Product Catalog

Packaged Rooftop Air Conditioners
IntelliPak™ — S*HL
24 - 89 Tons — Evaporative Condensers — 60 Hz

October 2013

RT-PRC058B-EN

IntelliPak™ Rooftop Air Conditioners

Designed For Today and Beyond

Innovative technology and an impressive lineup of features make the Trane IntelliPak™ Rooftop line the number one choice for today and the future. The Trane rooftop Unit Control Module (UCM), an innovative, modular microprocessor control design, coordinates the actions of the IntelliPak™ rooftop in an efficient manner and allows for stand-alone operation of the unit. Access to the unit controls, via a Human Interface Panel, provides a high degree of control, superior monitoring capability, and unmatched diagnostic information.

Optionally, for centralized building control on-site, or from a remote location, IntelliPak™ can be configured for direct communication with a Trane Tracer™ building management system or a 3rd party LonTalk® or BACnet building management system, using a twisted pair of wires. With one of these systems, the IntelliPak™ status data and control adjustment features can be conveniently monitored from a central location. IntelliPak™ has the technology *and flexibility* to bring total comfort to every building space.

Revision Summary

RT-PRC058B-EN (25 Sep 2013)

- Updated "Model Number Descriptions," p. 27 to include both evaporative condensing and air-cooled digits.
- Removed design special information which includes DDP fan curves.

Table of Contents

Features and Benefits

Standard Features

- 24 - 89 ton industrial/ commercial rooftops
- R-410A Refrigerant
- ASHRAE 90.1 - 2010 Efficiency Compliant
- cULus approval on standard options

Controls

- Fully integrated, factory-installed/ commissioned microelectronic controls
- Unit mounted Human Interface Panel with a 2 line x 40 character English display and a 16 function keypad that includes Custom, Diagnostics, and Service Test mode menu keys.
- CV or VAV, or Single Zone VAV control
- Frostat™ coil frost protection on all units
- Daytime warm-up (occupied mode) on VAV models and Morning warm-up operation on all units with heating options
- Supply air static over-pressurization protection on units with VFDs.
- Return air static over-pressurization protection on units with return fan option.
- Supply airflow proving
- Exhaust/return airflow proving on units with exhaust/return option
- Supply air tempering control
- Supply air heating control on CV or VAV units with DischargeTemp Control modulating gas, hot water or steam heat units
- Mappable sensors and setpoint sources
- Occupied/Unoccupied switching
- Emergency stop input
- Low Charge Protection
- Dirty filter switch
- Phase Monitor
- Humidification input
- Freeze Avoidance

Refrigeration

- Compressor or circuit lead/lag depending on unit
- Intertwined Evaporator Coil circuiting for full face area operation at part load conditions
- Evaporative condensers
- Replaceable core filter driers
- Liquid and Discharge Service Valves

Cabinet

- Hinged access doors on control panel, filter section, and gas heat section
- Horizontal discharge/return duct connections (SX, SL, SS, SF models)
- Pitched roof over air handler section
- Heavy-gauge, single-piece construction base rails
- Meets salt spray testing in accordance to ASTM B117 Standard

Mechanical

- Stainless steel flue stack on gas heat units
- Two-inch standard efficiency throwaway filters
- Forward-curved supply fans (24-89 ton)

Optional Features

For a comprehensive listing of standard options, special options, and accessories, please see "Options," p. 87, Table 44.

Controls

- LonTalk® Communication Interface Module
- BACnet Communication Interface Module
- Remote Human Interface Panel (controls up to 4 units)
- Five ventilation override sequences
- Generic BAS interface 0-5 VDC and 0-10 VDC
- Variable frequency drive control of supply/exhaust/return fan motor
- Single Zone VAV Control
- High duct temperature thermostats pressurization control
- Correction capacitors

Refrigeration

- Hot gas bypass to the evaporator inlet
- Sump Pump
- Conductivity Controller
- Dolphin WaterCare
- Suction service valves
- High capacity unit (24-89 ton)
- Copper evaporator coils

Cabinet

- Extended casing (SX models)
- Double wall access doors
- Double wall construction/perforated double wall
- Stainless steel drain pan in evaporator section
- Pitched evaporator drain pan
- Horizontal or Roof discharge on certain configurations
- Special paint colors

Mechanical

- eDrive™ direct drive plenum design special supply fans; 80% or 120% wheel width (24-89 tons)
- eDrive™ direct drive plenum design special supply fans; 100% wheel width (59 tons)
- Supply fan piezometer for direct drive plenum airflow measurement
- Outside air CFM compensation on VAV units with VFD and economizer
- Barometric relief
- 0-100 percent modulating outside air economizer
- Ultra low leak dampers for 0-100 percent modulating outside air economizers
- Choose from three economizer control options: comparative enthalpy, reference enthalpy, dry bulb control
- Trane Outside Air Measurement (Traq™)
- 10 year limited warranty on Full Modulation Gas Heat
- 50 percent modulating exhaust with forward-curved fans
- 100 percent modulating exhaust with forward-curved fans
- 100 percent modulating exhaust with FC fans and Statitrac™ direct space sensing building pressurization control
- 100 percent modulating return with airfoil fans

- 100 percent modulating return with AF fans and Statitrac™ direct space sensing building
- Two-inch spring fan isolation
- U-frame motors
- Oversized motors
- Motors with internal shaft grounding ring for VFD applications

Filtration

- Filter rack only (no filters)
- High efficiency throwaway filters, MERV 8
- 90-95 percent bag filters, MERV 14
- 90-95 percent cartridge filters, MERV 14
- Differential pressure gauge

Heat

- Heating options: natural gas, electric, hot water or steam
- Modulating Gas Heat

Electrical

- Dual electrical power connection
- Through the door non-fused disconnect with external handle
- Electrical convenience outlet

Field Installed Accessories

- Roof curbs
- Programmable sensors with night set back - CV and VAV
- Sensors without night set back - CV and VAV
- Remote zone sensors - used for remote sensing with remote panels.
- ICS zone sensors used with Tracer™ system for zone control
- Outdoor temperature sensor for units without economizers
- Remote minimum position control for economizer
- Field installed module kits available for field upgrade of controls
- Humidity Sensor
- BCI and LCI communication boards
- Wireless Comm Interface (WCI)

Features Summary

IntelliPak™ rooftop features make installation and servicing easy — and reliable operation a reality.

Installation Ease

- Factory-installed/commissioned controls
  - ease of startup
  - single twisted wire pair
  - communication for ICS interface
  - full unit points access, no field wiring of required points
- Unit mounted Human Interface Panel standard
  - user friendly keypad - edit
  - parameters
  - through the access door interface
  - startup adjustments

  - unit mounted and remote interface panel key pads are identical
- Unit mounted lifting lugs facilitate installation and can be used as unit tie-down points.

Easy to Service

- The microprocessor unit controls coordinates the operation of the rooftop with quality, industry-accepted components for service ease.
- Unit mounted Human Interface Panel standard
  - user friendly keypad - edit parameters
  - through the access door interface
  - startup adjustments
  - unit mounted and remote interface panel key pads are identical
- Modularity of unit control design
  - individual replaceable functional boards
- Advanced diagnostics

Reliability

- Advanced diagnostics
- Microprocessor controls
- Built-in safeties
- Modular control design
- cULus approval as standard
- Forward-curved supply and exhaust fans and airfoil supply and return fans are factory balanced.
- Design-special, direct-drive plenum supply fans reduce components for increased supply fan reliability.
- Fully insulated and gasketed panels reduce ambient air infiltration.
- Standard fixed-speed evaporator fan and optional exhaust/return drive offer smooth fan operation and belt durability.
- Standard with Frostat™ on all units as well as Freeze avoidance on hydronic heat units
- 200,000 hour average fan shaft and motor bearings enhance life of unit.
- Gas heater with free-floating stainless steel heat exchanger relieves the stresses of expansion and contraction. Stainless steel provides corrosion resistance through the entire material thickness.
- Integral condenser subcooler improves efficiency while helping avoid liquid flashing.
- Factory-wired and commissioned controls assure efficient and reliable rooftop operation.
- Trane Scroll compressors are designed for tough industrial operation and meet demanding operating conditions both in efficiency and reliability.
- Standard phase monitors for compressor protection .
- Roll-formed construction enhances cabinet integrity and assures a leakproof casing.
- Three-phase, direct-drive condenser fan motors enhance dependability and increase rooftop life.
- Trane industrial quality evaporator and evaporative condensing coils help increase rooftop life.

Application Flexibility

- Modularity in design

- Increased offering of standard options
- Generic BAS interface
- Five factory preset/re-definable in the field ventilation override sequences
- Superior Tracer™ interface for ICS applications
  - factory-installed Trane
- Superior LonTalk® interface for Tracer™ and 3rd party applications
  - factory or field-installed LonTalk® Communication Interface
- Superior BACnet interface for Tracer™ SC or 3rd party applications
  - factory or field-installed BACnet communication interface
  - Field installed Wireless Comm through BCI add available
- Unit mounted or Remote Human Interface panels
  - all parameter are editable from the Human Interface Panel
- Traq™ outside air measurement to meet LEED IEQ Credit 1
- Comparative enthalpy, Reference enthalpy, or Dry bulb control for economizers
- Statitrac™ direct space building pressure control
- Compensated outdoor air control - IAQ
- Factory-installed filter rack includes two-inch throwaway filters.
- CV controls stage both compressors and heat based on space requirements.
- Variable Frequency Drives (VFD) Included With or Without Bypass Control for Supply and Exhaust/Return Fans.
- Higher efficiency units with evaporative condensing option
- An array of heating options are available, including Steam, Hot Water, Electric and Natural Gas heat. The Gas Heating option provides a choice of two-stage gas heat, as well as full and limited modulating gas heat.

Integrated Rooftop Systems: Profitable, Simple

Trane integrated rooftop systems make design and installation of building management systems cost effective and easy. Trane offers three choices for building management controls: Tracer™ building automation system with LonTalk® Communication Interface (LCI) or Tracer™ SC with BacNet Communication Interface (BCI).

Trane Control System with LonTalk® and BACnet

Interoperability with LonTalk®

The Trane Tracer™ LonTalk® Control Interface (LCI) for IntelliPak™ offers a building automation control system with outstanding interoperability benefits. LonTalk®, which is an industry standard, is an open, secure and reliable network communication protocol for controls, created by Echelon Corporation and adopted by the LonMark Interoperability Association. It has been adopted by several standards, such as: EIA-709.1, the Electronic Industries Alliance (EIA) Control Network Protocol Specification and ANSI/ASHRAE 135, part of the American Society of Heating, Refrigeration, and Air-Conditioning Engineer's BACnet control standard for buildings.

Interoperability allows application or project engineers to specify the best products of a given type, rather than one individual supplier's entire system. It reduces product training and installation costs by standardizing communications across products.

Interoperable systems allow building managers to monitor and control IntelliPak™ equipment with a Trane Tracer Summit®, Tracer™ SC or a 3rd party building automation system. It enables

integration with many different building controls such as access/intrusion monitoring, lighting, fire and smoke devices, energy management, and a wide variety of sensors (temperature, pressure, light, humidity, occupancy, CO_2 and air velocity). For more information on LonMark, visit www.lonmark.org or Echelon, www.echelon.com.

Note: *LonTalk® and LonWorks® are registered trademarks of Echelon Corporation.*

Interoperability with BACnet

The Trane Tracer™ SC BACnet Control Interface (BCI) for IntelliPak™ offers a building automation control system with outstanding interoperability benefits. BACnet, which is an industry standard, is an open, secure and reliable network communication protocol for controls, created by American Society of Heating, refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE).

Interoperability allows application or project engineers to specify the best products of a given type, rather than one individual supplier's entire system. It reduces product training and installation costs by standardizing communications across products.

Interoperable systems allow building managers to monitor and control IntelliPak™ equipment with Tracer™ SC controls or a 3rd party building automation system. It also enables integration with many different building controls such as access/intrusion monitoring, lighting, fire and smoke devices, energy management, and a wide variety of sensors (temperature, pressure, light, humidity, occupancy, CO_2 and air velocity).

Typical points available through BACnet:

- All Rooftop diagnostics
- System setpoints
- System sensor inputs
- Supply fan mode and status
- VFD speed
- Unit heat/cool mode
- Exhaust fan status
- Exhaust damper position
- Economizer position, minimum position setpoint, economizing setpoint
- On/off status of each compressor
- Refrigerant evaporator and saturated condenser temperatures
- Hydronic heat valve position
- Electric heat stage status
- Ventilation override mode status

Control points for IntelliPak™ Rooftops:

- Cooling and heating setpoints
- Zone setpoint offsets for use with demand limiting
- VAV discharge air setpoints
- Supply air pressure setpoint
- Space pressure setpoint
- Zone and outdoor temperature values
- Cooling and heating enable/disable
- Economizer enable/disable
- Economizer setpoint
- Economizer minimum position
- Activation of ventilation override modes
- Diagnostics reset
- Unit priority shutdown
- Timed override activation

IntelliPak™ Rooftops setup and configuration information:

- Supply fan mode
- Configuration of supply air reset
- Ventilation override mode configuration
- Default system setpoint values
- Sensor calibration offsets

Optimum Building Comfort Control

The modular control design of the UCM allows for greater application flexibility. Customers can order exactly the options required for the job, rather than one large control package. Unit features are distributed among multiple field replaceable printed circuit boards. The Trane UCM can be set up to operate under one of three control applications:

1. Stand-alone
2. Interface with Trane Tracer™ building management system
3. Interface with a generic (non-Trane) building management system. All setup parameters are preset from the factory, requiring less start-up time during installation.

The unit mounted Human Interface and the Remote Human Interface Panels' functions are identical, except for the Service mode is not available on the Remote Human Interface Panel. This common interface feature requires less time for building maintenance personnel to learn to interact with the unit.

All of the rooftop's control parameters are adjustable and can be set up through the Remote Human Interface Panel such as, but not limited to: system on/off, demand limiting type, night setback setpoints, and many other setpoints. No potentiometers are required for setpoint adjustment, all adjustments are done through the Remote Human Interface keypad. Also up to 56 different rooftop diagnostic points can be monitored through the human interfaces such as: sensor failures, loss of supply airflow, and compressor trip.

No special tools are required for servicing of the unit. All diagnostic displays are available in clear English at the Remote Human Interface and will be held in memory, so that the operator/servicer can diagnose the root cause of failures.

Trane Wireless Comm Interface (WCI) - Field Installed

The Trane Wireless Comm Interface (WCI) is the perfect alternative to Trane's BACnet™ wired communication links (for example, Comm links between a Tracer™ SC and a Tracer™ UC400). Minimizing communication wire use between terminal products, zone sensors, and system controllers has substantial benefits. Installation time and associated risks are reduced. Projects are completed with fewer disruptions. Future re-configurations, expansions, and upgrades are easier and more cost effective.

Building Pressure Control

Statitrac™ Direct Space Building Pressurization Control

Trane's Statitrac™ control is a highly accurate and efficient method of maintaining building pressure control with a large rooftop air conditioner.

The efficiency is achieved with a 100 percent modulating exhaust system that only operates as needed. Most of the operating hours of the 100 percent modulating exhaust system are at part load, saving more energy. Trane's Statitrac™, with the 100 percent modulating exhaust system, provides comfort and economy for buildings with large rooftop air conditioning systems.

Statitrac™ control is simple. The space pressure control turns the exhaust fans on and off as required and modulates exhaust dampers to maintain space pressure within the space pressure dead band. Using the unit mounted Human Interface Panel you can:

1. Adjust space pressure setpoint

2. Adjust space pressure dead band
3. Measure and read building space pressure. The modulating exhaust system maintains the desired building pressure, saving energy while keeping the building at the right pressure. Proper building pressurization eliminates annoying door whistling, doors standing open, and odors from other zones.

The Statitrac™ direct space building control sequence will be maintained when a variable frequency drive is used.

Statitrac™ Control with Plenum Return Fan is State of the Art

Other manufacturers utilize a fan tracking control scheme whereby the return fan speed tracks the supply fan speed in a linear fashion. This scheme works well at minimum and maximum CFM airflow. However, due to the dissimilar performance characteristics of the supply and return fan, building pressure is difficult to control at points between minimum and maximum CFM airflow.

The Trane return fan/building pressurization control system eliminates the effects of dissimilar supply/return fan characteristics experienced in a linear tracking control system by modulating the exhaust dampers based on space pressure, the return/economizer dampers based on ventilation requirements, and the return fan speed based on return plenum static pressure. The supply fan, return fan, exhaust damper, and return/economizer damper systems act independently from one another to maintain comfort and building pressure.

The return fan operates whenever the supply fan is in operation. The unit exhaust dampers are modulated in response to the space pressure signal to maintain space pressure within the space pressure deadband. The unit economizer and return air dampers are modulated based on ventilation control, minimum outside air economizer position, and economizer cooling request. The return fan speed is modulated based on a return duct static pressure deadband control. Using the unit mounted Human Interface, the operator can:

1. Adjust space pressure setpoint
2. Adjust space pressure deadband
3. Measure and read building space pressure
4. Measure and read return duct static pressure.

Proper building pressurization eliminates annoying door whistling, doors standing open, and odors from other zones.

Variable Frequency Drives (VFD)

Variable Frequency Drives are factory installed and tested to provide supply/exhaust/return fan motor speed modulation. VFD's, as compared to discharge dampers, are quieter, more efficient, and are eligible for utility rebates. The VFD's are available with or without a bypass option. Bypass control will simply provide full nominal airflow in the event of drive failure.

Evaporative Condensing

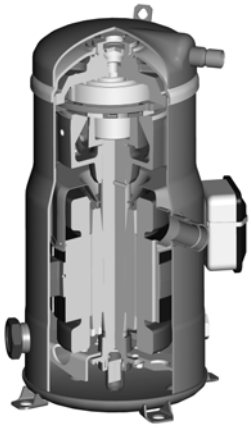
Evaporative Condensing Units

Unlike air-cooled condensers, evaporative condensers are dependent on the ambient wet bulb, rather than dry bulb, temperature. Wet bulb temperature is generally several degrees lower than dry bulb. Utilizing the lower wet bulb temperature to condense refrigerant vapor can dramatically decrease compressor power consumption by reducing compressor discharge pressure thereby increasing unit efficiency. Once thought of as limited to dry/arid climates, people are finding evaporative condensing useful in virtually any climate. To help with this determination, Standard Trane Selection systems (TOPSS) provides performance and kW outputs to help define which option is right for your application.

Trane 3-D® Scroll Compressors

The Trane 3-D® Scroll provides important reliability and efficiency benefits inherent to its design. The 3-D® Scroll allows the orbiting scrolls to touch in all three dimensions forming a completely enclosed compression chamber which leads to increased efficiency.

In addition, the orbiting scrolls only touch with enough force to create a seal; thereby resulting in no wear between the scroll involutes. The fixed and orbiting scrolls are made of high strength cast iron which results in less thermal distortion and minimal leakage. In addition, better part isolation has resulted in reduced compressor sound levels compared to previous designs.



Features listed below optimize the compressor design and performance:

- Optimized scroll profile
- Heat shield protection to reduce heat transfer between discharge and suction gas
- Improved sealing between condenser side and air handler side

Additional features are incorporated in the compressor design for greater compressor reliability:

- Patented design motor cap for improved motor cooling
- Improved bearing alignment
- Improved resistance to dry start up
- Oil sight glass for evaluating proper oil levels

Low Torque Variation

The 3-D® Scroll compressor has a very smooth compression cycle. This means that the scroll compressor imposes very little stress on the motor resulting in greater reliability. Low torque variation reduces noise and vibration.

Suction Gas Cooled Motor

Compressor motor efficiency and reliability is further optimized with the latest scroll design. The patented motor cap directs suction gas over the motor resulting in cooler motor temperatures for longer life and better efficiency.

Energy Savings, Improved IAQ and Comfort

IntelliPak™ offers several ways to save energy while improving indoor air quality (IAQ) and zone comfort. Standard factory installed options for energy savings include hot gas reheat and evaporative condensers.

Single Zone VAV (SZVAV)

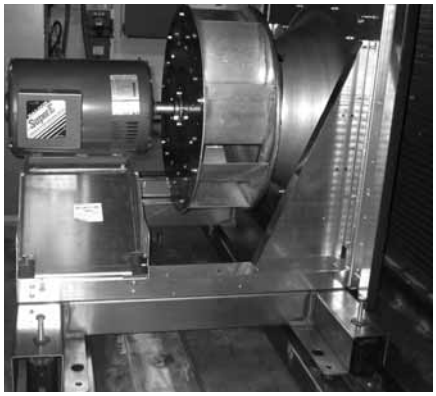
Single Zone VAV (SZVAV) is designed for use in single zone applications such as gymnasiums, auditoriums, manufacturing facilities, retail box stores, and any large open spaces where there is a diversity in the load profile. It is an ideal replacement to "yesterday's" constant-volume (CV) systems, as it reduces operating costs while improving occupant comfort.

SZVAV systems combine Trane application, control and system integration knowledge to exactly match fan speed with cooling and heating loads, regardless of the operating condition. Trane algorithms meet and/or exceed ASHRAE 90.1- 2010 SZVAV energy-saving recommendations and those of CA Title 24. The result is an optimized balance between zone temperature control and

system energy savings. Depending on your specific application, energy savings can be as much as 20+%.

Note: *Building system modeling in energy simulation software such as TRACE is recommended to evaluate performance improvements for your application.*

SZVAV is fully integrated into the IntelliPak™ Control system. It provides the simplest and fastest commissioning in the industry through proven factory-installed, wired, and tested system controllers. All control modules, logic boards and sensors are factory installed and tested to ensure the highest quality and most reliable system available. This means no special programming of algorithms, or hunting at the jobsite for field installed sensors, boards, etc. Single zone VAV is a quick and simple solution for many applications and is available from your most trusted rooftop VAV system solution provider -Trane.



eDrive™ Direct-Drive Plenum Fans

In addition to higher reliability, direct-drive plenum fans offer higher fan efficiency at AHRI rating points. Direct drive plenum fans have a peak operating efficiency which is typically 10-20% more efficiency than traditional housed fans. Trane offers two fan widths to optimize fan efficiency for the building system. Since there are some low static applications, where forward-curved fans may be the best choice, use Trane's TOPSS™ computer software selection program to select the most efficient fan option for your system design. Direct-drive plenum fans are offered as a design special with evaporative condenser units.

Trane Air Quality (Traq™) Outside Air Measurement System

Trane Air Quality (Traq™) outside air measurement system uses velocity pressure sensing rings to measure airflow in the outside air opening from 40 cfm/ton to maximum airflow. Measurement accuracy is at least ±15%, meeting requirements of LEED IE Q Credit 1.

Application Considerations

Exhaust/Return Fan Options

When is it necessary to provide building exhaust? Whenever an outdoor air economizer is used, a building generally requires an exhaust system. The purpose of the exhaust system is to exhaust the proper amount of air to prevent over or under-pressurization of the building. The goal is to exhaust approximately 10 percent less air than the amount of outside air going into the building. This maintains a slightly positive building pressure.

The reason for applying either a return, or exhaust fan is to control building pressure. The Trane 100 percent modulating exhaust system with Statitrac is an excellent choice for controlling building pressure in the majority of applications. For more demanding applications, Trane's 100 percent modulating return fan system with Statitrac is an excellent choice for systems with high return static pressure losses, or duct returns. Both systems employ direct digital control technology to maintain building pressure. Either return or exhaust fan systems with Statitrac may be used on any rooftop application that has an outdoor air economizer.

A building may have all or part of its exhaust system in the rooftop unit. Often, a building provides exhaust external to the air conditioning equipment. This external exhaust must be considered when selecting the rooftop exhaust system.

With an exhaust 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. However, a supply fan can typically overcome return duct losses more efficiently than a return air fan system. Essentially, one large fan by itself is normally more efficient than two fans in series because of only one drive loss, not two as with return fan systems.

In a return fan system, the return fan is in series with the supply fan, and operates continuously whenever the supply fan is operating to maintain return air volume. The supply fan motor and drives are sized to deliver the design CFM based on internal and discharge static pressure losses only. 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 an exhaust fan

Exhaust/Return Systems

- Barometric Relief
- 50 percent exhaust air fan option
- 100 percent modulating exhaust with Statitrac direct space sensing building pressurization control (with or without exhaust variable frequency drives)
- 100 percent modulating exhaust without Statitrac
- 100 percent modulating plenum return airfoil fan with Statitrac direct space sensing building pressurization control with variable frequency drive
- 100 percent modulating plenum return airfoil fan without Statitrac
- Drivers for applying either return or exhaust fan systems range from economy, to building pressure control, to code requirements, to generally accepted engineering practices.

Application Recommendations

Barometric Relief Dampers

Barometric relief dampers consist of gravity dampers which open with increased building pressure. As the building pressure increases, the pressure in the unit return section also increases, opening the dampers and relieving air. Barometric relief may be used to provide relief for single story buildings with no return ductwork and exhaust requirements less than 25 percent.

50 Percent Exhaust System

The 50 percent exhaust system is a single FC exhaust fan with half the air moving capabilities of the supply fan system. It is Trane's experience that a non-modulating exhaust system selected for 40 to 50 percent of nominal supply CFM can be applied successfully. The 50 percent exhaust system generally should not be selected for more than 40 to 50 percent of design supply airflow. Since it is an on/off non-modulating system, it does not vary exhaust CFM with the amount of outside air entering the building. Therefore, if selected for more than 40 to 50 percent of supply airflow, the building may become under-pressurized when economizer operation is allowing lesser amounts of outdoor air into the building. If, however, building pressure is not of a critical nature, the non-modulating exhaust system may be sized for more than 50 percent of design

100 Percent Modulating Exhaust with Statitrac Control, Constant Volume and VAV Units

For both CV and VAV rooftops, the 100 percent modulating exhaust discharge dampers or fan 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 exhaust fan is turned on when required to lower building static pressure to setpoint. The Statitrac control system then modulates the discharge dampers or fan to control the building pressure to within the adjustable, specified deadband that is set at the Human Interface Panel. Economizer and return air dampers are modulated independent of the exhaust dampers or fan based on ventilation control and economizer cooling requests.

Advantages:

- The exhaust fan runs only when needed to lower building static pressure.
- Statitrac compensates for pressure variations within the building from remote exhaust fans and makeup air units.
- When discharge dampers are utilized to modulate the exhaust airflow, the exhaust fan may be running unloaded whenever the economizer dampers are less than 100 percent open.

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

100 Percent Modulating Exhaust System without Statitrac, Constant Volume Units Only

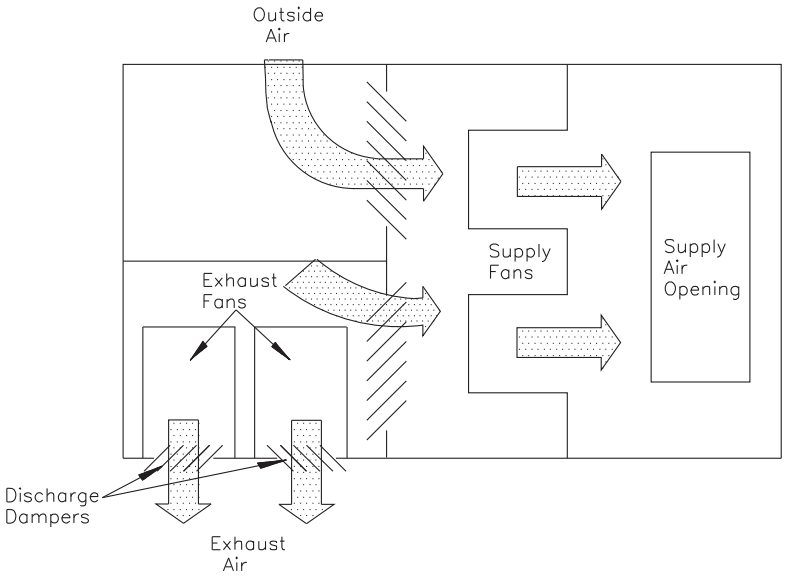
This fan system has performance capabilities equal to the supply fan. The FC exhaust fans are started by the economizer's outdoor air damper position and the exhaust dampers track the economizer outdoor air damper position. The amount of air exhausted by this fan is controlled by modulating discharge dampers at the fan outlet. The discharge damper position is controlled by a signal that varies with the position of the economizer dampers. When the exhaust fans start, the modulating discharge dampers are fully closed, and exhaust airflow is 15 to 20 percent of total exhaust capabilities.

Advantages:

- The exhaust fan runs only when the economizer reaches the desired exhaust enable point.
- Exhaust dampers are modulated based on the economizer position.
- When discharge dampers are utilized to modulate the exhaust airflow, the exhaust fan may be running unloaded whenever the economizer dampers are less than 100 percent open.

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

Figure 1. Plan view of modulating 100-percent exhaust system



100 Percent Modulating Return Fan Systems with Statitrac Control, Constant Volume and VAV units

For both CV and VAV applications, the IntelliPak™ rooftop unit offers 100 percent 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 exhaust dampers are modulated, based on space pressure, to control the building pressure to within the adjustable, specified deadband that is set at the Human Interface Panel. A VFD modulates the return fan speed based on return duct static pressure. Economizer and return air dampers are modulated independent of the exhaust 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 exhaust fans and makeup air units.
- The return fan acts as both exhaust and return fan based on operation requirements.

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

100 Percent Modulating Return Fan without Statitrac Control, Constant Volume Units Only

The return fan runs continuously while the supply fan is energized. Economizer, return air, and exhaust dampers are modulated based on ventilation control, and economizer cooling requests.

Advantages:

- The return fan enhances total system static capability.
- The return fan discharges in two directions, thereby balancing exhaust and unit return air volumes.

Horizontal Discharge

Note: *Horizontal discharge cannot be applied to units with return fans.*

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.

Trane has two ways to accomplish horizontal supply and/or return. The first method is through special field supplied curbs that use the unit's standard discharge and return openings. The supply and return air is routed through the curb to horizontal openings on the sides of the curb. The second method available for horizontal supply and return applies to 24 - **89** tons SXHL, SFHL, SLHL, and SSHL design units ONLY. With this method the standard discharge and return openings are blocked in the factory as a design special. Access panels are removed as indicated in Figure 2, p. 19. These openings are used for the discharge and return. No special curb is needed.

SXHL, SFHL, SLHL, SSHL Units

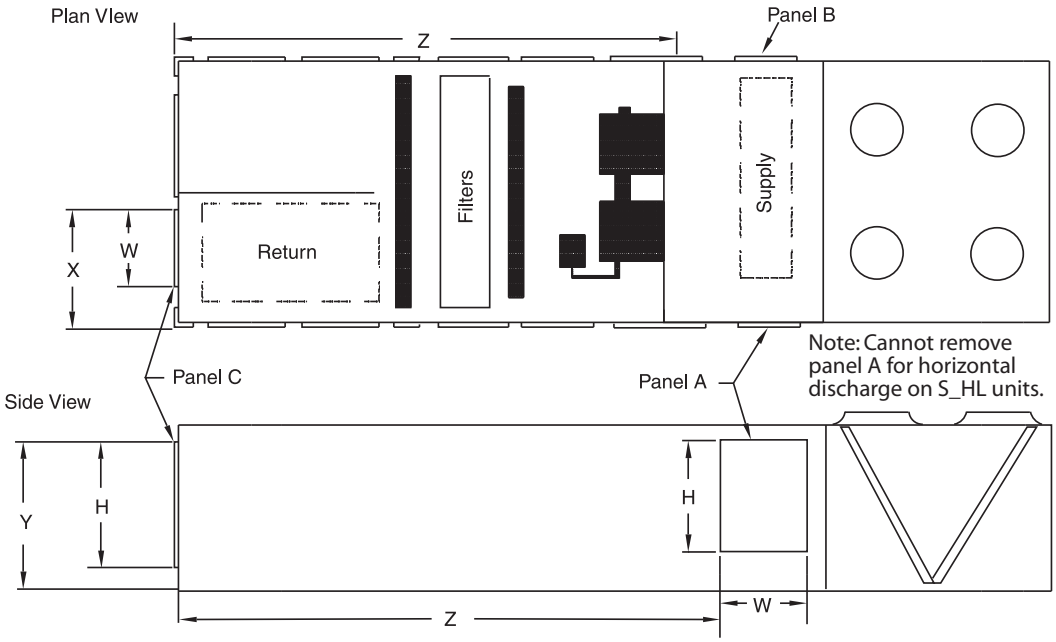
Figure 2 is a simplified sketch of the rooftop showing which panels can be used for horizontal supply and/or return. To supply air horizontally, the panels that normally house the heat accessory controls (Panel A) and the gas heat barometric dampers (Panel B) can be removed and either of the openings used as a unit discharge (see note 1.). To return air horizontally, the exhaust fan access door (Panel C) can be removed and used as a return opening. Table 1, Table 2 and Table 3, p. 20 show dimensions for those panels (see note 4.).

