TRANE®

Product Catalog

Packaged Rooftop Air Conditioners IntelliPak™ 1

Including eFlex™ /eDrive™

Evaporative Condensers — 60 Hz

24 - 89 Tons, S*HL

June 2021

RT-PRC058G-EN

TRANE TECHNOLOGIES™

Introduction

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 rooftop unit control modules (UCM) coordinates the actions of the IntelliPak™ rooftop for reliable and efficient operation and allows for standalone 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.

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 third party LonTalk® or BACnet® building management system, using a twisted pair of wires. Trane also has Air-Fi® Wireless, a state of the art communication platform that minimizes installation time, material, and risk. With any of these optional 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. AHRI certifies up to 63 ton units, all air-cooled units over 63 tons are tested in accordance with the code. The applications in this catalog specifically excluded from the AHRI certification program are ventilation modes, heat recovery, and evaporative condensing.

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Revision History

Updated the Table 8. EER ratings in the General Data chapter.

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Features and Benefits

Standard Features

- 24 - 89 ton industrial/ commercial rooftops
- R-410A refrigerant
- ASHRAE 90.1 - 2016 efficiency compliant
- cULus approval on standard options

Controls

- Fully integrated, factory-installed/commissioned microelectronic controls
- Unit-mounted human interface panel
- Frostat™ coil frost protection
- 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 discharge temp 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
- Discharge service valves

Cabinet

- Hinged access doors on control panel, filter section, and gas heat section
- 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, see "Options," p. 95.

Controls

- LonTalk® communication interface module
- BACnet® communication interface module
- Remote human interface panel (controls up to four 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
- High duct temperature thermostats pressurization control
- Correction capacitors
- Economizer fault detection and diagnostics (FDD) control with ultra low leak economizers

Refrigeration

- Hot gas bypass to the evaporator inlet
- Sump Pump
- Conductivity Controller
- Dolphin WaterCare
- Suction service valves
- High capacity options via compressor and/or coils

Cabinet

- Extended casing (SX models)
- Double wall construction with access doors
- Stainless steel drain pan in evaporator section
- Horizontal Supply and Exhaust/Return on certain configurations
- Special paint colors
- IBC Compliance in certain configurations.

Mechanical

- eDrive™ direct drive plenum design special supply fans; 80%, 100%, or 120% wheel width (24 to 89 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
- Low leak, and Title 24-rated ultra low leak 0-100 percent modulating outside air economizer
- Ultra low leak power exhaust dampers
- Comparative enthalpy, reference enthalpy or dry bulb economizer control
- Trane® outside air measurement (Traq™)
- 50 or 100 percent modulating exhaust with forward-curved fans
- 100 percent modulating return with airfoil fans
- Statitrac™ direct space sensing building pressurization control on 100 perfect exhaust/return

- Two-inch spring fan isolation
- Motors with internal shaft grounding ring for VFD applications

Filtration

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

Heat

- Heating options: natural gas, electric, hot water, or steam
- Modulating gas heat, 4:1 or ultra
- 10 year limited warranty on 4:1 and ultra 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
- Air-Fi® Wireless (WCI)

Features Summary

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

Installation and Service 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 lifting lugs facilitate installation and can be used as unit tie-down points
- 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
- Sloped drain pan for water removal in the evaporator section
- Extended Grease lines on forward-curved fan shaft bearings
- Hinged access on the control panel as well as the filter, supply fan, exhaust/ return fan, and the heating sections

Reliability

- Advanced diagnostics
- Microprocessor controls
- Built-in safeties
- cULus approval as standard
- Factory balanced, forward-curved supply and exhaust fans and airfoil supply and return fans
- Corrosion protected condenser coil provides durability and defense against the destructive effects of alkalies, acids, alcohols, petroleum, seawater, salt air, and corrosive environments
- Internal Shaft Grounding Ring for motor bearing protection
- High fault unit interrupt rating (Short Circuit Current Rating-SCCR) up to 65k
- Fully insulated and gasketed panels reduce ambient air infiltration
- Standard with Frostat™ on all units as well as freeze avoidance on hydronic heat units
- 200,000 hour average fan shaft and motor bearings
- Gas heater with free-floating stainless steel heat exchanger relieves 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 designed to meet demanding operating conditions both in efficiency and reliability
- Phase monitors for compressor protection
- Roll-formed construction enhances cabinet integrity and assures a leak proof casing
- Three-phase, direct-drive condenser fan motors
- Ultra low leak economizer standard with 5-year limited warranty and functional life of 60,000 opening and closed cycles.

Application Flexibility

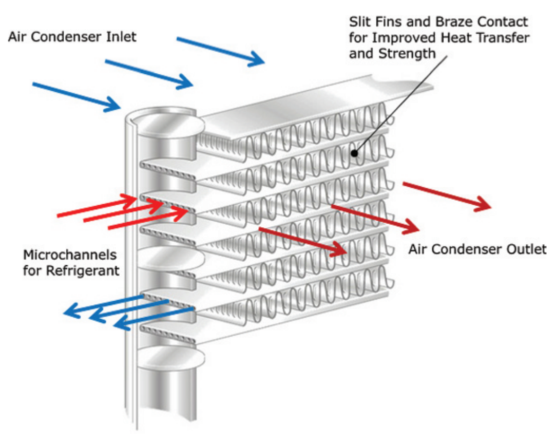
- Modularity in design
- Generic BAS interface
- Five factory preset/re-definable in the field ventilation override sequences
- Superior Tracer® interface for ICS applications
- Superior LonTalk® interface for Tracer® and 3rd party applications
- Superior BACnet® interface for Tracer® SC or 3rd party applications
  - Field-installed Wireless Comm through BCI add available

- Unit-mounted or remote human interface panels
  – all parameters can be edited from the human interface panel
- Multiple supply fan options to meet specific application needs
- Exhaust or return fan options available for building pressure control
- Low ambient cooling available to 0°F
- 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
- 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.

Microchannel Condenser Coil

Microchannel condensing coils are all-aluminum coils with fully-brazed construction. This design reduces risk of leaks and provides increased coil rigidity — making them more rugged on the jobsite. Their flat streamlined tubes with small ports and metallurgical tube-to-fin bond allow for exceptional heat transfer. Microchannel all-aluminum construction provides several additional benefits:

- Light weight (simplifies coil handling)
- Easy to recycle
- Minimize galvanic corrosion



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, but are not limited to, modulating hot gas reheat, eDrive™ Direct Drive Plenum Supply Fans and eFlex™ variable speed compressors.

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 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 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. SZVAV is a quick and simple solution for many applications and is available from your most trusted rooftop VAV system solution provider -Trane.

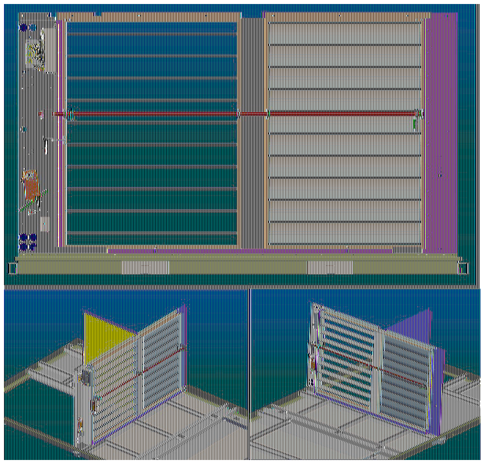
eDrive™ Direct-Drive Plenum Fans

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's belt-less Direct Drive Plenum design allows for less maintenance by requiring no bearing lubrication, and eliminating belt particles clogging the filters. Trane offers two fan widths to optimize fan efficiency for the building system. For 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.

Figure 1. eDrive™ direct-drive plenum fan

Ultra Low Leak, AMCA 1A Damper

Figure 2. Ultra low leak economizer



The Ultra Low Leak AMCA 1A Economizer Damper package will meet or exceed requirements of California Title 24, ASHRAE 90.1, and IECC. The economizer, including linkages and actuators, will have a 5 year limited warranty and functional life of 60,000 opening and closed cycles.

Dampers are AMCA 511 Class 1A certified with a maximum leakage rate of 3 CFM/sq-ft at 1.0 in. WC pressure differential. As part of this option, Fault Detection and Diagnostics (FDD) control is included to meet California requirements. FDD control monitors the commanded position of the economizer compared to the feedback position of the damper. If the damper position is outside of ±10% of the commanded position, a diagnostic is generated.

Ultra low leak power exhaust dampers are also provided on exhaust options that include motorized exhaust dampers when the ultra low leak economizer is ordered.

High Efficiency Unit

This option offers improved unit efficiency. All high-efficiency units meet CEE Tier 2 requirements for unitary equipment. This allows opportunities for owners to take advantage of valuable utility rebates for using energy-efficient equipment.

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. Traq™ dampers are AMCA certified (+/- 5.0%) from 300fpm to 2500fpm, meeting requirements of LEED IE Q Credit 1.

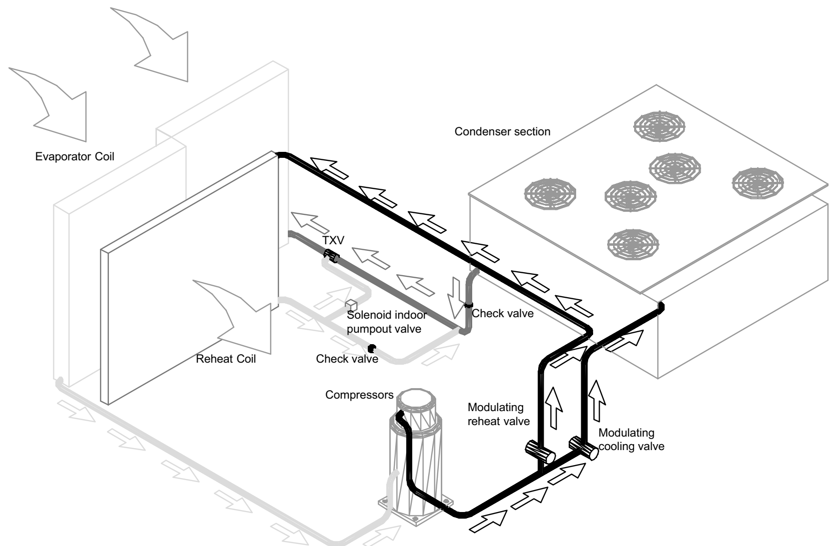
eFlex™ Variable Speed Scroll Compressor

Trane® eFlex™ variable speed scroll compressors are matched with a specially designed variable frequency drive that allows a modulating ratio of up to 4:1. Our eFlex™ compressors are paired with fixed speed compressors such that the units are capable of continuous capacity modulation from 15 to 100%. By design, unit capacity stages overlap to eliminate the frequent cycling between stages typical of competing designs. This allows for unmatched control of leaving air temperatures to meet space loads. The eFlex™ compressors also include brushless permanent magnet motors designed to operate at higher efficiency along with reducing the compressor motor speed and staging results in significant part load energy savings. This makes units with eFlex™ compressors the most efficient products in their class at part load.

Modulating Hot Gas Reheat

By its very nature, the colder the air, the less moisture it contains. With hot gas reheat, hot refrigerant gas leaving the compressor is diverted to a hot gas reheat coil. The cold air leaving the DX coil is then reheated to an acceptable temperature and returned as dehumidified air to the facility space. The modulation of the hot gas reheat helps maintain both temperature and humidity levels in cooling mode, while reducing unit operating costs and saving energy.

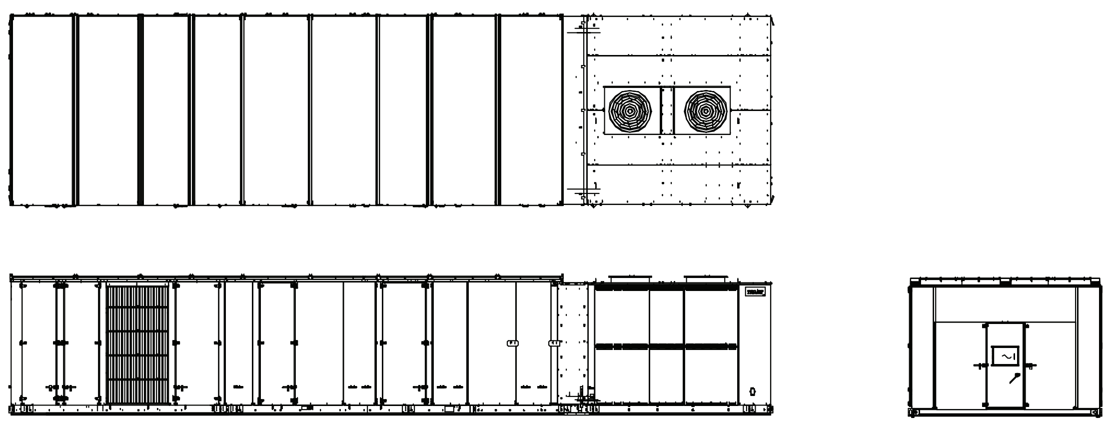
Figure 3. Hot gas reheat



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.

Figure 4. Unit top/left side view—evaporator-cooled condenser



Stainless Steel Sloped Drain Pans

The non-porous, stainless steel surface on these drain pans avoids the harboring of dirt and bacteria, while discouraging microbial growth and helping to promote indoor air quality. The material is easy to clean, long lasting, and extremely durable—all of which minimize drain pan deterioration, which can result in premature leakage. The stainless steel drain pans are sloped to both sides of the IntelliPak unit base rail, allowing for easy and fast water exit.

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 setup to operate under one of three control applications:

- Standalone
- Interface with Trane Tracer building management system

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

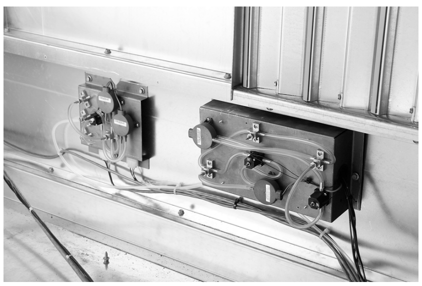
The unit mounted Human Interface and the Remote Human Interface Panels allow for less time spent servicing due to easy to read diagnostics and control adjustments made off of the roof.

All rooftop control parameters are adjustable and can be setup 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.

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 the unit. All diagnostic displays are available at the Remote Human Interface and will be held in memory, so that the operator/service person can diagnose the root cause of failures.

Statitrac Direct Space Building Pressurization Control

Figure 5. Statitrac



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

Building space pressurization control is achieved with a 100 percent modulating exhaust system that features a single forward curved fan, with modulating discharge dampers that operates only when needed or a 100% modulating plenum return fan with airfoil wheel that operates continuously with the supply fan. Most of the operating hours of the 100 percent modulating exhaust system are at part load, resulting in energy savings. Statitrac, with the 100 percent modulating exhaust system, provides comfort and economy for buildings with large rooftop air conditioning systems. Statitrac, with the 100% modulating plenum return fan provides comfort and space pressure control in more demanding applications with high return static pressure, and applications requiring duct returns.

Statitrac control with exhaust fan is simple! The space pressure control turns the exhaust fans on and off as required and modulates exhaust dampers, or fan speed, to maintain space pressure within the space pressure deadband. Economizer and return air dampers are modulated based on ventilation control and economizer cooling request.

The unit mounted Human Interface Panelcan be used to:

- Adjust space pressure setpoint
- Adjust space pressure deadband
- Measure and read building static pressure

The modulating exhaust system maintains the desired building pressure, while saving energy and 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 also be maintained when a variable frequency drive is used.

Statitrac Control with Plenum Return Fan

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:

- Adjust space pressure setpoint
- Adjust space pressure deadband
- Measure and read building space pressure
- 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 may be 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. Further motor reliability is added with the optional Internal Shaft Grounding Ring.

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.

Figure 6. 3-D® scroll compressor

Features listed below optimize the compressor design and performance:

- Optimized scroll profile
- Heat shield protection to reduce heat transfer between discharge and suction gas
- Suction Gas Cooled Motor
- Low Torque Variation
- 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.

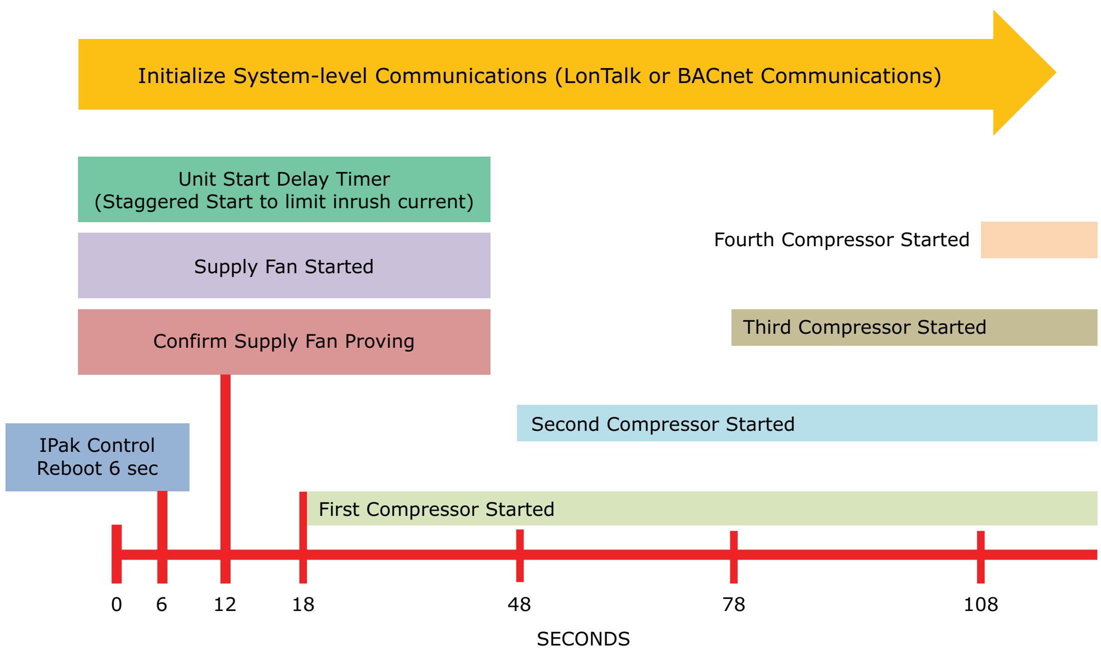
Rapid Restart

Trane understands that every second counts. Trane equipment, controls, and control sequences are designed to get the system back online and properly functioning should the facility experience a power cycle event.

