air damper option includes an outside air opening with moisture eliminator and motorized position damper for drawing up to 25 percent outside air. The damper position will be adjustable at the user interface.

### 0-100 Percent Modulating Economizer Option

Economizer is operated through the primary temperature controls to automatically utilize OA for "free" cooling. Automatically modulated return and OA dampers maintains proper temperature in the conditioned space. Economizer is equipped with an automatic lockout when the outdoor high ambient temperature is too high for proper cooling. Minimum position control is standard and adjustable at the user interface or with a remote potentiometer or through the building management system. A spring return motor ensures closure of OA dampers during unit shutdown or power interruption. Mechanical cooling is available to aid the economizer mode at any ambient. Standard economizer dampers have a leakage rate of 20 CFM/ft<sup>2</sup> at 1.0 in W.C. pressure difference.



## Low Leak Dampers

Low leak dampers are provided with chlorinated polyvinyl chloride gasketing added to the damper blades and rolled stainless steel jamb seals to the sides of the damper assembly. The low leak dampers have a leakage rate of 10 CFM/ft<sup>2</sup> (AMCA Class 2) at 1.0 in W.C. pressure difference.

## Ultra Low Leak Dampers AMCA Class 1

Standard ultra low leak damper will have added sealing under the jamb seals and in the frame. The ultra low leak dampers have a leakage rate of 4 CFM/ft<sup>2</sup> (AMCA Class 1) at 1.0 in W.C. pressure difference.

*Note: Based on testing completed in accordance with AMCA Standard 500D.*

## Ultra Low Leak, AMCA 1A Economizer

The AMCA 1A rated Ultra Low Leak Economizer option is provided with parallel operating, horizontal airfoil blades and spring-return actuators (to the fresh air closed, return air open position). The economizer, including linkages and actuators, have a 5 year limited warranty and functional life of 60,000 opening and closed cycles. Dampers are AMCA 511 Class 1A certified with a maximum leakage rate of 3 CFM/sq-ft at 1.0 in WC pressure differential.

Economizer frame and 6–inch wide blades are galvanized steel. Blade edge seals are Ruskiprene (-72° F to + 275°F) and jamb seals are be compressible, flexible metal.

The economizer fresh air damper includes an adjustable linkage to allow for field damper balance of pressure drop between 100% fresh and 100% return airflow paths. The adjustable linkage is used to limit the fresh air damper maximum wide open stroke.

## Fault Detection and Diagnostic

Fault Detection and Diagnostic (FDD) control are also be provided with Ultra Low Leak Economizers. FDD control monitors the commanded position of the economizer compared to the feedback position of the damper. If the damper position is outside +/- 10% of the commanded position, a diagnostic is generated.

Intellipak units ordered with Ultra Low Leak Economizers are listed on the California Energy Commission Registry for factory compliance with Title 24 Economizer and FDD requirements. A label is applied to the unit identifying construction with the Ultra Low Leak Economizer and FDD controls.

## Economizer Control with Comparative Enthalpy

Option includes two enthalpy sensors to compare total heat content of the indoor air and outdoor air to determine the most efficient air source when economizing.

## Economizer Control with Reference Enthalpy

Option includes an outdoor enthalpy sensor to compare the total heat content of outdoor air to a locally adjustable setpoint. The setpoint is programmed at the user interface, or remote user interface, to determine if the outdoor enthalpy condition is suitable for economizer operation.

## Economizer Control with Dry Bulb

Option includes an outdoor temperature sensor for comparing the outdoor dry bulb temperature to a locally adjustable temperature setpoint. The setpoint is programmed at the user interface, or remote user interface, to determine if outdoor air temperature is suitable for economizer operation.