Horizontal Discharge on SXHL, SFHL, SLHL and SSHL Rooftops (24-89 Ton)

The SXHL (extended casing cooling only), SFHL (gas heat), SSHL (steam heat) and SLHL (hot water heat) rooftops can be factory modified as a design special to supply and return air horizontally without the use of a horizontal supply/return curb.

To supply air horizontally on SXHL only, the panels that normally house the heat accessory controls (Panel A) and the gas heat barometric dampers (Panel B) can be removed and either of the openings used as a unit discharge. To return air horizontally, the exhaust fan access door (Panel C) can be removed and used as a return opening (see note 4.).

Figure 2. Horizontal discharge panel dimensions – SXHL, SFHL, SLHL, SSHL units (24-89 Ton)



Notes:
1. For horizontal discharge on SFHL, SLHL and SSHL units, only the Panel B can be removed. Panel A cannot be used due to the location of the heating
2. Add an extra 0.20-inches pressure drop to the supply external static to account for the extra turn the air is making.
3. The openings all have a 1.25-inch lip around the perimeter to facilitate ductwork attachment.
4. If exhaust/return fans are being used, provisions should be made for access to the exhaust components, since the access door is now being used as a return.
5. Use the dimensions provided and the supply Cfm to calculate the velocity (ft/min) through the openings to be sure they are acceptable coils.

Table 1. SXHL, SFHL, SSHL, SLHL - Panel A and B dimensions

			Total Area (H X W)	
Model	**H (in.)**	**W (in.)**	**(in.^{2})**	**(ft^2)**
S*HL *24	40.7	25.5	1038	7.2
S*HL *29	40.7	25.5	1038	7.2
S*HL *36	52.7	25.5	1344	9.3
S*HL *48	64.5	34.5	2225	15.5
S*HL *59	76.7	34.5	2646	18.4
S*HL *73	64.6	34.5	2229	15.5
S*HL *80	64.6	34.5	2229	15.5
S*HL *89	64.6	34.5	2229	15.5

* = Universal letter/number. See model number for specifics.

Table 2. SXHL, SFHL, SSHL, SLHL - Panel C dimensions

			Total Area (H X W)	
Model	H (in.)	W (in.)	($in.^2$)	(ft^2)
S*HL *24	40.7	34.5	1404	9.8
S*HL *29	40.7	34.5	1404	9.8
S*HL *36	52.7	34.5	1818	12.6
S*HL *48	64.5	34.5	2225	15.5
S*HL *59	76.7	34.5	2646	18.4
S*HL *73	64.6	34.5	2229	15.5
S*HL *80	64.6	34.5	2229	15.5
S*HL *89	64.6	34.5	2229	15.5

* = Universal letter/number. See model number for specifics.

Table 3. SXHL, SFHL, SSHL, SLHL - X, Y and Z dimensions

Model	X (in.)	Y (in.)	Z (in.)
S*HL *24	43.5	44.0	201.5
S*HL *29	43.5	44.0	201.5
S*HL *36	43.5	56.0	201.5
S*HL *48	44.5	67.8	237.0
S*HL *59	44.5	80.0	237.0
S*HL *73	44.5	68.0	237.5
S*HL *80	44.5	68.0	237.5
S*HL *89	44.5	68.0	237.5

* = Universal letter/number. See model number for specifics.

Miscellaneous Applications

Ventilation Override Sequences

One of the benefits of using an exhaust system is that the rooftop can be used as part of a ventilation override system. Several types of sequences can be easily done when power exhaust is a part of the rooftop system. What would initiate the ventilation override control sequence? 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.

Important: The ventilation override system should not be used to signal the presence of smoke caused by a fire.

Trane can provide five (5) different ventilation override sequences on both CV and VAV IntelliPak™ Rooftops. For your convenience the sequences can be factory preset or fully field editable from the Human Interface Panel or Tracer™. Any or all five sequences may be "locked" in by the user at the Human Interface Panel. 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
- Exhaust/Return Fan - on/off
- Exhaust 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, Exhaust, 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 Sequence of Operation provided in the Control section of this catalog for more details on each override sequence.

Natural Gas Heating Considerations

The IntelliPak™ standard, or limited modulation, gas heat exchangers are not recommended for applications with mixed air conditions entering the heat exchanger below 50°F. Mixed air temperatures below 50°F can cause condensation to form on the heat exchanger, leading to premature failure. For increased reliability, the recommendation in these applications is full modulation gas heat. For airflow limitations and temperature rise across the heat exchanger information, see Table 19, p. 44.

Acoustical Considerations

The ideal time to make provisions to reduce sound transmission to the space is during the project design phase. Proper placement of rooftop equipment is critical to reducing transmitted sound levels to the building. The most economical means of avoiding an acoustical problem is to place any rooftop equipment away from acoustically critical area. If possible, rooftop equipment should not be located directly above areas such as: offices, conference rooms, executive office areas and classrooms. Ideal locations are above corridors, utility rooms, toilet facilities, or other areas where higher sound levels are acceptable.

Several basic guidelines for unit placement should be followed to minimize sound transmission through the building structure:

1. Never cantilever the condensing section of the unit. A structural cross member must support this end of the unit.
2. Locate the unit's center of gravity close to or over a column or main support beam to minimize roof deflection and vibratory noise.
3. If the roof structure is very light, roof joists should be replaced by a structural shape in the critical areas described above.
4. If several units are to be placed on one span, they should be staggered to reduce deflection over that span.

It is impossible to totally quantify the effect of 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 guidelines listed above are experience proven guidelines which will help reduce sound transmission.

There are several other sources of unit sound, i.e., supply fan, compressors, exhaust fans, condenser fans and aerodynamic noise generated at the duct fittings. Refer to the current ASHRAE Applications Handbook for guidelines on minimizing the generation of aerodynamic noise associated with duct fittings.

For information on various duct installation considerations specifically addressing indoor sound level concerns, see the latest Trane Engineering bulletin on sound. This bulletin includes sound power data on Trane's IntelliPak™ Rooftops. Contact your local Trane representative for this bulletin.

The VariTrane™ Duct Design Program can be used to analyze the truck duct, run-out duct, VAV control unit and terminal unit noise attenuation. This program quantifies the airborne sound generation that can be expected in each terminal so that the designer can identify potential sound problems and make design alterations before equipment installation.

The Trane Acoustics Program (TAP) allows modeling of rooftop installation parameters. The output of this program shows the resulting indoor NC level for the modeled installation. This program is

available from Trane's Customer Direct Service Network (CDS), ask your local Trane representative for additional information on this program.

Clearance Requirements

The recommended clearances identified with unit dimensions should be maintained to assure adequate serviceability, maximum capacity and peak operating efficiency.

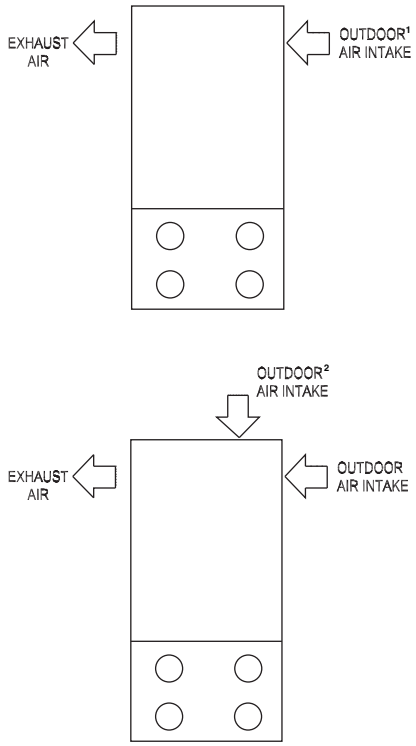
A reduction in unit clearance could result in condenser coil starvation or warm condenser air recirculation. Clearances must be considered for the following:

- 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, exhaust air removal and condenser airflow?
- If screening around the unit is being used, is there a possibility of air recirculation from the exhaust 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 as shown in Figure 3 for two reasons:

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

Figure 3. Unit placement



1. 24-48 ton evap cooled models have only one outdoor air intake. 59-89 ton evaporative condensing models have two outdoor air intakes.

Selection Procedure

Heating Capacity Selection

Step 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 = 51,900 Btu ÷ (1.085 x 17,500 CFM) = 2.73°F

Air temperature entering heating module = 63.0 + 2.73 = 65.7°F

Step 2 - Determine Total Winter Heating Load

Total winter heating load = peak heating load + ventilation load - supply fan motor heat = 475 + 133 - 51.9 = 556.1 MBh

Electric Heating System

Unit operating on 460/60/3 power supply.

From Table 23, p. 45, kW may be selected for a nominal 50 ton unit operating 460-volt power. The 170 kW heat module (580.1 MBh) will satisfy the winter heating load of 563 MBh.

Table 22, p. 45 shows an air temperature rise of 30.6°F for 17,500 CFM through the 170 kW heat module.

Unit supply temperature at design heating conditions = mixed air temperature + air temperature rise = 65.7°F + 30.6°F = 96.3°F.

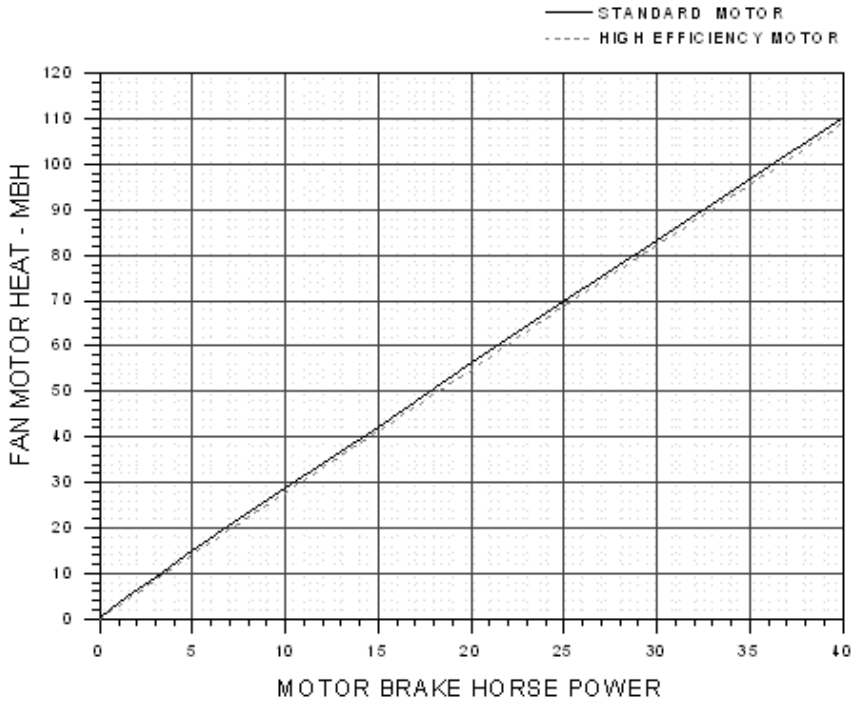
Gas Heating System (Natural Gas)

From Table 19, p. 44 select the high heat module (697 MBh output) to satisfy winter heating load of 563 MBh at unit CFM.

Table 19, p. 44 also shows an air temperature rise of 36.0°F for 17,500 CFM through the heating module.

Unit supply temperature at design heating conditions = mixed air temperature + air temperature rise = 65.7°F + 36.0°F = 101.7°F.

Figure 4. Fan motor



Hot Water Heating

Assume a hot water supply temperature of 190°F. Subtract the mixed air temperature from the hot water temperature to determine the ITD (initial temperature difference).

ITD = 190°F - 65.7°F = 126°F. Divide the winter heating load by ITD = 563 MBh ÷ 126°F = 4.50 Q/ITD.

From Table 24, p. 46, select the low heat module. By interpolation, a Q/ITD of 4.50 can be obtained at a gpm at 25.7.

Water pressure drop at 25.7 gpm is 0.57 ft. of water. Heat module temperature rise is determined by:

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

$$\frac{563{,}000}{(1.085 \times 17{,}500)} = 29.7°F$$

Unit supply air temperature = mixed air temperature + air temperature rise = 65.7 + 29.7 = 95°F.

Steam Heating System

Assume a 15 psig steam supply.

From Table 21, p. 44, the saturated temperature steam is 250°F. Subtract mixed air temperature from the steam temperature to determine ITD. ITD = 250°F - 65.7°F = 186°F.

Divide winter heating load by ITD = 563 MBh ÷ 186°F = 3.03 Q/ITD.

From Table 20, p. 44, select the high heat module.The high heat module at 17,500 CFM has a Q/ITD = 5.11.

Heat module capacity, Q = ITD x Q/ITD = 186 F x 5.11 Q/ITD = 950 MBh

Heat module air temperature rise

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

945 Btu ÷ (1.085 x 17,500 CFM) = 50°F.

Unit supply temperature at design conditions = mixed air temperature + air temperature rise = 65.1°F + 50°F = 116°F.

Air Delivery Procedure

Supply fan performance curves 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 exhaust fan, optional heating system, optional cooling only extended casing, optional roof curb).

Supply Fan Motor Sizing

The supply fan motor selected in the cooling capacity determination was 18.2 bhp and 993 rpm. Thus, a 20 hp supply fan motor is selected. For an FC fan selection, enter Table 30, p. 57 to select the proper drive. For a 50 ton rooftop with 20 hp motor, a drive number A - 1000 rpm is selected.

Exhaust Fan Motor Sizing

The exhaust fan is selected based on total return system negative static pressure and exhaust fan CFM. Return system negative static include return duct static and roof curb static pressure drop.

Return duct static pressure = 0.65 inches

Trane roof curb (Table 25, p. 51) = 0.12 inches

Total return system negative static pressure = 0.77 inches

Exhaust fan CFM = 12,000 CFM

From Table 37, p. 78, the required bhp is 3.45 hp at 574 rpm. Thus, the exhaust fan motor selected is 5 hp.

To select a drive, enter Table 29, p. 56 for a 5 hp motor for a 50 ton unit. Drive selection number 6 - 600 rpm.

Where altitudes are significantly above sea level, use Table 9, p. 35, and Table 10, p. 35 and Figure 5, p. 35 for applicable correction factors.

Return Fan Motor Sizing

The return fan is selected based on the return fan CFM and the total return system negative static pressure. The return system negative static includes the return duct static, the exhaust damper pressure drop, and any roof curb static pressure drop.

Since return fans handle all of the return static, supply fan motor sizing does not need to include this value. This feature is helpful if the supply motor HP is over the maximum limit and in some cases, can allow supply motor downsizing.

However, since the return fan runs continuously to handle all of the return static, the sensible heat generated by the motor must be included in the entering evaporator coil mixed temperature equation.

Return Duct Static Pressure = 0.65

Roof curb Static Pressure (Table 25, p. 51) = 0.12

Exhaust Damper Pressure Drop = 0.41

Total Return System Static Pressure = 1.18

Return Fan CFM = 12000

From Table 32, p. 58, the required bhp is 4.55. Thus the return fan is selected at 5HP. To select a drive, look at table Table 35, p. 61 for a 5HP return motor on a 50 HP unit. Drive selection number C - 1200.

Using Figure 4, p. 23 for fan motor heat, motor heat for 4.55 BHP = 10.4 MBH

10.4 MBH / (1.085 x 12000 return fan CFM) = 0.80°F

0.80°F is added to the return air temperature

Evaporative Condensing Rooftop

For unit selection, air-cooled or evaporative condensers can be selected using the same calculations, however evaporative capacities should be calculated based on wet bulb (WB) temperatures. For specific model selection, utilize TOPSS™ or contact the local Trane Sales Office.

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.

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 5, p. 35 shows the air density ratio at various temperatures and elevations. Trane rooftops are designed to operate between 40 and 90 degrees Fahrenheit leaving air temperature.

Selection Procedure

The procedure to use when selecting a supply or exhaust fan on a rooftop for elevations and temperatures other than standard is as follows:

1. First, determine the air density ratio using Figure 5.
2. Divide the static pressure at the nonstandard condition by the air density ratio to obtain the corrected static pressure.
3. Use the actual CFM and the corrected static pressure to determine the fan rpm and bhp from the rooftop performance tables or curves.
4. The fan rpm is correct as selected.
5. 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 60 ton rooftop unit that is to deliver 18,000 actual CFM at 3-inches total static pressure (tsp), 55°F leaving air temperature, at an elevation of 5,000 ft.

1. From Figure 5, the air density ratio is 0.86.
2. Tsp = 3.0-inches / 0.86 = 3.49 inches tsp.
3. From the performance tables: a 60 ton rooftop will deliver 18,000 CFM at 3.49-inches tsp at 992 rpm and 26.1 bhp.
4. The rpm is correct as selected - 906 rpm.
5. Bhp = 26.1 x 0.86 = 22.4 bhp actual.

Compressor MBh, SHR, and kW should be calculated at standard and then converted to actual using the correction factors in Table 9, p. 35. 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 10, p. 35 before calculating the heating supply air temperature.

Model Number Descriptions

S	A	H	L	*	5	0	4	0	A	6	8	A	6	B	D	8	0	0	1	0	0	W	0	0	G	0	B	0	0	0	R	0	0	0	8	0	0
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38

DIGIT 1 - UNIT TYPE

S = Self-Contained (Packaged Rooftop)

DIGIT 2 - UNIT FUNCTION

A = DX Cooling, No Heat
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 - UNIT AIRFLOW

H = Single Zone

DIGIT 4 - DEVELOPMENT SEQUENCE

L = Sixth

DIGITS 5,6,7 - NOMINAL CAPACITY

*24 = 24 Tons Evap Condenser
*29 = 29 Tons Evap Condenser
*36 = 36 Tons Evap Condenser
*48 = 48 Tons Evap Condenser
*59 = 59 Tons Evap Condenser
*73 = 73 Tons Evap Condenser
*80 = 80 Tons Evap Condenser
*89 = 89 Tons Evap Condenser

DIGIT 8 - POWER SUPPLY

4 = 460/60/3 XL E = 200/60/3 XL
5 = 575/60/3 XL F = 230/60/3 XL

Note: *SEHL units (units with electric heat) utilizing 208V or 230V require dual power source.*

DIGIT 9 - HEATING CAPACITY

Note: *When the second digit calls for "F" (Gas Heat), the following values apply: (please note G and M are available ONLY on 50 ton models and above.*

G = Low Heat-Limited Modulation
H = High Heat-2-Stage
J = High Heat-Limited
L = Low Heat-2-Stage
M = Low Heat- Full Modulation
0 = No Heat
P = High Heat-Full Modulation

Note: *When the second digit calls for "E" (electric heat), the following values apply:*

D = 30 kW R = 130 kW
H = 50 kW U = 150 kW
L = 70 kW V = 170 kW
N = 90 kW W = 190 kW
Q = 110 kW

Note: *When the second digit calls for ''L'' (Hot Water) or ''S''(Steam) Heat, one of the following valve size values must be in Digit 9:*

High Heat Coil:

1 = .50" 2 = .75" 3 = 1"
4 = 1.25" 5 = 1.5" 6 = 2"

Low Heat Coil:

A = .50" B = .75" C = 1"
D = 1.25" E = 1.5" F = 2"

DIGIT 10 - DESIGN SEQUENCE

A = First (Factory Assigned)

Note: *Sequence may be any letter A thru Z, or any digit 1 thru 9.*

DIGIT 11 - EXHAUST/RETURN OPTION

0 = None
1 = Barometric
3 = 100% Exhaust 3 HP w/Statitrac
4 = 100% Exhaust 5 HP w/Statitrac
5 = 100% Exhaust 7.5 HP w/Statitrac
6 = 100% Exhaust 10 HP w/Statitrac
7 = 100% Exhaust 15 HP w/Statitrac
8 = 100% Exhaust 20 HP w/Statitrac
B = 50% Exhaust 3 HP
C = 50% Exhaust 5 HP
D = 50% Exhaust 7.5 HP
F = 100% Exhaust 3 HP w/o Statitrac (CV Only)
G = 100% Exhaust 5 HP w/o Statitrac (CV Only)
H = 100% Exhaust 7.5 HP w/o Statitrac (CV Only)
J = 100% Exhaust 10 HP w/o Statitrac (CV Only)
K = 100% Exhaust 15 HP w/o Statitrac (CV Only)
L = 100% Exhaust 20 HP w/o Statitrac (CV Only)
9 = 100% Return 3 HP w/Statitrac
M = 100% Return 5 HP w/Statitrac
N = 100% Return 7.5 HP w/Statitrac
P = 100% Return 10 HP w/Statitrac
R = 100% Return 15 HP w/Statitrac
T = 100% Return 20 HP w/Statitrac
U = 100% Return 3 HP w/o Statitrac (CV Only)
V = 100% Return 5 HP w/o Statitrac (CV Only)
W = 100% Return 7.5 HP w/o Statitrac (CV Only)
X = 100% Return 10 HP w/o Statitrac (CV Only)
Y = 100% Return 15 HP w/o Statitrac (CV Only)
Z = 100% Return 20 HP w/o Statitrac (CV Only)

DIGIT 12 - EXHAUST/RETURN AIR FAN DRIVE

(Exhaust/Return Fan)
0 = None 8 = 800 RPM
4 = 400 RPM 9 = 900 RPM
5 = 500 RPM A = 1000 RPM
6 = 600 RPM B = 1100 RPM
7 = 700 RPM
(Return Fan only)
C = 1200 RPM H = 1700 RPM
D = 1300 RPM J = 1800 RPM
E = 1400 RPM K = 1900 RPM
F = 1500 RPM
G = 1600 RPM

DIGIT 13 - FILTER (PRE DX/FINAL)

A = Throwaway
B = Cleanable Wire Mesh
C = High-EfficiencyThrowaway
D = Bag With Prefilter
E = Cartridge with Prefilter
F = Throwaway Filter Rack (Filter Not Included)

DIGIT 14 - SUPPLY AIR FAN HP

1 = 3 HP FC
2 = 5 HP FC
3 = 7.5 HP FC
4 = 10 HP FC
5 = 15 HP FC
6 = 20 HP FC
7 = 25 HP FC
8 = 30 HP FC
9 = 40 HP FC
A = 50 HP FC

DIGIT 15 - SUPPLY AIR FAN RPM

4 = 400 RPM
5 = 500 RPM
6 = 600 RPM
7 = 700 RPM
8 = 800 RPM
9 = 900 RPM
A = 1000 RPM
B = 1100 RPM
C = 1200 RPM
D = 1300 RPM
E = 1400 RPM

DIGIT 16 - OUTSIDE AIR

A = No Fresh Air
B = 0-25% Manual
D = 0-100% Economizer
E = 0-100% Economizer w/ Traq/DCV

Note: *Must install CO_2 sensor(s) for DCV to function properly*

DIGIT 17 - SYSTEM CONTROL

1 = CV - Zone Temp Control
2 = CV - Discharge Temp Control
4 = CV - Zone Temp Control Space Pressure Control w/ Exhaust/ Return VFD w/o Bypass
5 = CV - Zone Temp Control Space Pressure Control w/ Exhaust/Return VFD and Bypass
6 = VAV Discharge Temp Control w/ VFD w/o Bypass
7 = VAV Discharge Temp Control w/ VFD and Bypass
8 = VAV Discharge Temp Control Supply and Exhaust/Return Fan w/ VFD w/o Bypass
9 = VAV Discharge Temp Control Supply and Exhaust/Return Fan with VFD and Bypass
A = VAV - Single Zone VAV - w/ VFD w/o Bypass
B = VAV - Single Zone VAV - w/ VFD and Bypass
C = VAV - Single Zone VAV - Supply and Exhaust/Return Fan w/ VFD w/o Bypass
D = VAV - Single Zone VAV - Supply and Exhaust/Return Fan w/ VFD w/ Bypass

DIGIT 18 - ZONE SENSOR

0 = None
A = Dual Setpoint Manual or Auto Changeover (BAYSENS108*)
B = Dual Setpoint Manual or Auto Changeover w/ System Function Lights (BAYSENS110*)
C = Room Sensor w/ Override and Cancel Buttons (BAYSENS073*)
D = Room Sensor w/ Temperature Adjustment and Override and Cancel Buttons (BAYSENS074*)
L = Programmable Zone Sensor w/ System Function Lights for CV, SZVAV, and VAV (BAYSENS119*)

Note: **Asterisk indicates current model number digit A, B, C, etc. These sensors can be ordered to ship with the unit.*

DIGIT 19 - AMBIENT CONTROL

0=Standard
1=0° Fahrenheit

DIGIT 20 - AGENCY APPROVAL

0=None (cULus Gas Heater, see note)
1=cULus

Note: *Includes cULus classified gas heating section only when second digit of Model No. is a "F."*

DIGITS 21 - 38 - MISCELLANEOUS

21 A = Unit Disconnect Switch
22 B = Hot Gas Bypass
23 0 = Without Economizer
C = Economizer Control w/ Comparative Enthalpy
Z = Economizer Control w/ Reference Enthalpy
W = Economizer Control w/Dry Bulb
24 E = Low Leak Fresh Air Dampers
25 F = High Duct Temperature Thermostat
26 G = High Capacity Unit
27 A = Evap Condenser
B = Evap Condenser w/ Sump Heater
C = Evap Condenser w/ Dolphin WaterCare System
D = Evap Condenser w/ Sump Heater and Dolphin WaterCare System
E = Evap Condenser w/ Conductivity Controller
F = Evap Condenser w/ Conductivity Controller and Sump Heater
28 B = GBAS 0-10V
K = GBAS 0-5V
R = Rapid Restart
29 A = Motors w/ Internal Shaft Grounding
30 M = Remote Human Interface
31 N = Ventilation Override Module
32 0 = None
R = Extended Grease Lines
1 = Differential Pressure Gauge
2 = Extended Grease Lines and Differential Pressure Gauge
33 0 = Standard Panels
T = Access Doors
U = IRU - w/ Std Panels
W = IRU - w/ Access Doors
Y = IRU w/SST - w/ Std Panels
Z = IRU w/SST - w/ Access Doors
34 V = Inter-Processor Communication Bridge
35 M = BACnet Communication Interface (BCI) Module
Y = Trane Communication Interface (TCI) Module
7 = Trane LonTalk Communication Interface (LCI) Module
36 8 = Spring Isolators
37 6 = Factory-Powered 15A GFI Convenience Outlet/Disconnect Switch
38 J = Temperature Sensor

Tip: ***EXAMPLE***

*Model numbers: SAHL*5040A68A6BD800100W00G0 B000R000800 describes a unit with the following characteristics:*

DX Cooling Only unit w/ no extended casing, 50 ton nominal cooling capacity, 460/60/3 power supply,100 percent exhaust with Statitrac, 10 HP exhaust fan motor with drive selection No. 8 (800 RPM), throwaway filters, 20 HP supply fan motor with drive selection No. B (1100 RPM), 0-100% economizer w/ dry bulb control, supply and exhaust VFD w/o bypass, no remote panel, standard ambient control, cULus agency approval. High capacity unit, extended grease lines and spring isolators.

The service digit for each model number contains 38 digits; all 38 digits must be referenced.

General Data

Table 4. General Data - 20-48 Tons

	24[a] Ton		29[a] Ton		36[a] Ton		48[a] Ton		59[a] Ton	
Compressor Data - High Capacity / High Efficiency[b]										
Number/Size (Nominal)	2/10.5		1/10, 1/13.5		1/13.5, 1/15		4/9		2/10, 2/11.5	
Model	Scroll		Scroll		Scroll		Scroll		Scroll	
Unit Capacity Steps (%)	100/50		100/43		100/47		100/75/50/25		100/73/46/23	
RPM	3450		3450		3450		3450		3450	
No. of Circuits	1		1		1		2		2	
Evaporator Fans										
Number/Size/Type	2/15"/FC		2/15"/FC		2/18"/FC		2/20"/FC		2/20"/FC	
Number of Motors	1		1		1		1		1	
Hp Range	3-20		3-20		5-20		7.5-30		7.5-30	
Cfm Range[b]	4000-9000		5000-11000		6000-13500		8000-18000		10000-22500	
ESP Range - (In. WG)	0.25-4.0		0.25-4.0		0.25-4.0		0.25-4.0		0.25-4.0	
Exhaust Fans	50%	100%	50%	100%	50%	100%	50%	100%	50%	100%
Number/Size/Type	1/15"/FC	2/15"/FC	1/15"/FC	2/15"/FC	1/15"/FC	2/15"/FC	1/18"/FC	2/18"/FC	1/18"/FC	2/18"/FC
Hp Range	3	3	3	3-5	3-5	3-7.5	5-7.5	5-10	5-7.5	5-15
Cfm Range[b]	2000-6000	4000-10000	2000-6000	4000-12000	2000-7000	4000-14000	3000-11000	7500-16000	3000-11000	9000-20000
ESP Range - (In. WG)	0.25-1.4	0.2-2.0	0.25-1.4	0.2-2.0	0.25-1.4	0.2-2.0	0.25-1.4	0.2-2.0	0.25-1.4	0.2-2.0
Return Fans										
Number/Size/Type	1/24.5/AF		1/24.5/AF		1/24.5/AF		1/27.0/AF		1/27.0/AF	
Hp Range	3.0		3.0 - 5.0 HP		3.0 - 7.5		5.0 - 10.0		5.0 - 15.0	
Cfm Range[b]	4000-9000		4000-11000		4000-12500		7500-18000		9000-20000	
ESP Range - (In. WG)	0.25 - 2.0		0.25 - 2.0		0.25 - 2.0		0.25 - 2.0		0.25 - 2.0	
Evaporative Condenser - Condenser Fans										
Number/Size/Type	1/32/Prop		1/32/Prop		1/32/Prop		1/32/Prop		1/32/Prop	
Hp (Each)	5.4		5.4		5.4		5.4		5.4	
RPM/CFM	1000/8000		1000/8000		1000/8000		1100/10000		1100/10000	
Cycle/Phase	60/3		60/3		60/3		60/3		60/3	
Evaporative Condenser Pump										
Number/Type	1/Submersible		1/Submersible		1/Submersible		1/Submersible		1/Submersible	
HP	.5		.5		.5		.5		.5	
RPM	3430		3430		3430		3430		3430	
Cycle/Phase	60/3		60/3		60/3		60/3		60/3	
Sump Pump GPM	50		50		50		50		50	
Evaporative Condenser - Condenser Coil										
Dimensions	46.5 x 41.25		46.5 x 41.25		46.5 x 41.25		46.5 x 41.25		46.5 x 41.25	
Size (Ft^2)	13.3		13.3		13.3		13.3		13.3	
Tube Diameter	5/16"		5/16"		5/16"		5/16"		5/16"	
Evaporator Coil										
Size (Ft)	20.3		20.3		25.5		32.5		38	
Rows/Fin Series	4/168		4/168		5/168		5/168		4/168	
Tube Diameter/Surface	1/2"/Enhanced		1/2"/Enhanced		3/8"/Enhanced		3/8"/Enhanced		1/2"/Enhanced	
Electric Heat										
kW Range[c]	30-110		30-130		30-150		50-170		90-190	
Capacity Steps:	3		3		3		3		3	

Table 4. General Data - 20-48 Tons (continued)

	24[a] Ton	29[a] Ton	36[a] Ton	48[a] Ton	59[a] Ton
Natural Gas Heat					
Standard Gas Heat[d]					
Low Heat Input	235	235	350	350	500
High Heat Input	500	500	500	850	850
Standard Heating Capacity Steps:	2	2	2	2	2
Modulating Gas Heat (Not Available on 20-40 Ton Models with Low Heat)					
High Heat - Limited Modulation[e]	See Table 6	See Table 6	See Table 6	See Table 6	See Table 6
Heat Exchanger Type	Standard	Standard	Standard	Standard	Standard
High Heat - Full Modulation[f]	See Table 6	See Table 6	See Table 6	See Table 6	See Table 6
Heat Exchanger Type	Stainless Steel	Stainless Steel	Stainless Steel	Stainless Steel	Stainless Steel
Hot Water Coil					
Size (Inches)	30x66x2 Row	30x66x2 Row	30x66x2 Row	42x66x2 Row	42x66x2 Row
Type	5W Prima-Flo E w/ turbolators	5W Prima-Flo E w/ turbolators	5W Prima-Flo E w/ turbolators	5W Prima-Flo E w/ turbolators	5W Prima-Flo E w/ turbolators
High Heat (Fins/Ft)	110	110	110	110	110
Low Heat (Fins/Ft)	80	80	80	80	80
Steam Coil					
Size (Inches)	30x66x1 Row	30x66x1 Row	30x66x1 Row	30x66x1 Row 12x66x1 Row	30x66x1 Row 12x66x1 Row
Type	Type NS	Type NS	Type NS	Type NS	Type NS
High Heat (Fins/Ft)	96	96	96	96	72
Low Heat (Fins/Ft)	42	42	42	42	42
Pre-Evap Filters					
Panel Filters					
Number/Size (Inches)	12 - 20x20x2	12 - 20x20x2	16 - 20x20x2	16 - 20x25x2	20 - 20x25x2
Face Area (Ft^2)	33.3	33.3	44.4	55.5	69.4
Bag Filters					
Number/Size (Inches)	4 - 12x24x19 3 - 24x24x19	4 - 12x24x19 3 - 24x24x19	2 - 12x24x19 6 - 24x24x19	5 - 12x24x19 6 - 24x24x19	3 - 12x24x19 9 - 24x24x19
Cartridge Filters	4 - 12x24x12 3 - 24x24x12	4 - 12x24x12 3 - 24x24x12	2 - 12x24x12 6 - 24x24x12	5 - 12x24x12 6 - 24x24x12	3 - 12x24x12 9 - 24x24x12
Prefilters (For Bag & Cartridge)	4 - 12x24x2 3 - 24x24x2	4 - 12x24x2 3 - 24x24x2	2 - 12x24x2 6- 24x24x2	5 - 12x24x2 6 - 24x24x2	3 - 12x24x2 9 - 24x24x2
Face Area (Ft^2)	20	20	28	34	42
Standard Unit Minimum Outside Air Temperature for Mechanical Cooling					
Without Hot Gas Option	55°F	50°F	50°F	55°F	45°F
With Hot Gas Option	55°F	50°F	50°F	55°F	45°F

(a) Model sizes are listed are for air-cooled/evaporative condensers. Not all data applies to both condenser configurations.
(b) For CFM values outside these ranges, contact your local Trane sales office.
(c) Refer to Table 23, p. 45 for availability of electric heat kW ranges by voltage
(d) Two-stage gas heat: 1st stage 50% on gas heat exchangers up to 500 Mbh; 60% on 800-1000 Mbh gas heat exchangers.
(e) The firing rate of the unit can vary from 33% of the heater Mbh up to the nameplate rating of the unit.
(f) The firing rate of the unit can vary from pilot rate of 125,000 Btuh up to the nameplate rating of the unit.