- Trane HVAC system design is optimized for fast restart.
- IntelliPak Rooftop System controls and equipment provide an integrated, pre-engineered solution for fast restart.
- Proven operational procedures maximize uptime outside of critical outages and get the system up and running as quickly as possible.

With Rapid Restart and use of a backup generator, the IntelliPak™ Rooftop System can provide full cooling in 120 seconds or less after regaining electrical power. This option is fully integrated into the IntelliPak controls logic via standard human interface. Rapid Restart is a perfect fit in time-sensitive applications where extended down time is not an option and heating/cooling is crucial.

Figure 7. Rapid restart



Ultra Modulating Gas Heat

The Ultra-Modulating Gas Heat option uses an increased turn-down ratio to offer precise temperature control in heating applications. The ultra modulating turn down ratios are 14 to 1 for 500 Mbh, 18 to 1 for 850 Mbh, and 21 to 1 for 1000 Mbh, and are available in both low and high heat. For specific unit heating inputs, please reference the General Data section.

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 a LonTalk® Communication Interface (LCI) or Tracer® SC with BACnet® Communication Interface (BCI).

The Tracer TCI Integrated Comfort™ System (ICS) improves job profit and increases job control by combining Trane rooftop units with the Trane Tracer building management system. These integrated systems provide total building comfort and control. Some of the primary motivations for building owners/managers in deciding to purchase a HVAC controls system are energy savings, cost control, and the convenience of facility automation.

Integrated Comfort with LonTalk Communication

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 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.

Integrated Comfort with BACnet Communication

The Trane SC BACnet Control Interface (BCI-I) 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 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).

Diagnostic Points	Control Points	Setup and Configuration
All self-contained unit diagnostics	Cooling and heating setpoints	Supply fan mode
System setpoints	Zone setpoint offsets	Configuration of supply air reset
System sensor inputs	VAV discharge air setpoints	Ventilation override mode configuration
Supply fan mode and status	Supply air pressure setpoint	Default system setpoint values
VFD speed	Space pressure setpoint	Sensor calibration offsets
Unit heat/cool mode	Zone and outdoor temperature values	
Economizer position & setpoints	Cooling and heating enable/disable	
On/off status of each compressor	Economizer enable/disable	

Diagnostic Points	Control Points	Setup and Configuration
Evaporator and saturated condenser temps	Economizer setpoint	
Hydronic heat valve position	Economizer minimum position	
Electric heat stage status	Activation of ventilation override modes	
Ventilation override mode status	Diagnostics reset	
	Unit priority shutdown	
	Timed override activation	

Trane Air-Fi® Wireless Communication

Trane Air-Fi® Wireless replaces the need for wired building controls, allowing installations to be completed quickly with less disruption to occupants in existing buildings, while also providing greater reliability, simplified installation and more flexibility as building spaces change. Many building owners face challenges connected to maintenance and repair with traditional wired systems, which fail when wires are cut or disconnected or fail intermittently when damaged. Air-Fi Wireless can help optimize any building's performance with less risk, thanks to self-repairing mesh technology that features redundant signal paths to help prevent communication failures.

Trane offers a typical 200-foot indoor signal range, with up to four times the number of paths, extending up to half-mile when unobstructed for even greater levels of signal reliability. With a battery life that's three times what competitors offer, the lifetime battery[1] eliminates the need to replace batteries over the life of the system in most installations and saves time and money. Air-Fi Wireless is a ZigBee® Certified Building Automation solution, and the system is built on a platform that supports BACnet® open standards. This allows customers to integrate devices in the future when the building expands or changes. Wireless sensors are easy to move or replace, as needed, to resolve issues related to sensing accuracy, aesthetics or reconfigured spaces.

Trane Air-Fi Wireless also conforms to the IEEE 802.15.4 standard, so customers get a wireless BAS communication system that reliably coexists with other wireless systems, including Bluetooth® and Wi-Fi® — without interference. There's no security risk with Air-Fi Wireless, which uses a separate, secure network from those used by a building's IT system. Air-Fi Wireless secures building automation networks by the use of AES-128 encryption, keys and device authentication.

The Trane Air-Fi Wireless interface is available factory-installed and addressed as a design special to expedite installation and reduce labor and upfront costs. It also ensures higher installation quality that results in better building performance for customers because the work is done in a controlled environment, making it more repeatable and consistent. To learn more about Trane Air-Fi Wireless technology, visit www.trane.com.

1. *Based on typical indoor operating conditions.*

Controls

Rapid Restart (RR) Only

The IntelliPak™ controls platform will support rapid restart unit startup after every power cycle occurs. There will be no assumptions about how long the unit has been OFF, so the unit will perform the same startup sequence with each occurrence.

The following is a list of the control operations:

- This is a cooling only function and will not function with heating.
- RR will target a four-minute maximum time from start signal to 100% cooling with an upper limit of five minutes.
- Outside air temperatures relative to the Low Ambient Lockout Setpoint will determine whether economizer cooling or DX staging will be the primary source for cooling.
- The use of economizing below low ambient lockout (typically 50°F) during the RR function will be a selectable option on the HI.
- Until the RR termination conditions are met, the unit will ramp the outside air damper open, if under economizer operation. Until the RR termination conditions are met, the unit will stage DX mechanical cooling, if available, at six second intervals.
- Supply fan capacity will increase accordingly: CV and SZVAV: Supply fan operation at full airflow will be utilized.
- VAV: Once the supply fan proving switch is closed, the supply fan speed will ramp to 50% command, then control to normal discharge static pressure control limited by the high duct static limit.
- Building pressure will always be in control.
- The unit will indicate via local HI and remote BAS that the RR event is active.
- Valid RR temperature sensor or return air temperature sensor is required to determine initialization and deactivation of RR relative to RR critical temperature setpoint. If this sensor fails, the unit will terminate RR when the discharge temperature sensor indicates a value below the active SA cooling setpoint – 1/2 deadband.
- Limit OA humidity infiltration to humidity greater than 20% RH.

Variable Air Volume (VAV) Only

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

Variable Frequency Drive (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 or BAS/Network.

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

Supply Air Static Pressure Limit

The opening of VAV terminals, and the amount of supply air provided by the variable frequency drive are coordinated during start up and transition to/from Occupied/Unoccupied modes to prevent over pressurization of the supply air ductwork. However, if for any reason the supply air pressure exceeds the user-defined supply air static pressure limit that was set at the Human

Interface Panel, the supply fan and VFD are shut down. The unit is then allowed to restart three times. If the over pressurization condition occurs on the third restart, the unit is shut down and a manual reset diagnostic is set and displayed at the Human Interface Panel and BAS/Network.

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

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

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

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

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

Heating

Modulating Gas

Upon a call for heating, the HEAT module closes the heating contacts, beginning the firing sequence. First, the heat exchanger combustion blower begins operation. Upon positive proving of combustion airflow, a 60 second pre-purge cycle is executed. Then the ignition sequence takes place.

If ignition is not proven, the safety control locks out and must be manually reset. As long as there is a call for heat, the safety control can be reset, which starts another purge cycle and try for ignition.

Once ignited, as additional heat is required, the combustion air 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 and be locked out until reset at the unit mounted Human Interface panel.

As the heating requirement is satisfied, the HEAT module will modulate the combustion air damper closed 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.

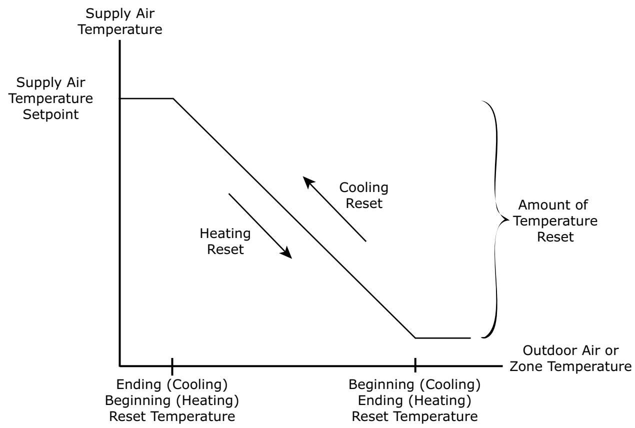
Hot Water or Steam

On units with hot water or steam heating, the supply air temperature can be controlled to a heating setpoint during the Occupied mode. The supply air temperature heating setpoint and deadband are user-defined at the Human Interface Panel. VAV Occupied heating on hot water and steam heat units is enabled by closing a field-supplied switch or On units with hot water or steam heating, the supply air temperature can be controlled to a heating setpoint during the

Occupied mode. The supply air temperature heating setpoint and deadband are user-defined at the Human Interface Panel. VAV Occupied heating on hot water and steam heat units is enabled by closing a field-supplied switch or contacts connected to an changeover input on the RTM.

Supply Air Setpoint Reset

Figure 8. Supply air temperature reset



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

Outdoor air cooling reset

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

Outdoor air heating reset

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

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

Zone reset

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

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 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.

Unit Feedback – Supply and Exhaust Fan Speed Setpoints

BACnet® control network (BCI-I) points are available to allow for communication of the Supply and Exhaust Fan Speed Setpoints to the BAS. These points are only available for true VAV units. These setpoints will be overridden by equipment protection functionality, when applicable. These point additions eliminate the need to hard-wire directly to the VFDs for control.

Outside Air CFM Compensation

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

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

Both are user adjustable at the Human Interface Panel.

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.

VFD Control

Single Zone VAV units will be equipped with a VFD-controlled supply fan which will be controlled via a 0-10 VDC signal from the Rooftop Module (RTM). With the RTM supply fan output energized and the RTM VFD output at 0 VDC, the fan speed output is 37% (22Hz) from the VFD by default; and at 10 VDC the fan speed output is 100% (60Hz). The control scales the 0-10 VDC 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.

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.

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

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 Heating type will utilize 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 three minute minimum on, off, and inter-stage timers. Also, all existing head pressure control schemes will be in effect.

Cooling Sequence

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

Note: The compressor staging order will be based on unit configuration and compressor lead/lag status.

Once the discharge air target setpoint calculation has reached the user define Minimum Setpoint and compressors are being utilized to meet the demand, if the cooling demand increases, the discharge air target setpoint value will continue to lower past the minimum setpoint and begin to ramp the supply fan speed upward toward 100%.

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

As the cooling load in the zone decreases the zone cooling algorithm will reduce the speed of the fan down to minimum per compressor stage and control the compressors accordingly. As the compressors begin to de-energize, the supply fan speed will fall back to the Cooling Stage's associated minimum fan speed, but not below. As the load in the zone continues to drop, cooling capacity will be reduced in order to maintain the discharge air within the ±½ discharge air target deadband.

Constant Volume (CV) Only

Occupied Zone Temperature Control

Cooling/Economizer

During Occupied cooling mode, the economizer (if provided) and mechanical cooling are used to control zone temperature. The zone temperature cooling setpoint is user-defined at the Human Interface Panel or from the BAS/Network. If the conditions of outside air is appropriate to use "free cooling", the economizer will be first be used 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 outside 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 outside air damper will open. First stage of cooling will be allowed to start after the economizer reaches full open.

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

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

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

Heating

Gas Heating: Two-Stage

Upon a call for heating, the HEAT module 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 60 second pre-purge cycle is executed. Then the ignition sequence takes place.

If ignition is not proven, the safety control locks out and must be manually reset. As long as there is a call for heat, the safety control can be reset, which starts another purge cycle and try for ignition. As additional heat is required, the HEAT module 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. On the low heat for all unit sizes and the medium heat for the 90 and 105 ton, after a one minute delay, plus another 60 second pre-purge cycle the ignition cycle begins. On all other heat sizes the heating section will be shutdown and locked out after the first shutdown due to flame instability, until manually reset at the ignition module and at the unit-mounted Human Interface Panel .

As the heating requirement is satisfied, the HEAT module 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.

Gas Heating: Modulating Gas

Upon a call for heating, the HEAT module 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 safety control locks out and must be manually reset. As long as there is a call for heat, the safety control can be reset, which starts another purge cycle and try for ignition. Once ignited, as additional heat is required, the combustion air 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 and be blocked out until reset at the unit-mounted Human Interface panel.

As the heating requirement is satisfied, the HEAT module will modulate the combustion air damper closed, 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.

Gas Heating: Ultra Modulating Gas

Upon a call for heating, the heat module closes the heating contact and sends a 10VDC signal to the heat exchanger's combustion blower controller. Upon positive proving of combustion airflow, the DC signal runs the heat exchanger's combustion blower at maximum speed, and the pre-purge cycle is executed. After 30 seconds of pre-purge, the ignition sequence then takes place.

If ignition is not proven, the safety control locks out and must be manually reset. As long as there is a call for heat, the burner controller can be reset, which starts another purge cycle and ignition attempt. Once the heater has been ignited, the DC input drops to 2VDC and the blower goes to minimum speed. Additional heat is provided through ramping of the DC signal/speed of the combustion blower. During heating operation, the burner controller uses a flame sensor to provide continuous flame supervision. If combustion should become unstable for any reason, heating will automatically shut down and be blocked out until reset at the unit mounted Human Interface panel.

As the heating requirement is satisfied, the Heat module will modulate the combustion blower slower to maintain the desired outlet temperature. When the heating requirement is fully satisfied, the heating contact is opened, and the burner controller is de-energized. The specific sequence of operation of the gas heather will depend on the size of the heat exchanger.

Electric Heating

The individual 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. The number of available stages will depend on the unit size and heat capacity selected.

For units with SCR electric heat, the first stage is modulating. The modulating stage and the necessary additional stages are sequenced to precisely meet the zone 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

Cooling and/or heating modes can be selected to maintain Unoccupied zone temperature setpoints. 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, space pressure deadband and exhaust enable point. As the economizer opens, the building pressure rises and once above the exhaust enable point, enables the exhaust fan and dampers or exhaust VFD. The exhaust dampers or VFD then modulate to maintain space pressure within the deadband.

Morning Warm-up Options (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 (see descriptions below). The unit is then released to Occupied mode.

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 occupied mode.

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 the MWU setpoint is reached or for 60 minutes, then the unit switches to Occupied mode. A control algorithm is used to increase or decrease the amount of heat in order to achieve the MWU zone temperature setpoint.

Note: *When using the Morning Warm-up option in a VAV heating/cooling rooftop, airflow must be maintained through the rooftop unit. This can be accomplished by electrically tying the VAV boxes to the VAV box output relay contacts on the 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

Modulating gas, electric, hot water and steam heat units only—when supply air temperature falls below the supply air temperature deadband low end, the heat valve is modulated open to maintain the set minimum supply air temperature.

Emergency Override

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

PRESSURIZE_EMERG:

- 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 (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 - 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 - 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 - 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 - 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)

Ventilation Override Module (VOM)

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

UNIT OFF sequence “A”

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

- Supply Fan - Off
- Supply Fan VFD - 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 - 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)

To use a RHI the unit must be equipped with an optional Inter-Processor Communications Bridge (IPCB) module. 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 four (4) rooftops, each containing an IPCB.

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 an independent 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.
- **CUSTOM** — allows the user to create a custom status menu consisting of up to four (4) screens of the data available in the Status menu.
- **SETPOINTS** — used to review and/or modify all the factory preset Default setpoints and setpoint source selections.
- **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 unique diagnostics can be held in an active history buffer log.
- **SETUP** — Control parameters, sensor source selections, function enable/disable, 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 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.

Demand Limit

This mode is used to reduce electrical consumption at peak load times. When demand limiting is needed, mechanical cooling and/or heating operation are either partially or completely disabled in order to save energy.

This function is operational on units with a GBAS. 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 request for demand limit has been cancelled, the unit cooling and/or heating functions will become fully enabled.

Generic Building Automation System Module (GBAS 0-5 / 0-10 VDC)

The Generic Building Automation System Module (GBAS) is used to provide broad control capabilities for building automation systems other than the Trane Tracer Summit™ building automation system. The modules differ on the input signal and the number of binary I/O.

The following inputs and outputs are provided:

Analog Inputs — Four analog inputs, controlled via a field provided potentiometer or a VDC signal.