## Outside Air Measurement (Traq)

A factory mounted airflow measurement station (Traq) is provided in the outside air opening to measure airflow. The airflow measurement station is AMCA certified (+/- 5.0%) from 300fpm to 2500fpm. The airflow measurement station adjusts for temperature variations

## Demand Control Ventilation

When equipped with a CO<sub>2</sub> sensor and the (VCM) module, the outside air damper position modulates in response to a CO<sub>2</sub> sensor in the conditioned space, in order to minimize the unit energy consumption,



## Mechanical Specifications

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yet simultaneously meet the ventilation requirements of ASHRAE Std 62.1. The Traq airflow monitoring solution augments the system, allowing for measurement and control of outside airflow.

**Note:** *CO<sub>2</sub> sensor used with Demand Control Ventilation must be powered from an external power source or separate 24 VAC transformer.*

### Ventilation Override Mode

With the optional Ventilation Override Mode (VOM) installed, the unit is programmed to transition to up to 5 different programmed sequences for Smoke Purge, Evacuation, Pressurization, Purge, Purge with duct control sequence and Unit off. The transition occurs when a binary input on the VOM is closed (shorted); typically a hard-wired relay output from a smoke detector or fire control panel.

## Heating System

### Electric Heating Option

All electric heat models shall be completely assembled and have wired electric heating system integral within the rooftop unit. Heavy duty nickel chromium elements internally wired with a maximum density of 40 watts per square inch shall be provided. Heater circuits shall be 48 amps or less, each individually fused. Automatic reset high limit control shall operate through heater backup contactors. The 460 and 575 volt electric units shall have optional factory mounted non-fused disconnect switch located in the main control panel to serve the entire unit.

### Gas Fired Heating Option

All gas-fired units shall be completely assembled, have a wired, gas-fired heating system integral within unit, and fire tested prior to shipment. Units shall be cULus approved specifically for outdoor applications downstream from refrigerant cooling coils.

All gas heaters shall have 81% steady state efficiency, meeting the 2023 Department of Energy efficiency code. Gas-fired heating system control shall be fully integrated with the unit controls. Gas safety controls shall include electronic flame sensing capability, which proves combustion air prior to ignition sequence and during operation. The ignition sequence shall include a pre-purge cycle. Direct spark ignition shall be provided to the pilot line on all heat exchangers.

A three minute delay shall be provided between first and second stage gas valve operation on two-stage heaters.

Heat exchangers shall be drum and tube design with pre-mix burners. Free-floating design shall eliminate expansion and contraction stresses and noises. Heating system shall incorporate forced draft fans and include a chimney that exhausts away from the air intake. All gas heaters shall be made from 304L stainless steel suitable for condensing situations. Gasketed cleanout plate shall be provided for maintenance and inspection of tubes/turbulators.

All gas piping shall be threaded connection with a pipe cap provided. Gas supply connection shall be provided through the side or bottom of unit. Heat exchanger shall be factory pressure and leak tested.

### Steam Heating Option

Steam coils shall be Type NS with non-freeze steam distribution circuits. Distributor tubes shall be located concentrically within condensing tubes to assure even steam distribution. Coils shall be pitched to provide complete drainage. Steam modulating valve with actuator shall be provided.

### Hot Water Heating Option

Hot water coils shall be Type 5W and factory mounted in the rooftop unit to provide complete drainage of coil. Hot water modulating valve with actuator shall be provided.

## Energy Saving Options

### Energy Recovery Wheel

The energy recovery option shall incorporate a rotary wheel in an insulated cassette frame complete with seals, drive motor, and drive belt. Two wheel size options shall be available for each unit. The standard size option shall be capable of treating 50% of maximum unit outside airflow, while the low CFM shall be able to treat only 30%. A relief fan shall be required in conjunction with the energy recovery option. A return fan option is incompatible with the energy recovery wheel option.

A total energy recovery wheel shall be required to recover both sensible and latent energy. The factory installed wheel shall be coated with a silica gel desiccant. The desiccant shall be permanently bonded without the use of binders or adhesives or other means which may degrade desiccant performance. The substrate shall be lightweight polymer and shall not degrade nor require additional coatings for application in marine or coastal environments.