Table 5. General Data - 50 - 89 Tons

	73[a] Ton		80[a] Ton		89[a] Ton	
Compressor Data						
Number/Size (Nominal)	4/13.5		4/15		2/15.5, 2/21	
Model	Scroll		Scroll		Scroll	
Unit Capacity Steps (%)	100/73/46/23		100/75/50/25		100/71/43/21	
RPM	N/A		3450		N/A	
No. of Circuits	2		2		2	
Evaporator Fans						
Number/Size/Type	2/22"/FC		2/22"/FC		2/22"/FC	
Number of Motors	1		1		1	
Hp Range	10-50[a]		10-50[a]		10-50[a]	
Cfm Range[a]	14000-27000		16000-27000		16000-27000	
ESP Range - (In. WG)	0.25-4.0		0.25-4.0		0.25-4.0	
Exhaust Fans	50%	100%	50%	100%	50%	100%
Number/Size/Type	1/20"/FC	2/20"/FC	1/20"/FC	2/20"/FC	1/20"/FC	2/20"/FC
Hp Range	5-7.5	5-20	5-7.5	5-20	5-7.5	5-20
Cfm Range[a]	4000-13000	12000-27000	4000-13000	12000-27000	4000-13000	12000-27000
ESP Range - (In. WG)	0.25-1.4	0.20-2.0	0.25-1.4	0.20-2.0	0.25-1.4	0.20-2.0
Return Fans						
Number/Size/Type	1/36.5/AF		1/36.5/AF		1/36.5/AF	
Hp Range	5.0 - 20.0		5.0 - 20.0		5.0 - 20.0	
Cfm Range[a]	12000-27000		12000-27000		12000-27000	
ESP Range - (In. WG)	0.25 - 2.0		0.25 - 2.0		0.25 - 2.0	
Evaporative Condenser - Condenser Fans						
Number/Size/Type	1/32/Prop		1/32/Prop		1/32/Prop	
Hp (Each)	5.4		5.4		5.4	
RPM/CFM	1365/13000		1365/13000		1365/13000	
Cycle/Phase	60/3		60/3		60/3	
Evaporative Condenser Pump						
Number/Type	1/Submersible		1/Submersible		1/Submersible	
HP	.5		.5		.5	
RPM	3430		3430		3430	
Cycle/Phase	60/3		60/3		60/3	
Sump Pump GPM	50		50		50	
Evaporative Condenser - Condenser Coil						
Dimensions	55.2 x 50		55.2 x 50		55.2 x 50	
Size (Ft^2)	19.2		19.2		19.2	
Tube Diameter	5/16"		5/16"		5/16"	
Evaporator Coil						
Size (Ft)	43		43		43	
Rows/Fin Series	6/168		6/168		6/168	
Tube Diameter/Surface	3/8"/Enhanced		3/8"/Enhanced		3/8"/Enhanced	
Electric Heat						
kW Range[b]	90-190		90-190		90-190	
Capacity Steps:	3		3		3	
Natural Gas Heat						
Standard Gas Heat[c]						
Low Heat Input	500		500		500	
High Heat Input	850		850		850	
Standard Heating Capacity Steps:	2		2		2	
Modulating Gas Heat						
High/Low Heat - Limited Modulation[d]	See Table 7		See Table 7		See Table 7	
Heat Exchanger Type	Standard		Standard		Standard	
High/Low Heat - Full Modulation[e]	See Table 7		See Table 7		See Table 7	
Heat Exchanger Type	Stainless Steel		Stainless Steel		Stainless Steel	
Hot Water Coil						
Size (Inches)	42x90x2 Row		42x90x2 Row		42x90x2 Row	
Type	5W Prima-Flo E w/turbolators		5W Prima-Flo E w/turbolators		5W Prima-Flo E w/turbolators	
High Heat (Fins/Ft)	110		110		110	
Low Heat (Fins/Ft)	80		80		80	
Steam Coil						
Size (Inches)	30x90x1 Row 12x90x1 Row		30x90x1 Row 12x90x1 Row		30x90x1 Row 12x90x1 Row	
Type	Type NS		Type NS		Type NS	
High Heat (Fins/Ft)	72		72		72	

Table 5. General Data - 50 - 89 Tons (continued)

	73[a] Ton	80[a] Ton	89[a] Ton
Low Heat (Fins/Ft)	42	42	42
Pre-Evap Filters			
Panel Filters			
Number/Size (Inches)	35 - 16x20x2	35 - 16x20x2	35 - 16x20x2
Face Area (Ft^2)	77.8	77.8	77.8
Bag Filters			
Number/Size (Inches)	6 - 12x24x19 8 - 24x24x19	6 - 12x24x19 8 - 24x24x19	6 - 12x24x19 8 - 24x24x19
Cartridge Filters	6 - 12x24x12 8 - 24x24x12	6 - 12x24x12 8 - 24x24x12	6 - 12x24x12 8 - 24x24x12
Prefilters (For Bag & Cartridge)	6 - 12x24x2 8 - 24x24x2	6 - 12x24x2 8 - 24x24x2	6 - 12x24x2 8 - 24x24x2
Face Area (Ft^2)	44	44	44
Standard Unit Min. Outside Air Temperature For Mechanical Cooling			
Without Hot Gas Option	30°F	45°F	45°F
With Hot Gas Option	30°F	45°F	45°F
Low Ambient Option Min. Outside Air Temp			
Without Hot Gas Option	0°F	0°F	0°F
With Hot Gas Option	10°F	10°F	10°F

(a) For CFM values outside these ranges, contact your local Trane sales office.
(b) Refer to Table 23, p. 45 for availability of electric heat kW ranges by voltage.
(c) Two-stage gas heat: 1st stage 50% on gas heat exchangers up to 500 Mbh; 60% on 800-1000 Mbh gas heat exchangers
(d) The firing rate of the unit can vary from 33% of the heater Mbh up to the nameplate rating of the unit.
(e) The firing rate of the unit can vary from pilot rate of 125,000 Btuh up to the nameplate rating of the unit.

Table 6. Economizer Outdoor Air Damper Leakage (of Rated Airflow)

	ΔP Across Dampers (In. WC)	
	0.5 (In.)	1.0 (In.)
Standard "Low Leak""	1.5 %	2.5 %
Optional "Ultra Low Leak	0.5 %	1.0 %

Note: Above data based on tests completed in accordance with AMCA Standard 500 at AMCA Laboratories.

Table 7. Gas Heat Inputs/Input Ranges

	Two-Stage Gas Heat		Modulating Gas Heat[(a)]	
	Low Fire	High Fire	Full Modulating Heat	Limited Modulating Heat
Standard Gas Heat (MBh)	Heat Input (MBh)	Heat Input (MBh)	Input Range (MBh)	Input Range (MBh)
235	120	235	NA	NA
350	175	350	NA	NA
500	250	500	125 - 500	167 - 500
850	425	850	125 - 850	284 - 850
1000	500	1000	125 - 1000	334 - 1000

(a) Modulating Gas Heat (Not available on 24-48 ton evaporative condensing models with low heat)

Performance Adjustment Factors

Table 8. Enthalpy of Saturated AIR

Wet Bulb Temperature	Btu Per Lb.
40	15.23
41	15.70
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
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
75	38.61

Figure 5. Air Density Ratios

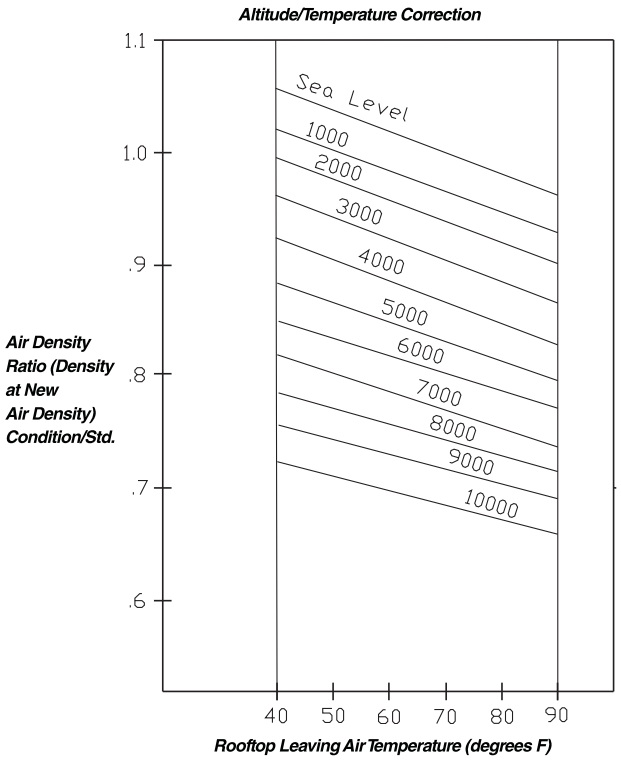


Table 9. Cooling Capacity Altitude Correction Factors

	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
SHR Correction Multiplier	1.00	.98	.95	.93	.91	.89	.87	.85
Maximum Condenser Ambient	118°F	119°F	120°F	121°F	122°F	123°F	124°F	125°F

Note: SHR = Sensible Heat Ratio

Table 10. Gas Heating Capacity Altitude Correction Factors

	Altitude (Ft)						
	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 AGA Std 221.30 - 1964, Part VI, 6.12. Local codes may supersede.

Performance Data

Evaporative Condensing Performance Data

Table 11. Gross Cooling Capacities (MBh)— 24 Ton Evaporative Condensing— High Capacity — R-410A

		Ambient Temperature																	
		60						65						70					
	ENT DB	Entering Wet Bulb																	
		61		67		73		61		67		73		61		67		73	
CFM	(F)	CAP	SHC	CAP	SHC	CAP	SHC	CAP	SHC	CAP	SHC	CAP	SHC	CAP	SHC	CAP	SHC	CAP	SHC
4000	75	249	174	277	144	309	115	245	171	273	142	305	112	239	167	268	138	298	108
	80	250	198	279	169	311	139	246	196	275	167	306	136	241	191	269	163	300	133
	85	252	222	280	193	312	163	248	219	276	191	307	161	243	215	270	187	301	157
	90	256	246	282	218	313	187	252	244	277	215	309	185	247	240	271	211	303	181
6000	75	279	211	310	169	341	123	275	208	305	167	336	120	269	204	298	162	328	117
	80	284	247	312	205	344	160	279	244	307	203	339	157	273	240	301	198	332	153
	85	289	283	315	239	348	196	285	280	310	236	342	194	279	276	303	232	335	189
	90	303	303	319	274	350	232	299	299	314	271	344	229	293	293	307	267	336	224
7000	75	290	228	320	180	347	123	285	225	315	177	344	124	279	221	308	173	337	120
	80	295	269	322	220	353	167	291	266	317	217	349	166	284	262	310	213	341	162
	85	305	305	327	260	359	211	300	300	321	257	353	208	295	295	315	253	346	204
	90	322	322	332	300	361	250	318	318	327	297	355	247	312	312	320	293	348	243
8000	75	299	244	326	189	353	123	294	240	320	187	354	127	287	236	313	182	343	122
	80	305	291	331	234	359	173	301	288	326	231	357	174	294	283	319	227	348	170
	85	319	319	336	279	366	224	315	315	331	276	360	221	309	309	324	272	352	217
	90	338	338	343	326	371	268	333	333	338	323	365	265	327	327	331	319	358	261
9000	75	306	258	332	198	362	131	301	255	327	195	355	129	294	251	320	191	347	125
	80	314	312	338	247	367	184	309	309	333	244	361	181	303	303	326	240	353	177
	85	332	332	344	299	373	236	327	327	339	296	367	233	321	321	332	291	360	229
	90	351	351	353	351	379	285	347	347	348	348	373	282	340	340	341	341	365	278

		Ambient Temperature											
		75						80					
	ENT DB	Entering Wet Bulb											
		61		67		73		61		67		73	
CFM	(F)	CAP	SHC	CAP	SHC	CAP	SHC	CAP	SHC	CAP	SHC	CAP	SHC
4000	75	235	165	263	136	293	105	232	163	259	133	289	105
	80	237	189	264	160	295	130	234	186	261	158	290	128
	85	239	212	266	184	296	154	236	210	262	182	290	152
	90	243	237	267	208	298	178	239	235	263	206	294	177
6000	75	264	201	293	159	322	114	260	199	265	135	317	112
	80	268	236	294	195	326	150	264	234	290	193	321	148
	85	274	273	298	229	329	187	271	271	294	227	325	185
	90	289	289	302	264	330	221	286	286	298	262	326	219
7000	75	274	218	302	170	330	117	270	215	298	168	323	111
	80	279	259	305	210	335	159	275	256	300	207	329	155
	85	290	290	309	249	340	202	286	286	305	247	335	199
	90	307	307	315	290	342	240	303	303	310	288	337	237
8000	75	282	233	307	179	336	119	278	230	303	177	330	117
	80	289	280	313	223	341	167	285	278	308	221	336	164
	85	304	304	318	269	346	214	300	300	314	267	341	211
	90	322	322	325	315	351	257	318	318	321	313	346	255
9000	75	289	248	313	187	340	122	284	245	309	185	334	120
	80	297	297	320	237	347	174	293	293	315	234	341	171
	85	316	316	326	288	353	225	312	312	321	286	348	223
	90	335	335	335	335	359	275	331	331	331	331	354	272

Table 12. Gross Cooling Capacities (MBh)— 29 Ton Evaporative Condensing— High Capacity — R-410A

		Ambient Temperature																	
		60						65						70					
	ENT DB	Entering Wet Bulb																	
		61		67		73		61		67		73		61		67		73	
CFM	(F)	CAP	SHC	CAP	SHC	CAP	SHC	CAP	SHC	CAP	SHC	CAP	SHC	CAP	SHC	CAP	SHC	CAP	SHC
5000	75	290	205	322	168	358	131	286	203	318	165	353	128	282	200	314	163	348	126
	80	291	235	324	199	359	161	288	233	320	196	355	158	284	230	316	194	350	157
	85	295	265	326	229	361	191	291	262	322	227	357	189	287	260	317	225	352	187
	90	300	295	327	258	363	221	296	293	323	256	359	219	293	291	319	254	354	216
7000	75	317	241	351	191	385	138	313	239	346	189	380	136	308	236	341	186	375	133
	80	322	282	353	233	389	180	318	280	349	231	385	178	313	277	344	229	379	176
	85	329	324	356	273	392	222	325	322	352	270	388	220	321	319	347	268	382	218
	90	345	345	361	313	393	263	341	341	357	311	389	261	337	337	352	308	384	258
8750	75	333	269	366	209	399	143	329	266	361	207	394	141	324	264	356	205	387	138
	80	340	320	369	258	399	194	336	318	364	255	400	194	331	315	359	253	395	191
	85	354	354	374	308	407	247	351	351	370	305	402	244	346	346	365	302	396	242
	90	374	374	381	358	412	294	371	371	377	356	407	292	366	366	372	353	401	289
10000	75	342	287	372	220	405	146	338	285	367	218	400	144	333	282	361	215	393	141
	80	351	347	378	275	414	207	347	344	373	272	408	205	342	341	368	269	402	203
	85	370	370	385	332	416	262	366	366	380	329	411	259	361	361	375	327	405	256
	90	391	391	394	390	422	316	387	387	389	387	417	314	383	383	384	384	411	311
11000	75	349	302	377	228	409	148	344	299	373	226	403	146	339	296	367	223	397	144
	80	359	359	384	288	415	214	355	355	379	285	410	212	350	350	374	282	404	209
	85	381	381	392	351	422	273	377	377	387	348	417	271	372	372	381	345	411	268
	90	403	403	403	403	429	333	399	399	399	399	423	330	394	394	394	394	417	327

		Ambient Temperature											
		75						80					
	ENT DB	Entering Wet Bulb											
		61		67		73		61		67		73	
CFM	(F)	CAP	SHC	CAP	SHC	CAP	SHC	CAP	SHC	CAP	SHC	CAP	SHC
5000	75	278	198	310	161	344	125	274	196	305	159	339	121
	80	280	228	311	192	346	154	276	225	307	189	341	151
	85	284	257	313	222	348	185	280	255	309	220	343	183
	90	289	288	315	251	349	215	285	285	311	249	345	212
7000	75	304	233	336	185	369	131	300	231	331	182	363	129
	80	309	274	338	225	374	174	305	272	333	223	368	171
	85	316	316	342	265	377	216	312	312	337	263	372	213
	90	333	333	347	306	378	255	329	329	342	303	373	253
8750	75	320	261	351	202	381	136	315	258	345	200	375	133
	80	327	312	354	250	388	189	322	309	349	247	376	184
	85	342	342	360	300	390	239	338	338	354	297	385	236
	90	362	362	367	350	396	287	357	357	362	348	390	284
10000	75	328	279	356	212	387	139	323	276	351	210	380	136
	80	337	337	362	267	396	200	332	332	357	264	386	197
	85	357	357	369	324	399	254	352	352	364	321	393	251
	90	378	378	379	379	405	308	373	373	373	373	399	305
11000	75	334	293	361	220	390	141	329	290	356	217	384	139
	80	346	346	368	279	398	207	341	341	363	277	391	205
	85	367	367	376	343	405	265	362	362	371	340	399	262
	90	389	389	389	389	412	325	384	384	384	384	406	322

Table 13. Gross Cooling Capacities (MBh)— 36 Ton Evaporative Condensing— High Capacity — R-410A

		Ambient Temperature																	
		60						65						70					
	ENT DB	Entering Wet Bulb																	
		61		67		73		61		67		73		61		67		73	
CFM	(F)	CAP	SHC	CAP	SHC	CAP	SHC	CAP	SHC	CAP	SHC	CAP	SHC	CAP	SHC	CAP	SHC	CAP	SHC
6000	75	353	251	391	207	434	161	348	248	386	203	428	158	341	244	379	199	420	154
	80	354	287	394	243	436	197	349	284	388	240	430	195	342	280	381	236	422	190
	85	357	323	395	280	438	234	352	320	390	277	432	231	345	315	383	273	424	226
	90	362	360	397	316	439	269	357	356	390	312	434	266	351	351	383	307	426	262
9000	75	389	301	430	240	471	171	383	298	424	236	463	168	376	293	415	232	454	164
	80	394	356	433	292	475	225	388	353	427	289	468	222	381	348	419	284	459	218
	85	401	401	435	344	479	277	396	396	429	340	472	274	390	390	421	335	463	270
	90	423	423	440	395	479	327	418	418	434	392	472	324	411	411	426	387	464	319
10500	75	401	323	442	254	481	175	395	320	435	251	473	172	388	315	427	246	464	167
	80	408	389	443	310	487	238	402	385	437	307	480	235	395	381	429	302	471	230
	85	423	423	448	373	491	297	418	418	442	370	484	294	411	411	434	365	475	290
	90	446	446	455	434	493	352	440	440	449	430	486	349	433	433	441	426	477	344
12000	75	412	344	451	268	488	178	405	341	444	264	480	175	397	336	435	259	470	171
	80	420	420	453	329	497	249	411	411	447	326	490	246	404	404	438	321	480	242
	85	441	441	460	402	498	313	435	435	453	399	491	310	428	428	444	394	482	305
	90	465	465	469	469	504	376	459	459	459	459	497	373	452	452	452	452	488	368
13500	75	420	364	458	280	493	182	414	361	451	276	485	178	405	356	442	272	475	174
	80	431	431	462	347	504	261	425	425	455	343	497	258	418	418	446	338	487	252
	85	456	456	469	431	507	329	450	450	462	427	500	326	442	442	454	422	490	321
	90	481	481	481	481	513	400	475	475	475	475	506	396	467	467	467	467	496	391

		Ambient Temperature											
		75						80					
	ENT DB	Entering Wet Bulb											
		61		67		73		61		67		73	
CFM	(F)	CAP	SHC	CAP	SHC	CAP	SHC	CAP	SHC	CAP	SHC	CAP	SHC
6000	75	336	241	373	196	413	151	331	238	368	194	408	148
	80	336	276	375	233	415	187	332	273	370	230	409	184
	85	340	312	377	269	417	223	335	309	372	267	412	221
	90	345	345	377	304	419	259	341	341	373	301	414	256
9000	75	369	289	408	229	446	160	364	286	402	226	440	158
	80	375	344	409	279	452	215	369	341	403	276	446	212
	85	384	384	414	332	456	267	380	380	408	329	449	264
	90	405	405	419	384	456	315	401	401	413	381	450	313
10500	75	381	311	419	243	455	164	375	308	413	241	448	161
	80	388	377	421	298	463	227	383	374	415	295	457	224
	85	405	405	427	361	468	286	400	400	421	358	458	282
	90	427	427	434	422	469	340	422	422	428	419	463	337
12000	75	390	332	428	256	461	167	385	335	421	253	454	164
	80	398	398	431	317	472	239	393	393	424	314	465	236
	85	422	422	437	390	474	301	416	416	431	387	467	298
	90	445	445	445	445	480	364	440	440	440	440	473	361
13500	75	398	351	434	268	466	170	392	357	428	265	458	168
	80	411	411	438	334	479	249	406	406	432	331	472	246
	85	436	436	446	418	482	317	430	430	440	415	475	314
	90	461	461	461	461	488	387	455	455	455	455	482	384

Table 14. Gross Cooling Capacities (MBh)— 48 Ton Evaporative Condensing — High Capacity — R-410A

		Ambient Temperature																	
		60						65						70					
	ENT DB	Entering Wet Bulb																	
		61		67		73		61		67		73		61		67		73	
CFM	(F)	CAP	SHC	CAP	SHC	CAP	SHC	CAP	SHC	CAP	SHC	CAP	SHC	CAP	SHC	CAP	SHC	CAP	SHC
8000	75	460	328	511	289	568	237	454	336	504	286	561	233	447	332	497	281	552	229
	80	460	386	513	334	569	282	455	383	507	330	562	279	448	378	499	326	553	275
	85	464	431	515	382	571	327	459	428	509	379	564	324	452	423	501	374	556	319
	90	468	468	516	425	573	374	463	463	510	422	566	371	456	456	502	417	558	367
11000	75	496	387	550	322	606	250	490	383	543	318	598	246	482	378	534	314	588	242
	80	501	455	554	381	610	311	495	451	545	377	602	307	487	446	537	372	593	303
	85	505	505	555	445	613	370	500	500	548	441	606	367	493	493	540	437	597	362
	90	510	510	560	505	615	436	505	505	553	501	607	432	520	520	545	497	596	427
14000	75	522	428	575	349	628	260	515	424	567	346	619	256	506	419	558	341	609	251
	80	524	511	577	418	635	335	518	506	570	413	627	331	510	500	561	409	617	327
	85	549	549	583	504	636	406	543	543	575	500	627	402	536	535	566	495	618	397
	90	573	573	585	570	642	489	567	567	578	565	634	485	561	561	570	559	624	480
16000	75	534	454	587	366	638	265	527	449	579	362	629	261	518	444	570	357	618	257
	80	540	540	590	440	648	350	534	534	582	436	639	346	526	526	573	431	629	341
	85	572	572	597	542	650	427	565	565	589	538	641	422	558	557	580	533	631	417
	90	603	603	603	603	656	524	596	596	596	596	647	520	589	589	588	588	638	515
18000	75	545	478	597	381	645	270	538	473	588	377	635	266	529	468	579	372	624	261
	80	558	558	601	462	658	363	552	552	593	458	649	359	544	544	583	452	638	355
	85	591	591	600	574	661	446	584	584	592	569	652	442	576	576	584	562	642	437
	90	623	623	623	623	668	558	617	617	617	617	659	554	608	608	608	608	649	549

		Ambient Temperature											
		75						80					
	ENT DB	Entering Wet Bulb											
		61		67		73		61		67		73	
CFM	(F)	CAP	SHC	CAP	SHC	CAP	SHC	CAP	SHC	CAP	SHC	CAP	SHC
8000	75	441	328	490	278	544	225	435	324	483	274	537	222
	80	442	374	492	322	545	271	436	371	486	319	538	268
	85	446	419	494	371	548	315	440	416	488	367	542	312
	90	450	450	495	413	550	363	444	444	489	410	544	360
11000	75	474	374	526	310	579	238	468	370	519	306	571	234
	80	480	442	528	368	583	299	473	438	520	363	576	296
	85	487	487	532	432	588	358	482	482	525	429	580	355
	90	495	495	537	492	588	422	490	490	530	489	580	419
14000	75	498	415	549	337	598	247	491	411	542	333	590	243
	80	503	495	552	404	607	323	497	490	545	400	599	319
	85	528	528	557	490	608	392	522	522	551	487	601	389
	90	554	554	562	554	614	476	548	548	556	549	607	472
16000	75	510	440	560	352	607	252	503	435	553	349	598	248
	80	519	519	564	426	619	337	513	513	557	422	611	333
	85	550	550	571	528	621	413	544	544	564	524	613	409
	90	580	580	581	581	628	510	575	575	574	574	620	506
18000	75	520	463	569	368	613	257	513	459	561	364	604	253
	80	536	536	574	447	628	350	530	530	567	444	619	347
	85	568	568	575	556	632	432	562	562	568	551	623	428
	90	601	601	600	600	639	544	594	594	594	594	631	540

Table 15. Gross Cooling Capacities (MBh)— 59 Ton Evaporative Condensing — High Capacity — R-410A

		Ambient Temperature																	
		60						65						70					
	ENT DB	Entering Wet Bulb																	
		61		67		73		61		67		73		61		67		73	
CFM	(F)	CAP	SHC	CAP	SHC	CAP	SHC	CAP	SHC	CAP	SHC	CAP	SHC	CAP	SHC	CAP	SHC	CAP	SHC
10000	75	567	407	627	359	696	293	559	416	618	354	686	288	547	408	606	346	672	280
	80	569	480	631	414	696	349	560	474	622	408	686	344	549	466	609	401	672	337
	85	574	536	633	475	700	405	566	530	625	470	690	400	555	523	612	462	676	392
	90	580	580	635	528	703	464	573	573	626	522	693	459	564	564	614	514	680	452
14000	75	617	484	681	404	748	312	607	478	670	398	737	306	594	469	656	390	721	298
	80	624	572	682	475	752	390	614	566	672	469	740	384	602	558	658	460	725	376
	85	632	632	688	559	756	463	624	624	678	553	745	458	612	612	664	544	730	449
	90	665	665	695	635	758	545	656	656	685	629	747	539	645	645	671	620	732	530
17500	75	646	532	710	437	775	324	636	525	699	431	762	318	622	516	684	422	745	310
	80	652	641	714	518	782	417	643	633	703	512	770	411	630	623	688	503	753	402
	85	681	681	721	627	783	504	672	672	710	621	772	497	660	659	695	612	756	488
	90	710	710	731	722	791	608	701	701	721	716	779	601	689	689	702	695	763	593
20000	75	662	563	725	455	788	332	652	556	714	449	775	326	638	547	698	441	757	317
	80	670	670	730	546	797	434	661	661	719	540	785	428	649	649	703	531	768	420
	85	708	708	738	674	800	529	699	699	727	667	788	523	686	686	712	658	772	513
	90	746	746	746	746	808	651	737	737	736	736	796	644	723	723	723	723	779	635
22500	75	676	592	737	475	798	338	665	585	725	468	784	332	651	576	709	460	766	324
	80	692	692	743	572	809	451	682	682	732	566	797	445	669	669	716	556	779	436
	85	731	731	753	719	814	553	721	721	742	713	802	546	708	708	726	704	785	537
	90	771	770	771	770	822	693	761	760	760	760	810	686	747	747	746	746	793	677

		Ambient Temperature											
		75						80					
	ENT DB	Entering Wet Bulb											
		61		67		73		61		67		73	
CFM	(F)	CAP	SHC	CAP	SHC	CAP	SHC	CAP	SHC	CAP	SHC	CAP	SHC
10000	75	537	402	595	340	660	274	530	397	588	336	653	270
	80	539	460	599	395	661	330	533	456	592	391	654	327
	85	545	516	600	455	665	386	539	513	592	450	657	382
	90	556	556	603	508	668	445	550	550	597	504	661	442
14000	75	584	463	644	384	707	292	577	458	636	380	698	288
	80	591	551	646	453	712	369	584	546	638	449	703	366
	85	603	603	652	537	717	443	597	597	645	533	708	439
	90	635	635	660	613	719	523	629	629	652	609	710	519
17500	75	611	509	671	416	730	303	603	505	662	412	721	299
	80	619	614	675	496	739	395	607	607	667	491	730	391
	85	649	649	682	604	741	481	642	642	674	600	732	477
	90	679	679	684	684	749	585	677	677	677	677	740	581
20000	75	626	540	680	431	742	310	618	535	676	430	732	306
	80	638	638	690	523	753	413	631	631	681	518	743	409
	85	675	675	699	651	757	506	668	668	690	646	748	501
	90	712	712	711	711	765	628	704	704	704	704	755	623
22500	75	639	568	695	453	750	317	630	563	686	449	740	312
	80	658	658	702	548	764	429	651	651	693	544	754	425
	85	696	696	713	696	770	529	689	689	698	682	760	524
	90	735	735	735	735	779	670	727	727	726	726	768	664

Table 16. Gross Cooling Capacities (MBh)— 73 Ton Evaporative Condensing — High Capacity — R-410A

		Ambient Temperature																	
		60						65						70					
		Entering Wet Bulb																	
	ENT DB	61		67		73		61		67		73		61		67		73	
CFM	(F)	CAP	SHC	CAP	SHC	CAP	SHC	CAP	SHC	CAP	SHC	CAP	SHC	CAP	SHC	CAP	SHC	CAP	SHC
14000	75	732	548	805	472	884	376	727	562	800	469	879	373	721	558	793	466	871	370
	80	734	643	809	550	887	456	729	641	804	547	882	453	724	637	797	544	874	449
	85	743	723	811	632	891	533	738	720	807	629	886	531	733	717	800	626	878	527
	90	767	767	814	707	894	614	748	748	809	704	889	611	742	742	802	700	881	608
18000	75	768	624	844	512	920	389	763	621	839	509	914	386	756	617	831	505	905	383
	80	778	731	846	608	928	491	773	729	843	607	922	488	767	725	834	602	913	484
	85	798	798	851	710	933	588	794	794	846	708	927	585	788	788	839	704	919	581
	90	818	818	861	810	932	690	815	815	856	807	926	687	810	810	849	803	918	683
21000	75	790	666	865	538	937	397	785	663	859	536	930	394	778	659	852	532	921	390
	80	801	787	866	645	949	514	799	792	861	642	943	511	789	780	853	638	934	507
	85	837	837	876	769	955	626	832	832	870	766	949	623	826	826	863	762	941	620
	90	880	880	888	873	956	743	875	875	883	871	950	740	864	864	874	866	942	736
24000	75	808	706	881	564	949	405	803	703	875	561	942	401	796	699	867	557	933	398
	80	824	824	884	681	966	536	819	819	878	678	959	533	813	813	870	674	950	529
	85	869	869	896	826	967	657	864	864	890	822	960	653	857	857	882	818	952	649
	90	914	914	914	914	976	795	909	909	909	909	969	792	902	902	902	902	961	788
27000	75	823	744	894	588	958	411	818	741	887	585	950	408	811	736	879	581	941	404
	80	849	849	899	715	979	556	844	844	893	712	971	553	837	837	885	708	963	550
	85	896	896	914	882	981	687	891	891	908	878	974	684	884	884	900	874	966	680
	90	943	943	943	943	992	847	937	937	937	937	985	843	930	930	930	930	977	839