Table 1. Analog inputs (0-5 VDC, 0-10 VDC)

Set Point	System Control
Occupied Zone Cooling Setpoint	CV and SZVAV
Unoccupied Zone Cooling Setpoint	ALL
Occupied Zone Heating Setpoint	CV and SZVAV
Unoccupied Zone Heating Setpoint	ALL
Supply Air Cooling Setpoint	CV, SZVAV, VAV[a]
Supply Air Heating Setpoint	CV, SZVAV, VAV[a]
Space Static Pressure Setpoint	ALL
Supply Air Static Pressure Setpoint	VAV
Minimum Outside Air Flow Setpoint	ALL
Morning Warm Up Setpoint	CV & VAV
Economizer Dry Bulb Enable Setpoint	ALL
Minimum Outside Air Position Setpoint	ALL
Occupied Humidification Setpoint	ALL
Unoccupied Humidification Setpoint	ALL
Occupied Dehumidification Setpoint	ALL
Unoccupied Dehumidification Setpoint	ALL

(a) With discharge temperature control only

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

Table 2. Analog outputs (0-10 VDC only)

Ouput	System Control
Outdoor Air Temperature	ALL
Zone Temperature	ALL
Supply Air Temperature	CV, SZVAV, VAV[a]
Supply Air Pressure	SZVAV and VAV
Space Pressure	ALL
Space Relative Humidity	ALL
Outdoor Air Relative Humidity	ALL
Space CO_2 Level	ALL
Compressor Staging (%)	ALL
Heat Staging (%)	ALL
Outdoor Air Damper Position	ALL
Outdoor Airflow	ALL
Occupied Humidification Setpoint	ALL
Unoccupied Humidification Setpoint	ALL

(a) With discharge temperature control only

Binary Outputs — each of the five 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.

Frost Avoidance

Evaporator Coil Frost Protection - Frostat™

A temperature sensor on each evaporator circuit 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 utilizes the suction line surface temperature sensor near the TXV bulb location to shed cooling when coil frosting conditions occur. The supply fans are not shut off and will de-ice the coil. Timers prevent the compressors from rapid cycling.

Steam and Hot Water Coil - Freeze Avoidance

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

Occupied/Unoccupied Switching

There are three ways to switch Occupied/Unoccupied:

- Night Setback (NSB) Panel
- Field-supplied contact closure (hard wired binary input to RTM) (CV, SZVAV and VAV)
- Tracer (or third party BAS with LCI or BCI module)

Night Setback Sensors

The Trane night setback sensors are programmable with a time clock function that provides communication to the rooftop unit through a two-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 setup 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 VAV Box 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.

Trane Tracer® Ensemble™ or BAS System

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

Timed Override Activation - ICS

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

Timed Override Activation - Non-ICS

This function is active whenever the RTM is selected as the Zone Temperature Sensorsource 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.

Outdoor Air Damper Fault Detection and Diagnostics

Fault Detection of the Outdoor Air Damper will be evaluated based on the commanded position of the damper compared to the feedback position of the damper. The damper is commanded to a position based on a 0-10 / 2-10 VDC signal. If the Damper position is outside of the commanded position, a diagnostic is generated. The new Diagnostics can be placed into two groups, Economizer and Outdoor Air Damper. To be classified as an Economizer diagnostic, the unit must be actively cooling with either mechanical cooling and or Economizer cooling. The following are the Diagnostics displayed by the Controller: Unit Not Economizing when it should be, Unit Economizing when it should not be, Outdoor Air Damper Not Modulating, Excessive Outdoor Air.

Economizer Controls

Comparative Enthalpy Control of Economizer

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

Reference Enthalpy Control of Economizer

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

Dry Bulb Temperature Control of Economizer

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

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 20-30 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 or units with variable speed compressors.

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.

CO_2 Control - Demand Control Ventilation (DCV)

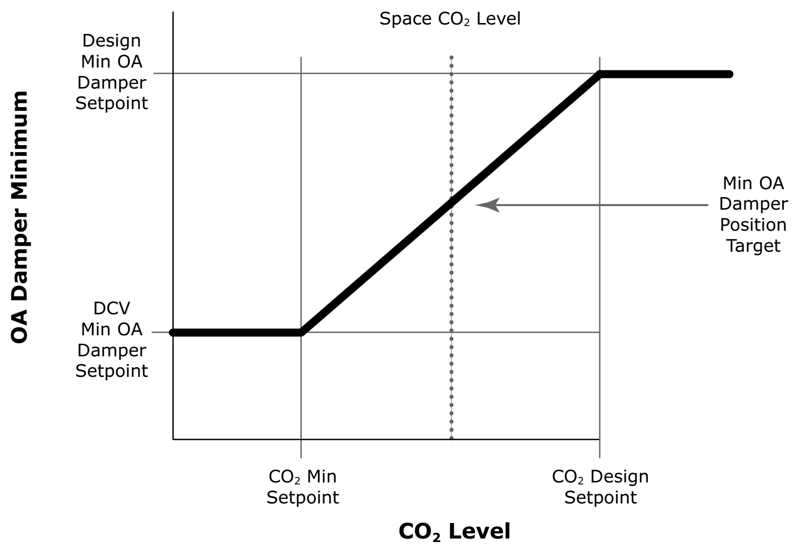
A ventilation reset function that provides the necessary ventilation for occupants and reduces energy consumption by minimizing the outdoor air damper position (or the OA flow setpoint with Traq) below the Building Design Minimum, while still meeting the ASHRAE Std 62.1-2004 ventilation requirements.

- If the space CO_2 level is greater than or equal to the CO_2 Design Setpoint, the outdoor air damper will open to the Design Min Outdoor Air Damper (or OA Flow) Setpoint. If there is a call for economizer cooling, the outdoor air damper may be opened further to satisfy the cooling request.

- If the space CO_2 level is less than or equal to the CO_2 Minimum Setpoint, the outdoor air damper will close to the DCV Minimum Outdoor Air Damper (or OA Flow) Setpoint. If there is a call for economizer cooling, the outdoor air damper may be opened further to satisfy the cooling request.
- If the space CO_2 level is greater than the CO_2 Minimum Setpoint and less than the CO_2 Design Setpoint, the outdoor air damper position is (or OA flow) modulated proportionally to the Space CO_2 level relative to a point between the CO_2 Min Setpoint and the CO_2 Design Setpoint. If there is a call for economizer cooling, the outdoor air damper may be opened further to satisfy the cooling request.

Note: *CO_2 sensor used with Demand Control Ventilation must be powered from an external power source or separate 24 VAC transformer.*

Figure 9. CO_2 control



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

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

BACnet® Building Automation Control Network

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

AirFi® Wireless Communication Interface

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

Twinning

Twinning is a main unit and one or more similarly configured dependent unit(s) operating cooperatively, to provide higher capacity and/or redundancy at partial capacity.

Twinning requires an LCI module be installed in each unit and is accomplished by binding variables between unit communication modules, communicating common setpoints and conditions (temperatures, pressures, fan speeds, damper positions, occupancy, states, etc.), and allowing each unit to run independent algorithms.

Note: *BCI-I does not have twinning capabilities.*

Twinned units must share a common supply and return duct network. Twinned units operate:

- as part of a Trane Integrated Comfort System installation, with Tracer Summit.
- on an inter-operable project with a third party LonTalk.
- as an independent group (bound via Rover or third party tool).

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.

Modulating Hot Gas Reheat

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

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

Low Ambient Compressor Lockout

This function will lock out the compressor if the outdoor air temperature is below the low ambient compressor lock out temperature setpoint. The factory setpoint is 50°F on standard units and 0°F on low ambient units. This setpoint is adjustable at the Human Interface Panel.

Compressors will be locked out when outdoor air temperatures fall below the selected temperature and will be allowed to start again when temperatures rise 5°F above the setpoint.

Application Considerations

Available Options

High Efficiency Methods

High Efficiency and eDrive™ Direct Drive Plenum Supply Fans

Trane offers a high-efficiency option for 20 to 75 ton units. This option is especially helpful in meeting high efficiency requirements legislated by some states as well as qualifying for local utility rebates. High efficiency units meet CEETier 2 requirements.

The 90 ton unit can be equipped with an increased number of condenser coil rows to enhance the rooftop capacity and efficiency. This option is especially helpful to meet the high efficiency requirements legislated by some states, and to qualify for local utility rebates. Capacity tables for both standard and high efficiency condenser coils are available in the cooling data section of this catalog.

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% 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% 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% 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 Fan Systems

- Barometric relief
- 50% exhaust air fan option
- 100% modulating exhaust with Statitrac direct space sensing building pressurization control (with or without exhaust variable frequency drives)
- 100% modulating exhaust without Statitrac
- 100% modulating plenum return airfoil fan with Statitrac direct space sensing building pressurization control with variable frequency drive
- 100% modulating plenum return airfoil fan without Statitrac

- Drivers for applying either return or exhaust fan systems include economy, building pressure control, code requirements, and generally accepted engineering practices

Barometric Relief Dampers

This approach uses non-motorized, gravity-operated relief dampers that are located in the return-air section of the rooftop unit. When the building pressure increases, the pressure inside the return-air section also increases, eventually forcing open the relief dampers and allowing air to leave the building.

Barometric relief dampers are typically used in small buildings that use an open ceiling plenum for the return-air path. They are relatively inexpensive and require no sensors or controls, but they may require the building pressure to increase significantly before relieving sufficient airflow.

50% 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% Modulating Exhaust with Statitrac™ Control, Constant Volume (CV) and Variable Air Volume (VAV) Units

For both CV and VAV rooftops, the 100% modulating exhaust discharge dampers (or VFD) are modulated in response to building pressure. A differential pressure control system, Statitrac, uses a differential pressure transducer to compare indoor building pressure to atmospheric pressure. The FC exhaust fan is turned on when required to lower building static pressure to setpoint. The Statitrac control system then modulates the discharge dampers (or VFD) to control the building pressure to within the adjustable, specified deadband that is set at the Human Interface Panel. Economizer and return air dampers are modulated independent of the exhaust dampers (or VFD) 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.
- The exhaust fan discharges in a single direction resulting in more efficient fan operation compared to return fan systems.
- When discharge dampers are utilized to modulate the exhaust airflow, the exhaust fan may be running unloaded whenever the economizer dampers are less than 100% open.

The Trane 100% 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.

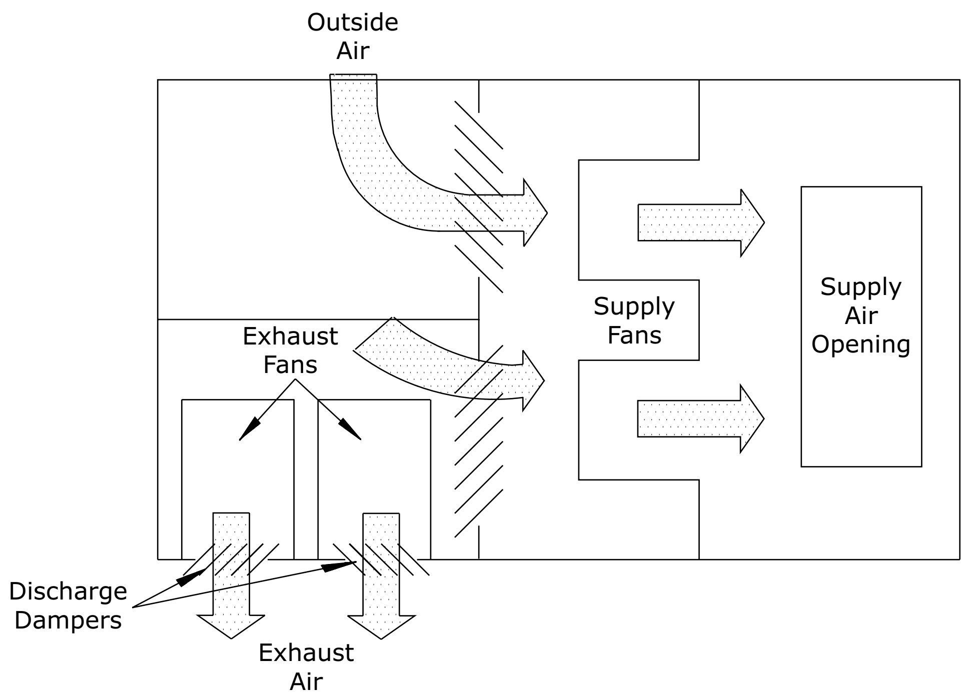
100% Modulating Exhaust System without Statitrac, Constant Volume (CV) Units Only

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

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.

Figure 10. Plan view of modulating 100-percent exhaust system



100% Modulating Exhaust with or without Statitrac Control, SZVAV Units

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

For SZVAV the user will select an Exhaust Enable Setpoint 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 to be added to the Active Building Design OA Minimum Position Target to calculate the dynamic Exhaust Enable Target to be used throughout the Supply Fan Speed/OA Damper Position range.

Advantages:

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

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

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

For both CV and VAV applications, the IntelliPak 2 rooftop unit offers 100% modulating return fan systems. A differential pressure control system, Statitrac, uses a differential pressure transducer to compare indoor building pressure to atmospheric pressure.

The return fan 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% 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% Modulating Return Fan without Statitrac Control, Constant Volume (CV) Units Only

The return fan runs continuously while the supply fan is energized. The exhaust discharge dampers are modulated in response to building 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 enhances total system static capability.
- The return fan discharges in two directions, thereby balancing exhaust and unit return air volumes.

Clearance Requirements

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

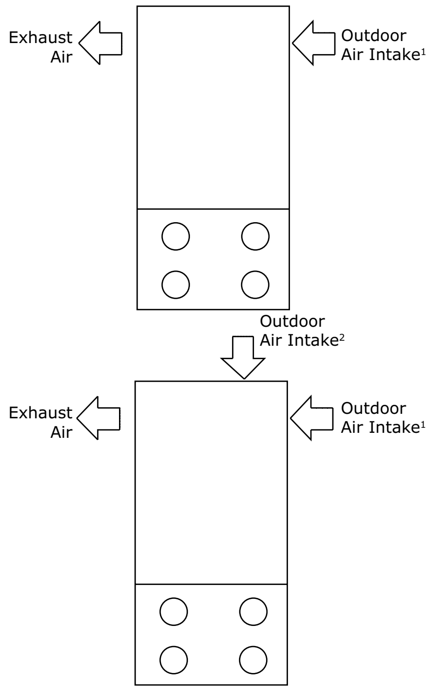
- Do the clearances available allow for major service work such as changing compressors or coils?
- Do the clearances available allow for proper outside air intake, exhaust air removal and condenser airflow?
- If screening around the unit is being used, is there a possibility of air recirculation from 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, see and Figure 11, p. 40, for the following reasons:

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

Figure 11. Unit placement



Note: *24-48 ton evap cooled models have only one outdoor air intake. 59-89 ton evaporative condensing models have two outdoor air intakes. 90-130 ton models have two outdoor air intakes on the backside of the unit and one small air intake at the end of the unit.*

Horizontal Supply and Return

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. With this method the standard discharge and return openings are blocked. Access panels are removed as indicated in Figure 12, p. 41. These openings are used for the discharge and return. No special curb is needed.

Note: *Horizontal return with a return fan must be handled through design specials. Fan airflow cannot be field converted.*

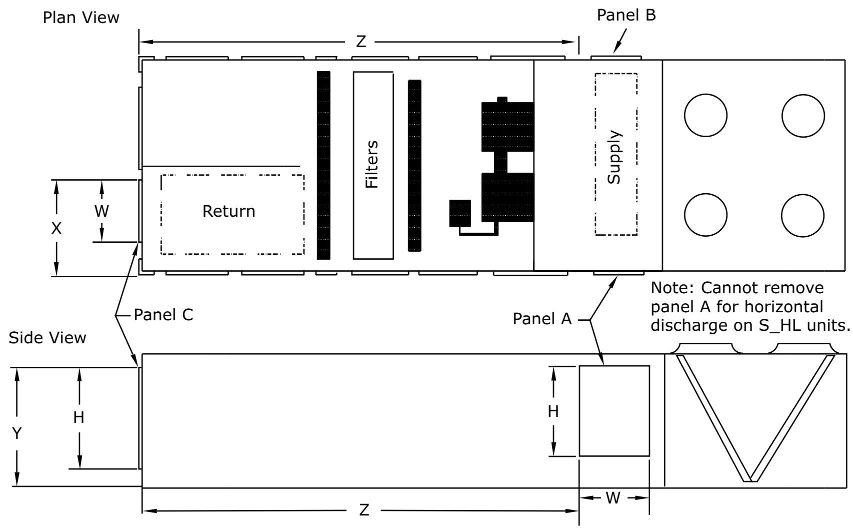
20 to 75 Ton Units

Figure 2, p. 11 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 3, p. 41, Table 4, p. 42, and Table 5, p. 42 show dimensions for those panels (see note 4).

Note: *Horizontal discharge cannot be applied to SFHL 20-55 ton units with DDP fan.*

The SXHL (extended casing cooling only), SFHL (gas heat), SSHL (steam heat), and SLHL (hot water heat) rooftops can be factory modified for horizontal supply and return air 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 12. Horizontal discharge panel dimensions – SXHL, SFHL, SLHL, SSHL units (20–8924-75 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 piping and components.*
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 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 3. SXHL, SFHL, SSHL, SLHL – Panel A and B dimensions

Model	H (in.)(a)	W (in.)(a)	Total Area (H x W)	
			(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

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

Table 3. SXHL, SFHL, SSHL, SLHL – Panel A and B dimensions (continued)

(a) Dimensions include a 1/25 inch lip around perimeter. See Horizontal discharge panel dimensions, Note 3.