Desiccant shall not dissolve or deliquesce in the presence of water or high humidity. The coated wheel segments shall be washable with non-acid coil cleaner or alkaline detergent and warm water. Wheel segments shall be removable without specialized tools or compartment modifications to facilitate maintenance and cleaning.



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### Hot Gas Reheat Option

Hot Gas Reheat option shall consist of hot gas reheat coil, located on the leaving air side of the evaporator coil, and pre-piped to circuit 1 along with a set of modulating reheat valves.

## Accessories

### Roof Mounting Curb

Roof mounting curb shall be heavy gauge zinc coated steel with nominal two-inch by four-inch nailer setup. Supply/return air opening gasketing shall be provided. Curb shall ship knocked down for easy assembly. Channel shall be provided to allow for adjustment of return air opening location. Curb shall be manufactured to National Roofing Contractors Association guidelines.

### Electronic Zone Sensors

- Zone Sensor provide two temperature setpoint levers, Heat, Auto, Off, or Cool system switch, Fan Auto or Fan On switch. This sensor is used with SZVAV units.
- VAV Zone Sensor is provided with supply air single temperature setpoint and AUTO/OFF system switch. Sensor is provided for zone temperature control with VAV units. VAV units are not compatible with SZVAV units.
- Fast Warmup Sensor is used as morning warmup sensor with VAV units.
- Integrated Comfort System sensors is available with sensor only, sensor with timed override, and sensor with local temperature setpoint adjustment with timed override.
- AirFi™ Wireless Zone Sensor is available with a RF wireless zone temperature, setpoint and timed override transmitter and a RF receiver that connects directly to the IntelliPak 2 controller and uses spread spectrum technology. Option includes sensor, receiver wiring harness and (2) AA lithium batteries. Sensor battery life provides at least 5 years life under normal operating conditions and provides a readily visual indication of battery condition.

### CO<sub>2</sub> (Carbon Dioxide) Sensing

The CO<sub>2</sub> sensor shall have the ability to monitor space occupancy levels within the building by measuring the parts per million of CO<sub>2</sub> in the air. As the CO<sub>2</sub> levels increase, the outside air damper modulates to meet the CO<sub>2</sub> space ventilation requirements.

### Humidity Sensor

A wall or duct-mounted humidity sensor shall be used to control activation of the hot gas reheat dehumidification option. The humidity sensor shall be set for humidity levels between 40% and 60% relative humidity

### High Duct Temperature Thermostats

Two temperature sensors, Discharge Air and Return Air (if installed) are used to determine if duct temperatures are excessively high. If the discharge air temperature exceeds 200°F or if the return air temperature exceeds 135°F, the unit will be placed into Emergency Stop Mode.

## Trane Startup

A Trane technician shall provide unit startup after the unit is properly installed. The installation shall include:

- Unit and all ship-with items installed
- All utilities and drain pipes connected
- All refrigerant piping reconnected and all refrigerant charge adequately distributed throughout the system
- All ductwork attached to the unit

## Prior to Trane Unit Startup

Prior to Trane startup, the following work should be inspected and verified:

### ***Unit inspection - Cabinet***

Review the overall unit for exterior damage (dents, bends, missing panels, doors working properly, etc). Verify the unit interior is free from debris/obstructions, the panels and doors are secured properly, the unit clearances are adequate to avoid air recirculation, and that the unit drain lines and traps are properly installed.

### ***Wiring***

Review the unit main power to ensure that the unit is properly grounded, the main power feed wire gauge is adequately sized, the correct voltage is supplied to the unit and electric heaters (if applicable), and the incoming voltage is phase balanced. Verify that all wiring connections are tight, all field installed control wiring is landed on correct terminals, and that all automation and remote controls, along with control wiring for CV and VAV controls, are correctly installed/wired.

### ***Refrigeration system***

Review the refrigeration system to ensure the coil fins are straightened, shipping hardware and plastic covers for compressors have been removed, compressors contain the correct oil level, service valves are in the correct position, and the crankcase heaters have been operational for at least 12 hours prior to Trane startup.