		Ambient Temperature											
		75						80					
		Entering Wet Bulb											
	ENT DB	61		67		73		61		67		73	
CFM	(F)	CAP	SHC	CAP	SHC	CAP	SHC	CAP	SHC	CAP	SHC	CAP	SHC
14000	75	716	555	787	463	864	366	712	553	782	460	859	364
	80	718	634	791	541	867	446	714	631	786	538	863	444
	85	728	714	794	623	872	524	721	706	787	619	867	522
	90	737	737	797	697	875	605	750	750	792	694	871	603
18000	75	751	614	825	502	897	379	746	611	821	500	892	377
	80	761	721	827	598	906	481	756	719	821	595	901	479
	85	783	783	832	700	911	578	779	779	828	698	907	576
	90	806	806	843	800	911	679	802	802	839	797	906	677
21000	75	772	655	845	528	913	387	767	652	840	526	908	385
	80	783	774	846	634	926	503	779	770	842	632	921	501
	85	821	821	856	758	932	616	817	817	852	756	928	614
	90	864	864	868	860	934	732	855	855	864	856	929	730
24000	75	790	695	860	554	923	394	784	692	855	551	920	392
	80	808	808	863	670	942	525	803	803	859	668	937	523
	85	852	852	875	814	943	645	848	848	871	812	938	643
	90	896	896	896	896	953	784	893	893	892	892	948	782
27000	75	804	733	872	578	931	400	799	730	867	575	927	398
	80	832	832	877	704	954	546	828	828	873	702	949	544
	85	877	877	892	870	957	676	874	874	882	859	952	673
	90	923	923	923	923	968	835	920	920	920	920	963	833

Table 17. Gross Cooling Capacities (MBh) — 80 Ton Evaporative Condensing — High Capacity — R-410A

		Ambient Temperature																	
		60						65						70					
	ENT	Entering Wet Bulb																	
	DB	61		67		73		61		67		73		61		67		73	
CFM	(F)	CAP	SHC	CAP	SHC	CAP	SHC	CAP	SHC	CAP	SHC	CAP	SHC	CAP	SHC	CAP	SHC	CAP	SHC
16000	75	771	579	850	485	936	376	766	589	845	483	929	373	760	586	837	479	922	370
	80	775	683	855	575	940	466	770	680	850	572	934	464	764	677	842	568	926	460
	85	788	775	859	669	945	555	783	772	854	666	939	552	774	763	847	663	932	549
	90	800	800	864	755	950	648	796	796	859	752	943	645	776	776	852	748	936	642
20000	75	804	650	887	524	970	389	799	647	881	521	963	386	792	643	873	518	954	382
	80	817	770	892	634	978	500	812	767	887	631	971	497	805	764	879	627	963	494
	85	842	842	897	747	984	609	837	837	891	744	978	606	831	831	883	740	969	602
	90	867	867	910	857	987	725	882	882	904	854	978	720	876	876	897	850	970	716
22000	75	819	678	901	542	982	394	814	675	894	539	975	391	807	671	886	535	966	388
	80	835	813	903	657	992	516	829	810	896	654	985	513	822	806	889	650	977	509
	85	868	868	913	785	999	634	863	863	907	782	992	631	857	857	900	778	984	628
	90	914	914	929	908	1001	759	897	897	923	904	994	755	891	891	916	900	986	752
24000	75	832	706	912	559	991	399	827	703	906	556	984	396	820	698	898	553	975	393
	80	847	843	916	681	1004	530	842	838	909	678	997	528	836	832	902	674	988	524
	85	891	891	928	824	1011	659	886	886	922	820	1004	656	879	879	914	816	1002	655
	90	939	939	939	939	1015	794	934	934	933	933	1008	790	927	927	926	926	1016	786
26000	75	844	732	922	576	1000	404	839	729	916	573	992	401	831	725	908	569	982	397
	80	862	862	927	705	1014	545	857	857	920	702	1007	542	851	850	913	698	1005	541
	85	911	911	941	861	1016	678	906	906	935	858	1009	675	899	899	927	854	1027	684
	90	961	961	961	961	1028	828	955	955	955	955	1021	825	948	948	948	948	1049	828
27000	75	850	745	927	584	1003	407	844	742	920	581	995	404	836	738	912	577	986	400
	80	871	871	932	717	1019	552	866	866	926	714	1012	549	859	859	918	710	997	541
	85	921	921	947	880	1022	689	915	915	941	877	1015	685	908	908	933	873	1008	683
	90	971	971	971	971	1034	846	965	965	965	965	1026	842	958	958	958	958	1020	839

		Ambient Temperature											
	ENT	75						80					
CFM	DB	Entering Wet Bulb											
	(F)	61		67		73		61		67		73	
		CAP	SHC	CAP	SHC	CAP	SHC	CAP	SHC	CAP	SHC	CAP	SHC
16000	75	754	583	831	476	914	366	747	579	827	474	909	364
	80	759	673	836	565	919	457	754	671	832	563	914	455
	85	769	758	839	658	924	545	768	763	835	656	919	543
	90	780	780	846	745	928	638	801	801	842	743	924	636
20000	75	786	640	866	514	953	384	782	637	861	512	940	376
	80	799	760	872	624	958	492	795	758	865	620	949	488
	85	826	826	876	736	962	599	823	823	872	734	956	596
	90	853	853	890	847	962	712	850	850	886	844	957	710
22000	75	801	668	879	532	962	387	797	665	874	530	951	382
	80	812	794	881	646	969	506	808	791	877	644	962	503
	85	851	851	892	774	976	624	847	847	888	772	970	622
	90	890	890	909	896	978	748	887	887	900	882	972	745
24000	75	813	695	890	549	966	389	809	692	885	547	960	387
	80	830	826	893	670	979	520	826	822	889	668	974	518
	85	873	873	906	812	991	650	869	869	902	810	978	644
	90	916	916	920	920	992	783	913	913	916	916	986	780
26000	75	825	721	899	565	974	394	820	719	895	563	967	392
	80	845	845	904	694	983	530	841	841	900	692	983	532
	85	893	893	919	850	992	667	889	889	915	848	986	664
	90	942	942	942	942	1003	817	938	938	937	937	997	814
27000	75	830	734	904	574	977	396	825	732	899	571	970	394
	80	853	853	910	706	994	542	849	849	905	703	988	539
	85	902	902	925	869	997	677	898	898	920	866	991	675
	90	951	951	951	951	1009	834	947	947	947	947	1003	831

Table 18. Gross Cooling Capacities (MBh)— 89 Ton Evaporative Condensing —High Capacity — R-410A

		Ambient Temperature																	
		60						65						70					
	ENT	Entering Wet Bulb																	
	DB	61		67		73		61		67		73		61		67		73	
CFM	(F)	CAP	SHC	CAP	SHC	CAP	SHC	CAP	SHC	CAP	SHC	CAP	SHC	CAP	SHC	CAP	SHC	CAP	SHC
16000	75	868	636	958	550	1057	443	860	650	948	545	1046	438	845	640	932	535	1031	429
	80	871	749	963	640	1059	534	862	743	953	635	1049	528	848	733	937	625	1035	520
	85	883	841	967	735	1064	623	874	835	957	729	1054	617	860	825	941	719	1039	611
	90	894	894	969	824	1068	716	885	885	960	818	1058	710	872	872	945	808	1044	702
20000	75	908	720	1003	592	1101	459	899	713	992	586	1090	453	883	703	975	576	1072	447
	80	920	839	1008	702	1106	570	911	833	998	696	1094	564	895	823	983	687	1080	556
	85	935	935	1010	818	1112	679	927	927	1001	812	1100	673	913	913	983	802	1087	665
	90	983	983	1023	929	1116	797	975	975	1013	923	1105	791	931	931	996	912	1089	782
22000	75	926	749	1020	611	1117	465	917	743	1009	605	1105	459	900	732	994	596	1089	453
	80	941	883	1026	731	1123	586	931	877	1015	725	1112	580	915	866	1002	719	1095	571
	85	966	965	1030	858	1130	705	957	957	1020	852	1118	699	943	943	1010	841	1102	690
	90	1016	1016	1045	981	1135	836	983	983	1035	974	1124	830	970	970	1018	963	1108	809
24000	75	942	778	1035	629	1131	471	932	771	1024	623	1119	465	915	760	1015	580	1105	458
	80	959	926	1038	757	1138	602	949	920	1028	751	1126	596	933	909	1018	721	1110	587
	85	992	992	1048	898	1145	731	983	983	1037	891	1133	724	968	968	1029	873	1116	715
	90	1026	1026	1066	1031	1146	870	1018	1018	1055	1025	1135	864	1004	1004	1048	1017	1124	858
26000	75	956	805	1047	646	1142	477	946	799	1036	640	1130	471	929	788	1014	612	1112	462
	80	972	958	1050	781	1151	617	960	951	1039	775	1139	611	945	936	1025	766	1121	601
	85	1016	1016	1063	936	1158	755	1007	1007	1052	930	1146	749	992	992	1037	920	1129	740
	90	1060	1060	1084	1078	1161	906	1054	1054	1074	1072	1149	899	1038	1038	1058	1058	1132	889
27000	75	963	819	1053	655	1148	480	952	812	1042	649	1135	474	935	801	1027	640	1124	467
	80	974	973	1056	793	1157	624	965	965	1045	787	1145	618	949	949	1032	778	1131	610
	85	1027	1027	1070	956	1164	767	1018	1018	1059	949	1152	761	1002	1002	1044	939	1138	754
	90	1082	1082	1093	1093	1168	923	1072	1072	1083	1083	1156	917	1058	1058	1068	1068	1142	909

		Ambient Temperature											
	ENT	75						80					
CFM	DB	Entering Wet Bulb											
	(F)	61		67		73		61		67		73	
		CAP	SHC	CAP	SHC	CAP	SHC	CAP	SHC	CAP	SHC	CAP	SHC
16000	75	833	633	918	527	1019	423	829	631	914	525	1008	418
	80	837	725	923	617	1017	511	833	723	919	615	1010	508
	85	849	817	927	711	1022	600	845	815	924	709	1016	597
	90	861	861	931	799	1027	689	857	857	927	797	1020	690
20000	75	871	695	961	568	1063	382	866	692	956	566	1047	432
	80	883	815	967	678	1068	551	879	813	962	675	1053	543
	85	902	902	969	793	1074	620	898	898	965	791	1059	652
	90	921	921	984	905	1076	737	918	918	978	901	1064	770
22000	75	887	724	978	588	1077	445	883	722	971	585	1062	438
	80	902	585	984	707	1084	567	898	856	977	704	1069	559
	85	931	931	988	833	1091	685	927	927	983	830	1076	678
	90	961	961	1005	956	1095	815	955	955	999	952	1081	809
24000	75	902	752	991	596	1090	452	898	749	985	602	1074	444
	80	919	901	1000	735	1098	582	910	889	989	729	1082	574
	85	957	957	1010	875	1105	710	952	952	999	869	1090	703
	90	994	994	1024	1006	1112	853	994	994	1018	1002	1098	832
26000	75	915	779	1003	622	1100	457	911	777	996	619	1084	450
	80	932	924	1014	768	1110	597	928	920	999	752	1095	589
	85	979	979	1025	913	1117	734	975	975	1013	907	1106	729
	90	1027	1027	1036	1039	1120	883	1027	1027	1032	1027	1116	869
27000	75	921	792	1008	630	1105	460	917	790	1001	627	1093	454
	80	941	941	1012	767	1115	604	936	936	1005	764	1102	598
	85	991	991	1026	930	1123	747	985	985	1020	926	1112	741
	90	1040	1040	1048	1048	1127	902	1034	1034	1041	1041	1121	885

Table 19. Natural Gas Heating Capacities

Nom. Tons	Gas Heat Module	Heat Input (MBh)	Heat Output (MBh)	Air Temperature Rise Vs Unit Cfm — CFM																										
				4000	5000	5760	6000	6284	7000	8000	9000	9792	10000	10682	10830	11200	11750	12000	13500	15000	16129	18000	20000	22500	23040	25000	27000	29377	30000
24	Low	235	192.7	44	36	31	30	28	25	22	20																		
	High	500	410.0			66	63	60	54	47	42																		
29	Low	235	192.7		36	31	30	28	25	22	20	18	18	17	16														
	High	500	410.0			66	63	60	54	47	42	39	38	35	35	34													
36	Low	350	287.0				44	42	38	33	29	27	26	25	24	24	23	22	20										
	High	500	410.0					60	54	47	42	39	38	35	35	34	32	31	28										
48	Low	350	287.0							33	29	27	26	25	24	24	23	22	20	18	16								
	High	850	697.0									66	64	60	59	57	55	54	48	43	40	36							
59	Low	500	410.0										38	35	35	34	32	31	28	25	23	21	19	17					
	High	850	697.0										60	59	57	55	54	48	43	40	36	32	29						
73	Low	500	410.0															31	28	25	23	21	19	17	16	15	14		
	High	850	697.0															54	48	43	40	36	32	29	28	26	24		
80	Low	500	410.0															31	28	25	23	21	19	17	16	15	14	13	13
	High	850	697.0															54	48	43	40	36	32	29	28	26	24	22	
89	Low	500	410.0															31	28	25	23	21	19	17	16	15	14	13	13
	High	850	697.0															54	48	43	40	36	32	29	28	26	24	22	

Notes:
1. All heaters are 81% efficient.
2. CFM values below the minimum and above the maximum shown in this table are **not** cULus approved.
3. Air temperature rise = heat output (Btu) ÷ (CFM x 1.085).

Table 20. Steam Heating Capacities (Q/ITD)[(a)]

24 Nominal Ton Unit

Steam Module	Unit Standard Air Volume (CFM)			
	4000	6000	8000	10000
Low Heat	0.95	1.18	1.37	1.52
High Heat	1.94	2.47	2.95	3.31

29 Nominal Ton Unit

Steam Module	Unit Standard Air Volume (CFM)			
	5000	7500	10000	12500
Low Heat	1.06	1.33	1.52	1.74
High Heat	2.20	2.85	3.31	3.65

36 Nominal Ton Unit

Steam Module	Unit Standard Air Volume (CFM)			
	6000	9000	12000	15000
Low Heat	1.18	1.64	1.69	2.00
High Heat	2.47	3.12	3.59	3.95

48 Nominal Ton Unit

Steam Module	Unit Standard Air Volume (CFM)			
	8000	12000	16000	20000
Low Heat	1.61	2.01	2.29	2.60
High Heat	3.36	4.28	4.93	5.43

59 Nominal Ton Unit

Steam Module	Unit Standard Air Volume (CFM)			
	10000	15000	20000	25000
Low Heat	1.82	2.21	2.60	2.85
High Heat	3.86	4.79	5.43	5.97

73 Nominal Ton Unit

Steam Module	Unit Standard Air Volume (CFM)			
	12000	18000	24000	30000
Low Heat	2.32	2.81	3.33	3.71
High Heat	3.85	4.84	5.62	6.18

89 Nominal Ton Unit

Steam Module	Unit Standard Air Volume (CFM)			
	16000	20000	24000	30000
Low Heat	2.65	2.98	3.33	3.71
High Heat	4.50	5.10	5.62	6.18

(a) Capacities expressed as MBH (Q) per initial temperature difference (ITD) between the entering air temperature to the steam module and the entering steam temperature. Maximum recommended operating pressure is 35 PSIG.

Table 21. 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

Table 22. Electric Heat Air Temperature Rise — 24 to 89 Tons

kW Input	Total MBh	CFM											
		4000	6000	8000	10000	12000	14000	16000	18000	20000	22000	24000	26000
30	102.4	23.6	15.7	11.8	9.4	7.9	6.7	5.9	5.2	4.7	4.3	3.9	3.6
50	170.6	39.3	26.2	19.7	15.7	13.1	11.2	9.8	8.7	7.9	7.1	6.6	6.0
70	238.8	55.0	36.7	27.5	22.0	18.3	15.7	13.8	12.2	11.0	10.0	9.2	8.5
90	307.1		47.2	35.4	28.3	23.6	20.2	17.7	15.7	14.2	12.9	11.8	10.9
110	375.3		57.7	43.2	34.6	28.8	24.7	21.6	19.2	17.3	15.7	14.4	13.3
130	443.6			51.1	40.9	34.1	29.2	25.6	22.7	20.4	18.6	17.0	15.7
150	511.8			59.0	47.2	39.3	33.7	29.5	26.2	23.6	21.4	19.7	18.1
170	580.1				53.5	44.6	38.2	33.4	29.7	26.7	24.3	22.3	20.6
190	648.3				59.8	49.8	42.7	37.3	33.2	29.9	27.2	24.9	23.0

Notes:
1. Maximum permitted air temperature rise; 20-50 tons (cULus - 50°F), 60 - 75 tons (cULus - 43°F).
2. Air temperature rise = kW x 3413 ÷ (scfm x 1.085)
3. All heaters on units provide 3 increments of capacity.

Table 23. Electric Heat kW Ranges

Nominal Tons	Nominal Voltage			
	200	230	460	575
24	30-90	30-110	30-110	30-110
29	30-90	30-110	30-130	30-130
36	30-110	30-110	30-150	30-150
48	50-110	50-110	50-170	50-170
59	70-110	70-110	70-190	70-190
73	90-110	90-110	90-190	90-190
80	90-110	90-110	90-190	90-190
89	90-110	90-110	90-190	90-190

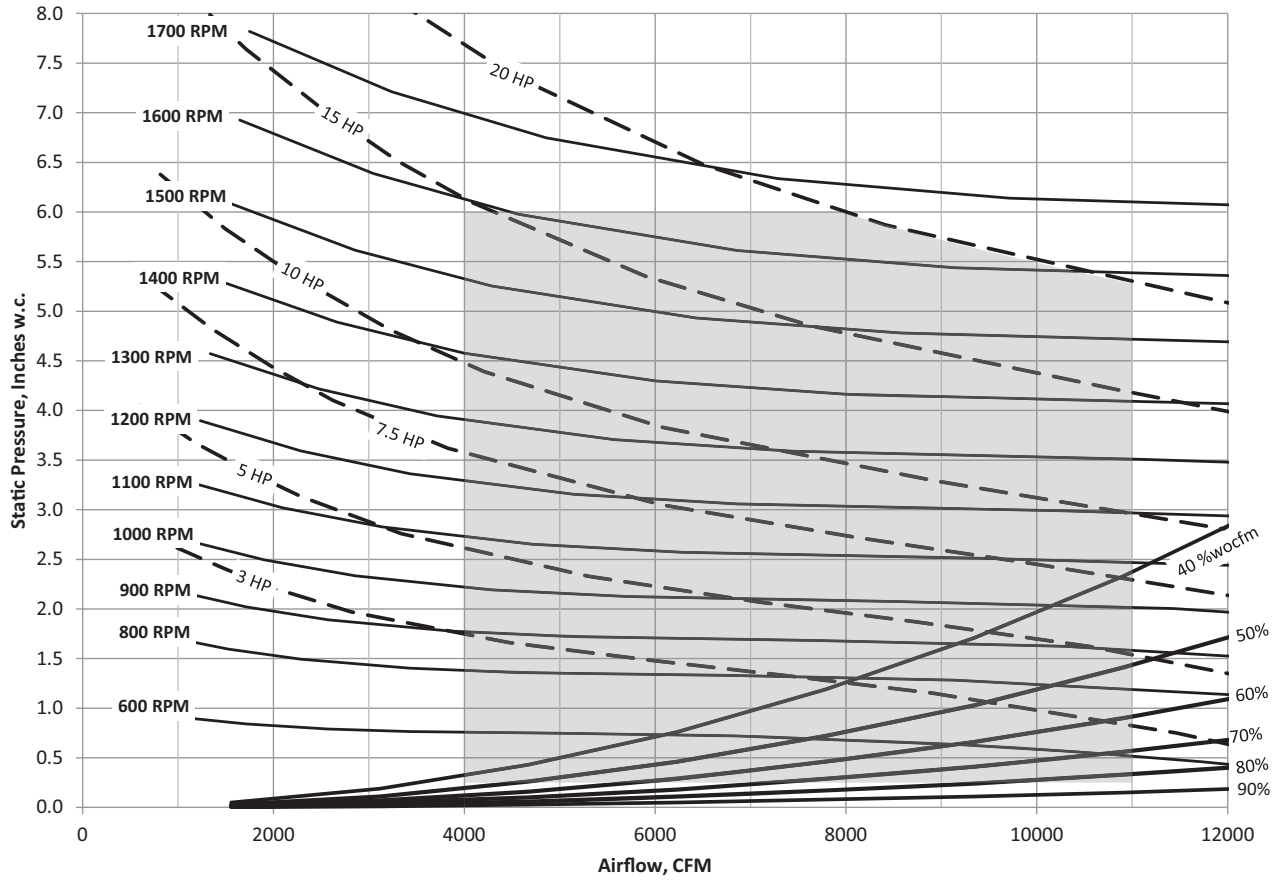
Table 24. Hot Water Heating Capacities (Q/ITD)[a]

24, 29, 36 Nominal Tons[b]								
Hot Water Module	Gpm	Water PD (Ft)	Unit Standard Air Volume (CFM)					
			4000	6000	8000	10000	12000	14000
Low	10	0.54	1.65	1.99	2.21	2.37	2.48	2.56
High	20	0.91	2.23	2.78	3.16	3.44	3.67	3.85
Low	20	0.91	1.88	2.35	2.69	2.94	3.12	3.27
High	30	1.49	2.36	3.00	3.46	3.81	4.09	4.31
Low	30	1.49	1.97	2.51	2.90	3.19	3.42	3.60
High	40	2.25	2.43	3.12	3.63	4.02	4.34	4.60
Low	40	2.25	2.02	2.60	3.02	3.34	3.60	3.79
High	50	3.2	2.48	3.20	3.74	4.17	4.51	4.80
Low	60	4.31	2.08	2.69	3.16	3.51	3.79	4.02
High	70	5.65	2.54	3.30	3.88	4.35	4.73	5.04
48, 59 Nominal Tons[b]								
Hot Water Module	Gpm	Water PD (Ft)	Unit Standard Air Volume (CFM)					
			8000	11000	14000	17000	20000	23000
Low	20	0.70	3.00	3.44	3.75	3.98	4.14	4.29
High	30	1.05	3.85	4.46	4.91	5.26	5.54	5.76
Low	40	1.51	3.40	4.00	4.43	4.76	5.02	5.21
High	50	2.10	4.20	4.95	5.52	5.97	6.34	6.64
Low	60	2.78	3.56	4.23	4.73	5.11	5.40	5.63
High	75	4.04	4.39	5.24	5.89	6.41	6.85	7.21
Low	80	4.50	3.65	4.36	4.89	5.31	5.63	5.88
High	90	5.54	4.46	5.34	6.03	6.58	7.04	7.42
Low	100	6.66	3.71	4.44	5.00	5.43	5.77	6.04
High	125	9.99	4.56	5.50	6.23	6.83	7.33	7.75
73, 80, 89 Nominal Tons[b]								
Hot Water Module	Gpm	Water PD (Ft)	Unit Standard Air Volume (CFM)					
			12000	16000	20000	24000	28000	31500
Low	25	0.98	4.28	4.82	5.20	5.48	5.69	5.83
High	30	1.22	5.24	5.91	6.40	6.77	7.06	7.27
Low	50	2.48	4.90	5.63	6.18	6.60	6.92	7.15
High	60	3.33	6.01	6.94	7.66	8.22	8.69	9.03
Low	75	4.83	5.14	5.97	6.60	7.09	7.46	7.73
High	90	6.65	6.32	7.38	8.20	8.87	9.42	9.83
Low	100	8.0	5.28	6.16	6.84	7.36	7.78	8.07
High	120	11.15	6.49	7.62	8.51	9.23	9.84	10.30
Low	125	11.99	5.37	6.29	6.99	7.54	7.98	8.29
High	150	16.8	6.60	7.77	8.71	9.47	10.11	10.60

(a) Capacities expressed as MBh per initial temperature difference (ITD) between the entering air temperature to the hot water coil and the entering water temperature. Ethylene glycol or other capacities can be determined from the Trane heating coil computer program. Capacity and pressure drop of ethylene glycol vary greatly with temperature and concentration.
(b) Model number sizes are listed as air-cooled/evaporative condensing

Supply Fan Performance

Figure 6. Supply fan performance with or without variable frequency drive - 24 and 29 ton evaporative condensing - forward curved

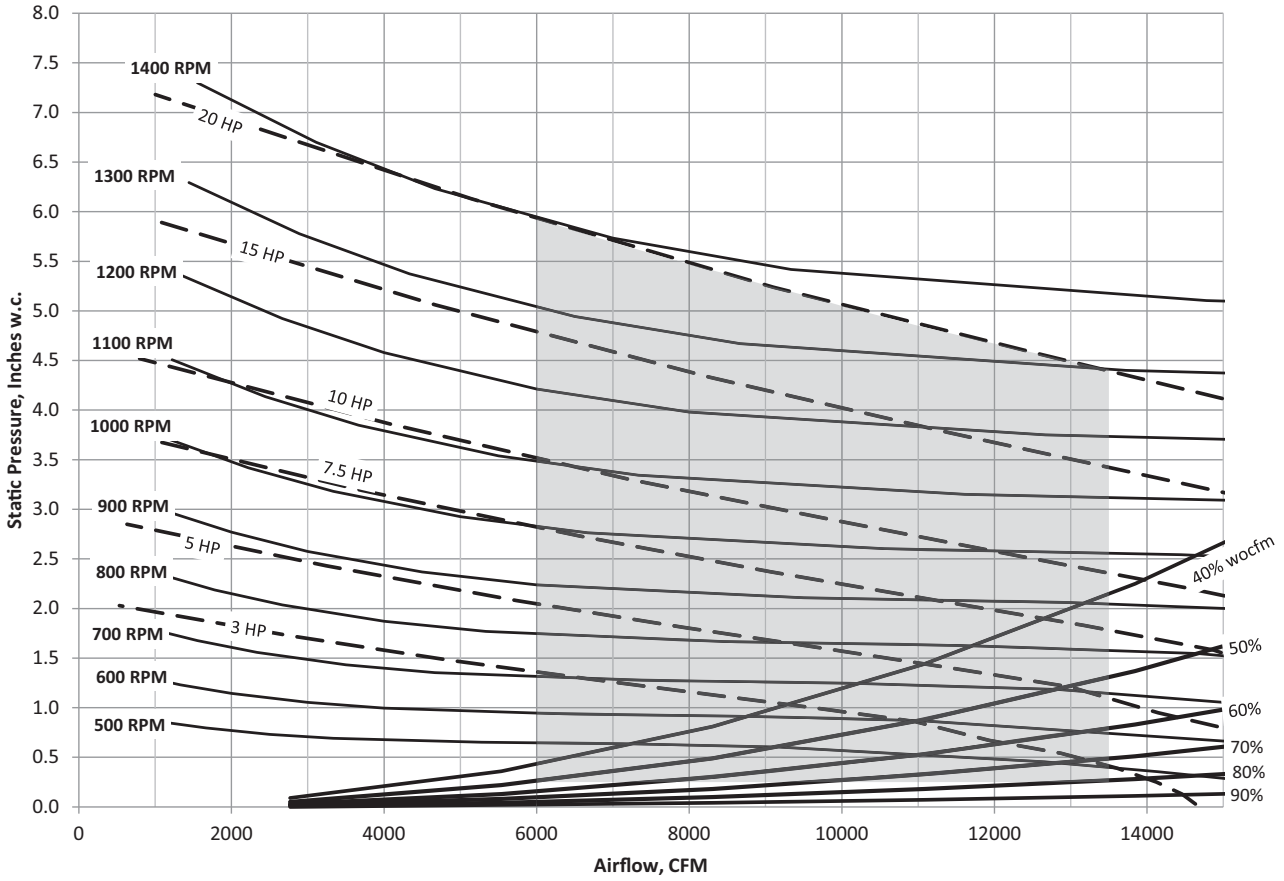


Important: *Maximum static pressure leaving the rooftop is 4.0" H_2O positive. The static pressure drops from the supply fan to the space cannot exceed 4.0" H_2O.*

Notes:

1. Fan performance for 24 and 29 ton rooftops is identical. Contact your local Trane representative for information on oversized motors.
2. Shaded areas represent selectable area. Contact your local Trane representative for more information.
3. Supply fan performance table includes internal resistance of rooftop. For total static pressure determination, system external static must be added to appropriate component static pressure drops (evaporator coil, filters, optional economizer, optional exhaust fan, optional heating system, optional cooling only extended casing, optional roof curb).
4. Maximum Cfm (for cULus approval) as follows: 24 ton - 9,000 Cfm, 29 ton - 11,000 Cfm.
5. Minimum motor horsepower is 3 hp.
6. Maximum motor horsepower is 20 hp.
7. Maximum fan RPM is 1750.

Figure 7. Supply fan performance with or without variable frequency drive — 36 ton evaporative condensing - forward curved

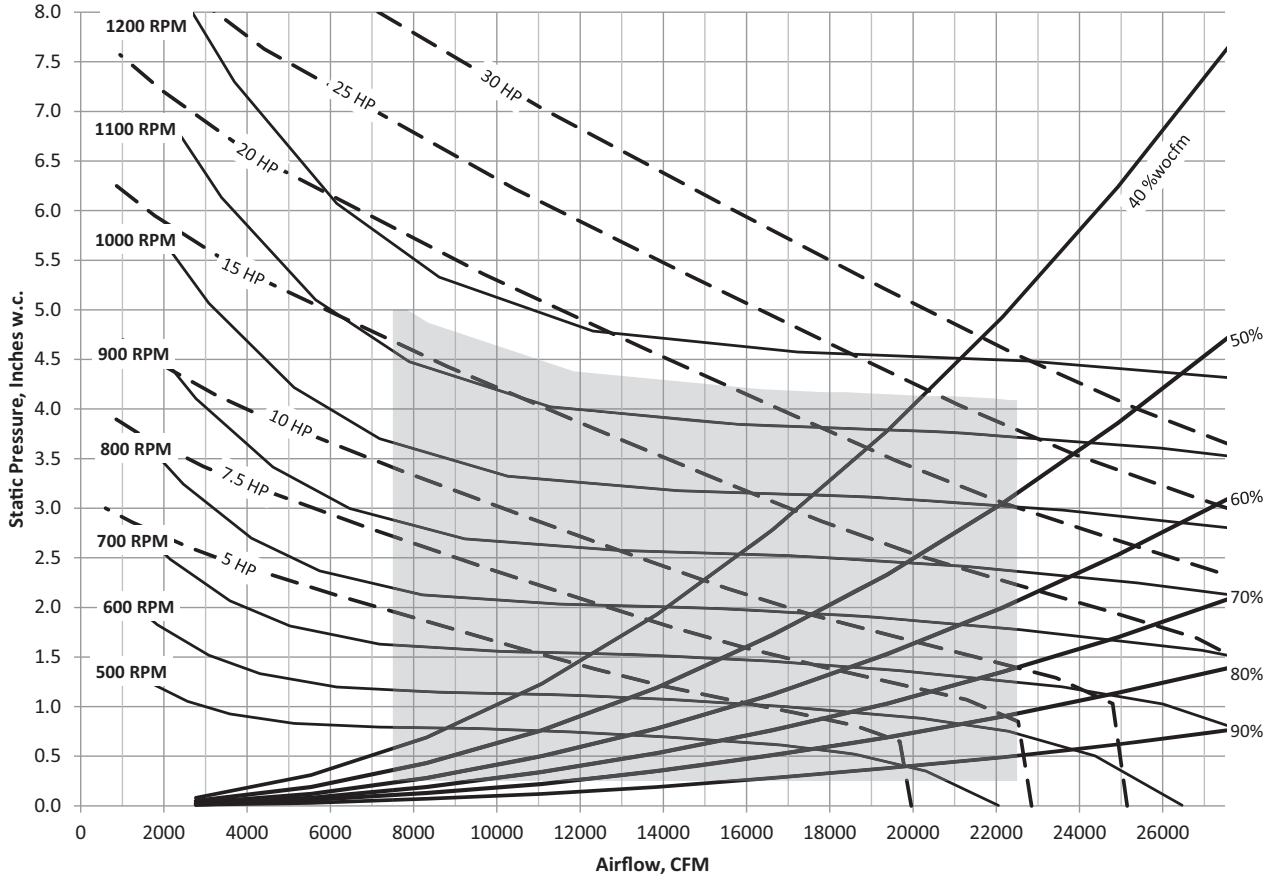


Important: *Maximum static pressure leaving the rooftop is 4.0" H_2O positive. The static pressure drops from the supply fan to the space cannot exceed 4.0" H_2O.*

Notes:

1. Shaded areas represent selectable area. Contact your local Trane representative for more information.
2. Supply fan performance table includes internal resistance of rooftop. For total static pressure determination, system external static must be added to appropriate component static pressure drops (evaporator coil, filters, optional economizer, optional exhaust fan, optional heating system, optional cooling only extended casing, optional roof curb).
3. Minimum motor horsepower is 5 hp, maximum motor horsepower is 20 hp. Maximum fan RPM is 1450.
4. Max Cfm (for cULus approval) as follows: 36 ton-13,500 Cfm.