Table 4. SXHL, SFHL, SSHL, SLHL – Panel C dimensions

Model	H (in.)(a)	W (in.)(a)	Total Area (H x W)	
			(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

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

(a) Dimensions include a 1/25 inch lip around perimeter. See Horizontal discharge panel dimensions, Note 3.

Table 5. 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

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

Acoustic Considerations

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

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

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

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

For more information:

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

In addition, the Trane TAP™ Acoustics Program allows for modeling of various sound paths to predict sound levels in the occupied space. The software models airborne sound from supply- and return-air paths, as well as duct breakout and roof transmission sound, so that the designer can identify potential sound problems and make design alterations before equipment installation. TAP is also capable of modeling the effect of outdoor sound on adjacent properties. This program is available from Trane's Customer Direct Service Network (C.D.S.), ask your local Trane representative for additional information.

Ventilation Override Sequences

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

Trane can provide five (5) different ventilation override sequences on both CV and VAV IntelliPak™ rooftops. For convenience, the sequences are factory preset but are fully field edited 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 Ventilation Override Mode (VOM) information in the Control section of this catalog for more details on each override sequence.

Natural Gas Heating Considerations

Trane uses heavy gauge stainless steel throughout the construction of its natural gas tubular exchangers. These heat exchangers can be applied with confidence, particularly with full modulation control, when mixed air temperatures are below 50°F, and low ambient temperatures can cause condensation to form on the heat exchanger. The IntelliPak™ natural gas heat exchangers are not recommended for applications with mixed air conditions entering the heat exchanger below 30°F to ensure adequate leaving air heating temperature.

High Entering Return Temperature Applications

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

Modulating Hot Gas Reheat

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

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

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

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

Generally, the standard Modulating Hot Gas Reheat option requires a call for cooling to initiate. If there is no call for cooling, and there is a desire for dehumidification, another solution will need to be investigated. The IntelliPak™ packaged rooftop systems include non-standard solutions which can be considered for these types of applications.

Selection Procedure

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

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

Summer Design	
Summer outdoor design conditions	95 DB/76 WB ambient temperature
Summer room design conditions	78 DB/64 WB
Total cooling load	430 MBh (35.8 tons)
Sensible cooling load	345 MBh (28.8 tons)
Outdoor air ventilation load	66.9 MBh
Return air temperature	80 DB/65 WB
Winter design:	
Winter outdoor design conditions	0°F
Return air temperature	70°F
Total heating load	475 MBh
Winter outdoor air ventilation load	133 MBh
Air delivery data:	
Supply fan CFM	17,500 CFM
External duct static pressure	1.2 in wg
Minimum outdoor air ventilation	1,750 CFM
Exhaust/Return fan CFM	12,000 CFM
Return air duct negative static pressure	0.65 in wg
Electrical characteristics:	
Voltage/cycle/phase	460/60/3
Unit Accessories	• Gas fired heat exchanger - high heat module • Throwaway filters • Economizer • Modulating 100% exhaust/return fan

Heating Capacity Selection

1. Determine air temperature entering heating module

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

   Supply air fan motor heat temperature rise = 51,900 Btu ÷ (1.085 x 17,500 CFM) = 2.73°F

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

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

   a. Electric heating system

      Unit operating on 460/60/3 power supply.

      From Table 26, p. 70, 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.

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

Table 25, p. 70 shows an air temperature rise of 30.6°F for 17,500 CFM through the 170 kW heat module.

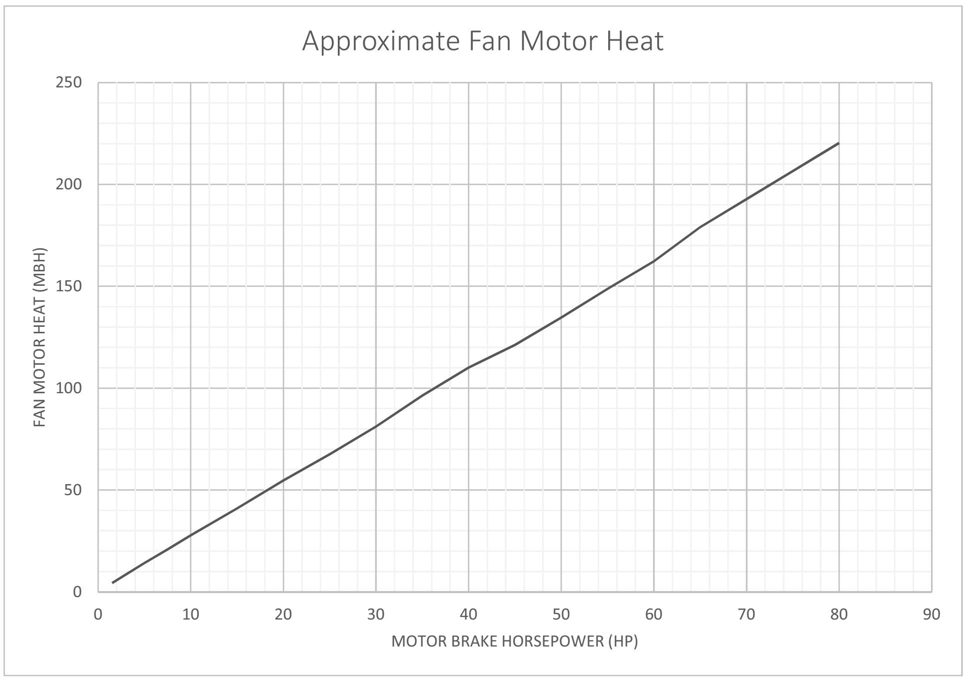
b. Gas heating system (natural gas)

From Table 22, p. 68 select the high heat module (680 MBh output) to satisfy winter heating load of 563 MBh at unit CFM.

Table 22, p. 68 also shows an air temperature rise of 35.0°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 + 35.0°F = 100.7°F.

Figure 13. Fan motor



c. 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 27, p. 71, 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.

d. Steam heating system

Assume a 15 psig steam supply.

From Table 24, p. 69, 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 23, p. 69, 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

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

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 16 bhp and 989 rpm. Thus, a 20 hp supply fan motor is selected. For an FC fan selection, enter Table 33, p. 79 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 28, p. 76) = 0.12 inches

Total return system negative static pressure = 0.77 inches

Exhaust fan CFM = 12,000 CFM

From, 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 32, p. 79 for a 5 hp motor for a 50 ton unit. Drive selection number 6 - 600 rpm.

Where altitudes are significantly above sea level, use , and Table 13, p. 59 and Figure 14, p. 59 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 28, p. 76) = 0.12

Exhaust Damper Pressure Drop = 0.41

Total Return System Static Pressure = 1.18

Return Fan CFM = 12000

From Table 35, p. 80, the required bhp is 4.55. Thus the return fan is selected at 5HP. To select a drive, look at table Table 38, p. 82 for a 5HP return motor on a 50 HP unit. Drive selection number C - 1200.

Using Figure 13, p. 46 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.

Modulating Hot Gas Reheat Selection

The hot gas reheat coil is designed to deliver maximum reheat temperatures. Contact the local Trane Sales Office or refer to the IntelliPak™ TOPSS™ selection program to determine leaving air temperature, latent capacity, reheat sensible capacity, leaving unit dew point, and moisture removal when the unit is in reheat operation. If the reheat set point is not obtainable at the provided conditions the customer will be required to make adjustments to the conditions or change the reheat set point value. Please note that reheat operation will not be allowed when there is a call for heating or more than 50% call for cooling.

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 14, p. 59 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. 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 14, p. 59.
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. From Figure 14, p. 59, the air density ratio is 0.86.

   The rpm is correct as selected - 906 rpm.

   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.

   Tsp = 3.0-inches / 0.86 = 3.49 inches tsp.

   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 . 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 13, p. 59 before calculating the heating supply air temperature.

Model Number Description

S*HL — 24 - 89 Ton, Evaporative Condensing

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 — System Type

H = Single Zone

Digit 4 — Development Sequence

L = Sixth

Digit 5, 6, 7 — Nominal Capacity

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

Digit 8 — Voltage Selection

4 = 460/60/3 XL
5 = 575/60/3 XL
E = 200/60/3 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 is "F" (Gas Heat), the following applies: (M is available ONLY on 50 ton and above).*

H = High Heat — 2-Stage
K = Low Heat — Ultra Modulation
L = Low Heat — 2-Stage
M = Low Heat — 4 to 1 Modulation
0 = No Heat
P = High Heat — 4 to 1 Modulation
T = High Heat — Ultra Modulation

Note: *When the second digit is "E" (Electric Heat), the following applies:*

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

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

High Heat Coil
1 = 0.50 inch
2 = 0.75 inch
3 = 1 inch
4 = 1.25 inches
5 = 1.5 inches
6 = 2 inches

Low Heat Coil
A = 0.50 inch
B = 0.75 inch
C = 1 inch
D = 1.25 inches
E = 1.5 inches
F = 2 inches

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
4 = 400 RPM
5 = 500 RPM
6 = 600 RPM
7 = 700 RPM
8 = 800 RPM
9 = 900 RPM
A = 1000 RPM
B = 1100 RPM

Digit 12— Exhaust/Return Option (continued)

(Return Fan Only)
C = 1200 RPM
D = 1300 RPM
E = 1400 RPM
F = 1500 RPM
G = 1600 RPM
H = 1700 RPM
J = 1800 RPM
K = 1900 RPM

Digit 13 — Filter (Pre DX/Final)

A = Throwaway
B = Cleanable Wire Mesh
C = High Efficiency Throwaway
D = Bag with Prefilter
E = Cartridge with Prefilter
F = Throwaway Filter Rack (Filter not included)
R = High Efficiency Throwaway/Final filter rack (no filters)
T = 2 inch and 1 inch Vertical Filter Rack (no filters) /Final Filter Rack (no filters)

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
F = 0-100% Economizer w/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/Cancel Buttons (BAYSENS073*)
D = Room Sensor w/ Temp Adjustment/ Override/Cancel Buttons (BAYSENS074*)
L = Programmable Zone Sensor w/ System Function Lights for CV/SZVAV/VAV (BAYSENS119*)

Note: **Asterisk indicates current model number digit. 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 is a "F."*

Digit 21 — Miscellaneous Options

0 = Unit Mounted Terminal Block
A = Unit Disconnect Switch
B = Unit Disconnect Switch w/ high fault SCCR

Digit 22 — Refrigeration Options

B = Hot Gas Bypass

Digit 23 — Economizer Control Options

O = Without Economizer
C = Economizer Control w/ Comparative Enthalpy
W = Economizer Control w/ Dry Bulb
Z = Economizer Control w/ Reference Enthalpy

Digit 24 — Damper Options

E = Low Leak Economizer Dampers

Digit 25 — Miscellaneous Options

F = High Duct Temp Thermostat

Digit 25 — Miscellaneous Options

F = High Duct Temp Thermostat

Digit 26 — Capacity/Efficiency Options

G = High Capacity Unit

Digit 27 — Condenser Options

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

Digit 28 — Control Options

B = GBAS 0-10V
K = GBAS 0-5V
R = Rapid Restart

Digit 29 — Miscellaneous Options

A = Motors w/ Internal Shaft Grounding

Digit 30 — Miscellaneous Options

M = Remote Human Interface

Digit 31 — Miscellaneous Options

N = Ventilation Override Module

Digit 32 — Service Options

0 = None
R = Extended Grease Lines
1 = Differential Pressure Gauge
2 = Extended Grease Lines and Differential Pressure Gauge
3 = Stainless Steel Sloped Drain Pan
4 = Stainless Steel Sloped Drain Pan with Grease Lines
5 = Stainless Steel Sloped Drain Pan with Filter Gauge
6 = Stainless Steel Sloped Drain Pan with Grease Lines and Filter Gauge

Digit 33 — Cabinet Options

0 = Standard Panels
T = Hinged Access Doors
U = IRU - w/ Std Panels
W = IRU - w/ Hinged Access Doors
Y = IRU w/SST - w/ Std Panels
Z = IRU w/SST - w/ Hinged Access Doors

Digit 34 — Miscellaneous Options

V = Inter-Processor Communication Bridge

Digit 35 — BAS/Communication Options

M = BACnet® Communication Interface (BCI) Module
Y = Trane® Communication Interface (TCI) Module
7 = Trane® LonTalk® Communication Interface (LCI) Module

Digit 36 — Miscellaneous Options

8 = Spring Isolators

Digit 37 — Miscellaneous Options

6 = Factory-Powered 15A GFI Convenience Outlet/Disconnect Switch

Digit 38 — Miscellaneous Options

J = Temperature Sensor

Notes: Example

*Model numbers: SAH-L*5040A68A6BD800100W00G0-B000R000800 describes a unit with the following characteristics:*

- *DX Cooling Only unit w/ no extended casing*
- *59 ton nominal cooling capacity*
- *460/60/3 power supply*
- *100% 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*
- *extended grease lines*
- *spring isolators*

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

TRANE

General Data

Table 6. General data - 24 to 59 tons

	24 Ton	29 Ton	36 Ton	48 Ton	59 Ton
Compressor Data - High Capacity/High Efficiency[(a)]					
Number/Size (Nominal)	2/10	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					
Forward-Curved Fans (FC)					
Number/Size/Type	2/15"	2/15"	2/18"	2/20"	2/20"
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)]	4,000-9,000	5,000-11,000	6,000-13,500	8,000-18,000	10,000-22,500
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					
Forward-Curved Fans (FC) 50% Airflow					
Number/Size	1/15"/FC	1/15"/FC	1/15"/FC	1/18"/FC	1/18"/FC
Hp Range	3	3	3-5	5-7.5	5-7.5
Cfm Range[(b)]	2000-6000	2000-6000	2000-7000	3000-11000	3000-11000
ESP Range - (In. WG)	0.25-1.4	0.25-1.4	0.25-1.4	0.25-1.4	0.25-1.4
Forward-Curved Fans (FC) 100% Airflow					
Number/Size/Type	2/15"	2/15"	2/15"	2/18"	2/18"
Hp Range	3	3-5	3-7.5	5-10	5-10
Cfm Range[(b)]	4,000-10,000	4,000-12,000	4,000-14,000	7,500-16,000	9,000-20,000
ESP Range - (In. WG)	0.2-2.0	0.2-2.0	0.2-2.0	0.2-2.0	0.2-2.0
Return Fans					
Belt Drive Plenum Fans					
Number/Size	1/24.5	1/24.5	1/24.5	1/27.0	1/27.0
Hp Range	3	3.0 - 5.0 HP	3.0 - 7.5	5.0 - 10.0	5.0 - 15.0
Cfm Range	4,000-9,000	4,000-11,000	4,000-12,500	7,500-18,000	9,000-20,000
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	1,000/8,000	1,000/8,000	1,000/8,000	1,100/10,000	1,100/10,000
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	0.5	0.5	0.5	0.5	0.5
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
Natural Gas Heat - Standard[(d)]					
Low Heat Input	235	235	350	350	500
High Heat Input	500	500	500	850	850
Std. Heating Capacity Steps	2	2	2	2	2
Modulating Gas Heat (Not Available on 24 to 48 Ton Models with Low Heat). See Gas heat inputs/input ranges table[(e)]					
4 to 1[(f)] and Ultra[(g)] Modulation 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/ turbulators	5W Prima-Flo E w/ turbulators	5W Prima-Flo E w/ turbulators	5W Prima-Flo E w/ turbulators	5W Prima-Flo E w/ turbulators

Table 6. General data - 24 to 59 tons (continued)

	24 Ton	29 Ton	36 Ton	48 Ton	59 Ton
High Heat (Fins/Ft) Low Heat (Fins/Ft)	110 80	110 80	110 80	110 80	110 80
Steam Coil					
Size (Inches) Type High Heat (Fins/Ft) Low Heat (Fins/Ft)	30x66x1 Row Type NS 96 42	30x66x1 Row Type NS 96 42	30x66x1 Row Type NS 96 42	30x66x1 Row, 12x66x1 Row Type NS 96 42	30x66x1 Row 12x66x1 Row Type NS 72 42
Pre-Evap Filters					
Panel Filters (Number/Size - Inches) Face Area (Ft^2)	12 - 20x20x2 33.3	12 - 20x20x2 33.3	16 - 20x20x2 44.4	16 - 20x25x2 55.5	20 - 20x25x2 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 (Number/Size - Inches)	4 - 12x24x12 3 - 24x24x12	4 - 12x24x12 3 - 24x24x12	2 - 12x24x12 6 - 24x24x12	5 - 12x24x12 6 - 24x24x12	3 - 12x24x12 9 - 24x24x12
Prefilters (For Bag & Cartridge) (Number/Size - Inches)	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[g]					
Without Hot Gas Option With Hot Gas Option	55°F 55°F	50°F 50°F	50°F 50°F	55°F 55°F	45°F 45°F
Low Ambient Option Min. Outside Air Temp					
Without Hot Gas Option With Hot Gas Option	— —	— —	— —	— —	— —

(a) 24 to 36 ton models are single circuit, 48 ton models and up are dual circuit.
(b) For CFM values outside these ranges, contact your local Trane sales office.
(c) Refer to Electric heat kW ranges table for availability of 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) Heating Performance is AHRI and DOE certified
(f) The firing rate of the unit can vary from pilot rate of 125 or 210 MBh up to the nameplate rating of the unit.
(g) The firing rate of the unit can vary from 36 MBh on 500 MBh or 48 MBh on 850 MBh gas heat exchangers, up to the nameplate rating of the unit.