### ***Fans***

Check the unit fans to ensure the condenser fan blade set-screws to the motor shaft are tight, hold down bolts and channels from fan sections have been removed, proper adjustment of fan section spring isolators, proper fan belts tension, adequate fan bearings greased, alignment of fan sheaves, adequate tightness of supply and relief fan pulley bolts, proper fan rotation, and proper fan motor amperage.

### ***Multi-piece units***

Check to ensure both piping to the condenser and air handler side of the system have been completed and interconnecting refrigerant tubing has been evacuated. Verify base rail connection points. Inspect and verify wiring connection points related to multi-piece units.

### ***Economizer***

Check all damper linkages for proper adjustment. Verify proper damper operation and outside air pressure sensors.

### ***Electric Heat***

On units equipped with electric heaters, check to ensure the heating system matches the unit nameplate and verify that the correct voltage is supplied to the heaters.

### ***Hot Water/Steam***

On units equipped with hot water heat, check and verify the following: hot water pipes are properly routed, sized and leak free; the presence of swing joints or flexible connectors next to the hot water coil; proper gate valve installation in the supply and return branch line; proper three way modulating valve installation, and proper coil venting. On units equipped with steam heat, check and verify the following: hot water pipes are properly routed, sized and leak free; proper swing check vacuum breaker installation; proper 2-way modulating valve installation; and proper steam trap installation.

### ***Gas Heat***

On units equipped with gas heaters, check to ensure that the flue assembly is secure and properly installed, sufficient gas pressure exists at the unit, no leaks exist in gas supply line, the gas heat piping includes a drip leg, and condensate line is run if required.

## Trane Unit Startup

After the unit installation has been fully completed, a Trane technician shall do the following:

- Verify and log supply fan operation, proper compressor operation, and condenser fan operation, as well as correct levels of superheat and subcooling.
- Verify operation of all VAV modes per job requirements, which include: Supply Air Cooling and Heating, Daytime Warmup, Morning Warmup, and Supply Air Tempering.



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**Return Fan** — Establish the return fan maximum setpoint based on the required building pressure setpoint.

**Space pressure control** — Verify that unit is sensing field installed building pressure input.

**Ventilation override** — Verify that sequences are set up and functional per customer requirement.

**Economizer** — Adjust outside air travel and verify all sensor inputs.

**Dehumidification** — Verify that dehumidification mode operates correctly and is set up per job requirements.

**Outside Air Measurement** — Verify that there is correct Traq damper linkage and actuator operation, as well as matched left and right air flow. Verify that Demand Flow Ventilation function is correct.

**Gas Heat** — Startup gas heat per the unit Installation, Operation, Maintenance Manual (IOM) and record CO<sub>2</sub> and O<sub>2</sub> levels.

**Energy Recovery** — Check to ensure proper rotation and operation of the wheel. Use the service test guide in the unit Installation, Operation, Maintenance Manual (IOM) to operate unit components.

**All units** — Verify user interface programming, including setpoints and sensor sources per customer requirements. Leave the unit in a running state or off per customer requirement. Once the IntelliPak® unit startup is complete, provide a startup activities communication and the associated operating log.

## Certified AHRI Performance

Packaged Rooftop units cooling, heating capacities and efficiencies shall be rated within the scope of the Air-Conditioning, Heating & Refrigeration Institute (AHRI) Certification Program and display the AHRI Certified® mark as a visual confirmation of conformance to the certification sections of AHRI Standard 340-360 (I-P) and ANSI Z21.47 and 10 CFR Part 431 pertaining to Commercial Warm Air Furnaces. The applications in this catalog specifically excluded from the AHRI certification program are:

- Ventilation modes
- Heat Recovery





The AHRI Certified mark indicates Trane U.S. Inc. participation in the AHRI Certification program. For verification of individual certified products, go to [ahridirectory.org](http://ahridirectory.org).

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