Figure 8. Supply fan performance with or without variable frequency drive - 48 and 59 ton evaporative condensing - forward curved

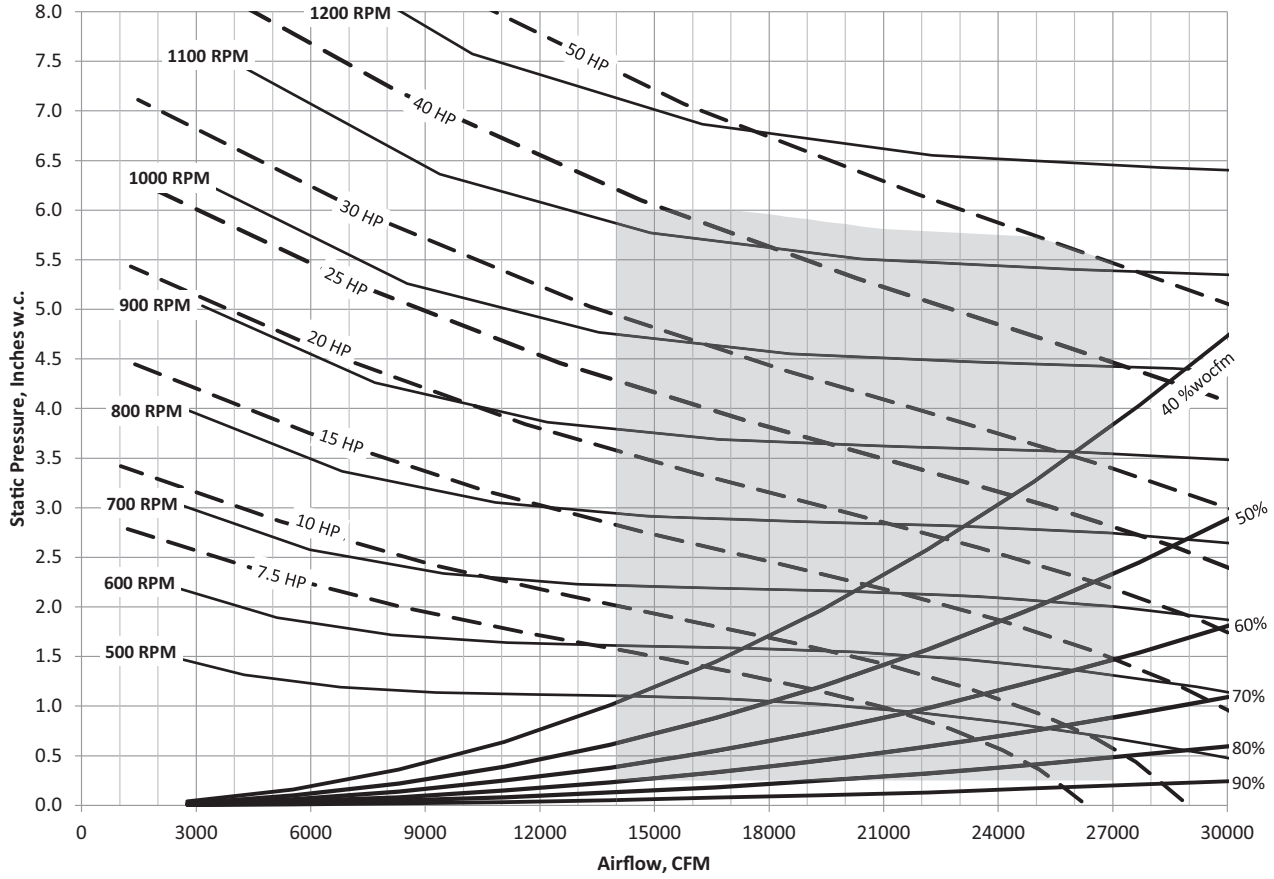


Important: *Maximum static pressure leaving the rooftop is 4.0" H_2O positive. The static pressure drops from the supply fan to the space cannot exceed 4.0" H_2O.*

Notes:

1. Fan performance for 48 and 59 ton rooftops is identical. Contact your local Trane representative for information on oversized motors.
2. Shaded areas represent selectable area. Contact your local Trane representative for more information.
3. Supply fan performance table includes internal resistance of rooftop. For total static pressure determination, system external static must be added to appropriate component static pressure drops (evaporator coil, filters, optional economizer, optional exhaust fan, optional heating system, optional cooling only extended casing, optional roof curb).
4. Maximum Cfm (for cULus approval) as follows:
   48 ton - 18,000 Cfm
   59 ton - 22,500 Cfm
5. Minimum motor horsepower is 7.5 hp
6. Maximum motor horsepower is 30 hp
7. Maximum 7.5 hp to 15 hp fan Rpm is 1,141 Rpm, maximum 20 hp to 30 hp fan Rpm is 1,170 Rpm.

Figure 9. Supply fan performance with or without variable frequency drive - 73, 80 and 89 ton evaporative condensing - forward curved



Important: *Maximum static pressure leaving the rooftop is 4.0" H_2O positive. The static pressure drops from the supply fan to the space cannot exceed 4.0" H_2O.*

Notes:

1. Fan performance for 73, 80 and 89 ton rooftops are identical. However, note maximum motor hp size for each size. Contact your local Trane representative for information on non-standard motors.
2. Shaded areas represent selectable area. Contact your local Trane representative for more information.
3. Supply fan performance table includes internal resistance of rooftop. For total static pressure determination, system external static must be added to appropriate component static pressure drops (evaporator coil, filters, optional economizer, optional exhaust fan, optional heating system, optional cooling only extended casing, optional roof curb).
4. Maximum Cfm (for cULus approval) as follows: 73-89 ton - 27,000 Cfm
5. Minimum motor horsepower is 10 hp.
6. Maximum motor horsepower is 50 hp.
7. Maximum fan Rpm is 1,130.
8. 40 & 50 HP motor available as standard in 460 & 575 volt only

Table 25. Component static pressure drops (in. W.G.)

Nom	CFM Std	Evaporator Coil		Heating System							Filters						Std Roof	Economizer With or Without Exhaust
				SFHL		SEHL	SLHL		SSHL		Throwaway		Perm Wire	Bag & Prefilter	Cartridge & Prefilter	Final Filter Cartridge		
		Dry	Wet	Low	High	All kW	Low	High	Low	High	Std.	High						
24	4000	0.12	0.16	.02	N/A	0.02	.05	.06	.02	.06	.03	.03	.01	.3	.24	0.22	.01	.03
	6000	0.24	0.29	.05	.05	0.04	.09	.12	.05	.12	.06	.06	.02	.5	.44	0.30	.02	.06
	8000	0.37	0.44	.09	.09	0.07	.15	.19	.10	.20	.09	.09	.03	.71	.68	0.45	.05	.12
	9000	0.45	0.52	.12	.12	0.09	.19	.24	.12	.22	.11	.11	.04	.83	.81	0.55	.07	.15
	10000	0.53	0.6	.14	.15	0.11	.23	.28	.15	.29	.13	.13	.05	.95	.95	0.66	.10	.19
	12000	0.7	0.78	.20	.22	0.17	.33	.40	.22	.42	.15	.15	.06	1.19	1.26	0.94	.14	.27
29	5000	0.18	0.22	.03	N/A	0.03	.07	.09	.04	.09	.05	.05	.02	.40	.34	0.25	.01	.03
	6000	0.24	0.29	.05	.05	0.04	.10	.12	.06	.13	.07	.07	.02	.50	.44	0.30	.02	.05
	7500	0.34	0.41	.08	.08	0.06	.14	.17	.09	.18	.09	.09	.03	.66	.62	0.41	.04	.10
	10000	0.53	0.62	.14	.15	0.11	.23	.28	.15	.29	.13	.13	.05	.95	.95	0.66	.10	.19
	11000	0.62	0.71	.17	.18	0.13	.29	.33	.19	.35	.15	.15	.06	1.06	1.11	0.79	.12	.23
	12500	0.75	0.85	.22	.23	0.18	.33	.42	.24	.42	.19	.19	.08	1.29	1.34	1.02	.19	.30
	14000	0.9	0.99	.28	.29	0.21	.41	.53	.30	.53	.24	.24	.10	-	-	1.28	.24	.39
36	6000	0.17	0.24	.05	.05	0.04	.09	.12	.05	.12	.04	.04	.01	.34	.26	0.24	.02	.06
	9000	0.33	0.45	.11	.12	0.09	.19	.24	.12	.22	.07	.07	.02	.54	.48	0.36	.07	.15
	12000	0.53	0.67	.20	.21	0.16	.31	.39	.22	.41	.11	.11	.04	.75	.75	0.58	.16	.27
	14000	0.68	0.83	.26	.29	0.22	.40	.51	.30	.50	.14	.14	.06	.95	.95	0.76	.25	.39
	15000	0.76	0.92	.30	.33	0.25	.45	.57	.33	.52	.16	.16	.07	1.03	1.06	0.87	.30	.43
	17000	0.92	1.09	.39	.42	0.35	.58	.73	.42	.67	.21	.21	.09	1.20	1.30	1.11	.39	.59
48	8000	0.19	0.26	.09	N/A	0.07	.09	.11	.05	.11	.04	.04	.02	.37	.31	0.25	.01	.03
	10000	0.27	0.36	.14	.11	0.11	.13	.16	.08	.16	.06	.06	.02	.49	.43	0.32	.02	.03
	12000	0.36	0.48	.20	.15	0.16	.17	.22	.11	.21	.08	.08	.03	.61	.56	0.41	.04	.07
	16000	0.57	0.73	.34	.26	0.29	.28	.36	.20	.36	.12	.12	.05	.88	.87	0.66	.10	.09
	17000	0.62	0.79	N/A	.29	0.32	.31	.39	.22	.41	.13	.13	.06	.95	.95	0.74	.12	.11
	20000	0.81	0.99	N/A	.41	0.44	.42	.52	.30	.51	.17	.17	.08	1.17	1.22	1.02	.19	.17
	22000	0.94	1.13	N/A	.50	0.53	.51	.63	.36	.62	.21	.21	.10	-	-	1.23	.23	.20
59	10000	0.2	0.25	.12	.10	0.11	.13	.16	.07	.15	.04	.04	.01	.37	.30	0.25	.03	.05
	14000	0.34	0.42	.26	.20	0.22	.22	.28	.15	.28	.07	.07	.03	.56	.50	0.37	.07	.08
	17000	0.46	0.57	.39	.29	0.32	.31	.40	.22	.41	.10	.10	.04	.72	.68	0.50	.12	.11
	20000	0.59	0.73	.58	.41	0.44	.42	.52	.30	.51	.12	.12	.05	.88	.88	0.66	.19	.17
	24000	0.79	0.94	.73	.58	0.62	.48	.72	.45	.75	.16	.16	.07	1.11	1.17	0.94	.30	.23
	28000	1.01	1.17	.99	.79	0.84	.62	.98	.61	.99	.20	.20	.10	-	-	1.28	.39	.30
73	12000	0.27	0.37	.10	.08	0.06	.10	.13	.06	.11	.05	.05	.01	.44	.37	0.27	.02	.07
	16000	0.43	0.58	.18	.14	0.11	.17	.21	.11	.19	.07	.07	.02	.63	.58	0.39	.05	.10
	20000	0.62	0.8	.27	.21	0.17	.24	.31	.16	.27	.10	.10	.03	.84	.82	0.56	.10	.16
	24000	0.83	1.03	.40	.30	0.24	.33	.42	.22	.39	.11	.11	.04	1.06	1.08	0.78	.16	.23
	28000	1.06	1.28	.48	.33	0.32	.44	.55	.32	.50	.17	.17	.06	1.22	1.29	1.05	.30	.30
	30000	1.19	1.41	.62	.38	0.37	.51	.63	.37	.57	.20	.20	.07	-	-	1.21	.34	.34
80	12000	0.28	0.37	.10	.08	0.06	.10	.13	.06	.11	.05	.05	.01	.44	.37	0.27	.02	.07
	16000	0.44	0.58	.18	.14	0.11	.17	.21	.11	.19	.07	.07	.02	.63	.58	0.39	.05	.10
	20000	0.62	0.81	.27	.21	0.17	.24	.31	.16	.27	.10	.10	.03	.84	.82	0.56	.10	.16
	22000	0.73	0.94	.33	.25	0.2	.29	.37	.19	.33	.12	.12	.04	.95	.95	0.66	.13	.20
	24000	0.84	1.06	.40	.30	0.24	.33	.42	.22	.39	.14	.14	.04	1.06	1.08	0.78	.16	.23
	26000	0.95	1.19	.47	.32	0.28	.39	.49	.27	.45	.16	.16	.05	1.17	1.23	0.91	.23	.26
	28000	1.07	1.32	.54	.33	0.32	.44	.55	.32	.50	.17	.17	.06	1.22	1.29	1.05	.30	.30
	31000	1.26	1.52	.60	.40	0.4	.49	.61	.39	.55	.21	.21	.07	-	-	1.29	.37	.36
	33000	1.39	1.66	.65	.46	0.45	.52	.67	.44	.60	.24	.24	.08	-	-	1.47	.42	.40

continued on next page

Table 25. Component static pressure drops (in. W.G.) (continued)

Nom	CFM Std	Evaporator Coil		Heating System							Filters						Std Roof	Economizer With or Without Exhaust
				SFHL		SEHL	SLHL		SSHL		Throwaway		Perm Wire	Bag & Prefilter	Cartridge & Prefilter	Final Filter Cartridge		
		Dry	Wet	Low	High	All kW	Low	High	Low	High	Std.	High						
89	12000	0.28	0.38	.10	.08	0.06	.10	.13	.06	.11	.05	.05	.01	.44	.37	0.27	.02	.07
	16000	0.44	0.58	.18	.14	0.11	.17	.21	.11	.19	.07	.07	.02	.63	.58	0.39	.05	.10
	20000	0.63	0.82	.27	.21	0.17	.24	.31	.16	.27	.10	.10	.03	.84	.82	0.56	.10	.16
	22000	0.73	0.94	.33	.25	0.2	.29	.37	.19	.33	.12	.12	.04	.95	.95	0.66	.13	.20
	24000	0.84	1.07	.40	.30	0.24	.33	.42	.22	.39	.14	.14	.04	1.06	1.08	0.78	.16	.23
	26000	0.95	1.2	.47	.32	0.28	.39	.49	.27	.45	.16	.16	.05	1.17	1.23	0.91	.23	.26
	28000	1.07	1.33	.54	.33	0.32	.44	.55	.32	.50	.17	.17	.06	1.22	1.29	1.05	.30	.30
	31000	1.27	1.54	.60	.40	0.4	.49	.61	.39	.55	.21	.21	.07	-	-	1.29	.37	.36
	33000	1.4	1.68	.65	.46	0.45	.52	.67	.44	.60	.24	.24	.08	-	-	1.47	.42	.40

Notes:

1. Static pressure drops of accessory components must be added to external static pressure to enter fan selection tables.
2. Gas heat section maximum temperature rise of 60 F.
3. Throwaway filter option limited to 300 ft/min face velocity.
4. Bag filter option limited to 740 ft/min face velocity.
5. Horizontal roof curbs assume 0.50" static pressure drop or double the standard roof curb pressure drop, whichever is greater.
6. No additional pressure loss for model SXHL.
7. For final filters w/ prefilters (digit 13 = M, N, P, Q) also add pressure drop for throwaway filter.

Table 26. Component static pressure drops (in. W.G.)—exhaust damper for return fan

Nom Tons	Cfm	Exhaust Damper for Return Fan
24	4000	0.08
	6000	0.19
	8000	0.35
	9000	0.44
	10000	0.55
	12000	0.79
29	5000	0.13
	6000	0.19
	7500	0.3
	10000	0.55
	11000	0.67
	12500	0.85
	14000	1.08
36	6000	0.19
	9000	0.44
	12000	0.79
	14000	1.08
	15000	1.2
	17000	1.6
48	8000	0.18
	10000	0.28
	12000	0.41
	16000	0.73
	17000	0.82
	20000	1.15
	22000	1.39
59	10000	0.28
	14000	0.56
	17000	0.75
	20000	1.15
	24000	1.66
	28000	2.26
73	12000	0.31
	16000	0.56
	20000	0.88
	24000	1.27
	28000	1.73
	30000	1.99
80	12000	0.31
	16000	0.56
	20000	0.88
	22000	1.05
	24000	1.27
	26000	1.47
	28000	1.73
	31000	-
	33000	-
89	12000	0.31
	16000	0.56
	20000	0.88
	22000	1.05
	24000	1.27
	26000	1.47
	28000	1.73
	31000	-
	33000	-

Notes:
1. Exhaust Damper drop is only added when Return Fan is ordered.
2. Use Return CFM for exhaust damper drop add on return fan selections.

Table 27. FC supply air fan drive selections — 24-89 ton

Nominal Tons	3 Hp		5 Hp		7½ Hp		10 Hp		15 Hp		20 Hp		25 Hp		30 Hp		40 Hp		50 Hp	
	RPM	Drive No	RPM	Drive No	RPM	Drive No	RPM	Drive No	RPM	Drive No	RPM	Drive No	RPM	Drive No	RPM	Drive No	RPM	Drive No	RPM	Drive No
24	500	5	700	7	900	9	1100	B	1200	C	1400	E								
	600	6	800	8	1000	A	1200	C	1300	D	1500	F								
	700	7	900	9	1100	B	1300	D	1400	E	1600	G								
	800	8	1000	A	1200	C	1400	E	1500	F	1700	H								
	900	9	1100	B	1300	D			1600	G										
29	500	5	700	7	800	8	1000	A	1200	C	1400	E								
	600	6	800	8	900	9	1100	B	1300	D	1500	F								
	700	7	900	9	1000	A	1200	C	1400	E	1600	G								
	800	8	1000	A	1100	B	1300	D	1500	F	1700	H								
	900	9	1100	B	1200	C	1400	E	1600	G										
					1300	D														
36			600	6	700	7	800	8	900	9	1100	B								
			700	7	800	8	900	9	1000	A	1200	C								
			800	8	900	9	1000	A	1100	B	1300	D								
			900	9	1000	A	1100	B	1200	C	1400	E								
									1300	D										
48					500	5	700	7	800	8	900	9	1000	A	1000	A				
					600	6	800	8	900	9	1000	A	1100	B	1100	B				
					700	7	900	9	1000	A	1100	B								
					800	8														
59					500	5	600	6	700	7	800	8	900	9	1000	A				
					600	6	700	7	800	8	900	9	1000	A	1100	B				
					700	7	800	8	900	9	1000	A	1100	B						
					800	8	900	9	1000	A	1100	B								
73,, 80, 89							400	4	500	5	600	6	700	7	800	8	900	9	1000	A
							500	5	600	6	700	7	800	8	900	9	1000	A	1100	B
							600	6	700	7	800	8	900	9	1000	A	1100	B		
							700	7	800	8	900	9	1000	A						

Table 28. Modulating 100% exhaust fan performance — 24-89 ton

Nominal Tons	CFM Std Air	Negative Static Pressure															
		0.250		0.500		0.750		1.000		1.250		1.500		1.750		2.000	
		RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
24	4000	379	0.34	515	0.70	622	1.12	712	1.59	791	2.10	861	2.64				
	6000	421	0.61	541	1.03	643	1.52	732	2.07	811	2.66						
	8000	487	1.10	583	1.56	674	2.11	757	2.72								
	10000	567	1.88	643	2.37	719	2.96										
29	4000	379	0.34	515	0.70	622	1.12	712	1.59	791	2.10	861	2.64	927	3.22	988	3.84
	6000	421	0.61	541	1.03	643	1.52	732	2.07	811	2.66	882	3.28	948	3.94	1010	4.64
	8000	487	1.10	583	1.56	674	2.11	757	2.72	834	3.38	904	4.09	970	4.82		
	10000	567	1.88	643	2.37	719	2.96	794	3.63	864	4.35						
	12000	651	2.98	716	3.56	779	4.18	843	4.88								
36	4000	379	0.34	515	0.70	622	1.12	712	1.59	791	2.10	861	2.64	927	3.22	988	3.84
	6000	421	0.61	541	1.03	643	1.52	732	2.07	811	2.66	882	3.28	948	3.94	1010	4.64
	8000	487	1.10	583	1.56	674	2.11	757	2.72	834	3.38	904	4.09	970	4.82	1030	5.59
	10000	567	1.88	643	2.37	719	2.96	794	3.63	864	4.35	931	5.11	993	5.91	1053	6.77
	12000	651	2.98	716	3.56	779	4.18	843	4.88	905	5.64	967	6.47	1026	7.34		
	14000	736	4.47	796	5.17	850	5.83	904	6.57	960	7.38						
48	7500	318	0.67	444	1.21	545	1.85	629	2.54	702	3.27	767	4.02	828	4.83	884	5.66
	9000	331	0.97	444	1.47	543	2.17	628	2.94	702	3.75	770	4.60	831	5.48	887	6.37
	12000	381	2.13	460	2.40	546	3.04	627	3.89	701	4.83	769	5.82	831	6.87	889	7.93
	14000	422	3.40	486	3.49	557	3.98	631	4.76	701	5.72	768	6.78	830	7.90	888	9.07
	16000	468	5.12	520	5.07	579	5.37	643	6.01	707	6.88	769	7.92	829	9.08	887	10.32
59	9000	331	0.97	444	1.47	543	2.17	628	2.94	702	3.75	770	4.60	831	5.48	887	6.37
	12000	381	2.13	460	2.40	546	3.04	627	3.89	701	4.83	769	5.82	831	6.87	889	7.93
	15000	445	4.20	502	4.21	567	4.61	636	5.32	704	6.26	769	7.32	830	8.47	888	9.67
	18000	516	7.41	559	7.19	609	7.32	662	7.76	719	8.49	776	9.44	833	10.56	887	11.79
	20000	566	10.31	602	9.91	644	9.88	690	10.15	739	10.69	789	11.48	841	12.48	893	13.68
73, 80 & 89	12000	351	1.49	423	2.09	502	3.00	572	4.02	634	5.07	690	6.09	740	7.04	784	7.91
	15000	412	2.68	460	3.15	521	3.96	585	5.02	646	6.24	702	7.53	749	8.83	801	10.14
	18000	478	4.41	516	4.88	557	5.54	607	6.49	662	7.66	715	9.01	766	10.48	814	12.01
	21000	549	6.75	578	7.36	612	7.92	647	8.71	688	9.77	735	11.03	781	12.46	827	14.03
	24000	617	9.83	644	10.59	672	11.22	702	11.88	732	12.77	766	13.89	805	15.22	846	16.72
	27000	688	15.11	711	15.09	736	15.45	761	16.18	788	17.02	815	17.92	844	18.99	876	20.31

Table 29. 100% Exhaust fan drive selections — 24-89 ton

Nominal Tons	3 Hp		5 Hp		7½ Hp		10 Hp		15 Hp		20 Hp	
	RPM	Drive No	RPM	Drive No	RPM	Drive No	RPM	Drive No	RPM	Drive No	RPM	Drive No
24	500	5										
	600	6										
	700	7										
	800	8										
	900	9										
29	500	5	700	7								
	600	6	800	8								
	700	7	900	9								
	800	8	1000	A								
	900	9										
36	500	5	700	7	800	8						
	600	6	800	8	900	9						
	700	7	900	9	1000	A						
	800	8	1000	A	1100	B						
	900	9										
48			400	4	600	6	700	7				
			500	5	700	7	800	8				
			600	6	800	8						
			700	7								
			800	8								
59			400	4	600	6	700	7	700	7		
			500	5	700	7	800	8	800	8		
			600	6	800	8			900	9		
			700	7								
			800	8								
73			400	4	600	6	600	6	700	7	800	8
80			500	5	700	7	700	7	800	8		
89			600	6								

Table 30. 50% Exhaust fan performance — 24-89 ton

Nominal Tons	CFM Std Air	Negative Static Pressure (In. W.G.)													
		0.200		0.400		0.600		0.800		1.000		1.200		1.400	
		RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
24, 29	2000	346	0.14	465	0.27	560	0.43	641	0.60	712	0.79	776	1.00	836	1.21
	3000	397	0.27	495	0.42	583	0.61	662	0.81	731	1.03	795	1.27	854	1.51
	4000	469	0.51	546	0.68	621	0.88	691	1.11	757	1.36	818	1.62	876	1.90
	5000	548	0.88	613	1.08	675	1.30	736	1.55	794	1.81	850	2.10	903	2.39
	6000	630	1.40	690	1.66	742	1.90	793	2.16	844	2.45	894	2.75	943	3.06
36	2000	346	0.14	465	0.27	560	0.43	641	0.60	712	0.79	776	1.00	836	1.21
	3000	397	0.27	495	0.42	583	0.61	662	0.81	731	1.03	795	1.27	854	1.51
	4000	469	0.51	546	0.68	621	0.88	691	1.11	757	1.36	818	1.62	876	1.90
	5000	548	0.88	613	1.08	675	1.30	736	1.55	794	1.81	850	2.10	903	2.39
	6000	630	1.40	690	1.66	742	1.90	793	2.16	844	2.45	894	2.75	943	3.06
	7000	714	2.10	769	2.42	818	2.72	862	3.00	906	3.29	950	3.61	993	3.95
48, 59	3000	281	0.20	396	0.39	486	0.60	560	0.83	625	1.07	683	1.33	737	1.61
	5000	326	0.55	404	0.73	485	0.99	559	1.29	627	1.61	687	1.94	741	2.28
	7000	411	1.35	459	1.51	513	1.74	571	2.04	629	2.39	686	2.77	740	3.18
	9000	508	2.80	540	2.92	578	3.13	618	3.40	662	3.72	706	4.09	751	4.50
	11000	609	5.05	633	5.16	661	5.34	691	5.58	723	5.87	756	6.21	792	6.59
73, 80, 89	4000	271	0.29	364	0.54	438	0.82	499	1.07	550	1.30	601	1.56	651	1.87
	6000	339	0.71	391	0.90	456	1.22	517	1.60	572	2.01	622	2.43	668	2.85
	8000	425	1.55	460	1.73	497	1.96	542	2.30	591	2.72	639	3.20	684	3.73
	10000	517	2.88	543	3.13	571	3.34	600	3.59	632	3.94	649	4.37	707	4.87
	12000	612	4.84	651	5.15	655	5.43	678	5.68	702	5.95	726	6.29	752	6.71
	13000	659	6.09	679	6.44	699	6.76	720	7.04	741	7.31				

Table 31. 50% Exhaust fan drive selections

Nominal Unit Size	3 HP		5 HP		7½ HP		15 HP	
	RPM	Drive No	RPM	Drive No	RPM	Drive No	RPM	Drive No
24, 29	500	5						
	600	6						
	700	7						
	800	8						
	900	9						
36	500	5	800	8				
	600	6	900	9				
	700	7	1000	A				
	800	8						
	900	9						
48, 59			500	5	600	6		
			600	6	700	7		
			700	7				
73, 80, 89			400	4	700	7		
			500	5				
			600	6				

Table 32. Return fan performance—24, 29, 36 ton evaporative condensing (24.5" Fan)

CFM	Return Fan Static Pressure Including Exhaust Damper P.D.															
Std.	0.25		0.50		0.75		1.00		1.25		1.50		1.75		2.00	
Air	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
4000	557	0.29	638	0.48	710	0.68	776	0.89	838	1.10	899	1.32	969	1.60	1038	1.89
4500	605	0.36	682	0.57	749	0.79	811	1.02	869	1.25	926	1.49	980	1.73	1033	1.99
5000	654	0.44	727	0.67	790	0.91	850	1.16	905	1.41	957	1.67	1007	1.93	1057	2.20
5500	704	0.53	773	0.79	834	1.04	889	1.30	943	1.58	992	1.86	1040	2.15	1087	2.44
6000	756	0.64	821	0.92	879	1.20	932	1.47	982	1.77	1030	2.06	1076	2.38	1121	2.70
6500	808	0.76	868	1.06	925	1.36	976	1.66	1024	1.97	1070	2.29	1114	2.61	1157	2.95
7000	861	0.90	917	1.21	972	1.55	1021	1.87	1067	2.19	1112	2.53	1154	2.87	1195	3.22
7500	913	1.06	968	1.39	1019	1.74	1068	2.10	1112	2.44	1155	2.79	1196	3.15	1235	3.51
8000	967	1.24	1019	1.58	1068	1.96	1115	2.34	1158	2.71	1199	3.08	1238	3.45	1277	3.84
8500	1021	1.44	1071	1.80	1116	2.19	1162	2.60	1204	3.00	1244	3.39	1283	3.79	1320	4.19
9000	1075	1.67	1123	2.04	1166	2.45	1210	2.88	1252	3.30	1290	3.72	1327	4.14	1363	4.56
9500	1130	1.92	1175	2.31	1217	2.73	1258	3.17	1299	3.62	1337	4.07	1373	4.52	1408	4.96
10000	1186	2.20	1228	2.60	1269	3.04	1307	3.50	1347	3.97	1384	4.45	1419	4.91	1454	5.38
10500	1241	2.50	1280	2.92	1321	3.37	1357	3.85	1395	4.34	1432	4.85	1466	5.33	1500	5.84
11000	1297	2.84	1334	3.27	1373	3.74	1409	4.23	1443	4.74	1480	5.26	1515	5.79	1546	6.29
11500	1353	3.20	1387	3.64	1425	4.13	1460	4.64	1493	5.16	1528	5.71	1561	6.25	1594	6.79
12000	1408	3.60	1441	4.06	1477	4.56	1512	5.08	1544	5.62	1576	6.18	1610	6.75	1642	7.32
12500	1464	4.03	1496	4.50	1530	5.01	1565	5.56	1596	6.11	1626	6.68	1658	7.28	1689	7.87
13000	1520	4.49	1551	4.98	1583	5.51	1617	6.06	1648	6.64	1677	7.22	1707	7.84	1737	8.44
13500	1576	4.99	1606	5.50	1636	6.03	1669	6.60	1700	7.20	1728	7.80	1756	8.42	1785	9.06
14000	1633	5.52	1661	6.05	1690	6.60	1721	7.19	1752	7.79	1780	8.42	1807	9.05	1834	9.70

Notes:
1. Max fan RPM 1715 for 24.5" Class I Fan
2. Max motors Available are as follows: 24T: 3HP, 29T; 5HP, 36T: 7.5 HP
3. Max CFM available is as follows; 24T: 9000, 29T: 11000, & 36T: 13500
4. Min CFM is 4000 for 24T, 29T, & 36T
5. Return fan belt drive RPM selections will be available to cover 500-1600 RPM range +/- 50 RPM
6. Performance data includes cabinet and rain hood effect. Damper pressure drop must be added to the return duct static per Table 26, p. 53
7. Outlined area indicates nonstandard BHP or RPM selections. Contact a local Trane representative for more information.