Table 7. General data - 72 to 89 tons

	73 Ton	80 Ton	89 Ton
Compressor Data - High Capacity/High Efficiency[a]			
Number/Size (Nominal) Model Unit Capacity Steps (%) RPM No. of Circuits	4/13.5 Scroll 100/73/46/23 N/A 2	4/15 Scroll 100/75/50/25 3450 2	2/15.5, 2/21 Scroll 100/71/43/21 N/A 2
Evaporator Fans			
Forward-Curved Fans (FC)			
Number/Size/Type Number of Motors Hp Range Cfm Range[c] ESP Range - (In. WG)	2/22" 1 10-50 [b] 14,000-27,000 0.25-4.0	2/22" 1 10-50 [b] 16,000-27,000 0.25-4.0	2/22" 1 10-50 [b] 16,000-27,000 0.25-4.0
Exhaust Fans			
Forward-Curved Fans (FC) 50% Airflow			
Number/Size Hp Range Cfm Range[c] ESP Range - (In. WG)	1/20" 5-7.5 4,000-13,000 0.25-1.4	1/20" 5-7.5 4,000-13,000 0.25-1.4	1/20" 5-7.5 4,000-13,000 0.25-1.4
Forward-Curved Fans (FC) 100% Airflow			
Number/Size/Type Hp Range Cfm Range[c] ESP Range - (In. WG)	2/20" 5-20 12,000-27,000 0.20-2.0	2/20" 5-20 12,000-27,000 0.20-2.0	2/20" 5-20 12,000-27,000 0.20-2.0
Return Fans			
Belt Drive Plenum Fans			
Number/Size Hp Range Cfm Range ESP Range - (In. WG)	1/36.5 5.0 - 20.0 12,000-27,000 0.25 - 2.0	1/36.5 5.0 - 20.0 12,000-27,000 0.25 - 2.0	1/36.5 5.0 - 20.0 12,000-27,000 0.25 - 2.0
Evaporative Condenser - Condenser Fans			
Number/Size/Type	1/32/Prop	1/32/Prop	1/32/Prop

Table 7. General data - 72 to 89 tons (continued)

	73 Ton	80 Ton	89 Ton
Hp (Each) RPM/CFM Cycle/Phase	5.4 1365/13000 60/3	5.4 1365/13000 60/3	5.4 1365/13000 60/3
Evaporative Condenser Pump			
Number/Type HP RPM Cycle/Phase Sump Pump GPM	1/Submersible 0.5 3430 60/3 50	1/Submersible 0.5 3430 60/3 50	1/Submersible 0.5 3430 60/3 50
Evaporative Condenser - Condenser Coil			
Dimensions Size (Ft^2) Tube Diameter	55.2 x 50 19.2 5/16″	55.2 x 50 19.2 5/16″	55.2 x 50 19.2 5/16″
Evaporator Coil			
Size (Ft) Rows/Fin Series Tube Diameter/Surface	43 6/168 3/8″/Enhanced	43 6/168 3/8″/Enhanced	43 6/168 3/8″/Enhanced
Electric Heat			
kW Range[b] Capacity Steps	90-190 3	90-190 3	90-190 3
Natural Gas Heat - Standard[d]			
Low Heat Input High Heat Input Std. Heating Capacity Steps	500 850 2	500 850 2	500 850 2
Modulating Gas Heat (Not Available on 24 to 48 Ton Models with Low Heat). See Gas heat inputs/input ranges table[e]			
4 to 1[f] and Ultra[g] Modulation Heat Exchanger Type	Stainless Steel	Stainless Steel	Stainless Steel
Hot Water Coil			
Size (Inches) Type High Heat (Fins/Ft) Low Heat (Fins/Ft)	42x90x2 Row 5W Prima-Flo E w/ turbulators 110 80	42x90x2 Row 5W Prima-Flo E w/ turbulators 110 80	42x90x2 Row 5W Prima-Flo E w/ turbulators 110 80
Steam Coil			
Size (Inches) Type High Heat (Fins/Ft) Low Heat (Fins/Ft)	30x90x1 Row 12x90x1 Row Type NS 72 42	30x90x1 Row 12x90x1 Row Type NS 72 42	30x90x1 Row 12x90x1 Row Type NS 72 42
Pre-Evap Filters			
Panel Filters (Number/Size - Inches) Face Area (Ft^2)	35 - 16x20x2 77.8	35 - 16x20x2 77.8	35 - 16x20x2 77.8
Bag Filters (Number/Size - Inches)	6 - 12x24x19 8 - 24x24x19	6 - 12x24x19 8 - 24x24x19	6 - 12x24x19 8 - 24x24x19
Cartridge Filters (Number/Size - Inches)	6 - 12x24x12 8 - 24x24x12	6 - 12x24x12 8 - 24x24x12	6 - 12x24x12 8 - 24x24x12
Prefilters (For Bag & Cartridge) (Number/Size - Inches)	6 - 12x24x2 8 - 24x24x2	6 - 12x24x2 8 - 24x24x2	6 - 12x24x2 8 - 24x24x2
Face Area (Ft^2)	44	44	44
Standard Unit Minimum Outside Air Temperature for Mechanical Cooling[g]			
Without Hot Gas Option With Hot Gas Option	30°F 30°F	45°F 45°F	45°F 45°F
Low Ambient Option Min. Outside Air Temp			
Without Hot Gas Option With Hot Gas Option	0°F 10°F	0°F 10°F	0°F 10°F

(a) 24 to 36 ton models are single circuit, 48 ton models and up are dual circuit.
(b) Refer to Electric heat kW ranges table for availability of kW ranges by voltage
(c) For CFM values outside these ranges, contact your local Trane sales office.
(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) Heating Performance is AHRI and DOE certified
(f) The firing rate of the unit can vary from pilot rate of 125 or 210 MBh up to the nameplate rating of the unit.
(g) The firing rate of the unit can vary from 36 MBh on 500 MBh or 48 MBh on 850 MBh gas heat exchangers, up to the nameplate rating of the unit.

Table 8. EER ratings

Model	EER	AHRI Net Cooling Capacity
S(A,X)HL*24(4,E,F)***1GA*	13.5	28200
SEHL*24(4,E,F)***1GA*	13.5	28200
S(F,L,S)HL*24(4,E,F)***1GA*	13.5	28200
S(A,X)HL*24(4,E,F)***6GA*	13.5	28200
SEHL*24(4,E,F)***6GA*	13.5	28200
S(F,L,S)HL*24(4,E,F)***6GA*	13.5	28200
S(A,X)HL*245***1GA*	13.5	28200
SEHL*245***1GA*	13.5	28200
S(F,L,S)HL*245***1GA*	13.5	28200
S(A,X)HL*245***6GA*	13.5	28200
SEHL*245***6GA*	13.5	28200
S(F,L,S)HL*245***6GA*	13.5	28200
S(A,X)HL*29(4,E,F)***1GA*	13.6	324000
SEHL*29(4,E,F)***1GA*	13.4	324000
S(F,L,S)HL*29(4,E,F)***1GA*	13.4	324000
S(A,X)HL*29(4,E,F)***6GA*	13.6	324000
SEHL*29(4,E,F)***6GA*	13.4	324000
S(F,L,S)HL*29(4,E,F)***6GA*	13.4	324000
S(A,X)HL*295***1GA*	13.6	324000
SEHL*295***1GA*	13.4	324000
S(F,L,S)HL*295***1GA*	13.4	324000
S(A,X)HL*295***6GA*	13.6	324000
SEHL*295***6GA*	13.4	324000
S(F,L,S)HL*295***6GA*	13.4	324000
S(A,X)HL*36(4,E,F)***1GA*	13.5	382000
SEHL*36(4,E,F)***1GA*	13.4	382000
S(F,L,S)HL*36(4,E,F)***1GA*	13.4	382000
S(A,X)HL*36(4,E,F)***6GA*	13.5	382000
SEHL*36(4,E,F)***6GA*	13.4	382000
S(F,L,S)HL*36(4,E,F)***6GA*	13.4	382000
S(A,X)HL*365***1GA*	13.5	382000
SEHL*365***1GA*	13.4	382000
S(F,L,S)HL*365***1GA*	13.4	382000
S(A,X)HL*365***6GA*	13.5	382000
SEHL*365***6GA*	13.4	382000
S(F,L,S)HL*365***6GA*	13.4	382000
S(A,X)HL*48(4,E,F)***1GA*	12.4	480000
SEHL*48(4,E,F)***1GA*	12.2	480000
S(F,L,S)HL*48(4,E,F)***1GA*	12.2	480000
S(A,X)HL*48(4,E,F)***6GA*	12.4	480000
SEHL*48(4,E,F)***6GA*	12.2	480000
S(F,L,S)HL*48(4,E,F)***6GA*	12.2	480000
S(A,X)HL*485***1GA*	12.4	480000
SEHL*485***1GA*	12.2	480000
S(F,L,S)HL*48(4,E,F)***1GA*	12.2	480000
S(A,X)HL*485***6GA*	12.4	480000
SEHL*485***6GA*	12.2	480000
S(F,L,S)HL*485***6GA*	12.2	480000
S(A,X)HL*59(4,E,F)***1GA*	12.1	585000
SEHL*59(4,E,F)***1GA*	11.8	585000
S(F,L,S)HL*59(4,E,F)***1GA*	11.8	585000
S(A,X)HL*59(4,E,F)***6GA*	12.1	585000
SEHL*59(4,E,F)***6GA*	11.8	585000
S(F,L,S)HL*59(4,E,F)***6GA*	11.8	585000
S(A,X)HL*595***1GA*	12.1	585000
SEHL*595***1GA*	11.8	585000
S(F,L,S)HL*595***1GA*	11.8	585000
S(A,X)HL*595***6GA*	12.1	585000
SEHL*595***6GA*	11.8	585000
S(F,L,S)HL*595***6GA*	11.8	585000

Notes:

1. Cooling performance is rated at 95°F ambient, 80°F entering dry bulb, 67°F entering wet bulb. Gross capacity does not include the effect of fan motor heat. AHRI capacity is net and includes the effect of fan motor heat. Units are suitable for operation to ±20% of nominal cfm. Units are certified in accordance with the Unitary Air-Conditioner Equipment certification program, which is based on AHRI Standard 340/360.
2. EER is rated at AHRI conditions and in accordance with DOE test procedures.
3. For simplified verification of your specific unit EER and capacity at operating conditions, it is strongly recommended that a TOPSS (Trane Official Product Selection System) report be run.

Table 9. Economizer outdoor air damper leakage (of rated airflow)

	ΔP Across Dampers (In. WC)	
	0.5 (In.)	**1.0 (In.)**
Standard	1.5%	2.5%
Optional Low Leak	0.5%	1.0%
Optional Ultra Low Leak	—	3 CFM/Ft^2

Note: Above data for Standard and Low Leak based on tests completed in accordance with AMCA Standard 500 at AMCA Laboratories. Ultra low leak damper leakage rate is AMCA certified and meets California Title 24.

Table 10. Gas heat inputs/input ranges

Standard Gas Heat (MBh)	Two-Stage Gas Heat		Modulating Gas Heat	
	Low Fire Heat Input (MBh)	**High Fire Heat Input (MBh)**	**4 to 1 Modulating Heat Input Range (MBh)**	**Ultra Modulating Heat Input Range (MBh)**
235	117	235	NA	NA
350	175	350	NA	NA
500	250	500	125 - 500	36 - 500
850	425	850	210 - 850	48 - 850

Performance Adjustment Factors

Table 11. 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 14. Air density ratios

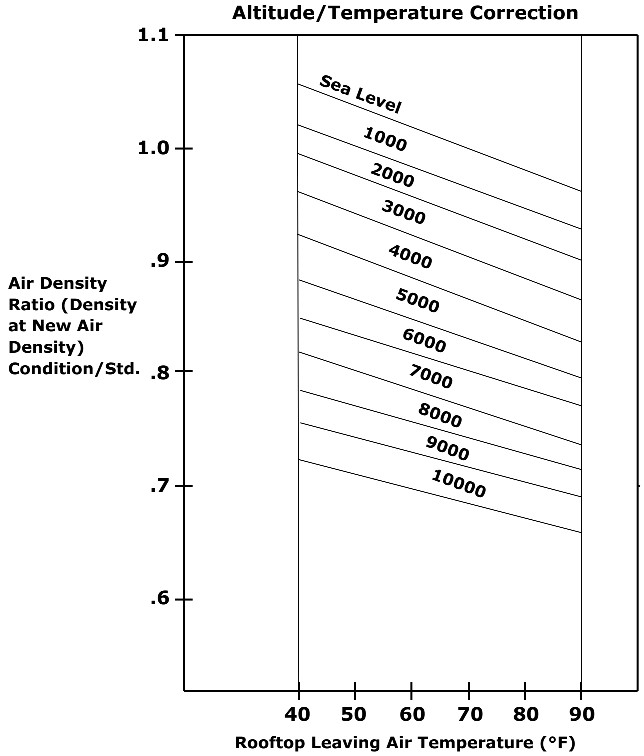


Table 12. Cooling capacity altitude correction factors

	Altitude (ft)								
	Sea Level	1000	2000	3000	4000	5000	6000	7000	8000
Cooling Capacity Multiplier	1.00	1.00	0.99	0.99	0.99	0.98	0.98	0.97	0.97
kW Correction Multiplier	1.00	1.00	1.00	1.00	1.01	1.01	1.01	1.02	1.02
Sensible Heat Ratio Correction Multiplier	1.00	0.97	0.94	0.92	0.89	0.87	0.84	0.81	0.79

Table 13. Gas heating capacity altitude correction factors

	Sea Level to 2000	2001 to 2500	2501 to 3500	3501 to 4500	4501 to 5500	5501 to 6500	6501 to 7500
Capacity Multiplier	1.00	0.92	0.88	0.84	0.80	0.76	0.72

Performance Data

Gross Cooling Capacities

Table 14. Gross Cooling Capacities (MBh) — 24 Ton Evaporative Condensing — High Capacity — R-410A

CFM	Ent DB (°F)	Ambient Temperature (°F)																	
		60						65						70					
								Entering Wet Bulb (°F)						Entering Wet Bulb (°F)					
		61		67		73		61		67		73		61		67		73	
		CAP	SHC	CAP	SHC	CAP	SHC	CAP	SHC	CAP	SHC	CAP	SHC	CAP	SHC	CAP	SHC	CAP	SHC
4000	75	237	165	264	137	295	110	233	163	260	135	290	106	228	159	255	132	284	103
	80	238	188	266	161	296	132	235	186	262	159	291	130	229	182	256	155	285	126
	85	240	211	267	184	297	155	237	209	263	182	293	153	232	205	258	178	287	149
	90	243	235	268	208	298	178	240	232	264	205	294	176	235	228	258	201	288	173
6000	75	266	201	295	161	325	117	262	199	291	159	320	115	256	195	284	154	313	111
	80	270	235	297	195	328	152	266	232	293	193	323	150	260	228	286	189	316	146
	85	276	269	300	228	331	187	271	267	295	225	326	184	266	263	289	221	319	180
	90	288	288	303	261	333	221	285	285	299	258	328	218	279	279	293	254	320	214
7000	75	276	217	305	171	331	117	272	214	300	169	328	118	266	210	293	165	321	114
	80	281	256	307	209	336	159	277	253	302	206	332	158	271	249	295	203	325	154
	85	290	290	311	247	342	201	286	286	306	244	336	198	281	281	300	240	329	195
	90	306	306	316	286	344	238	302	302	311	283	338	235	297	297	305	279	332	231
8000	75	285	232	310	180	336	117	280	229	305	178	337	121	274	225	298	174	326	117
	80	291	277	315	223	342	165	286	274	310	220	340	166	280	270	303	216	331	162
	85	304	304	320	266	348	213	300	300	315	263	343	210	294	294	309	259	336	207
	90	322	322	327	310	353	255	317	317	322	308	348	252	311	311	315	304	340	248
9000	75	291	246	316	189	344	125	287	243	311	186	338	123	280	239	304	182	330	119
	80	299	297	322	236	350	175	295	294	317	233	344	172	288	288	310	229	336	168
	85	316	316	328	285	355	225	312	312	323	282	350	222	306	306	316	278	342	218
	90	335	335	336	335	361	272	330	330	331	331	355	269	324	324	325	325	348	265

CFM	Ent DB (°F)	Ambient Temperature (°F)											
		75						80					
		Entering Wet Bulb (°F)						Entering Wet Bulb (°F)					
		61		67		73		61		67		73	
		CAP	SHC	CAP	SHC	CAP	SHC	CAP	SHC	CAP	SHC	CAP	SHC
4000	75	224	157	250	129	279	100	221	155	247	127	275	100
	80	226	180	252	153	281	124	223	178	248	150	276	122
	85	228	202	253	176	282	147	225	200	250	174	276	145
	90	231	226	254	198	284	170	228	224	251	196	280	169
6000	75	251	192	279	152	307	108	248	190	253	129	302	106
	80	255	225	280	186	310	143	252	223	276	184	306	141
	85	261	260	284	218	314	178	258	258	280	216	309	176
	90	275	275	288	251	315	211	272	272	284	249	310	209
7000	75	261	207	288	162	315	111	257	205	284	160	308	106
	80	266	246	290	200	319	152	262	244	286	197	313	148
	85	276	276	294	237	323	192	273	273	290	235	319	190
	90	292	292	300	276	326	228	289	289	295	274	321	226
8000	75	269	222	293	171	320	114	264	220	288	169	315	112
	80	275	267	298	213	325	159	271	264	293	211	320	156
	85	290	290	303	256	330	203	286	286	299	254	325	201
	90	307	307	310	300	335	245	303	303	306	298	330	243
9000	75	275	236	299	178	324	116	271	233	294	176	318	114
	80	283	283	304	225	330	165	279	279	300	223	325	163
	85	301	301	310	274	336	215	297	297	306	272	331	212
	90	319	319	319	319	342	262	315	315	315	315	337	259

Table 15. Gross Cooling Capacities (MBh) — 29 Ton Evaporative Condensing — High Capacity — R-410A

		Ambient Temperature (°F)																	
		60						65						70					
								Entering Wet Bulb (°F)						Entering Wet Bulb (°F)					
	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
5000	75	276	195	307	160	341	125	272	193	303	158	337	122	269	191	299	155	332	120
	80	277	223	308	189	342	153	274	221	305	187	338	151	270	219	301	185	334	149
	85	281	252	310	218	344	182	277	250	306	216	340	180	274	248	302	214	336	178
	90	285	281	312	246	346	211	282	279	308	244	342	208	279	277	304	242	337	206
7000	75	302	229	334	182	367	131	298	227	330	180	362	129	294	225	325	178	357	127
	80	306	268	336	222	371	172	303	266	332	220	366	170	298	264	327	218	361	167
	85	313	309	339	260	374	212	309	307	335	257	369	210	305	304	330	255	364	207
	90	328	328	344	298	375	250	325	325	340	296	370	248	321	321	335	293	365	246
8750	75	318	256	349	199	380	136	314	254	344	197	375	134	309	251	339	195	369	132
	80	324	305	351	246	380	185	320	303	347	243	381	185	316	300	342	241	376	182
	85	337	337	357	293	388	235	334	334	352	291	383	233	330	330	347	288	377	230
	90	357	357	363	341	392	280	353	353	359	339	388	278	349	349	354	336	382	276
10000	75	326	274	354	210	386	139	322	271	350	208	381	137	317	268	344	205	374	135
	80	335	330	360	262	394	197	331	328	356	259	389	195	326	325	350	257	383	193
	85	352	352	366	316	396	249	349	349	362	314	391	247	344	344	357	311	386	244
	90	373	373	375	371	402	301	369	369	371	369	397	299	364	364	366	366	391	296
11000	75	332	287	360	217	390	141	328	285	355	215	384	139	323	282	349	212	378	137
	80	342	342	366	274	395	204	338	338	361	272	390	202	334	334	356	269	384	199
	85	363	363	373	334	402	260	359	359	368	332	397	258	354	354	363	329	391	255
	90	384	384	384	384	408	317	380	380	380	380	403	315	375	375	375	375	398	312

		Ambient Temperature (°F)											
		75						80					
		Entering Wet Bulb (°F)						Entering Wet Bulb (°F)					
	Ent DB	61		67		73		61		67		73	
CFM	(°F)	CAP	SHC	CAP	SHC	CAP	SHC	CAP	SHC	CAP	SHC	CAP	SHC
5000	75	265	189	295	153	327	119	261	187	291	151	323	115
	80	267	217	297	182	329	146	263	215	293	180	325	144
	85	270	245	298	212	331	176	267	243	294	210	327	174
	90	275	275	300	239	333	204	272	272	296	237	328	202
7000	75	290	222	320	176	351	125	285	220	316	173	346	122
	80	294	261	321	215	356	165	290	259	317	212	351	163
	85	301	301	326	252	359	205	297	297	321	250	354	203
	90	317	317	330	291	360	243	314	314	326	289	355	241
8750	75	304	248	334	193	363	129	300	246	329	190	357	127
	80	311	297	337	238	370	180	307	295	332	236	358	175
	85	326	326	342	285	372	228	322	322	338	283	366	225
	90	344	344	349	334	377	273	340	340	345	331	372	271
10000	75	312	266	339	202	368	132	308	263	334	200	362	130
	80	321	321	345	254	377	190	316	316	340	251	368	188
	85	340	340	352	308	380	242	336	336	347	306	375	239
	90	360	360	361	361	386	293	355	355	355	355	380	291
11000	75	318	279	344	210	372	134	313	276	339	207	365	132
	80	329	329	351	266	379	197	325	325	345	263	373	195
	85	350	350	358	326	386	253	345	345	353	324	380	250
	90	370	370	370	370	392	309	366	366	366	366	386	307

Table 16. Gross Cooling Capacities (MBh) — 36 Ton Evaporative Condensing — High Capacity — R-410A

CFM	Ent DB (°F)	Ambient Temperature (°F)																	
		60						65						70					
								Entering Wet Bulb (°F)						Entering Wet Bulb (°F)					
		61		67		73		61		67		73		61		67		73	
		CAP	SHC	CAP	SHC	CAP	SHC	CAP	SHC	CAP	SHC	CAP	SHC	CAP	SHC	CAP	SHC	CAP	SHC
6000	75	336	240	373	197	414	153	332	237	368	194	408	150	325	232	361	190	400	146
	80	337	274	375	232	415	188	332	271	370	229	409	186	326	266	363	225	402	181
	85	340	308	377	267	417	223	335	305	371	264	411	220	329	300	365	260	404	216
	90	345	343	378	301	419	256	340	339	372	297	413	254	334	334	365	293	406	250
9000	75	370	287	409	228	448	163	365	284	403	225	441	160	358	279	396	221	433	156
	80	375	339	412	278	452	215	370	336	406	275	446	212	363	332	399	271	438	208
	85	382	382	414	327	456	264	378	378	408	324	449	261	371	371	401	320	441	257
	90	403	403	419	377	456	312	398	398	413	373	450	308	391	391	406	369	442	304
10500	75	382	308	421	242	458	167	377	305	414	239	451	164	369	300	406	234	442	159
	80	389	370	422	296	464	227	383	367	416	292	457	224	376	362	408	288	449	219
	85	403	403	427	356	468	283	398	398	421	352	461	280	391	391	413	348	453	276
	90	425	425	434	413	469	335	419	419	428	410	463	332	413	413	420	405	454	328
12000	75	392	328	429	255	465	170	386	325	423	252	457	167	378	320	415	247	448	163
	80	400	400	432	313	473	238	392	392	425	310	466	235	385	385	417	305	457	230
	85	420	420	438	383	475	299	415	415	431	380	468	295	407	407	423	375	459	291
	90	443	443	446	446	480	358	437	437	437	437	473	355	430	430	430	430	464	350
13500	75	400	347	436	266	469	173	394	344	430	263	462	170	386	339	421	259	452	166
	80	410	410	440	331	480	248	405	405	433	327	473	245	398	398	425	322	464	240
	85	434	434	447	411	483	314	429	429	440	407	476	310	421	421	432	402	467	306
	90	458	458	458	458	489	381	453	453	452	452	482	377	445	445	445	445	473	373

CFM	Ent DB (°F)	Ambient Temperature (°F)											
		75						80					
		Entering Wet Bulb (°F)						Entering Wet Bulb (°F)					
		61		67		73		61		67		73	
		CAP	SHC	CAP	SHC	CAP	SHC	CAP	SHC	CAP	SHC	CAP	SHC
6000	75	320	229	355	187	394	144	315	227	350	184	388	141
	80	320	263	357	222	396	179	316	260	352	219	390	176
	85	324	297	359	256	398	212	319	294	354	254	392	210
	90	328	328	359	289	399	246	325	325	355	287	394	244
9000	75	352	275	389	218	425	153	347	273	383	215	419	150
	80	357	328	390	265	430	204	352	325	384	263	424	202
	85	366	366	394	316	434	254	362	362	389	313	428	251
	90	386	386	399	365	435	300	382	382	394	363	429	298
10500	75	363	296	399	231	434	156	357	293	393	230	427	153
	80	370	359	401	284	441	216	364	356	395	281	435	214
	85	385	385	406	344	445	273	381	381	401	341	436	268
	90	407	407	413	402	447	324	402	402	408	399	441	321
12000	75	372	316	407	244	439	159	366	319	401	241	432	157
	80	379	379	410	302	450	227	374	374	404	299	443	225
	85	402	402	416	371	452	287	397	397	410	369	445	284
	90	424	424	424	424	457	347	419	419	419	419	451	344
13500	75	379	335	414	255	443	162	374	340	407	253	436	160
	80	392	392	418	318	456	237	387	387	411	316	449	235
	85	415	415	425	399	459	302	410	410	419	396	452	299
	90	439	439	439	439	465	369	434	434	433	433	459	366

Table 17. Gross Cooling Capacities (MBh) — 48 Ton Evaporative Condensing — High Capacity — R-410A

		Ambient Temperature (°F)																	
		60						65						70					
								Entering Wet Bulb (°F)						Entering Wet Bulb (°F)					
	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
8000	75	422	301	469	266	521	217	417	308	463	262	514	214	410	304	456	258	507	210
	80	422	354	471	306	522	259	417	351	465	303	515	256	411	347	458	299	508	252
	85	426	396	473	351	524	300	421	392	467	347	518	297	415	388	460	343	510	293
	90	430	429	473	390	526	343	425	425	467	387	520	340	418	418	461	383	512	336
11000	75	455	355	505	295	556	229	449	351	498	292	549	226	442	347	490	288	540	222
	80	460	418	508	350	559	285	454	414	500	346	552	282	447	410	492	342	544	278
	85	464	464	509	409	563	340	459	459	503	405	556	336	453	453	495	401	547	332
	90	468	468	514	464	564	400	464	463	507	460	557	396	477	477	500	456	547	391
14000	75	479	393	528	321	576	238	472	389	521	317	568	235	464	385	512	313	559	231
	80	481	469	530	383	583	307	475	465	523	379	575	304	468	459	514	375	566	300
	85	503	503	535	463	583	373	498	498	528	459	576	369	491	491	520	454	567	364
	90	526	526	536	523	589	449	521	520	530	519	581	445	514	515	523	513	572	441
16000	75	490	416	539	335	585	243	484	412	531	332	577	240	476	408	523	328	567	235
	80	496	496	542	404	594	321	490	490	534	400	586	317	483	483	526	395	577	313
	85	524	524	548	497	596	391	518	518	540	493	588	388	511	511	532	489	579	383
	90	553	553	553	553	602	481	547	547	547	547	594	477	540	540	540	540	585	472
18000	75	500	438	547	350	592	248	493	434	540	346	583	244	485	429	531	342	573	240
	80	512	512	551	424	603	333	506	506	544	420	595	330	499	499	535	415	585	326
	85	542	542	550	527	606	409	536	536	543	522	598	405	528	528	535	516	589	401
	90	572	572	572	572	612	512	566	566	566	566	604	508	558	558	558	558	595	504

		Ambient Temperature (°F)											
		75						80					
		Entering Wet Bulb (°F)						Entering Wet Bulb (°F)					
	Ent DB	61		67		73		61		67		73	
CFM	(°F)	CAP	SHC	CAP	SHC	CAP	SHC	CAP	SHC	CAP	SHC	CAP	SHC
8000	75	404	301	449	255	499	207	399	298	443	252	493	204
	80	405	343	452	296	500	249	400	340	446	292	494	246
	85	409	385	454	340	503	289	404	381	448	337	497	287
	90	413	413	454	379	505	333	408	407	449	376	499	330
11000	75	435	343	483	284	531	218	429	340	476	281	524	215
	80	440	406	485	338	535	274	434	402	477	333	529	271
	85	447	447	488	397	539	329	442	442	481	393	532	325
	90	454	454	493	452	539	387	450	450	486	448	533	384
14000	75	457	380	504	309	549	227	451	377	497	306	541	223
	80	462	454	506	370	557	296	456	450	500	367	550	293
	85	485	485	511	450	558	360	479	479	505	447	551	357
	90	508	508	515	508	564	436	503	503	510	504	557	433
16000	75	468	403	514	323	557	231	462	400	507	320	549	228
	80	476	476	517	391	568	309	471	471	511	388	560	306
	85	504	504	524	484	570	379	499	499	517	481	563	375
	90	532	532	533	533	576	468	528	528	527	527	569	465
18000	75	477	425	522	337	562	235	471	421	515	334	554	232
	80	492	492	526	410	576	321	486	486	520	407	568	318
	85	521	521	528	510	579	396	516	516	521	506	572	393
	90	551	551	551	551	586	499	545	545	545	545	579	496

Table 18. Gross Cooling Capacities (MBh) — 59 Ton Evaporative Condensing — High Capacity — R-410A

CFM	Ent DB (°F)	Ambient Temperature (°F)																	
		60						65						70					
								Entering Wet Bulb (°F)						Entering Wet Bulb (°F)					
		61		67		73		61		67		73		61		67		73	
		CAP	SHC	CAP	SHC	CAP	SHC	CAP	SHC	CAP	SHC	CAP	SHC	CAP	SHC	CAP	SHC	CAP	SHC
10000	75	518	372	573	328	636	268	510	380	565	323	626	263	500	373	553	316	614	256
	80	519	438	576	378	636	319	512	433	568	373	627	314	501	426	556	366	614	307
	85	524	490	579	434	639	370	517	484	570	429	630	365	507	477	559	422	618	358
	90	529	530	580	482	642	424	524	524	572	477	633	419	515	515	560	470	621	412
14000	75	563	442	622	369	683	285	554	436	612	364	673	280	543	429	599	356	658	273
	80	569	522	623	434	686	356	561	517	614	428	676	351	549	509	601	420	662	343
	85	577	577	628	510	691	423	570	570	619	505	681	418	559	559	606	497	667	410
	90	607	607	635	580	692	498	599	599	626	574	682	492	589	589	613	566	668	484
17500	75	590	486	648	399	707	296	581	480	638	394	696	291	568	472	625	385	681	283
	80	595	585	652	473	714	380	587	578	642	468	703	375	575	569	628	459	688	367
	85	622	622	658	572	715	460	614	614	648	567	705	454	602	602	635	559	690	446
	90	648	648	668	659	722	555	640	640	658	654	712	549	629	629	641	635	697	541
20000	75	605	514	662	416	719	303	596	508	652	410	708	297	583	500	638	403	692	290
	80	612	612	667	499	728	397	604	604	656	493	717	391	592	592	642	484	701	384
	85	647	647	674	615	731	483	638	638	664	609	720	477	627	626	650	601	705	469
	90	682	681	681	681	738	594	673	673	672	672	727	588	661	660	660	660	712	580
22500	75	617	540	673	433	728	309	608	534	662	428	716	303	594	526	648	420	700	296
	80	632	632	679	523	739	412	623	623	668	517	728	406	611	611	654	508	712	399
	85	668	668	688	657	744	505	659	659	677	651	732	499	646	646	663	643	717	490
	90	704	704	704	704	751	633	695	694	694	694	739	627	682	682	681	681	724	618

CFM	Ent DB (°F)	Ambient Temperature (°F)											
		75						80					
		Entering Wet Bulb (°F)						Entering Wet Bulb (°F)					
		61		67		73		61		67		73	
		CAP	SHC	CAP	SHC	CAP	SHC	CAP	SHC	CAP	SHC	CAP	SHC
10000	75	491	367	544	311	603	250	484	363	537	307	596	247
	80	492	420	547	360	603	302	487	417	541	357	597	299
	85	498	472	548	415	607	352	493	468	541	411	600	349
	90	507	507	551	464	610	407	503	503	545	460	603	404
14000	75	533	422	588	350	646	266	527	419	581	347	638	263
	80	540	503	590	414	650	337	533	499	583	410	642	334
	85	551	551	596	490	655	404	545	545	589	487	647	401
	90	580	580	603	560	656	478	574	574	596	556	649	474
17500	75	558	465	613	380	667	277	551	461	605	376	658	273
	80	566	561	617	453	675	361	555	555	609	449	666	357
	85	593	593	623	552	677	439	587	587	616	548	669	435
	90	620	620	625	625	684	534	619	619	618	618	676	530
20000	75	572	493	621	394	677	283	565	489	617	392	669	280
	80	583	582	630	478	688	377	576	576	622	473	679	373
	85	616	616	638	594	691	462	610	610	630	590	683	458
	90	650	650	650	649	698	573	643	643	643	643	690	569
22500	75	583	519	635	414	685	289	576	514	627	410	676	285
	80	601	601	641	501	698	392	594	594	633	497	689	388
	85	636	636	651	635	703	483	629	629	637	623	694	479
	90	671	671	671	671	711	611	664	664	663	663	702	607

Table 19. Gross Cooling Capacities (MBh) — 73 Ton Evaporative Condensing — High Capacity — R-410A