Table 33. Return fan performance—48 and 59 ton evaporative condensing (27" Fan)

CFM	Return Fan Static Pressure Including Exhaust Damper P.D.															
Std.	0.25		0.50		0.75		1.00		1.25		1.50		1.75		2.00	
Air	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
7500	709	0.82	766	1.16	815	1.50	861	1.85	906	2.22	949	2.60	991	2.99	1033	3.39
8000	748	0.95	803	1.31	851	1.67	895	2.04	938	2.43	979	2.82	1018	3.22	1058	3.64
8500	788	1.09	840	1.47	887	1.86	930	2.24	971	2.64	1010	3.05	1049	3.48	1087	3.92
9000	827	1.24	878	1.64	924	2.05	965	2.46	1005	2.88	1043	3.31	1080	3.75	1115	4.19
9500	867	1.41	916	1.83	961	2.27	1001	2.70	1040	3.14	1076	3.58	1112	4.03	1146	4.50
10000	908	1.60	955	2.04	999	2.50	1038	2.95	1075	3.41	1111	3.88	1145	4.34	1179	4.83
10500	948	1.81	994	2.27	1036	2.75	1075	3.23	1111	3.70	1145	4.18	1179	4.68	1212	5.18
11000	989	2.04	1033	2.51	1074	3.01	1112	3.51	1147	4.01	1181	4.51	1213	5.02	1245	5.53
11500	1030	2.28	1072	2.78	1112	3.29	1149	3.82	1184	4.33	1216	4.86	1248	5.38	1279	5.92
12000	1071	2.55	1112	3.06	1151	3.59	1187	4.14	1221	4.69	1253	5.24	1284	5.78	1314	6.33
12500	1112	2.83	1152	3.37	1189	3.92	1225	4.48	1258	5.06	1290	5.62	1320	6.19	1349	6.76
13000	1153	3.14	1192	3.70	1228	4.27	1263	4.86	1296	5.45	1327	6.04	1356	6.63	1385	7.23
13500	1194	3.47	1232	4.05	1267	4.63	1301	5.24	1333	5.85	1364	6.47	1393	7.08	1421	7.70
14000	1236	3.83	1272	4.42	1307	5.03	1340	5.66	1371	6.29	1401	6.94	1430	7.57	1457	8.20
14500	1277	4.21	1313	4.82	1346	5.45	1379	6.10	1410	6.75	1439	7.42	1467	8.08	1494	8.73
15000	1319	4.62	1353	5.25	1386	5.90	1417	6.55	1448	7.23	1477	7.92	1504	8.61	1531	9.29
15500	1361	5.05	1394	5.71	1426	6.37	1457	7.05	1486	7.74	1514	8.44	1542	9.16	1569	9.87
16000	1402	5.51	1435	6.18	1466	6.87	1496	7.57	1525	8.28	1553	9.01	1580	9.74	1606	10.47
16500	1444	6.00	1476	6.69	1506	7.40	1535	8.12	1564	8.85	1591	9.58	1617	10.34	1643	11.10
17000	1486	6.52	1517	7.23	1547	7.96	1575	8.70	1603	9.44	1629	10.20	1655	10.97	1681	11.75
17500	1528	7.07	1558	7.80	1587	8.55	1615	9.30	1642	10.07	1668	10.85	1694	11.64	1718	12.43
18000	1570	7.65	1599	8.40	1627	9.17	1655	9.94	1681	10.73	1707	11.53	1732	12.33	1757	13.15
18500	1612	8.26	1640	9.03	1668	9.81	1695	10.62	1721	11.43	1746	12.23	1771	13.07	1794	13.89
19000	1654	8.91	1682	9.70	1709	10.50	1735	11.31	1760	12.14	1785	12.97	1809	13.82	1833	14.67
19500	1696	9.59	1723	10.40	1749	11.22	1775	12.06	1800	12.90	1825	13.76	1848	14.62	1872	15.50
20000	1738	10.30	1765	11.13	1790	11.97	1816	12.83	1840	13.69	1864	14.56	1888	15.46	1910	16.34
20500	1780	11.05	1806	11.90	1831	12.76	1856	13.63	1880	14.52	1903	15.41	1926	16.31	1949	17.22
21000	1822	11.84	1848	12.71	1872	13.59	1897	14.48	1920	15.39	1943	16.29	1966	17.23	1988	18.14
21500	1864	12.66	1889	13.55	1914	14.45	1937	15.36	1960	16.29	1983	17.22	2005	18.16	2027	19.11
22000	1899	13.05	1926	14.11	1952	15.16	1977	16.20	2001	17.23	2024	18.24	2047	19.27	2069	20.28
22500	1941	13.91	1967	14.98	1992	16.05	2017	17.12	2041	18.19	2064	19.23	2086	20.27	2108	21.31

Notes:
1. Max fan RPM 1981 For 27" Class II Fan
2. Max Motor Available 15 HP For 27" Fan Size
3. Max motors Available are as follows: 48T: 10 HP & 59T: 15 HP
4. Max CFM is as follows: 48T: 18000, 59T: 22500
5. Min CFM is as follows: 48T: 7500, 59T: 9000
6. Return fan belt drive RPM selections will be available to cover 700-1900 RPM range +/- 50 RPM
7. Performance data includes cabinet and rain hood effect. Damper pressure drop will have to be added to the return duct static per Table 26, p. 53
8. Outlined area indicates nonstandard BHP or RPM selections. Contact a local Trane representative for more information.

Table 34. Return fan performance—73-89 ton evaporative condensing (36.5″ fan)

CFM	Return Fan Static Pressure Including Exhaust Damper P.D.															
Std.	0.25		0.50		0.75		1.00		1.25		1.50		1.75		2.00	
Air	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
12000	459	1.07	502	1.59	541	2.13	578	2.71	613	3.31	647	3.91	681	4.54	713	5.20
13000	490	1.27	530	1.83	567	2.40	603	3.01	636	3.65	668	4.29	700	4.94	731	5.64
14000	520	1.49	560	2.09	595	2.70	628	3.34	660	3.99	691	4.69	721	5.38	751	6.10
15000	552	1.73	590	2.38	623	3.03	655	3.70	686	4.39	715	5.11	744	5.85	771	6.59
16000	583	2.00	619	2.70	652	3.39	682	4.09	712	4.82	740	5.57	767	6.34	794	7.14
17000	615	2.30	650	3.05	681	3.78	710	4.52	739	5.28	766	6.06	792	6.85	818	7.67
18000	646	2.64	680	3.43	711	4.20	739	4.98	766	5.78	792	6.60	817	7.41	842	8.27
19000	678	3.01	711	3.85	741	4.67	768	5.48	794	6.31	819	7.16	844	8.03	867	8.89
20000	711	3.42	742	4.30	771	5.17	797	6.02	823	6.90	847	7.77	871	8.66	894	9.59
21000	743	3.87	773	4.78	801	5.70	827	6.60	852	7.51	875	8.41	898	9.36	920	10.30
22000	775	4.36	805	5.31	832	6.28	857	7.22	881	8.17	904	9.11	926	10.09	947	11.06
23000	808	4.89	836	5.88	863	6.90	887	7.89	911	8.88	933	9.87	954	10.86	975	11.88
24000	840	5.46	868	6.49	894	7.56	918	8.60	941	9.63	962	10.67	983	11.71	1004	12.75
25000	873	6.08	900	7.15	925	8.26	948	9.35	970	10.42	992	11.49	1012	12.59	1032	13.67
26000	906	6.75	931	7.86	956	9.00	979	10.16	1001	11.28	1021	12.37	1041	13.49	1061	14.63
27000	939	7.47	963	8.62	987	9.79	1010	11.01	1031	12.18	1052	13.33	1071	14.47	1090	15.65

Notes:
1. Max fan RPM 1151 for 36.5" Class I Fan
2. Max motor available 20 HP for 36.5" fan size
3. Max motor available 20 HP for 73, 80 & 89T
4. Max CFM is 27000 for 73, 80 & 89T
5. Min CFM is 12000 for 73, 80 & 89T
6. Return fan belt drive RPM selections will be available to cover 500-1100 RPM range +/- 50 RPM
7. Performance data includes cabinet and rain hood effect. Damper pressure drop will have to be added to the return duct static per table Table 26, p. 53

Table 35. 100% return fan drive selections — 24-89 ton evaporative condensing

	3 Hp		5 Hp		7½ Hp		10 Hp		15 Hp		20 Hp	
Nominal Tons	RPM	Drive No.	RPM	Drive No.	RPM	Drive No.	RPM	Drive No.	RPM	Drive No.	RPM	Drive No.
24	500	5										
	600	6										
	700	7										
	800	8										
	900	9										
	1000	A										
	1100	B										
	1200	C										
	1300	D										
29	500	5	1100	B								
	600	6	1200	C								
	700	7	1300	D								
	800	8	1400	E								
	900	9	1500	F								
	1000	A	1600	G								
	1100	B										
	1200	C										
	1300	D										
36	500	5	1100	B	1400	E						
	600	6	1200	C	1500	F						
	700	7	1300	D	1600	G						
	800	8	1400	E								
	900	9	1500	F								
	1000	A	1600	G								
	1100	B										
	1200	C										
	1300	D										
48			700	7	1200	C	1400	E				
			800	8	1300	D	1500	F				
			900	9	1400	E	1600	G				
			1000	A	1500	F	1700	H				
			1100	B								
			1200	C								
			1300	D								
59			700	7	1200	C	1400	E	1600	G		
			800	8	1300	D	1500	F	1700	H		
			900	9	1400	E	1600	G	1800	J		
			1000	A	1500	F	1700	H	1900	K		
			1100	B								
			1200	C								
			1300	D								
73			500	5	700	7	800	8	900	9	1100	B
			600	6	800	8	900	9	1000	A		
			700	7	900	9	1000	A	1100	B		
			800	8								
80, 89			500	5	700	7	800	8	900	9	1100	B
			600	6	800	8	900	9	1000	A		
			700	7	900	9	1000	A	1100	B		
			800	8								

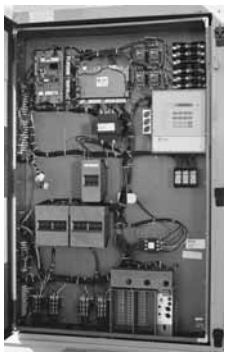
Controls

Variable Air Volume (VAV) Only

Sequence Of Operation

Note: *When noted in this sequence "Human Interface Panel," the reference is to both the unit-mounted and remote-mounted Human Interface Panel. All setpoint adjustments can be accomplished at the unit or Remote Human Interface Panel.*

Supply Air Pressure Control



VFD Control

Variable frequency drives are driven by a modulating 0-10 VDC signal from the Rooftop Module (RTM). 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 Human Interface Panel. Variable frequency drives provide supply fan motor speed modulation. The drive will accelerate or decelerate as required to maintain the supply static pressure setpoint.

When subjected to high ambient return conditions the VFD shall reduce its output frequency to maintain operation. Bypass control is offered to provide full nominal airflow in the event of drive failure.

Supply Air Static Pressure Limit

The opening of the VAV boxes are coordinated during unit startup and transition to/from Occupied/Unoccupied modes to prevent overpressurization 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 Human Interface Panel, the supply fan/VFD is shut down. The unit is then allowed to restart three times. If the overpressurization condition occurs on the third time, the unit is shut down and a manual reset diagnostic is set and displayed at the Human Interface Panel.

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 Human Interface Panel. If the enthalpy of the outside air is appropriate to use "free cooling," the economizer will be used first to 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 fresh air dampers open. The rate of economizer modulation is based on deviation of the discharge temperature from setpoint, i.e., the further away from setpoint, the faster the fresh air damper will open. First stage of cooling will be allowed to start after the economizer reaches full open.

Note that 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. For comparative enthalpy economizer control, outdoor air enthalpy must be below the enthalpy of the return air.

At outdoor air conditions above the enthalpy control setting, mechanical cooling only is used and the fresh air dampers remain at minimum position.

If the unit does not include an economizer, mechanical cooling only is used to satisfy cooling requirements. Outdoor air dampers may be set manually for a maximum of 25 percent outdoor air, if rooftop is equipped with 0 to 25 percent manual fresh air damper.

Heating: Hot Water or Steam

On units with hot water or steam heating, the supply air temperature can be controlled to a heating set point during the Occupied mode. The supply air temperature heating set point and deadband are user-defined at the Human Interface Panel. Discharge Temperature Control occupied heating on hot water and steam heat units is enabled by closing a field-supplied switch or contacts connected to a changeover input on the RTM.

Heating: Modulating Gas

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

If ignition is not proven, the ignition transformer is de-energized. After a time delay, another pre-purge cycle takes place, followed by another attempt to ignite. If ignition fails a second time, the heating section will be shut down and locked out until manually reset at the unit mounted Human Interface Panel.

As additional heat is required, the air damper opens, increasing 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. After one minute, another 60 second pre-purge and ignition cycle begins. As the heating requirement is satisfied, the UCM will reduce 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.

Supply Air Setpoint Reset

Supply air 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 reset adjustment is available from the Human Interface Panel for supply air heating and supply air cooling control.

A - reset based on outdoor air temperature. 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 subcooling 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 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 Human Interface Panel.

- beginning reset temperature

- ending reset temperature

- maximum amount of temperature reset

B - reset based on zone temperature. Zone reset is applied to the zone(s) in a building that tend to overcool or overheat. 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.

Zone Temperature Control

Unoccupied Zone Heating and Cooling

During Unoccupied mode, the unit is operated as a CV unit. VAV boxes are driven full open. The unit controls zone temperature within the Unoccupied zone cooling and heating (heating units only) deadbands.

Daytime Warm-up

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 Warm-up is initiated. The system changes over to CV zone temperature control heating (full unit airflow), the VAV boxes are fully opened and full heating capacity is provided until the Daytime Warm-up setpoint is reached. The unit is then returned to normal Occupied mode.

Outdoor Air CFM Compensation

The purpose of this feature is to modulate the minimum position of the economizer to compensate for varying unit airflows in VAV units, thereby minimizing the large variation of outdoor air CFM that can occur. The feature allows the user to set (calibrate) the economizer minimum position with the VFD at 0 percent and at 100 percent. On units with VFD and economizer, the minimum position of the economizer is modulated based on VFD speed.

Single Zone Variable Air Volume (SZVAV) Only

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 VAV/CV 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.

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.

VFD Control

Single Zone VAV units will be equipped with a VFD-controlled supply fan which will be controlled via a 0-10VDC signal from the Rooftop Module (RTM). With the RTM supply fan output energized and the RTM VFD output at 0VDC, the fan speed output is 37% (22Hz) from the VFD by default; and at 10VDC the fan speed output is 100% (60Hz). The control scales the 0-10VDC VFD output from the RTM linearly to control between the 37-100% range. 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. Bypass control is offered to provide full nominal airflow in the event of drive failure.

Ventilation Control

Units configured for Single Zone VAV control will require special handling of the OA Damper Minimum Position control in order to compensate for the non-linearity of airflow associated with the variable supply fan speed and damper combinations. Units configured for Traq™ with or without DCV will operate identically to traditional units with no control changes.

Space Pressure Control

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 Exhaust Enable Setpoint.

For SZVAV an Exhaust Enable Setpoint must be selected during the 100% Fan Speed Command. Once selected, the difference between the Exhaust 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 Exhaust Enable Target, which will be used throughout the Supply Fan Speed/OA Damper Position range.

The Exhaust Enable Target could be above or below the Active Building Design OA Minimum Position Target Setpoint, based on the Active Exhaust Enable Setpoint being set above or below the Building Design Minimum Position at 100% Fan Speed Command. Note that an Exhaust Enable Setpoint of 0% will result in the same effect on Exhaust 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 setup 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

Unoccupied Mode

In Unoccupied mode the unit will utilize setback setpoints, 0% Minimum OA Damper position, and Auto Fan Mode operation as on normal CV units. The Supply Fan speed, and cooling and modulating types of heat, will be controlled to the discharge air target setpoint as is done during occupied periods. The Supply fan speed during staged heat control will be forced to 100% as on normal CV units.

Occupied Heating Operation

Occupied heating operation has two separate control sequences; staged and modulated. All staged heating types will drive the supply fan to maximum flow and stage heating to control to the Zone Heating Setpoint. For units with Hydronic and Gas heat, modulated SZVAV Heating.

On an initial call for heating, the supply fan will drive to the minimum heating airflow. On an additional call for heating, the heat will control in order to meet the calculated discharge air target setpoint. As the load in the zone continues to request heat operation, the supply fan will ramp-up while the control maintains the heating discharge air temperature. Heating can be configured for either the energy saving SZVAV Heating solution as described above, or the traditional, less efficient CV Heating solution.

Compressor (DX) Cooling

Compressor control and protection schemes will function identical to that of a traditional unit. Normal compressor proving and disable input monitoring will remain in effect as well as normal 3-minute minimum on, off, and inter-stage timers. Also, all existing head pressure control schemes will be in effect.

Cooling Sequence

If the control determines that there is a need for active cooling capacity 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 that 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 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 ± ½ discharge air target deadband.

Constant Volume (CV) Only

Sequence Of Operation

Occupied Zone Temperature Control

Cooling/Economizer

During Occupied cooling mode, the economizer (if provided) and mechanical cooling are used to control zone temperature. If the enthalpy of outside air is appropriate to use "free cooling", the economizer will be used first to attempt to satisfy the cooling zone temperature setpoint; then the compressors will be staged up as necessary. Minimum on/off timing of compressors prevents rapid cycling.

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

Note that 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. For comparative enthalpy economizer control, outdoor air enthalpy must be below the enthalpy of the return air.

At outdoor air temperatures above the enthalpy control setting, mechanical cooling only is used and the outdoor air dampers remain at minimum position. If the unit does not include an economizer, mechanical cooling only is used to satisfy cooling requirements. Outdoor air dampers may be set manually for a maximum of 25 percent outdoor air, if rooftop is equipped with 0 to 25 percent manual fresh air damper.

Heating

Gas Heating: Two-Stage

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

If ignition is not proven, the ignition transformer is de-energized. After a time delay another pre-purge cycle takes place followed by another attempt to ignite. If ignition fails a second time, the

cycle repeats on 235 and 350 MBh modules. 500, 850 and 1000 MBh modules, the heating section will be shut down and locked out until manually reset at the unit mounted Human Interface Panel.

As additional heat is required, the UCM will close the second stage heating contacts and depending on heat module size, will open either the second stage of the gas valve, or a second stage gas valve.

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. After one minute, another 60 second pre-purge and ignition cycle begins.

As the heating requirement is satisfied, the UCM will open the second stage heating relay, de-energizing the second stage of heat. When the requirement is fully satisfied, the first stage contacts are opened, de-energizing the first stage of heat. The specific sequence of operation of the gas heat will depend on the size of the heat exchanger.

Gas Heating: Modulating Gas

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

If ignition is not proven, the ignition transformer is de-energized. After a time delay, another pre-purge cycle takes place, followed by another attempt to ignite. If ignition fails a second time, the heating section will be shut down and locked out until manually reset at the unit mounted Human Interface Panel.

As additional heat is required, the air damper opens, increasing 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. After one minute, another 60 second pre-purge and ignition cycle begins.

As the heating requirement is satisfied, the UCM will reduce 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 three stages of electric heat will be sequenced on the zone demand signal from the zone sensor. The signal is sent to the UCM and the stages are sequenced based on load demand.

Hot Water or Steam Heating

Upon a call for heat, the UCM will send a varying voltage signal to the valve actuator. The valve will modulate to meet building demand as indicated by the voltage signal. When heating is satisfied, the valve will modulate closed.

A temperature sensor is located on the coldest section of the coil. When it senses an impending freeze condition, a signal is sent to the hydronic valve to drive it full open. If the supply fan is on, or if the outside air damper is open when this freezing condition is sensed, the supply fan is turned off and the outside air damper is closed.

Auto Changeover

When the System Mode is "Auto" the mode will change to cooling or heating as necessary to satisfy the zone cooling and heating setpoints. The zone cooling and heating setpoints can be as close as 2°F apart.

Unoccupied Zone Temperature Control

Cooling and Heating

Both cooling or heating modes can be selected to maintain Unoccupied zone temperature deadbands. For Unoccupied periods, heating, economizer operation or compressor operation can be selectively locked out at the Human Interface Panels.

CV, SZVAV, and VAV

Note: *SZVAV exceptions are noted in parenthesis*

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 and deadband. As the economizer opens, the building pressure rises and enables the exhaust/return fan and dampers or exhaust VFD. The exhaust/return dampers or VFD then modulate to maintain space pressure within the deadband.

Morning Warm-up (Not applicable to SZVAV)

This feature is available on all types of factory-installed heat units and on units with no heat, this function may still be selected to support systems with heat sources not provided by the rooftop unit. At the conclusion of Unoccupied mode, while the economizer (if supplied) is kept closed, the selected zone is heated to the user-defined Morning Warm-up setpoint. The unit is then released to Occupied mode. There are two types of Morning Warm-up: full capacity or cycling capacity.

1. Full Capacity Morning Warm-up (MWU)

Full capacity Morning Warm-up uses full heating capacity, and heats the zone up as quickly as possible. Full heating capacity is provided until the Morning Warm-up setpoint is met. At this point, the unit is released to Daytime mode.

2. Cycling Capacity Morning Warm-up (MWU)

Cycling capacity Morning Warm-up 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 warm-up is used to overcome the "building sink" effect. Cycling capacity MWU will operate until MWU setpoint is reached or for 60 minutes, then the unit switches to Occupied mode.

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 unoccupied output relay contacts on the Rooftop Module (RTM) or by using changeover thermostats. Either of these methods will assure adequate airflow through the unit and satisfactory heating of the building.*

Supply Air Tempering

Hot water, steam, and modulating gas units only - When supply air temperature falls below the supply air temperature deadband low end, the heating valve is modulated open to maintain the set minimum supply air temperature.

Ventilation Override Module (VOM)

The user can customize up to five (5) 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 (5) corresponding binary input 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 deenergized for any VOM sequence. The factory default definitions for each mode are as follows:

UNIT OFF sequence “A”

When complete system shutdown is required the following sequence can be used.

- Supply Fan - Off
- Supply Fan VFD - Closed/Min (if so equipped)
- Exhaust Fan - Off; Exhaust Dampers Closed (if so equipped)

- OA Dampers - Closed; Return Damper - Open
- Heat - All heat stages off; Mod Heat output at 0 VDC
- Occupied/Unoccupied/VAV box output - Deenergized
- VOM Relay - Energized
- Preheat Output - Off
- Return Fan - Off; Exhaust Dampers - Closed (if so equipped)
- Return VFD - Min (if so equipped)
- OA Bypass Dampers - Open (if so equipped)
- Exhaust Bypass Dampers - Open (if so equipped)

PRESSURIZE sequence "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.

- Supply Fan - On
- Supply Fan VFD - Max (if so equipped)
- Exhaust Fan - Off; Exhaust Dampers Closed (if so equipped)
- OA Dampers - Open; Return Damper - Closed
- Heat - All heat stages off; Mod Heat output at 0 VDC
- Occupied/Unoccupied/VAV box output - Energized
- VOM Relay - Energized
- Preheat Output - Off
- Return Fan - Off; Exhaust Dampers - Closed (if so equipped)
- Return VFD - Min (if so equipped)
- OA Bypass Dampers - Open (if so equipped)
- Exhaust Bypass Dampers - Open (if so equipped)

EXHAUST sequence "C"

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.

- Supply Fan - Off
- Supply Fan VFD - Closed/Min (if so equipped)
- Exhaust Fan - On; Exhaust Dampers Open (if so equipped)
- OA Dampers - Closed; Return Damper - Open
- Heat - All heat stages off; Mod Heat output at 0 VDC
- Occupied/Unoccupied/VAV box output - Deenergized
- VOM Relay - Energized
- Preheat Output - Off
- Return Fan - On; Exhaust Dampers - Open (if so equipped)
- Return VFD - Max (if so equipped)
- OA Bypass Dampers - Open (if so equipped)
- Exhaust Bypass Dampers - Open (if so equipped)

PURGE sequence "D"

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.

- Supply Fan - On
- Supply Fan VFD - Max (if so equipped)
- Exhaust Fan - On; Exhaust Dampers Open (if so equipped)
- OA Dampers - Open; Return Damper - Closed

- Heat - All heat stages off; Mod Heat output at 0 VDC
- Occupied/Unoccupied/VAV box output - Energized
- VOM Relay - Energized
- Preheat Output - Off
- Return Fan - On; Exhaust Dampers - Open (if so equipped)
- Return VFD - Max (if so equipped)
- OA Bypass Dampers - Open (if so equipped)
- Exhaust Bypass Dampers - Open (if so equipped)

PURGE with duct pressure control sequence "E"

This sequence can be used when supply air control is required for smoke control.

- Supply Fan - On
- Supply Fan VFD - (If so equipped) Controlled by Supply Air Pressure Control function; Supply Air Pressure High Limit disabled
- Exhaust Fan - On; Exhaust Dampers Open (if so equipped)
- OA Dampers - Open; Return Damper - Closed
- Heat - All heat stages off; Mod Heat output at 0 VDC
- Occupied/Unoccupied/VAV box output - Energized
- VOM Relay - Energized
- Preheat Output - Off
- Return Fan - On; Exhaust Dampers - Open (if so equipped)
- Return VFD - Max (if so equipped)
- OA Bypass Dampers - Open (if so equipped)
- Exhaust Bypass Dampers - Open (if so equipped)

Emergency Override

When a LonTalk® or BACnet communication module is installed, the user can initiate from the Trane Tracer Summit (in the case of LCI), Tracer SC or 3rd Party BAS (with either BCI or LCI) one of five (5) predefined, not available to configure, Emergency Override sequences. All compressors, condenser fans and the humidification output are deenergized for any Emergency Override sequence. Each Emergency Override sequence commands the unit operation as follows:

EMERG_PRESSURIZE:

- Supply Fan - On
- Supply Fan VFD - Open/Max (if so equipped)
- Exhaust Fan - Off; Exhaust Dampers Closed (if so equipped)
- OA Dampers - Open; Return Damper - Closed
- Heat - All heat stages off; Mod Heat output at 0 VDC
- Occupied/Unoccupied/VAV box output - Energized
- VOM Relay - Energized (if so equipped)
- Preheat Output - Off
- Return Fan - Off; Exhaust Dampers - Closed (if so equipped)
- Return VFD - Min (if so equipped)

EMERG_DEPRESSURIZE:

- Supply Fan - Off
- Supply Fan VFD - Closed/Min (if so equipped)
- Exhaust Fan - On; Exhaust Dampers Open/Max (if so equipped)
- OA Dampers - Closed; Return Damper - Open
- Heat - All heat stages off; Mod Heat output at 0 VDC
- Occupied/Unoccupied/VAV box output - Energized
- VOM Relay - Energized (if so equipped)

- Preheat Output - Off
- Return Fan - On; Exhaust Dampers - Open (if so equipped)
- Return VFD - Max (if so equipped)

EMERG_PURGE:

- Supply Fan - On
- Supply Fan VFD - Open/Max (if so equipped)
- Exhaust Fan - On; Exhaust Dampers Open (if so equipped)
- OA Dampers - Open; Return Damper - Closed
- Heat - All heat stages off; Mod Heat output at 0 VDC
- Occupied/Unoccupied/VAV box output - Energized
- VOM Relay - Energized (if so equipped)
- Preheat Output - Off
- Return Fan - On; Exhaust Dampers - Open (if so equipped)
- Return VFD - Max (if so equipped)

EMERG_SHUTDOWN:

- Supply Fan - Off
- Supply Fan VFD - Closed/Min (if so equipped)
- Exhaust Fan - Off; Exhaust Dampers Closed (if so equipped)
- OA Dampers - Closed; Return Damper - Open
- Heat - All heat stages off; Mod Heat output at 0 VDC
- Occupied/Unoccupied/VAV box output - Energized
- VOM Relay - Energized (if so equipped)
- Preheat Output - Off
- Return Fan - Off; Exhaust Dampers - Closed (if so equipped)
- Return VFD - Min (if so equipped)

EMERG_FIRE - Input from fire pull box/system:

- Supply Fan - Off
- Supply Fan VFD - Closed/Min (if so equipped)
- Exhaust Fan - Off; Exhaust Dampers Closed (if so equipped)
- OA Dampers - Closed; Return Damper - Open
- Heat - All heat stages off; Mod Heat output at 0 VDC
- Occupied/Unoccupied/VAV box output - Energized
- VOM Relay - Energized (if so equipped)
- Preheat Output - Off
- Return Fan - Off; Exhaust Dampers - Closed (if so equipped)
- Return VFD - Min (if so equipped)

Human Interface Panel (HI)

The Human Interface (HI) Panel provides a 2 line X 40 character clear English liquid crystal display and a 16 button keypad for monitoring, setting, editing and controlling.The Human Interface Panel is mounted in the unit's main control panel and is accessible through a hatch built into the unit's control panel door.

The optional remote-mount version of the Human Interface (RHI) Panel has all the functions of the unit-mount version except Service Mode.To use a RHI the unit must be equipped with an optional InterProcessor Communications Bridge (IPCB).The RHI can be located up to 1,000 feet from the unit. A single RHI can be used to monitor and control up to 4 rooftops, each containing an IPCB.

Human Interface Panel Main Menu

- STATUS - used to monitor all temperatures, pressures, humidities, setpoints, input and output status. The
- CUSTOM key allows the user to customize a status report-consisting of up to (4) screens of the data available in the main Status menu.
- SET POINTS - used to edit all factory preset Default setpoints
- DIAGNOSTICS - used to review active and historical lists of diagnostic conditions. A total of 49 different diagnostics can be read at the Human Interface Panel. The last 20 diagnostics can be held in an active history buffer log.
- SETUP - Control parameters, sensor selections, setpoint source selections, output definitions, and numerous other points can be edited in this menu. All points have factory preset values so unnecessary editing is kept to a minimum.
- CONFIGURATION - Preset with the proper configuration for the unit as it ships from the factory, this information would be edited only if certain features were physically added or deleted from the unit. For example, if a field supplied Trane Communication Interface (TCI) module or Ventilation Override Module was added to the unit in the field, the unit configuration would need to be edited to reflect that feature.
- SERVICE - used to selectively control outputs (for compressors, fans, damper position, etc.) for servicing or troubleshooting the unit. This menu is accessible only at the unit-mounted Human Interface Panel.

Generic Building Automation System Module (GBAS)

Generic Building Automation System Module (GBAS 0-5 VDC)

The Generic Building Automation System Module (GBAS 0-5 VDC) available on IntelliPak™ 20-75 ton air-cooled/24-89 ton evaporative condensing is used to provide broad control capabilities for building automation systems other than Trane's Tracer system. The following inputs and outputs are provided:

Analog Inputs - Four analog inputs, controlled via a field provided potentiometer or a 0-5 VDC signal, that can be configured to be any of the following:

1. Occupied Zone Cooling Setpoint (CV & SZVAV)
2. Unoccupied Zone Cooling Setpoint
3. Occupied Zone Heating Setpoint
4. Unoccupied Zone Heating Setpoint (SZ)
5. Supply Air Cooling Setpoint (CV, SZVAV& VAV with Discharge Temperature Control only)
6. Supply Air Heating Setpoint (CV, SZVAV& VAV with Discharge Temperature Control only)
7. Space Static Pressure Setpoint
8. Supply Air Static Pressure Setpoint (CV & VAV)
9. Minimum Outside Air Flow Setpoint
10. Morning Warm Up Setpoint (CV & VAV)
11. Economizer Dry Bulb Enable Setpoint
12. Minimum Outside Air Position Setpoint
13. Occupied Humidification Setpoint
14. Unoccupied Humidification Setpoint

Binary Outputs - each of the five (5) relay outputs can be mapped to any/all of the available diagnostics.

Binary Input - the single binary input can initiate or terminate the Demand Limit mode of operation via a field supplied switch or contact closure.

Demand Limiting Binary Input - this function is operational on units with a GBAS and is used to reduce electrical consumption at peak load times. There are two types of demand limiting, 50% and 100%. When demand limiting is needed, mechanical cooling and heating operation are either partially (50%), or completely disabled (100%), in order to save energy. The definition of Demand Limit is user definable at the Human Interface Panel. Demand Limit binary input accepts a field supplied switch or contact closure. When the need for demand limiting has been discontinued, the unit cooling/heating functions will again become fully enabled.

Generic Building Automation System Module (GBAS 0-10 VDC)

The Generic Building Automation System Module (GBAS 0-10 VDC) is used to provide broad control capabilities for building automation systems other than Trane's Tracer system. The following inputs and outputs are provided:

Analog Inputs—Four analog inputs, controlled via a field provided potentiometer or a 0-10 VDC signal, that can be configured to be any of the following:

1. Occupied Zone Cooling Setpoint (CV & SZVAV)
2. Unoccupied Zone Cooling Setpoint
3. Occupied Zone Heating Setpoint
4. Unoccupied Zone Heating Setpoint
5. Supply Air Cooling Setpoint (CV, SZVAV & VAV with Discharge Temperature Control)
6. Supply Air Heating Setpoint (CV, SZVAV & VAV with Discharge Temperature Control)
7. Space Static Pressure Setpoint
8. Supply Air Static Pressure Setpoint (CV & VAV)
9. Minimum Outside Air Flow Setpoint
10. Morning Warm Up Setpoint (CV & VAV)
11. Economizer Dry Bulb Enable Setpoint
12. Minimum Outside Air Position Setpoint
13. Occupied Humidification Setpoint
14. Unoccupied Humidification Setpoint

Analog Outputs—Four analog outputs that can be configured to be any of the following:

1. Outdoor Air Temperature
2. Zone Temperature
3. Supply Air Temperature (CV, SZVAV & VAV with Discharge Temperature Control)
4. Supply Air Pressure (SZVAV & VAV)
5. Space Pressure
6. Space Relative Humidity
7. Outdoor Air Relative Humidity
8. Space CO_2 Level
9. Compressor Staging (%)
10. Heat Staging (%)
11. Outdoor Air Damper Position
12. Outdoor Airflow
13. Occupied Humidification Setpoint
14. Unoccupied Humidification Setpoint

Binary Output - the single relay output can be mapped to any/all of the available diagnostics.

Binary Input - the single binary input can initiate or terminate the Demand Limit mode of operation, via a field supplied switch or contact closure.

Demand Limiting Binary Input - this function is operational on units with a GBAS and is used to reduce electrical consumption at peak load times. There are two types of demand limiting, 50% and 100%. When demand limiting is needed, mechanical cooling and heating operation are either partially (50%), or completely disabled (100%), in order to save energy. The definition of Demand Limit is user definable at the Human Interface Panel. Demand Limit binary input accepts a field supplied switch or contact closure. When the need for demand limiting has been discontinued, the unit cooling/heating functions will again become fully enabled.

Frost Avoidance

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 at the unit mounted Human Interface to allow a minimum amount of steam or hot water to flow through the coil and avoid freezing conditions.

Evaporator Coil Frost Protection - Frostat™

A temperature sensor on the evaporator is used to determine if the coil is getting close to a freezing condition. Mechanical cooling capacity is shed as necessary to prevent icing.

The Frostat™ system eliminates the need for hot gas bypass and adds a suction line surface temperature sensor near the TXV bulb location to shut the cooling off 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.