CFM	Ent DB (°F)	Ambient Temperature (°F)																	
		60						65						70					
								Entering Wet Bulb (°F)						Entering Wet Bulb (°F)					
		61		67		73		61		67		73		61		67		73	
		CAP	SHC	CAP	SHC	CAP	SHC	CAP	SHC	CAP	SHC	CAP	SHC	CAP	SHC	CAP	SHC	CAP	SHC
14000	75	708	530	779	457	856	364	704	544	775	454	851	361	699	541	768	451	843	358
	80	710	623	783	532	859	441	706	620	778	530	854	439	701	617	772	526	846	435
	85	719	700	786	612	863	516	715	698	781	609	858	514	710	694	775	606	850	510
	90	743	743	788	684	866	595	724	724	783	682	861	592	719	718	777	678	853	589
18000	75	743	604	817	495	891	377	738	601	812	493	885	374	732	597	805	489	876	370
	80	753	708	819	589	898	475	748	705	817	588	892	472	742	702	807	583	884	468
	85	773	772	824	688	903	569	769	769	819	685	897	567	763	763	812	681	890	563
	90	792	792	834	784	903	668	789	789	829	781	897	665	784	784	822	777	889	661
21000	75	765	645	837	521	908	385	760	642	832	519	901	382	753	638	824	515	892	378
	80	776	762	839	625	919	497	774	767	833	622	913	495	764	755	826	618	905	491
	85	810	810	848	744	925	606	806	806	843	741	918	603	800	800	835	737	911	600
	90	852	852	860	846	926	719	847	847	854	843	920	716	836	837	846	838	912	713
24000	75	782	683	853	546	919	392	777	680	847	543	912	389	770	676	839	539	903	385
	80	798	798	856	659	935	519	793	793	850	656	928	516	787	787	843	652	920	512
	85	841	841	868	799	936	636	837	836	862	796	929	632	830	830	854	792	921	628
	90	885	885	885	885	945	770	880	880	880	880	938	767	874	873	873	873	931	763
27000	75	797	720	865	569	927	398	792	717	859	566	920	395	785	713	851	563	911	391
	80	822	822	870	693	947	539	817	817	864	689	941	536	811	811	856	685	932	532
	85	867	867	885	854	950	665	862	862	879	850	943	662	856	856	871	846	935	658
	90	913	913	913	913	961	820	907	907	908	908	954	816	900	900	901	901	946	812

CFM	Ent DB (°F)	Ambient Temperature (°F)											
		75						80					
		Entering Wet Bulb (°F)						Entering Wet Bulb (°F)					
		61		67		73		61		67		73	
		CAP	SHC	CAP	SHC	CAP	SHC	CAP	SHC	CAP	SHC	CAP	SHC
14000	75	693	538	762	448	836	355	689	535	758	445	832	353
	80	696	614	766	523	840	432	691	611	761	521	836	430
	85	705	691	769	603	844	507	698	684	762	599	840	505
	90	714	714	771	675	847	585	726	726	767	672	843	584
18000	75	727	594	799	486	869	367	722	591	794	484	864	365
	80	737	698	801	579	877	465	732	696	794	576	873	463
	85	758	758	806	678	882	559	754	754	802	676	878	558
	90	780	780	816	774	882	658	776	776	812	772	878	656
21000	75	748	635	818	512	884	374	743	632	813	510	879	372
	80	759	750	819	614	896	487	754	745	815	612	892	485
	85	795	795	829	734	902	596	791	791	825	732	898	594
	90	837	837	840	832	904	709	828	828	837	829	900	707
24000	75	764	673	832	536	894	381	759	670	828	534	890	380
	80	782	782	836	649	912	509	777	777	831	646	907	507
	85	824	824	848	789	913	625	821	821	843	786	908	622
	90	867	867	867	867	923	759	864	864	863	863	918	757
27000	75	779	709	844	559	902	387	774	706	839	557	897	386
	80	805	805	849	682	924	529	801	801	845	679	919	527
	85	850	850	864	842	927	654	846	846	854	832	922	652
	90	894	894	894	894	938	808	891	891	890	890	933	806

Table 20. Gross Cooling Capacities (MBh) — 80 Ton Evaporative Condensing — High Capacity — R-410A

		Ambient Temperature (°F)																	
		60						65						70					
								Entering Wet Bulb (°F)						Entering Wet Bulb (°F)					
	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
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 (°F)											
		75						80					
		Entering Wet Bulb (°F)						Entering Wet Bulb (°F)					
	Ent DB	61		67		73		61		67		73	
CFM	(°F)	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 21. Gross Cooling Capacities (MBh) — 89 Ton Evaporative Condensing — High Capacity — R-410A

CFM	Ent DB (°F)	Ambient Temperature (°F)																	
		60						65						70					
								Entering Wet Bulb (°F)						Entering Wet Bulb (°F)					
		61		67		73		61		67		73		61		67		73	
		CAP	SHC	CAP	SHC	CAP	SHC	CAP	SHC	CAP	SHC	CAP	SHC	CAP	SHC	CAP	SHC	CAP	SHC
16000	75	855	626	943	542	1041	436	846	640	933	536	1030	431	832	630	918	527	1015	422
	80	857	737	948	630	1043	526	849	731	938	625	1032	520	835	722	922	615	1019	512
	85	869	828	952	723	1047	613	860	822	942	718	1037	607	846	812	927	708	1023	601
	90	880	880	954	811	1051	705	871	871	945	805	1041	699	858	858	930	795	1027	691
20000	75	894	708	987	583	1084	452	885	702	977	577	1073	446	869	692	960	567	1055	440
	80	906	826	993	691	1089	561	897	820	983	685	1077	555	881	810	968	676	1063	547
	85	921	921	995	805	1094	668	912	912	985	800	1083	662	899	899	968	789	1070	655
	90	968	968	1007	915	1099	784	960	960	998	909	1088	778	917	917	981	898	1072	770
22000	75	912	738	1004	601	1100	458	902	731	994	595	1088	452	886	721	978	587	1072	445
	80	926	869	1010	719	1106	577	917	863	999	714	1094	571	901	853	986	708	1078	562
	85	950	950	1014	845	1112	694	942	942	1004	839	1101	688	928	928	994	828	1084	679
	90	1000	1000	1029	965	1117	823	967	968	1019	959	1106	817	955	955	1002	948	1091	796
24000	75	927	766	1018	619	1113	464	918	759	1008	613	1101	458	901	748	999	571	1087	451
	80	944	912	1022	746	1121	593	935	906	1012	740	1109	587	918	895	1002	709	1093	577
	85	977	977	1031	884	1127	719	968	968	1021	877	1116	713	953	953	1013	859	1099	704
	90	1010	1010	1049	1015	1129	857	1002	1002	1039	1009	1117	850	988	988	1032	1001	1106	845
26000	75	941	793	1031	636	1125	470	931	786	1020	630	1112	464	914	775	998	602	1095	455
	80	957	943	1033	769	1133	607	945	936	1023	763	1121	601	930	922	1009	754	1103	592
	85	1001	1000	1047	922	1140	744	992	992	1036	916	1128	737	976	976	1020	906	1112	728
	90	1044	1044	1068	1061	1143	892	1038	1038	1057	1055	1131	885	1022	1022	1042	1042	1115	876
27000	75	948	806	1036	645	1130	472	938	800	1025	639	1117	466	921	789	1011	630	1106	460
	80	958	958	1040	781	1139	615	950	950	1029	774	1127	609	934	934	1016	766	1113	601
	85	1011	1011	1054	941	1146	755	1002	1002	1043	935	1134	749	987	987	1027	925	1121	742
	90	1065	1065	1076	1076	1150	909	1056	1056	1066	1066	1138	902	1042	1042	1051	1051	1124	894

CFM	Ent DB (°F)	Ambient Temperature (°F)											
		75						80					
		Entering Wet Bulb (°F)						Entering Wet Bulb (°F)					
		61		67		73		61		67		73	
		CAP	SHC	CAP	SHC	CAP	SHC	CAP	SHC	CAP	SHC	CAP	SHC
16000	75	820	623	904	519	1003	416	816	621	900	517	992	411
	80	824	714	909	607	1001	503	820	712	905	605	995	500
	85	835	805	913	700	1006	591	832	803	909	698	1000	588
	90	847	848	917	787	1011	678	844	844	913	785	1004	679
20000	75	857	684	946	560	1046	376	853	682	941	557	1031	425
	80	869	802	952	668	1051	542	865	800	947	665	1037	535
	85	888	888	954	781	1057	611	884	884	950	778	1043	642
	90	906	907	969	891	1060	726	904	904	962	887	1048	758
22000	75	874	713	963	579	1060	438	869	710	956	576	1045	431
	80	888	845	969	696	1067	558	884	842	962	693	1052	550
	85	917	917	973	820	1074	674	912	912	968	817	1059	667
	90	946	946	989	941	1078	802	941	940	983	937	1064	796
24000	75	888	740	976	586	1073	445	884	738	969	592	1058	437
	80	905	887	985	724	1081	573	896	875	974	718	1065	565
	85	942	942	994	861	1088	699	937	937	983	856	1073	692
	90	979	979	1008	990	1095	840	979	979	1002	987	1081	819
26000	75	901	767	987	612	1083	450	897	764	981	609	1067	443
	80	917	910	998	756	1093	587	913	906	984	740	1078	580
	85	964	964	1009	899	1100	723	959	959	998	893	1088	718
	90	1011	1011	1020	1023	1103	870	1011	1011	1016	1011	1099	855
27000	75	907	780	992	620	1088	453	902	778	986	617	1076	447
	80	927	926	996	755	1098	594	922	921	989	752	1085	588
	85	976	975	1010	915	1106	735	970	970	1004	912	1094	730
	90	1024	1024	1031	1031	1109	888	1017	1018	1025	1025	1104	871

Heating Performance

Table 22. Natural gas heating capacities, 24-89 ton

Nom Ton	Gas Heat Mod	Heat Input (MBh)	Heat Output (MBh)	Air Temperature Rise vs Unit CFM								
				CFM								
				4000	5000	6000	6140	6700	7000	8000	9000	10000
20, 24	Low	235	188	43	35	29	28	26	25	22	19	
	High	500	400				60	55	53	46	41	
25, 29	Low	235	188		35	29	28	26	25	22	19	17
	High	500	400				60	55	53	46	41	37
30, 36	Low	350	280			43	42	39	37	32	29	26
	High	500	400					55	53	46	41	37
40, 48	Low	350	280							32	29	26
	High	850	680									
50-55, 59	Low	500	400									37
	High	850	680									
60–89	Low	500	400									
	High	850	680									

Nom Ton	Gas Heat Mod	Heat Input (MBh)	Heat Output (MBh)	Air Temperature Rise vs Unit CFM								
				CFM								
				10450	11000	11400	12000	13500	14000	15000	16000	17200
20, 24	Low	235	188									
	High	500	400									
25, 29	Low	235	188	17	16							
	High	500	400	35	34							
30, 36	Low	350	280	25	23	23	22	19				
	High	500	400	35	34	32	31	27				
40, 48	Low	350	280	25	23	23	22	19	18	17	16	15
	High	850	680	60	57	55	52	46	45	42	39	36
50-55, 59	Low	500	400	35	34	32	31	27	26	25	23	21
	High	850	680			55	52	46	45	42	39	36
60–89	Low	500	400						26	25	23	21
	High	850	680						45	42	39	36

Nom Ton	Gas Heat Mod	Heat Input (MBh)	Heat Output (MBh)	Air Temperature Rise vs Unit CFM				
				CFM				
				18000	20000	22500	25000	27000
20, 24	Low	235	188					
	High	500	400					
25, 29	Low	235	188					
	High	500	400					
30, 36	Low	350	280					
	High	500	400					
40, 48	Low	350	280					
	High	850	680	35				
50-55, 59	Low	500	400	20	18	16		
	High	850	680	35	31	28		
60–89	Low	500	400	20	18	16	15	14
	High	850	680	35	31	28	25	23

Notes:

1. All heaters are 80% efficient.
2. CFM values below the minimum and above the maximum shown in this table are not cULus approved.
3. Air temperature rise at sea level = heat output (Btu) ÷ (CFM x 1.085).

Table 23. Steam heating capacities (Q/ITD)

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	2.2	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
High Heat	2.47	3.12	3.59	3.95

46 Nominal Ton Unit				
Steam Module	Unit Standard Air Volume (CFM)			
	8000	12000	16000	20000
Low Heat	1.61	2.01	2.29	2.6
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	2.6	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	4.5	5.1	5.62	6.18

90, 105, 115, 130 Nominal Ton Unit				
Steam Module	Unit Standard Air Volume (CFM)			
	27000	33000	40000	46000
Low Heat	5.17	5.7	6.19	6.53
High Heat	8.83	8.8	9.04	9.26

Note: 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 24. 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 25. Electric heat air temperature rise — 24-89 ton

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		36.7	27.5	22	18.3	15.7	13.8	12.2	11	10	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			43.2	34.6	28.8	24.7	21.6	19.2	17.3	15.7	14.4	13.3
130	443.6				40.9	34.1	29.2	25.6	22.7	20.4	18.6	17	15.7
150	511.8				47.2	39.3	33.7	29.5	26.2	23.6	21.4	19.7	18.1
170	580.1					44.6	38.2	33.4	29.7	26.7	24.3	22.3	20.6
190	648.3					49.8	42.7	37.3	33.2	29.9	27.2	24.9	23

Notes:

1. Maximum permitted air temperature rise; 20-50 tons (cULus - 50°F), 60 - 75 tons (cULus - 43°F).
2. Air temperature rise at sea level = kW x 3413 ÷ (scfm x 1.085)
3. All heaters on units provide 3 increments of capacity.
4. See Electrical Data for electrical sizing information.
5. 200 and 230 volt electric heat rooftops require dual power supplies to the control box. All other rooftops have single power connections.

Table 26. 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

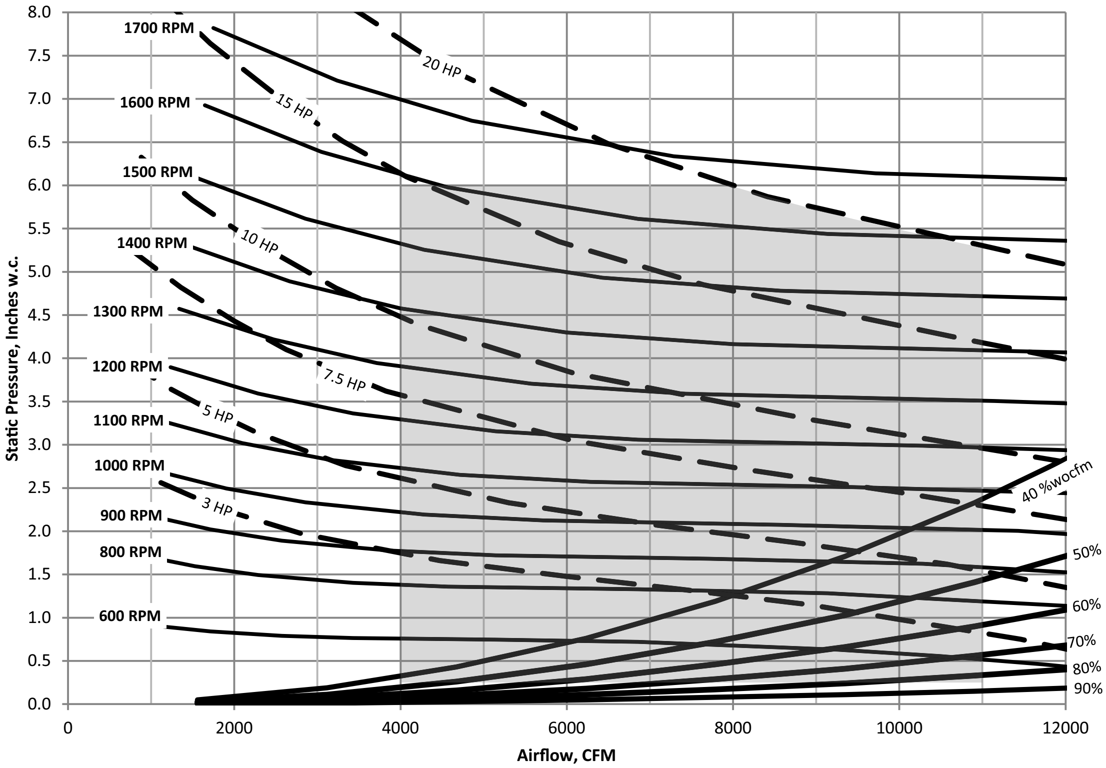
Table 27. Hot water heating capacities (Q/ITD)

24, 29, 36Nominal Tons								
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	3.46	3.81	4.09	4.31
Low	30	1.49	1.97	2.51	2.9	3.19	3.42	3.6
High	40	2.25	2.43	3.12	3.63	4.02	4.34	4.6
Low	40	2.25	2.02	2.6	3.02	3.34	3.6	3.79
High	50	3.2	2.48	3.2	3.74	4.17	4.51	4.8
Low	60	4.31	2.08	2.69	3.16	3.51	3.79	4.02
High	70	5.65	2.54	3.3	3.88	4.35	4.73	5.04
48, 59 Nominal Tons								
Hot Water Module	Gpm	Water PD (ft)	Unit Standard Air Volume (CFM)					
			8000	11000	14000	17000	20000	23000
Low	20	0.7	3	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	3.4	4	4.43	4.76	5.02	5.21
High	50	2.1	4.2	4.95	5.52	5.97	6.34	6.64
Low	60	2.78	3.56	4.23	4.73	5.11	5.4	5.63
High	75	4.04	4.39	5.24	5.89	6.41	6.85	7.21
Low	80	4.5	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	5.43	5.77	6.04
High	125	9.99	4.56	5.5	6.23	6.83	7.33	7.75
73, 80, 89 Nominal Tons								
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	5.2	5.48	5.69	5.83
High	30	1.22	5.24	5.91	6.4	6.77	7.06	7.27
Low	50	2.48	4.9	5.63	6.18	6.6	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	6.6	7.09	7.46	7.73
High	90	6.65	6.32	7.38	8.2	8.87	9.42	9.83
Low	100	8	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	10.3
Low	125	11.99	5.37	6.29	6.99	7.54	7.98	8.29
High	150	16.8	6.6	7.77	8.71	9.47	10.11	10.6

Note: 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.