Occupied/Unoccupied Switching

a. Description - 3 ways to switch Occupied/Unoccupied:

(1) NSB Panel

(2) Field-supplied contact closure (hardwired binary input to RTM)

(3) Tracer™ (or 3rd Party BAS with LCI or BCI module)

Trane Tracer or BAS System

The Trane Tracer System or a 3rd party BAS (with LCI or BCI module) can control the Occupied/Unoccupied status of the rooftop.

Night Setback Sensors

Trane's night setback sensors are programmable with a time clock function that provides communication to the rooftop unit through a 2-wire communications link. The desired transition times are programmed at the night setback sensor and communicated to the rooftop.

Night setback (unoccupied mode) is operated through the time clock provided in the sensors with night setback. When the time clock switches to night setback operation, the outdoor air dampers close and heating/cooling can be enabled or disabled depending on set-up parameters. As the building load changes, the night setback sensor energizes the rooftop heating/cooling (if enabled) function and the evaporator fan. The rooftop unit will cycle through the evening as heating/cooling (if enabled) is required in the space. When the time clock switches from night setback to occupied mode, all heating/cooling functions begin normal operation.

When using the night setback options with 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 Unoccupied output relay contacts on the Rooftop Module (RTM) or by using changeover thermostats. Either of these methods will assure adequate airflow through the unit and satisfactory temperature control of the building.

Timed Override Activation - ICS

This function is operational when the RTM is the zone temperature sensor source, which was set up at the Human Interface Panel. When this function is initiated by the push of a override button on the ICS sensor, the Tracer 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 RTM is selected as the Zone Temperature Sensor source, which was set up at the Human Interface Panel. 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.

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 ambient temperature and humidity to the economizer enthalpy control setpoint. If ambient 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 ambient temperature comparing it to the economizer control temperature setpoint. If the ambient 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.

Compressor Lead/Lag

Compressor lead/lag is always set as enabled on all units. After each request for compressor operation, the lead refrigeration circuit or compressor on 24-36 tons units switches, thereby causing a more equitable or balanced run time among compressors. Lead/lag is not available on units with hot gas bypass.

Emergency Stop Input

A binary input is provided on the Rooftop Module (RTM) for installation of field provided switch or contacts for immediate shutdown of all unit functions.

Humidification Control

A relay output is provided to control an externally connected, field supplied humidifier. Logic is provided for Occupied and Unoccupied humidification control with safeguards to prevent cycling between humidification and dehumidification.

Hot Gas Bypass Control

A hot gas bypass valve is installed on circuit 2. The valve modulates hot gas to the inlet of the evaporator when suction pressure falls below valve adjustable setpoint. This feature allows operation at low airflow, while avoiding coil frosting and damage to the compressors.

Return Fan Control

A return fan reduces the load on the supply fan motor or can allow a unit to operate at a higher static pressure. The return fan VFD is modulated independently to maintain desired return air plenum pressure. In all other cases the return fan is turned on or off with the supply fan.

Low Charge Protection

The low charge feature measures the entering and leaving evaporator temperatures on each circuit to calculate a superheat value for each circuit. The superheat value is used for multiple purposes:

- Displayed at the Human Interface panel to assist the service technician with unit charging and diagnostics
- A diagnostic message displayed at the Human Interface panel, 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 Human Interface panel, warning of a low charge situation when the unit is undercharged. The undercharged circuit will be locked out to protect the compressors.

LonTalk® Building Automation System

The LonTalk® Communication Interface for IntelliPak™ (LCI-I) controller expands communications from the unit UCM network to a Trane Tracer Summit or a 3rd party building automation system, utilizing LonTalk®, and allows external setpoint and configuration adjustment and monitoring of status and diagnostics. The LCI-I utilizes an FTT-10A FreeTopology transceiver, which supports non-polarity sensitive, free topology wiring, which 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 Trane Tracer Summit or a 3rd party building automation system that supports LonTalk®. The LCI-I controller is available as a factory or field-installed kit.

BACnet Building Automation System

The BACnet Communication Interface for IntelliPak™ (BCI-I) controller expands communications from the unit UCM network to Tracer SC or a 3rd party building automation system, utilizing BACnet, and allows external setpoint and configuration adjustment and monitoring of status and diagnostics. The BCI-I utilizes the BACnet defined MS/TP protocol as defined in ASHRAE standard 135-2004. This controller works in standalone mode, with Tracer SC or when connected to a 3rd party building automation system that supports BACnet. The BCI-I controller is available as a factory or field-installed kit.

CO_2 Demand Control Ventilation

CO_2 Demand Control Ventilation (DCV) provides ventilation for occupants while reducing energy consumption. It does so by minimizing the OA damper position (units without Traq™) or the OA flow setpoint (units with Traq™), below the Building Design Minimum, per ASHRAE Std 62.1-2004. If the space CO_2 level is below the CO_2 Minimum Setpoint the OA damper shall close to the DCV Minimum OA Damper Setpoint (units without Traq™) or until the DCV Minimum OA flow Setpoint is met (units with Traq™.)

Evaporative Condensing - models 24-89 tons

The evaporative condenser function is a method of head pressure control utilizing water as the condensing medium rather than air. This method of head pressure control provides increased unit efficiency.

The function activates whenever a compressor is active on a circuit. The function modulates the condenser fan to control Saturated Condenser Temperature (SCT) Control Setpoint.

If the saturated condenser temperature continues to rise above the SCT upper limit, sump pump will be energized. Once the temperature falls below the SCT lower limit, the sump pump will be de-energized. The function has sump water freeze protection, periodic partial water flush to reduce contaminant build up, external drain request, and optional water treatment.

Electrical Data

Electrical Service Sizing

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

MCA = (1.25 x LOAD1) + LOAD2 + LOAD4

MOP = (2.25 x LOAD1) + LOAD2 + 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 reselect the lowest standard maximum fuse size which is equal to or larger than the MCA, provided the reselected fuse size does not exceed 800 amps.*

RDE = (1.5 x LOAD1) + LOAD2 + LOAD4

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

Note: *If the selected RDE is greater than the selected MOP value, then reselect the RDE value to equal the MOP value.*

Set 2. Rooftop units with Electric Heat

b. Single Source Power (380V, 415V, 460V, and 575V)

To arrive at the correct MCA, MOP, and RDE values for these units, you must perform two sets of calculations. First calculate the MCA, MOP, and RDE values as if the unit was in cooling mode (use the equations given in Set 1). Then calculate the MCA, MOP, and RDE values as if the unit were in the heating mode as follows.

(Keep in mind when determining LOADS that the compressors don't run while the unit is in the heating mode).

For units using heaters less than 50 kW.

MCA = 1.25 x (LOAD1 + LOAD2 + LOAD4) + (1.25 x LOAD3)

For units using heaters equal to or greater than 50 kW.

MCA = 1.25 x (LOAD1 + LOAD2 + LOAD4) + LOAD3

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

MOP = (2.25 x LOAD1) + LOAD2 + LOAD3 + 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.

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

RDE = (1.5 x LOAD1) + LOAD2 + LOAD3 + LOAD4

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

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

Note: *If the selected RDE is greater than the selected MOP value, then reselect the RDE value to equal the MOP value.*

Table 36. Compressor electrical service sizing data (24-89 ton)[(a)]

Tonnage (AC/EC)	No. of Compressors	460V	
		RLA	LRA
24 Hi Cap	2	19.1	142
29 Hi Cap	1	19.1	142
	1	22.2	158
36 Hi Cap	1	22.2	158
	1	25.5	197
48 Hi Cap	4	15.9	142
59 Hi Cap	4	20.2	147
73 Hi Cap	4	22.2	158
80 Std	4	25.5	197
89 Hi Cap	2	25.4	160
	2	37.2	215

(a) Evaporative Condenser Units only available in 460V

Table 37. Electrical service sizing data evaporative condenser - All tonnages (24-89T), 460V/60Hz

Condenser Fan			Sump Pump			Sump Heater	
Qty	HP	FLA	Qty	HP	FLA	kW	FLA
1	5.4	5.9	1	0.5	1.55	3	3.8

Table 38. Electrical service sizing data — control power transformer heating and cooling modes — 24-89 tons

Nominal Tons (AC/EC)	Digit 2 Unit Function	Voltage
		460
24,29,36	A,E,L,S,X	1
	F	2
48,59,73	A,E,L,S,X	1
	F	2
80,89	A,E,L,S,X	2
	F	3

Table 39. Electrical service sizing data — crankcase heaters (heating mode on 460 volt only) — 24-89 tons

Nominal Tons (AC/EC)	(Add) FLA
24,29,36	1
48,59,73	2
80,89	3

Table 40. Voltage utilization range

Unit Voltage	Voltage Utilization Range
460/60/3	414-506

Dimensional Data

Figure 10. Heating/cooling unit dimensions (ft. in.) — 24-89 ton evaporative condensing

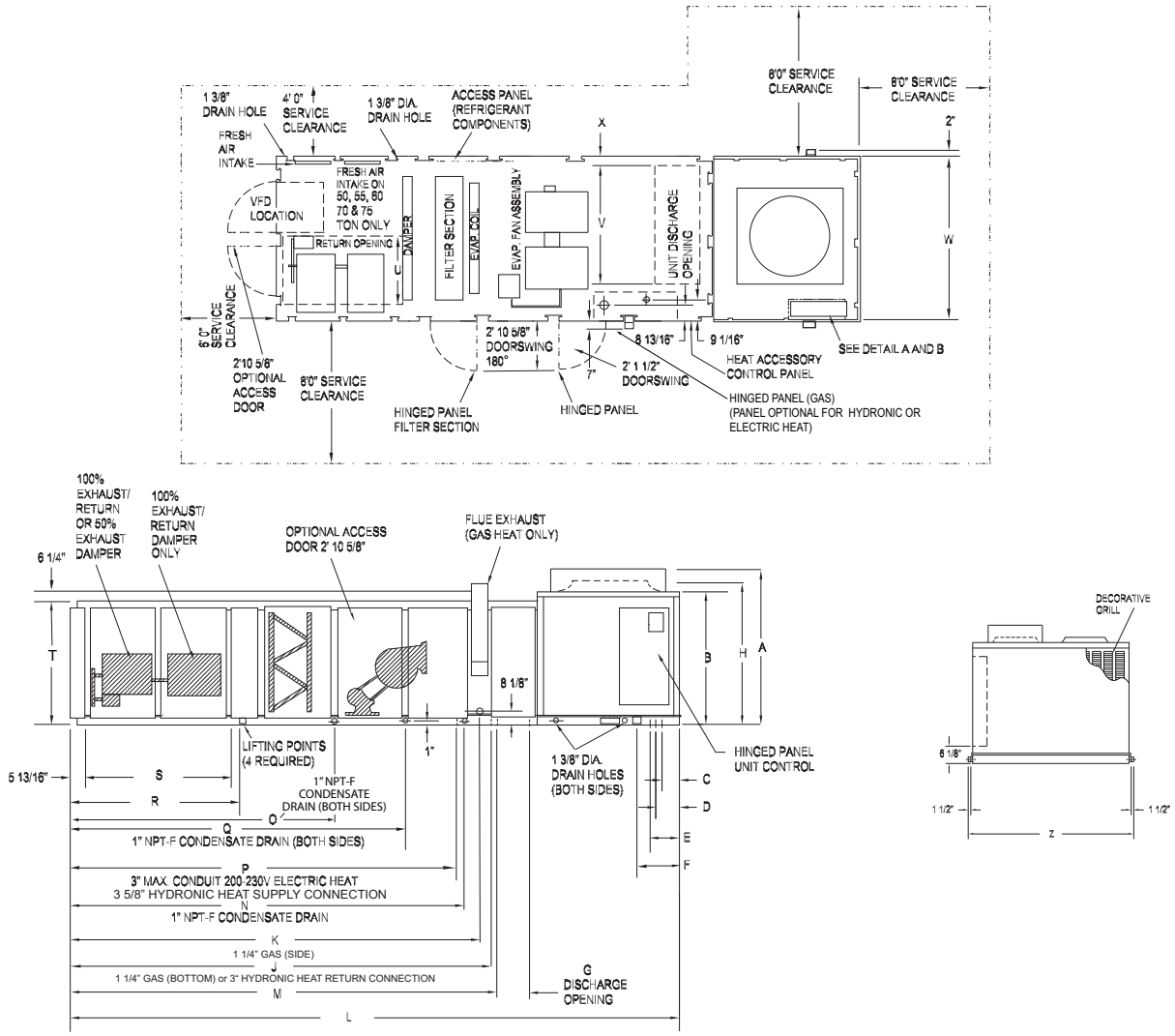


Table 41. Heating/cooling unit dimensions (ft. in.)— 24-89 ton evaporative condensing

Nom. Tons	H	L	W	A[4]	B	C	D	E	F	G	J[(a)]	K[(a)]	M
24 & 29	8-4 3/4	26-5 1/2	7-6 1/2	NA	6-9	0-9 7/8	1-5 7/8	1-10 1/8	2-2 1/2	2-2 1/2	16-9 3/4	16-6	16-3 13/16
											16-9 3/4	16-6	
36	8-4 3/4	26-5 1/2	7-6 1/2	NA	6-9	0-9 7/8	1-5 7/8	1-10 1/8	2-2 1/2	2-2 1/2	16-9 3/4	16-6	16-3 13/16
											16-9 3/4	16-6	
48	8-4 3/4	32-10 1/2	7-6 1/2	NA	6-9	0-9 7/8	1-5 7/8	1-10 1/8	2-2 1/2	2-5	20-1 3/4	19-6	19-10 5/16
											20-6 3/4	20-3	
59	8-4 3/4	32-10 1/2	7-6 1/2	NA	6-9	0-9 7/8	1-5 7/8	1-10 1/8	2-2 1/2	2-5	20-1 3/4	19-6	19-10 5/16
											20-6 3/4	20-3	
73, 80 & 89	8-4 3/4	32-10 1/2	9-8	NA	6-9	0-9 7/8	1-5 7/8	1-10 1/8	2-2 1/2	2-5	20-1 3/4	19-6	19-10 5/16
											20-6 3/4	20-3	

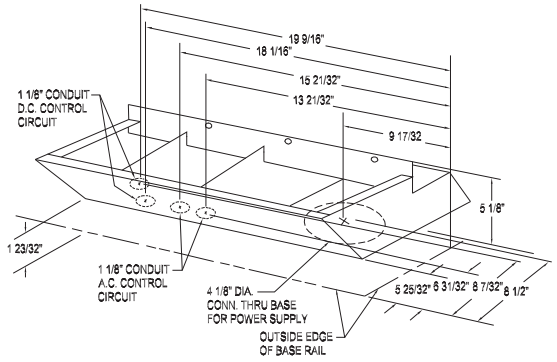
Table 41. Heating/cooling unit dimensions (ft. in.)— 24-89 ton evaporative condensing (continued)

Nom. Tons	N	O	P	Q	R	S		T	U		V	X	Z
						w/ exhaust fan	w/ return fan		w/ exhaust fan	w/ return fan			
24 & 29	16-7	10-7	15-5 5/16	13-3	7-0	6-6 15/16	3-0	3-9 5/16	3-4 3/8	2-9 15/16	5-7	0-5 13/16	7-9 1/2
36	16-7	10-7	15-5 5/16	13-3	7-0	6-6 15/16	3-0	4-9 5/16	3-4 3/8	2-9 15/16	5-7	0-5 13/16	7-9 1/2
48	19-7	12-1	18-11 11/16	15-11 1/8	8-0	7-8 3/16	3-4	5-9 5/16	3-4 3/8	3-1½	5-7	0-5 13/16	7-9 1/2
59	19-7	12-1	18-11 11/16	15-11 1/8	8-0	7-8 3/16	3-4	6-9 3/8	3-4 3/8	3-1½	5-7	0-5 13/16	7-9 1/2
73, 80 & 89	19-7	12-1	18-11 11/16	15-11 1/8	8-0	7-8 3/16	4-5	5-9 5/16	4-5 3/8	4-2½	7-8½	0-5 13/16	9-11

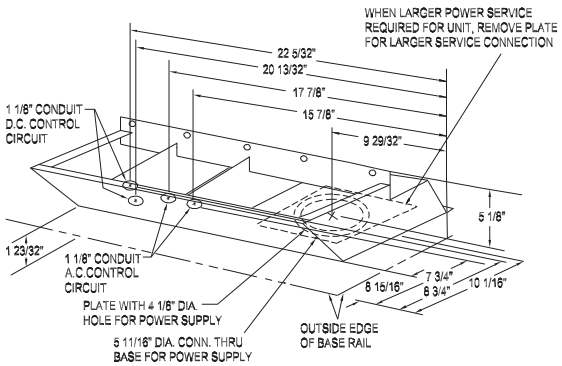
Notes:
1. Unit drawing is representative only and may not accurately depict all models.
2. Use high gas heat J dimension for all hydronic heat connections
3. Low ambient dampter (A) not used with evaporative condensing units.

(a) In columns J and K: top dimension = high gas heat, bottom dimension = low gas heat.

Figure 11. Cooling only unit dimensions - detail A and B — 24-89 ton

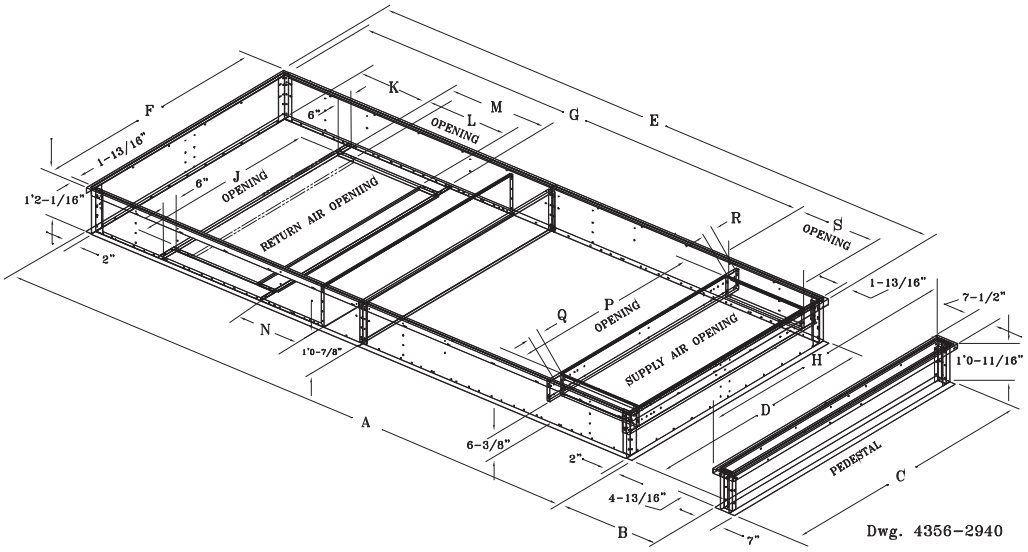


Detail "A" covers 20-59 ton units



Detail "B" covers 60-89ton units

Figure 12. Optional roof curb dimensions (downflow) — 24-89 ton evaporative condensing



Note:
1. The pedestal was purposely designed 1 3/8" shorter than the curb because the unit base rails rest on the pedestal at one point and on the curb at a different point.

Table 42. Downflow roof curb dimensions (ft. in.) — 24-89 ton evaporative condensing

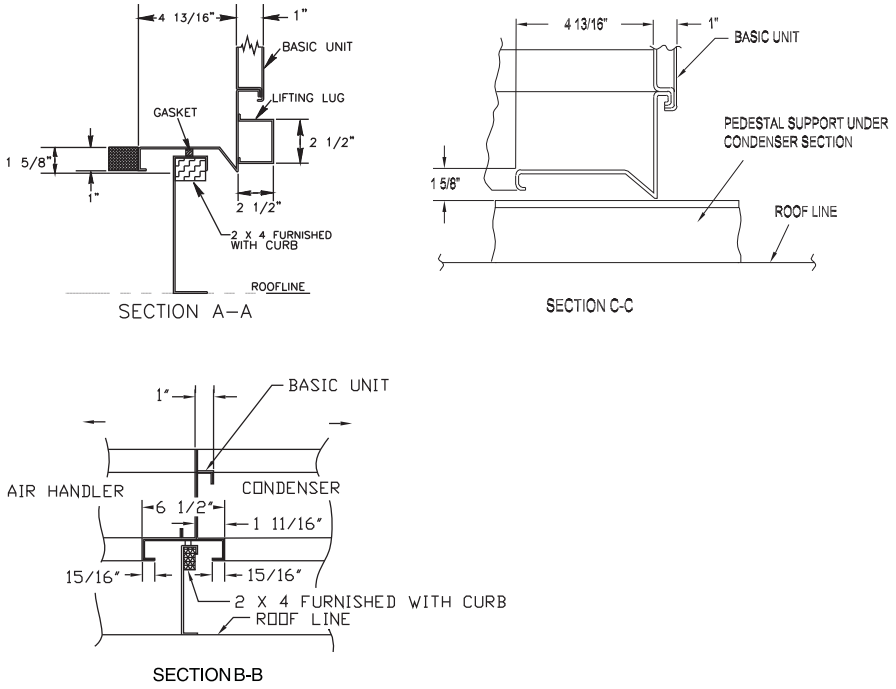
Tons	Model[a]	A	B	C	D	E	F	G	H	J
24,29,36	S*HL	18'-7 1/2"	4'-8 1/16"	7'-10 7/16"	7'-0 13/16"	18'-7 3/16"	7'-0 1/2"	15'-10 9/16"	7'-11 15/16"	5'-8 13/16"
48, 59	SAHL	19'-1 15/16"	7'-10 1/16"	7'-10 7/16"	7'-0 13/16"	19'-1 5/8"	7'-0 1/2"	16'-2 9/16"	7'-11 15/16"	5'-8 13/16"
	S*HL	22'-4 1/2"	7'-10 1/16"	7'-10 7/16"	7'-0 13/16"	22'-4 1/8"	7'-0 1/2"	19'-5"	7'-11 15/16"	5'-8 13/16"
73,80,89	SAHL	19'-1 15/16"	7'-10 1/16"	9'-11 15/16"	9'-2 5/16"	19'-1 5/8"	9'-2"	16'-2 9/16"	10'-1 7/16"	7'-10 5/16"
	S*HL	22'-4 1/2"	7'-10 1/16"	9'-11 15/16"	9'-2 5/16"	22'-4 1/8"	9'-2"	19'-5"	10'-1 7/16"	7'-10 5/16"

Tons	Model	K	L	M	N	P	Q	R	S
24,29,36	S*HL	2'-0"	3'-6"	4'-0"	1'-10 5/8"	5'-7 3/8"	0'-1 13/16"	0'-2 1/4"	2'-5 15/16"
48, 59	SAHL	2'-0"	3'-6"	4'-0"	1'-10 5/8"	5'-9 1/2"	0'-5 11/16"	0'-5 11/16"	2'-5 15/16"
	S*HL	2'-0"	3'-6	4'-0	1'-10 5/8"	5'-7 3/8"	0'-11 3/16"	0'-2 1/4"	2'-5 15/16"
73,80,89	SAHL	2'-0"	3'-6"	4'-0"	1'-10 5/8"	6'-11 7/8"	0'-11 3/16"	0'-11 3/16"	2'-5 15/16"
	S*HL	2'-0"	3'-6"	4'-0"	1'-10 5/8"	7'-8 3/4"	0'-11 3/16"	0'-2 3/8"	2'-5 15/16"

Note: The return opening of the roof curb is provided with an adjustable filler panel six inches wide. This panel allows adjustment of the return air opening in order to clear roof members of all standard roof constructions with both the supply and return openings. The return air opening of the curb is at a 90 degree angle as compared to the rooftop return air opening to allow this placement flexibility. The curb acts as a plenum between the ductwork and the unit return opening. A retainer clip is used to secure the adjustable filler piece to the roof curb.

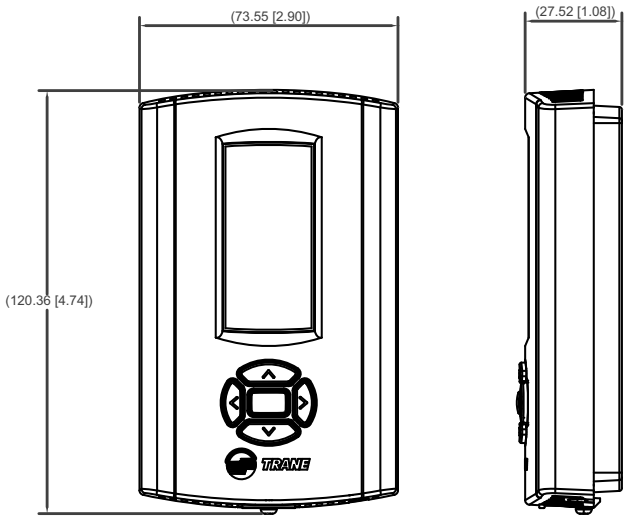
(a) Evaporative condenser units (24, 29, 36, 48, 59, 73, 80 and 89T) are not available with SAHL models.

Cross section thru roof curb and base pan



Field Installed Sensors

Figure 13. Field installed zone sensor—programmable night setback sensor (BAYSENS119*)



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

Dimensional Data

Figure 14. Field installed zone sensor—dual setpoint, manual/automatic changeover with system function lights (BAYSENS110*), without LED function lights (BAYSENS108*), single setpoint without LED function lights (BAYSENS106)

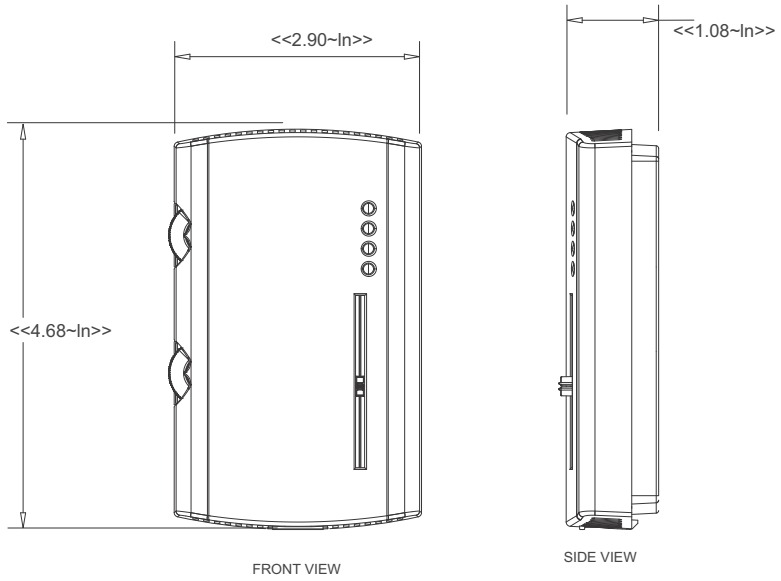
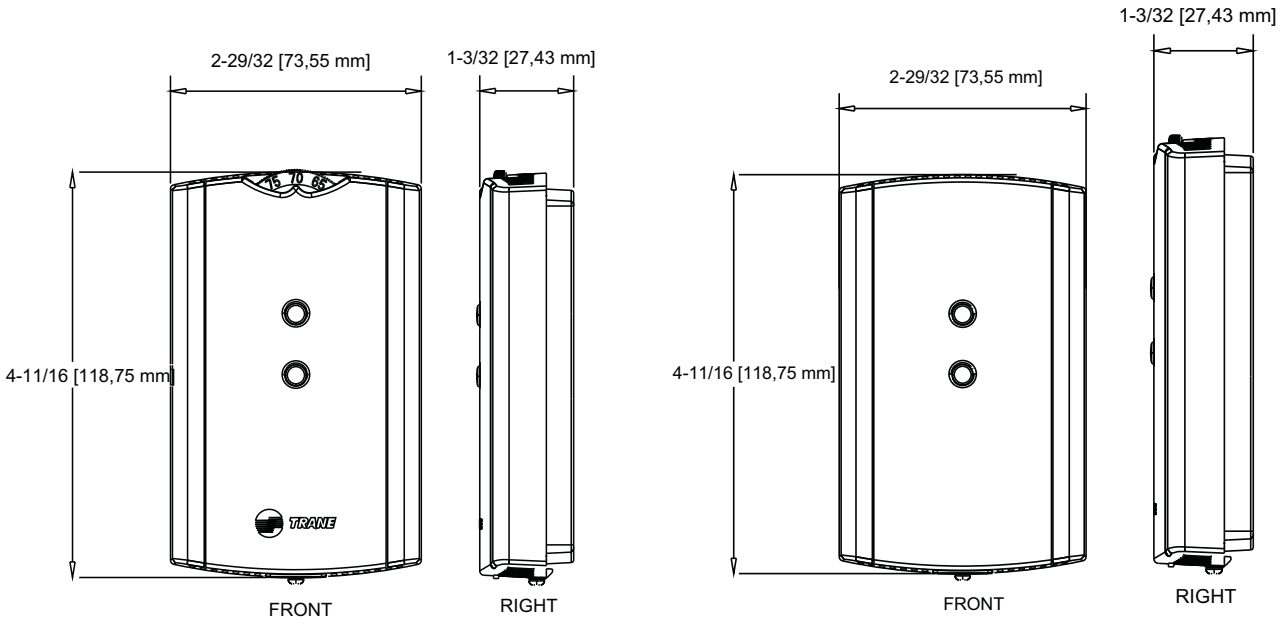


Figure 15. Field installed zone sensor—with timed override button and local setpoint adjustment (BAYSENS074*), with timed override only (BAYSENS073*), sensor only (BAYSENS077*)



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

Figure 16. Field installed temperature sensor (BAYSENS016*)

Figure 17. Field installed remote minimum position potentiometer control (BAYSTAT023*)

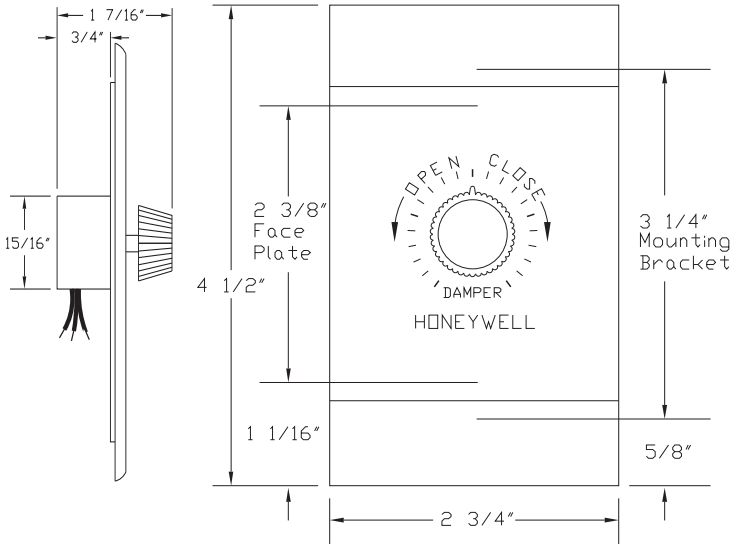
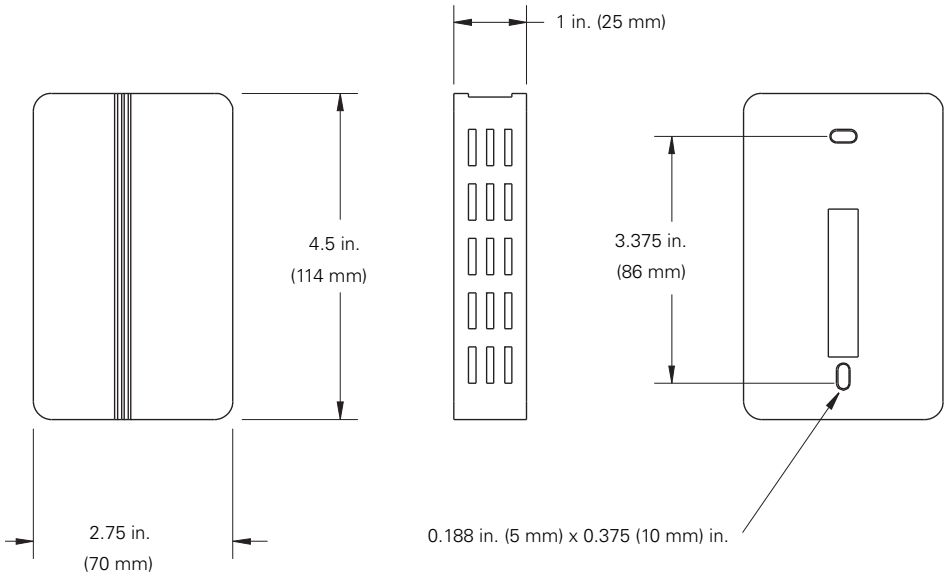


Figure 18. Field installed humidity sensor—wall (BAYSENS036*) or duct mount (BAYSENS037*)



Weights

Table 43. Evaporative Condenser - approximate operating weight (Lbs/Kg)

Unit		Without Exhaust Fan				With Exhaust Fan			
		SX	SE	SF	SL/SS	SX	SE	SF	SL/SS
24	Lb	6549	6679	6944	6763	6907	7037	7302	7121
	Kg	2971	3030	3150	3068	3133	3192	3312	3230
29	Lb	6599	6729	6994	6813	6963	7093	7358	7177
	Kg	2993	3052	3172	3090	3158	3217	3338	3255
36	Lb	7121	7251	7513	7335	7538	7668	7933	7752
	Kg	3230	3289	3409	3327	3419	3478	3598	3516
48	Lb	9001	9156	9631	9359	9585	9740	10215	9943
	Kg	4083	4153	4369	4245	4348	4418	4633	4510
59	Lb	9213	9368	9843	9571	9856	10011	10486	10214
	Kg	4179	4249	4465	4341	4471	4541	4756	4633
73	Lb	11303	11458	11933	11691	12128	12283	12758	12516
	Kg	5127	5197	5413	5303	5501	5571	5787	5677
80	Lb	11430	11585	12060	11818	12255	12410	12885	12643
	Kg	5185	5255	5470	5361	5559	5629	5845	5735
89	Lb	11820	11975	12450	12208	12645	12800	13275	13033
	Kg	5361	5432	5647	5537	5736	5806	6021	5912

Notes:

1. Weights shown for evaporative condensing units include the following features: high capacity evaportive coil and the weight of the extra structure associated with the two piece unit. Add 520 lbs for 24, 29, 36, 48 and 59 units and 680 lbs for 73, 80 and 89 units for installed sump base water weight for evaportive-cooled condenser total operating weight.
2. Weights shown represent approximate operating weights and have a ±5% accuracy. To calculate weight for a specific unit configuration, utilize TOPSS™ or contact the local Trane sales representative. ACTUAL WEIGHTS ARE STAMPED ON THE UNIT NAMEPLATE.

Options

Table 44. Comprehensive listing of available options and accessories[a]

Option or Accessory	Standard	Factory Design Special[b][c]	Enhanced Design Facility Special[b][c]	Standard Field Installed Accessory
Coils				
Complete Coat evaporator coils		X		
Black epoxy evaporator coils		X		
Copper finned evaporator coils		X		
Controls				
LonTalk® Communication Interface (LCI)	X			X
BACnet Communication Interface (BCI)	X			X
Wireless Comm Interface (WCI)				X
Generic BAS (Building Automation System) interface	X	X		
Inter-Processor Communication Bridge	X	X		
Kits available for field control upgrades				X
Remote Human Interface Panel (controls up to 4 units)	X			
Remote minimum position control for economizer				X
Single Zone VAV	X			
Outside Air Measurement (Traq™)	X			
Variable frequency drive (VFD) control of supply/exhaust fan motor	X			
Ventilation override module (five ventilation override sequences)	X			
Curbs				
Roof curbs				X
Roof curbs-Special design, including curbs for "twinning" large units together			X	
Dampers				
0-25 percent manual dampers	X			
Barometric relief exhaust dampers		X		
Low leak dampers for 0-100 percent modulating outside air economizer	X	X		
Drain Pans				
Positively sloping evaporator coil drain pan		X		
Stainless steel positively sloping evaporator coil drain pan		X		
Economizer				
0-100 percent modulating outside air economizer	X			
Economizer control options: comparative enthalpy, reference enthalpy, dry bulb	X			
Energy Recovery				
Energy Recovery Wheel			X	
Electrical				
Convenience Outlet (Factory-powered 15A GFI)	X			
Dual power source		X		
Unit disconnect - through-the-door, non-fused disconnect with external handle	X			
Phase monitors	X			
Power factor correction capacitors - compressors and fans		X		
Evaporative Condenser				
Evaporative Condenser	X			
Sump Heater	X			
Dolphin WaterCare® system	X			

Table 44. Comprehensive listing of available options and accessories[a] (continued)

Option or Accessory	Standard	Factory Design Special[b][c]	Enhanced Design Facility Special[b][c]	Standard Field Installed Accessory
Conductivity Controller	X			
Fans				
100 percent modulating exhaust w/or without Statitrac space pressure control	X			
100 percent modulating return w/ or without Statitrac space pressure control	X			
50 percent modulating exhaust	X			
eDrive™ direct drive plenum supply fans - 80% width and 120% width		X		
Alternative supply fans			X	
Horizontal Return fans		X		
Filters, Filter Racks and Related Tools				
90-95 percent bag filters	X			
90-95 percent cartridge filters	X			
90-95 percent bag or cartridge final filters and rack		X		
Filter rack - 4" deep panel rack placed in standard rack location		X		
High efficiency throwaway filters	X			
Replaceable core filter driers		X		
Differential pressure gauge		X		
Heat				
Heat modules		X		
Heating options: natural gas, electric, hot water or steam	X			
Modulating gas heat - full or limited	X			
Propane (LP) conversion / Modulating LP heat		X		
Insulation				
Double wall with perforated interior liner		X		
Manville Tuf-Skin® insulation w/ 25/50 flame/smoke development rating		X		
Solid double wall		X		
Motors				
Totally enclosed fan-cooled (TEFC) motors		X		
Totally enclosed non-ventilated (TENV) motors - Condenser fan only		X		
Motors with internal shaft grounding ring for VFD applications	X			
1.5 HP motor - exhaust fan		X		
Two-speed motors - supply fan		X		
Other				
Access doors (hinged)	X	X		
Burglar Bars			X	
Extended grease lines		X		
Horizontal supply and return openings (SX,SL,SS,SL models only)		X		
Hot gas bypass to the evaporator inlet	X			
Outside air CFM compensation on VAV units with VFD and economizer	X			
Reversal of return/outside air sections with exhaust fans			X	
Safety grates installed over supply and return		X		
Special paint colors		X		

Table 44. Comprehensive listing of available options and accessories[a] (continued)

Option or Accessory	Standard	Factory Design Special[b][c]	Enhanced Design Facility Special[b][c]	Standard Field Installed Accessory
Spring isolators	X			
Suction service valves		X		
Ultra-extended cabinet to accommodate field installed humidifiers,final filters, sound attentuators, wing coils, air blenders, special filters, etc.			X	
Vertical discharge, S_HL 24-89 tons (SX,SL,SS,SL models only)		X		
VFD line reactor		X		
VFD - Enclosure for field installed VFD		X		
Sensors and Thermostats				
Humidity sensor				X
ICS zone sensors used with Tracer system for zone control				X
High duct temperature thermostats	X			
Outdoor temperature sensor for units without economizers				X
Programmable sensors with night set back — CV and VAV				X
Remote zone sensors — used for remote sensing with remote panels				X
Sensors without night set back — CV and VAV				X
Warranty				
10 year limited warranty on Full Modulation Gas Heat	X			

(a) Options are provided for informational purposes only. For specifics, contact your local Trane sales office.
(b) Special Options may be subject to a net price add.
(c) For information on agency approval for special designs, contact your local Trane sales office.

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 R-410A compressor oil, factory run tested and shipped in one piece. 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, exhaust air system, optional non-fused disconnect switches and all operating and safety controls shall be furnished factory installed.

All units shall be UL listed to US and Canadian Safety Standards. Cooling capacity shall be rated 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 500 hours consecutive salt spray application in accordance with standard ASTM B117. Screws shall be coated with zinc-plus-zinc chromate. Heavy gauge steel hinged access panels with tiebacks to secure door in open position shall provide access to filters and heating sections.

Refrigeration components, supply air fan and compressor shall be accessible through removable panels as standard. Unit control panel, filter section, and gas heating section shall be accessible through hinged access panels as standard. Optional DoubleWall Construction hinged access doors shall provide access to filters, return/exhaust air, heating and supply fan section. All access doors and panels shall have neoprene gaskets. Interior surfaces or exterior casing members shall have ½ inch Manville Tuf-Skin® fiberglass insulation. Unit base shall be watertight with heavy gauge formed load bearing members, formed recess and curb overhang. Unit lifting lugs shall accept chains or cables for rigging. Lifting lugs shall also serve as unit tiedown points.

Refrigeration System

Compressors

The Trane 3-D® scroll compressors have a simple mechanical design with only three major moving parts. Scroll type compression provides inherently low vibration. The 3-D® scroll provides a completely enclosed compressor chamber with optimized scroll profiles which leads to increased efficiency. The 3-D® scroll includes a direct-drive, 3,600 rpm, suction gas cooled hermetic motor. Dependent on the compressor model, motor protection is provided by either a patented motor cap and integral line break motor protector or an external 24 VAC module which provides protection against incorrect phase sequence, excess motor temperatures, over current protection, and phase loss.

Trane 3-D® compressor includes centrifugal oil pump, scroll tips seals, internal heat shield that lowers the heat transfer from discharge and suction gas, oil level sight glass and oil charge valve. Some compressor models also provide a dip tube that allows for oil draining, in addition to a low leakage internal discharge check valve to help prevent refrigerant migration. 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.

Phase and Voltage Monitor

Standard on all evaporative condensing units. Protects 3-phase equipment from phase loss, phase reversal and low voltage. Any fault condition will produce a Failure Indicator LED and send the unit into an auto stop condition. cULus approved.

Power Supplies

The evaporative condenser units are available with 460 voltage power supply.

Evaporator Coil

Internally enhanced copper tubing of 3/8 or ½-inch O.D. shall be mechanically bonded to heavy-duty aluminum fins of configured design. All coils shall be equipped with thermal expansion valves and factory pressure and leak tested.

Evaporative Condensing

Evaporative Condensing-Pump

Minimal maintenance sump pump is fully accessible through the evaporative-condenser access panel. Water is pumped at a minimum 50 GPM. The pump shall be powered by 460V/3-phase.

Evaporative Condensing-Fan

The condenser fans are variable speed and are modulated based on head pressure control which is determined by the unit controls.

Evaporative Condensing-Housing

The water basin, corner posts and roof shall be constructed with 304 Stainless Steel. Water basin shall be lined with FRP coating to make it watertight. The side panels and sliding access doors shall be constructed of corrosion and UV resistant, low density fiberglass. Housing shall also have 4 lifting holes, one in each corner to handle the unit with crane.

Evaporative Condensing-Coils

Durable copper 5/16" OD, 0.022 wall thickness serpentine tubing provides strength and resilience for expansion.

Evaporative Condensing-Sump Float Level Switch

Water level in the Evaporative Condensing-Sump is maintained by a mechanical fill valve that is adjusted to a predetermined point. The sump consists of two float switches to ensure proper water levels are being maintained. The minimum level float switch shall protect the sump pump from running dry by de-energizing all stages of mechanical cooling and the sump pump, if the water ever drops below the minimum level.

The sump heater will also be de-energized in low water level conditions. The maximum level float switch shall prevent the overfilling of the sump and water wastage by de-energizing the fill valve when a predefined maximum level is reached in the sump. The level switches shall be permanently affixed to the water basin and shall not require any field adjustment.

Water Treatment

To simplify field installation of water treatment, unit shall have hookups for water treatment devices. A water conductivity controller shall be offered as an option. Water treatment is required for all evaporative condenser units to ensure proper equipment life, product performance and operation. If Dolphin WaterCare® system is used, water must be maintained by a water treatment professional throughout the unit's life cycle.

Dolphin WaterCare® System

The Dolphin WaterCare® System focuses on minimizing scale build up and managing biological agents with no chemicals. An electronic signal is sent through a PVC pipe at a constant rate, inducing electromagnetic fields. The electromagnetic fields interact with colloidal particles causing precipitation, which does not adhere to the pipe, and is removed through the sump purge. Bacteria and corrosion in the water system is controlled and kept to minimal levels by their incorporation into the precipitate and low frequency radiation generated through the electronic pulsing.

Air Handling System

Supply Fan

Supply fan motors are open drip-proof. All supply fans shall be dynamically balanced in factory. Supply fan shall be test run in unit and shall reach rated rpm. All 60 Hz supply fan motors meet the Energy Independence Security Act of 2007 (EISA). All 50 Hz supply fan motors meet the U.S. Energy Policy Act of 1992 (EPACT).

Evaporative Condensing with Forward Curved Supply Fan

Supply fans shall have two double-inlet, forward-curved fans mounted on a common shaft with fixed sheave drive. Fans shall be factory-tested to reach rated rpm before the fan shaft passes through first critical speed. Fan shaft shall be mounted on two grease lubricated ball bearings designed for 200,000 hours average life. Optional extended grease lines shall allow greasing of bearings from unit filter section. 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 assembly shall be completely isolated from unit and fan board by double deflection rubber-in-shear isolators, or by optional 2" deflection spring isolation.

System Control

- Constant Volume Zone Temperature Control - Provided with all the necessary controls to operate rooftop from a zone sensor, including CV microprocessor unit control module, a microprocessor compressor controller and a unit mounted Human Interface Panel.
- Constant Volume with Discharge Temperature Control - Provided with all the necessary controls to operate a CV rooftop with discharge air temperature control, 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.
- CV Zone Temperature Control and Exhaust/Return Fan Variable Frequency Drives w/o Bypass (with Statitrac Only) - Provided with all the necessary controls to control/maintain building space pressure through a CV rooftop. The Variable Frequency Drive (VFD) modulates the speed of the exhaust/return fan motor in response to building pressure.

  A differential pressure control system, called Statitrac, uses a differential pressure transducer to compare indoor building pressure to atmospheric pressure. The VFD receives a 0-10 VDC signal from the unit microprocessor based upon the space static pressure and causes the drive to accelerate or decelerate as required to maintain the space pressure within the deadband.
- CV Zone Temperature Control and Exhaust/Return Fan Variable Frequency Drives and Bypass (with Statitrac Only) -Bypass control provides full nominal airflow in the event of drive failure.
- VAV Discharge Temperature Control with Variable Frequency Drives without Bypass - Provided with all 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 discharge air temperature reset capabilities. Includes factory installed and tested variable frequency drives (VFD) to provide supply fan motor speed modulation. VFD receives 0-10 VDC from the unit microprocessor based upon supply static pressure and causes the drive to accelerate or decelerate as required to maintain the supply static pressure setpoint.
- VAV Supply Air Temperature Control with Variable Frequency Drives and Bypass - Bypass control provides full nominal airflow in the event of drive failure.
- Single Zone Variable Air Volume - Single Zone VAV option shall be provided with all necessary controls to operate a rooftop unit based on maintaining two temperature setpoints: discharge air and zone. Option shall include factory-installed variable frequency drive (VFD) to provide supply fan motor speed modulation. During One Zone VAV cooling, the unit will maintain zone cooling setpoint by modulating the supply fan speed more or less to meet zone load demand; and the unit will maintain discharge temperature to the discharge cooling setpoint by modulating economizer if available and staging dx cooling.

Controls

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. Unit mounted microprocessor controls shall provide anti-short cycle timing for compressors to provide a high level of machine protection.

Unit Controller

DDC microprocessor controls shall be provided to control all unit functions. The control system shall be suitable to control CV or VAV applications. The controls shall be factory-installed and mounted in the main control panel. All factory-installed controls shall be fully commissioned (run tested) at the factory.

The unit shall have a Human Interface Panel with a 16 key keypad, a 2 line X 40 character clear English display as standard to provide the operator with full adjustment and display of control data functions. The unit controls shall be used as a stand-alone controller, or as part of a building management system involving multiple units.

1. The unit shall be equipped with a complete microprocessor control system. This system shall consist of temperature and pressure (thermistor and transducer) sensors, printed circuit boards (modules), and a unit mounted Human Interface Panel. Modules (boards) shall be individually replaceable for ease of service. All microprocessors, boards and sensors shall be factory mounted, wired and tested.

   The microprocessor boards shall be stand-alone DDC controls not dependent on communications with an on-site PC or a Building Management Network. The microprocessors shall be equipped with on-board diagnostics, indicating that all hardware, software and interconnecting wiring are in proper operating condition.

   The modules (boards) shall be protected to prevent RFI and voltage transients from affecting the board's circuits. All field wiring shall be terminated at separate, clearly marked terminal strip.

   Direct field wiring to the I/O boards is not acceptable. The microprocessor's memory shall be non-volatile EEPROM type requiring no battery or capacitive backup, while maintaining all data.

2. Zone sensors shall be available in several combinations with selectable features depending on sensor.

3. The Human Interface Panel's keypad display character format shall be 40 characters x 2 lines. The character font shall be 5 x 7 dot matrix plus cursor. The display shall be Supertwist Liquid Crystal Display (LCD) with blue characters on a gray/green background which provides high visibility and ease of interface. The display format shall be in clear English. Two or three digit coded displays are not acceptable.

4. The keypad shall be equipped with 16 individual touch-sensitive membrane key switches. The switches shall be divided into four separate sections and be password protected from change by unauthorized personnel. The six main menus shall be STATUS, SETPOINTS, DIAGNOSTICS, SETUP, CONFIGURATION and SERVICE MODE.

Filters

General

Filter options shall mount integral within unit and be accessible by hinged access panels.

No Filters Option (two inch throwaway filter rack only)

Shall provide a complete set of two-inch thick filter racks, without the filter media to accommodate applications which require field supplied filters.

No Filters Option (bag/cartridge with prefilter filter rack)

Shall provide a long-lasting galvanized steel frame without the filter media to accommodate applications which require field supplied filters.

Pre-Evap Filter Options (Available for all units)

- **Throwaway Filters, MERV 4** — Filters are 2" [50.8 mm] thick, UL Class 2, glass fiber type. Filters rated at 80% average synthetic dust weight arrestance when tested in accordance with ASHRAE 52-76 and 52.1 test methods. Filters mounted in galvanized steel rack.
- **Permanent Cleanable Wire Mesh Option, MERV 3** — Shall be washable permanent wire mesh with metal frame.
- **High Efficiency Throwaway Option, MERV 8** — Shall be two-inch high efficiency media filters with average dust spot efficiency of 25-35 percent and an average arrestance in excess of 90 percent when tested in accordance with ASHRAE 52-76.
- **90-95 Percent Bag Filter Option, MERV 14** — Shall have glass fiber media mounted in a galvanized steel frame. These Class 1 single piece disposable bag filters shall have a 90-95% dust spot efficiency rating per ASHRAE 52-76. To ensure maximum bag filter life two-inch MERV 8 prefilters shall be included with the bag filters.
- **90-95 Percent Cartridge Filter Option, MERV 14** — Twelve-inch deep cartridge filters shall be mounted in a galvanized steel frame. Filters shall be Class 1 listed by Underwriters Laboratories and have a 90-95% dust spot efficiency per ASHRAE 52-76. To ensure maximum cartridge filter life, two-inch MERV 8 prefilters shall be provided.

Exhaust Air

General

Return air options shall include no relief, barometric relief, 50 percent exhaust fan, 100 percent modulating exhaust fan and 100 percent modulating exhaust fan with direct space building pressurization control. Exhaust motors are open drip-proof fan cooled. All 60 Hz motors meet the Energy Independence and Security Act of 2007 (EISA). All 50 Hz exhaust motors meet the U.S. Energy Policy Act of 1992 (EPACT).

No Relief (standard)

Rooftops can be built for makeup air applications with no exhaust. Relief air opening shall be sealed with panel and made watertight.

Barometric Relief Option

Gravity dampers shall open to relieve positive pressure in the return air section of the rooftop. Barometric relief dampers shall relieve building overpressurization, when that overpressurization is great enough to overcome the return duct pressure drops.

50 percent Exhaust Fan Option

One, double inlet, forward-curved fan shall be mounted rigidly to base with fixed sheave drive. Fan shall be dynamically balanced and tested in factory. Unit shall reach rated rpm before fan shaft passes through first critical speed. Fan shaft shall be mounted on two grease lubricated ball bearings designed for 200,000 hours average life. Optional extended grease lines shall allow greasing of bearings from unit filter section. Barometric dampers at fan outlet shall prevent air backdraft. Fifty percent exhaust fan shall be an on/off control based on economizer OA damper position.

Modulating 100 Percent Exhaust Fan Option

Two, double-inlet, forward-curved fans shall be mounted on a common shaft with fixed sheave drive. All fans shall be dynamically balanced and tested in factory before being installed in unit. Exhaust fan shall be test run in unit as part of unit test. Unit shall reach rated rpm before fan shaft

passes through first critical speed. Fan shaft shall be mounted on two grease lubricated ball bearings designed for 200,000-hour average life.

Optional extended grease lines shall be provided to allow greasing of bearings from unit filter section. Fan motor and assembly shall be mounted on common base to allow consistent belt tension with no relative motion between fan and motor shafts. On motor sizes larger than five hp entire assembly shall be completely isolated from unit and fan board by double deflection, rubber in shear isolators or spring isolation. Discharge dampers at unit outlet shall modulate exhaust airflow in response to OA damper position.

Modulating 100 Percent Exhaust Fan with Statitrac™ Control Option

Two, double-inlet, forward-curved fans shall be mounted on a common shaft with fixed sheave drive. All fans shall be dynamically balanced and tested in factory before being installed in unit. Exhaust fan shall be test run as part of unit final run test. Unit shall reach rated rpm before fan shaft passes through first critical speed.

Fan shaft shall be mounted on two grease lubricated ball bearings designed for 200,000-hour average life. Optional extended grease lines shall be provided to allow greasing of bearings from unit filter section. Fan motor and assembly shall be mounted on common base to allow consistent belt tension with no relative motion between fan and motor shafts. Entire assembly shall be completely isolated from unit and fan board by double deflection, rubber in shear isolators or spring isolation on motor sizes larger than five hp.

For both CV and VAV rooftops, the 100 percent modulating exhaust discharge dampers (or VFD) 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 FC exhaust fan shall be turned on when required to lower building static pressure setpoint.

The (Statitrac™) control system shall then modulate the discharge dampers (or VFD) to control the building pressure to within the adjustable, specified dead band that shall be adjustable at the Human Interface Panel.

Return Air

General

Return air options shall include 100 percent modulating return fan and 100 percent modulating return with direct space building pressurization control. All 60 Hz motors meet the Energy Independence and Security Act of 2007 (EISA). All 50 Hz exhaust motors meet the U.S. Energy Policy Act of 1992 (EPACT).

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.

A single width plenum fan with airfoil blade can relieve up to 100 percent supply air. The fan operates in conjunction with the supply fan. The relief damper modulates in response to economizer damper position on Constant Volume rooftops.

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.

Option shall be provided with all the necessary controls to control/ maintain building space pressure through a VAV rooftop. The Variable Frequency Drive (VFD) modulates the speed of the return fan motor in response to return plenum pressure.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 dampers to control the building pressure to within the adjustable, specified deadband that shall be adjustable at the Human Interface Panel. The return fan shall modulate in response to return duct static pressure. Optional bypass control provides full nominal airflow in the event of drive failure.

Outside Air

General

Three outside air options: 100 percent return air, 0 to 25 percent manually controlled outside air, and 0-100 percent fully modulating economizer.

Manual Outside Air Option

Manually controlled outside air damper shall provide up to 25 percent outside air. Manual outside air damper shall be set at desired position at unit start-up.

0-100 Percent Modulating Economizer Option

Operated through the primary temperature controls to automatically utilize OA for "free" cooling. Automatically modulated return and OA dampers shall maintain proper temperature in the conditioned space. Economizer shall be equipped with an automatic lockout when the outdoor high ambient temperature is too high for proper cooling.

Minimum position control shall be standard and adjustable at the Human Interface Panel or with a remote potentiometer or through the building management system. A spring return motor shall ensure closure of OA dampers during unit shutdown or power interruption. Mechanical cooling shall be available to aid the economizer mode at any ambient. Low leak economizer dampers shall be standard with a leakage rate of 2.5 percent of nominal airflow (400 CFM/ton) at 1 inch wg. static pressure.

Ultra Low-Leak Economizer Dampers Option

Standard low leak dampers shall be provided with chlorinated polyvinyl chloride gasketing added to the damper blades and rolled stainless steel jamb seals to the sides of the damper assembly. Ultra low-leak economizer dampers shall have a leakage rate of one percent based on testing data completed in accordance with AMCA Standard 500 at AMCA Laboratories.

Economizer Control with Comparative Enthalpy

Used with the outside air economizer, two enthalpy sensors are provided 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

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

Economizer Control with Dry Bulb

Used with the outside air economizer, an outdoor temperature sensor is included for comparing the outdoor dry bulb temperature to a locally adjustable temperature setpoint. The setpoint is programmed at the human interface, or remote human interface, to determine if outdoor air temperature is suitable for economizer operation.

Outside Air Measurement (Traq™)

A factory mounted airflow measurement station (Traq™) shall be provided in the outside air opening to measure airflow. The airflow measurement station shall measure from 40 cfm/ton to maximum airflow. The airflow measurement station shall adjust for temperature variations. Measurement accuracy shall meet requirements of LEED IE Q Credit 1 as defined by ASHRAE 62.1-2007.

Demand Control Ventilation

When equipped with a CO_2 sensor and the (VCM) module, the fresh air damper position shall modulate in response to a CO_2 sensor in the conditioned space, in order to minimize the unit energy consumption and 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.

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 volt electric units shall have optional factory mounted non-fused disconnect switch located in the main control panel to serve the entire unit.

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.

Gas-Fired Heating Option

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

- Heat Exchanger shall be tubular two pass design with stainless steel primary and secondary surfaces. Free floating design shall eliminate expansion and contraction stresses and noises.

Gasketed cleanout plate shall be provided for cleaning of tubes/turbulators. Heat exchanger shall be factory pressure and leak tested.

- Burner shall be a stainless steel industrial type with an air proving switch to prevent burner operation if the burner is open for maintenance or inspection. Ceramic cone shall be provided to shape the flame to prevent impingement on sides of heat exchanger drum. Burner assembly shall house ignition and monitoring electrode.
- Combustion Blower shall be centrifugal type fan to provide air required for combustion. Fan motor shall have built-in thermal overload protection.
- Gas Safety Controls shall include electronic flame safety controls to require proving of combustion air prior to ignition sequence which shall include a 60 second pre-purge cycle. Direct spark ignition shall be provided on 235 and 350 MBh heat exchangers and pilot ignition shall be provided on 500, 850 and 1000 MBh heat exchanger units. Sixty second delay shall be provided between first and second stage gas valve operation on two-stage heaters. Continuous electronic flame supervision shall be provided as standard.
- Full Modulation Gas Heaters shall be made from grades of stainless steel suitable for condensing situations. The heater shall have a turn down ratio of at least 4 to 1.
- Limited Modulation Gas Heaters shall have a minimum turn down ratio of at least 3 to 1.

Miscellaneous Options

- Non-Fused Disconnect Switch with External Handle — External handle enables the operator to disconnect unit power with the control box door closed for safety.
- Hot Gas Bypass — Valve, piping and controls are all included on circuit 2 to allow operation at low airflow, avoiding coil frosting and damage to compressor. When suction pressure falls below valve adjustable setpoint, the valve modulates hot gas to the inlet of the evaporator.
- High Duct Temperature Thermostats — Two manual reset thermostats, one located in the discharge section of the unit set at 240°F and the other in the return section set at 135°F. The rooftop will shut down if the thermostats are tripped.
- High Capacity Units — Units are made high capacity through the use of larger compressors that provide higher refrigerant mass flow rates. All evaporative condensing units are high capacity units.
- Internal Shaft Grounding Ring — Motors have internal bearing protection for use with VFDs to provide a conductive discharge path away from the motor bearings to ground. Bearing Protection Rings are circumferential rings with conductive micro fibers which provide the path of least resistance and dramatically extend motor life.
- Generic Building Automation System Module (GBAS 0-5 VDC) — Provided for those cases where non-Tracer building management system is used. The GBAS module provides a binary input for Demand Limiting, four (4) analog inputs for setpoint adjustment and five (5) relay outputs for diagnostic reporting. Inputs can use a potentiometer or 0-5 VDC signal.
- Generic Building Automation System Module (GBAS 0-10 VDC) — Used to provide broad control capabilities for building automation systems other than Trane's Tracer system. The GBAS module provides a binary input for Demand Limiting, four (4) analog inputs for setpoint adjustment and four (4) analog outputs as well as one (1) relay output for diagnostic reporting. Inputs can use a potentiometer or 0-10 VDC signal.
- Remote Human Interface Panel (RHI) — Remote Human Interface Panel can perform all the same functions as unit mounted Human Interface Panel, except for the Service Mode. Up to 4 rooftop units can be monitored and controlled with a single Remote Human Interface Panel.

  This panel uses the same attractive enclosure as our Tracker™ building management system control panel. With features such as a 2 line X 40 character clear English display, a red LED light to indicate an alarm condition (alarm also shown on the two line display), a simple 16 key keypad that is used in conjunction with the display, to prompt the infrequent user when making

desired changes and an attractive hinged door makes the RHI very suitable for mounting on any wall. The RHI can be mounted inside a building, up to 5,000 feet from the unit. The RHI is wired to the IPCB mounted in the rooftop with twisted wire pair communication wiring and 24V control wiring.

- Ventilation Override Module (VOM) — With the Ventilation Override Module installed, the unit can be 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); this would typically be a hard wired relay output from a smoke detector or fire control panel
- Extended Grease Lines — Lines allow greasing of supply and exhaust fan bearings through the filter access door.
- Access Doors — Hinged access doors provide easy access to supply fan, filters, exhaust fan, and the heating section. These access doors feature double wall construction with dual density insulation sandwiched between heavy gauge galvanized steel panels for strength and durability.
- Inter-Processor Communication Bridge (IPCB) — This module provides an amplified and filtered version of the IPC link for connection to a Remote Human Interface Panel. Each rooftop that is tied into a Remote Human Interface Panel must have a IPCB installed into it.
- Tracer LonTalk® Communication Interface Module — provides control and monitoring of the rooftop by Tracer or to a 3rd party building management system utilizing LonTalk® protocol.
- BACnet Communication Interface Module — provides control and monitoring of the rooftop by Tracer SC or a 3rd party building management system utilizing BACnet protocol.
- GFI Convenience Outlet (Factory Powered) — A 15A, 115V Ground Fault Interrupter convenience outlet shall be factory installed. It shall be wired and powered from a factory mounted transformer. Unit mounted non-fused disconnect with external handle shall be furnished with factory powered outlet.
- Two-Inch Spring Isolators — Supply and exhaust fan (if applicable) assemblies are isolated with two-inch nominal deflection to reduce transmission of vibrations (standard feature on 90-130 tons).
- Special Unit Paint Colors — allows matching of HVAC equipment to building color and sometimes eliminates the need for expensive barrier walls

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 Sensors shall provide two temperature setpoint levers, Heat, Auto, Off, or Cool system switch, Fan Auto or Fan On switch. Optional status indication LED lights, System On, Heat, Cool, and Service shall be available. These sensors shall be used with CV units.
- Programmable Night Setback Sensors shall be electronic programmable sensors with auto or manual changeover with 7 day programming. Keyboard shall provide selection of Heat, Cool, Fan Auto or On. All programmable sensors shall have System On, Heat, Cool, Service LED/ indicators as standard. Night setback sensors shall have (1) Occupied, (1) Unoccupied and (2) Override programs per day. Sensors shall be available for Zone Temperature Control and Supply Air Temperature Control.
- Discharge Temperature Control sensor shall be provided with supply air single temperature setpoint and AUTO/OFF system switch. Status indication LED lights shall include: System On,

Heat, Cool and Service. Sensor shall be provided for zone temperature control for daytime warm-up heat mode.

- Remote Sensor shall be available to be used for remote zone temperature sensing capabilities when zone sensors are used as Remote panels.
- Fast Warm-Up Sensor shall be used as Morning warm-up sensor for Discharge Temperature Control units.
- Integrated Comfort System sensors shall be available with sensor only, sensor with timed override, and sensor with local temperature setpoint adjustment with timed override.
- Remote Minimum Position Potentiometer shall be available to remotely adjust the minimum position setting of the unit's economizer.
- Humidity Sensor - Monitors the humidity levels in the space for Humidification.
- Temperature Sensor - bullet or pencil type sensor that could be used for temperature input such as return air duct temperature.

Field Installed Kits

- Remote Human Interface Panel kit -This kit can control up to four rooftops. The Remote Human Interface Panel has all the features of the Unit Mounted Human Interface Panel, except no service mode interface is allowed remotely for safety reasons. All other modules and their required hardware are available through the Trane service parts organization.
- Trane LonTalk® Communication Interface kit - For future opportunities and upgrade flexibility, this kit contains a LonTalk® Communication Interface (LCI-I) module, which is required for communication with Tracer Summit or a 3rd party building automation system.
- Trane BACnet Communication Interface kit - For future opportunities and upgrade flexibility, this kit contains a BACnet Communication Interface (BCI-I) module, which is required for communication with Tracer SC or a 3rd party building automation system
- Wireless Comm Interface (Field Installed) — Trane Wireless Comm interface provides wireless communication between the Tracer SC, Tracer Unit Controllers and BACnet Communication Interface (BCI) modules.

Note: *BCI required for operation*

Trane optimizes the performance of homes and buildings around the world. A business of Ingersoll Rand, the leader in creating and sustaining safe, comfortable and energy efficient environments, Trane offers a broad portfolio of advanced controls and HVAC systems, comprehensive building services, and parts. For more information, visit www.Trane.com.

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