Supply Fan Performance

Figure 15. Supply fan performance with or without variable frequency drive - 24 and 29 ton evaporative condensing - forward curved

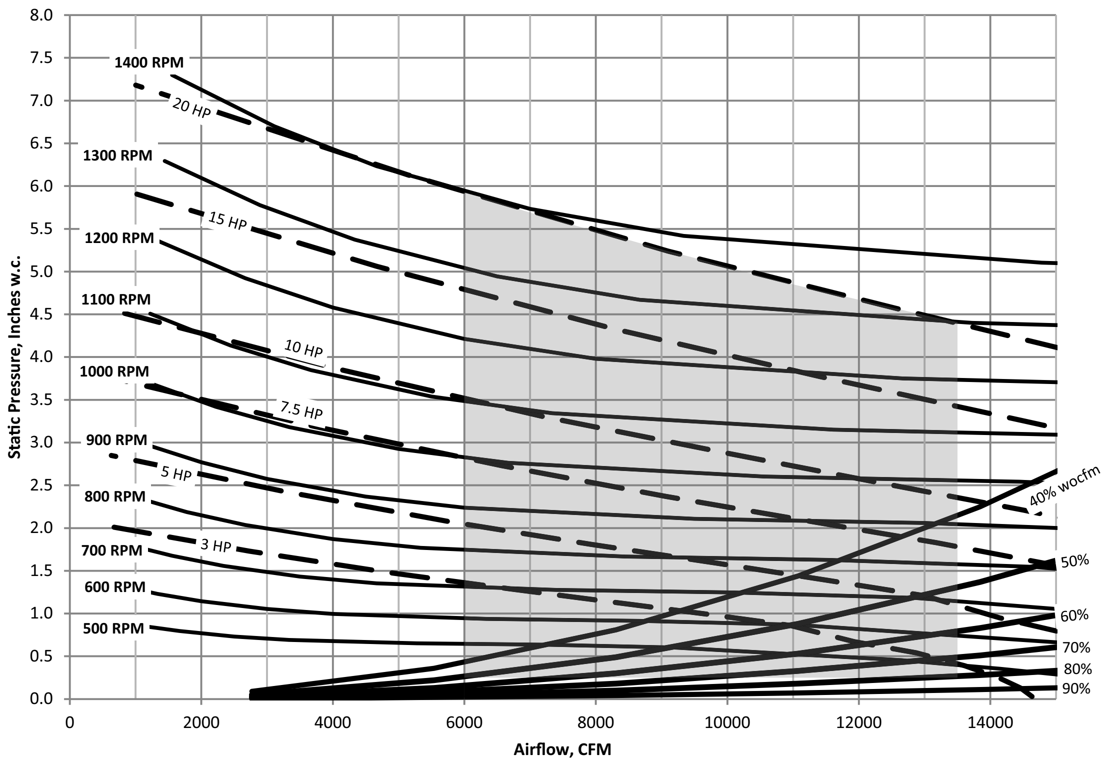


Important: *Maximum static pressure leaving the rooftop is 4.0" H_2O positive. The static pressure drops from the supply fan to the space cannot exceed 4.0" H_2O.*

Notes:

- *Fan performance for 24 and 29 ton rooftops is identical. Contact your local Trane® representative for information on oversized motors.*
- *Shaded areas represent selectable area. Contact your local Trane® representative for more information.*
- *Supply fan performance curve 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).*
- *Maximum Cfm (for cULus approval) as follows: 24 ton - 9,000 Cfm, 29 ton - 11,000 Cfm.*
- *Minimum motor horsepower is 3 hp. Maximum motor horsepower is 20 hp. Maximum fan RPM is 1750.*

Figure 16. Supply fan performance with or without variable frequency drive — 36 ton evaporative condensing - forward curved

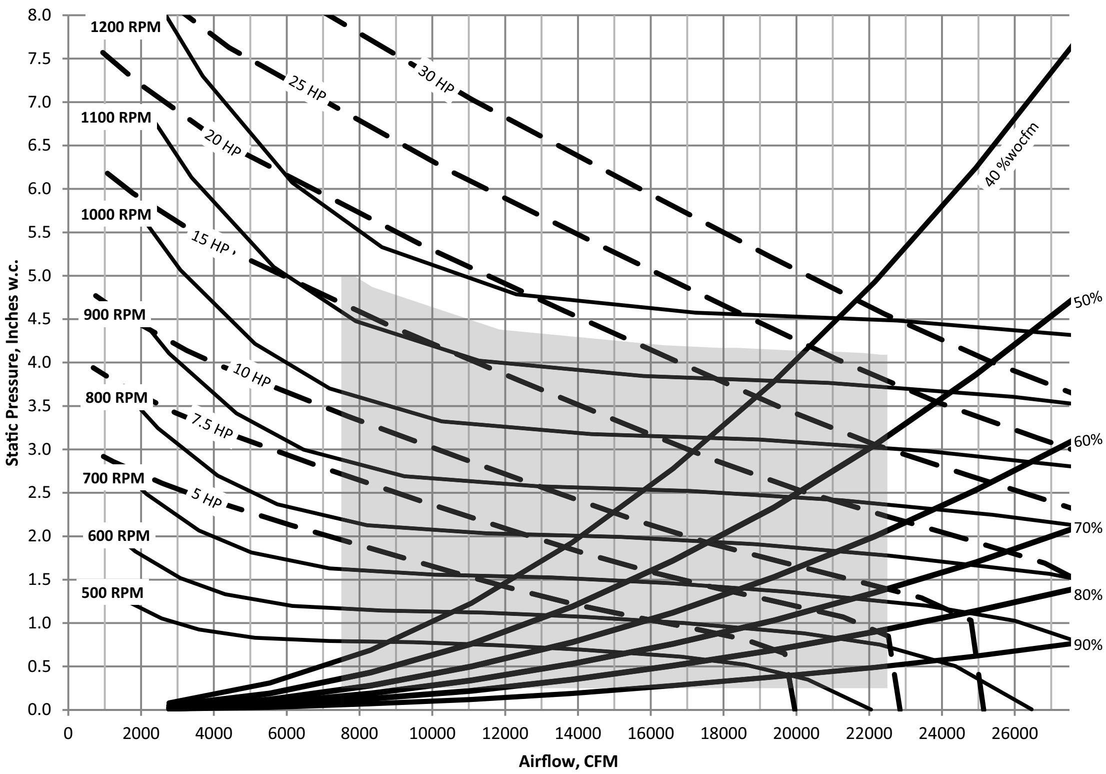


Important: *Maximum static pressure leaving the rooftop is 4.0" H_2O positive. The static pressure drops from the supply fan to the space cannot exceed 4.0" H_2O.*

Notes:

- *Shaded areas represent selectable area. Contact your local Trane® representative for more information.*
- *Supply fan performance curve 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).*
- *Maximum Cfm (for cULus approval) as follows: 36 ton - 13,500 Cfm.*
- *Minimum motor horsepower is 5 hp. Maximum motor horsepower is 20 hp. Maximum fan RPM is 1450.*

Figure 17. Supply fan performance with or without variable frequency drive - 48 and 59 ton evaporative condensing - forward curved

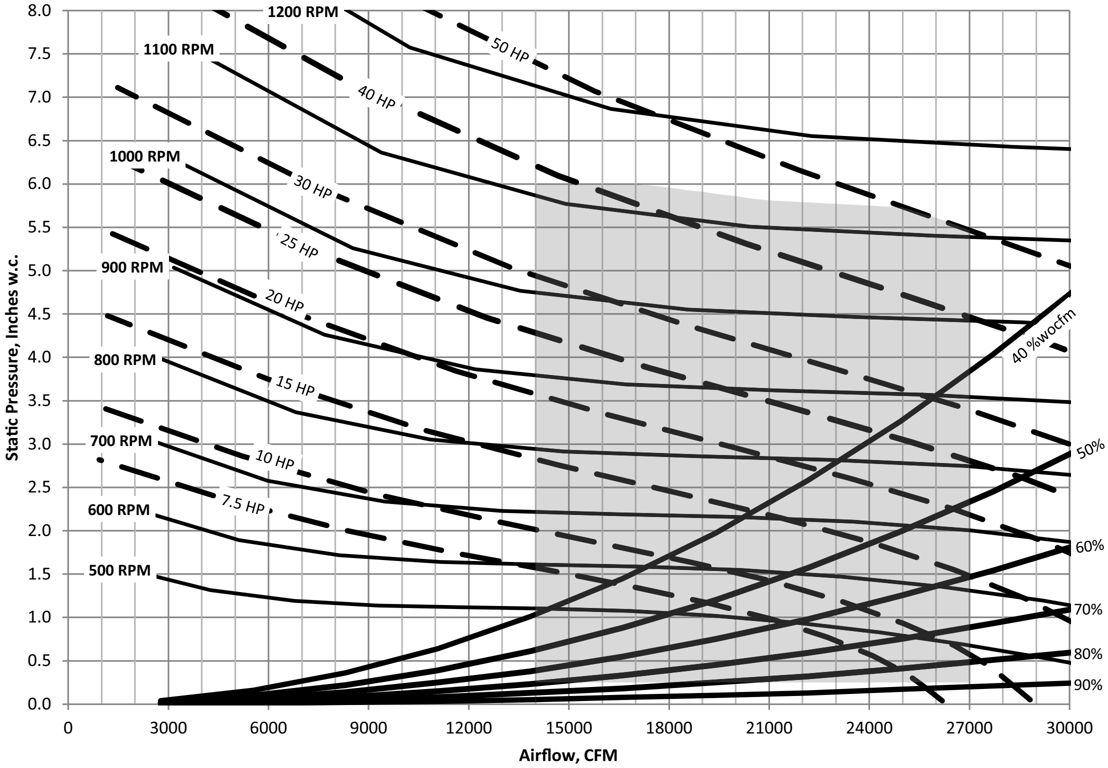


Important: *Maximum static pressure leaving the rooftop is 4.0" H_2O positive. The static pressure drops from the supply fan to the space cannot exceed 4.0" H_2O.*

Notes:

- *Fan performance for 48 and 59 ton rooftops is identical. Contact your local Trane® representative for information on oversized motors.*
- *Shaded areas represent selectable area. Contact your local Trane® representative for more information.*
- *Supply fan performance curve 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).*
- *Maximum Cfm (for cULus approval) as follows: 48 ton - 18,000 Cfm and 59 ton - 22,500 Cfm.*
- *Minimum motor horsepower is 7.5 hp. Maximum motor horsepower is 30 hp. Maximum ½ hp to 15 hp fan Rpm is 1,141 Rpm, maximum 20 hp to 30 hp fan Rpm is 1,170 Rpm.*

Figure 18. 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:

- *Fan performance for 73, 80 and 89 ton rooftops is identical. Contact your local Trane® representative for information on oversized motors.*
- *Shaded areas represent selectable area. Contact your local Trane® representative for more information.*
- *Supply fan performance curve 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).*
- *Maximum Cfm (for cULus approval) as follows: 79 to 89 ton - 27,000 Cfm and 59 ton - 22,500 Cfm.*
- *Minimum motor horsepower is 10 hp. Maximum motor horsepower is 50 hp. Maximum fan Rpm is 1,130 Rpm. 40 and 50 HP motor available as standard in 460 and 575 volt only*

Component Static Pressure Drops

Table 28. Component static pressure drops (in. W.G.), 24–80 ton air-cooled

		Evap Coil		Heating System									Filters									
				SFHL - FC		SFHL - DDP		SEHL	SLHL		SSHL		Throwaway									
Nom	CFM Std	Dry	Wet	Low	High	Low	High	All kW	Low	High	Low	High	Std	High	Perm Wire	Bag & Pre	Cart & Pre	Final Cart	Std Roof	Econ w/ or w/ out Exh	HGR-H
24	4000	0.12	0.16	0.02	N/A	0.03	N/A	0.02	0.05	0.06	0.02	0.06	0.03	0.03	0.01	0.30	0.24	0.22	0.01	0.03	0.01
	6000	0.24	0.29	0.05	0.05	0.05	0.04	0.04	0.09	0.12	0.05	0.12	0.06	0.06	0.02	0.50	0.44	0.30	0.02	0.06	0.02
	8000	0.37	0.44	0.09	0.09	0.08	0.70	0.70	0.15	0.19	0.10	0.20	0.09	0.09	0.03	0.71	0.68	0.45	0.05	0.12	0.04
	9000	0.45	0.52	0.12	0.12	0.10	0.08	0.09	0.19	0.24	0.12	0.22	0.11	0.11	0.04	0.83	0.81	0.55	0.70	0.15	0.05
29	5000	0.18	0.22	0.03	N/A	0.04	N/A	0.03	0.70	0.09	0.04	0.09	0.05	0.05	0.02	0.40	0.34	0.25	0.01	0.03	0.01
	6000	0.24	0.29	0.05	0.05	0.05	0.04	0.04	0.10	0.12	0.06	0.13	0.70	0.70	0.02	0.50	0.44	0.30	0.02	0.05	0.02
	7500	0.34	0.41	0.08	0.08	0.70	0.06	0.06	0.14	0.17	0.09	0.18	0.09	0.09	0.03	0.66	0.62	0.41	0.04	0.10	0.03
	10000	0.53	0.62	0.14	0.15	0.12	0.09	0.11	0.23	0.28	0.15	0.29	0.13	0.13	0.05	0.95	0.95	0.66	0.10	0.19	0.06
	11000	0.62	0.71	0.17	0.18	0.14	0.10	0.13	0.29	0.33	0.19	0.35	0.15	0.15	0.06	1.06	1.11	0.79	0.12	0.23	0.70
36	6000	0.17	0.24	0.05	0.05	0.03	N/A	0.04	0.09	0.12	0.05	0.12	0.04	0.04	0.01	0.34	0.26	0.24	0.02	0.06	0.02
	9000	0.33	0.45	0.11	0.12	0.05	0.05	0.09	0.19	0.24	0.12	0.22	0.70	0.70	0.02	0.54	0.48	0.36	0.70	0.15	0.04
	12000	0.53	0.67	0.20	0.21	0.70	0.70	0.16	0.31	0.39	0.22	0.41	0.11	0.11	0.04	0.75	0.75	0.58	0.16	0.27	0.70
	14000	0.68	0.83	0.26	0.29	0.09	0.09	0.22	0.40	0.51	0.30	0.50	0.14	0.14	0.06	0.95	0.95	0.76	0.25	0.39	0.09
48	8000	0.19	0.26	0.09	N/A	0.13	n/a	0.70	0.09	0.11	0.05	0.11	0.04	0.04	0.02	0.37	0.31	0.25	0.01	0.03	0.02
	10000	0.27	0.36	0.14	0.11	0.20	0.37	0.11	0.13	0.16	0.08	0.16	0.06	0.06	0.02	0.49	0.43	0.32	0.02	0.03	0.03
	12000	0.36	0.48	0.20	0.15	0.28	0.47	0.16	0.17	0.22	0.11	0.21	0.08	0.08	0.03	0.61	0.56	0.41	0.04	0.70	0.05
	16000	0.57	0.73	0.34	0.26	0.49	0.70	0.29	0.28	0.36	0.20	0.36	0.12	0.12	0.05	0.88	0.87	0.66	0.10	0.09	0.08
	17000	0.62	0.79	N/A	0.29	0.55	0.77	0.32	0.31	0.39	0.22	0.41	0.13	0.13	0.06	0.95	0.95	0.74	0.12	0.11	0.10
	18000	0.68	0.86	N/A	0.33	N/A	0.83	0.36	0.35	0.43	0.25	0.44	0.14	0.14	0.70	1.02	1.04	0.83	0.14	0.13	0.11
59	10000	0.20	0.25	0.12	0.10	0.20	N/A	0.11	0.13	0.16	0.70	0.15	0.04	0.04	0.01	0.37	0.30	0.25	0.03	0.05	0.03
	14000	0.34	0.42	0.26	0.20	0.38	0.17	0.22	0.22	0.28	0.15	0.28	0.70	0.70	0.03	0.56	0.50	0.37	0.70	0.08	0.05
	17000	0.46	0.57	0.39	0.29	0.55	0.26	0.32	0.31	0.40	0.22	0.41	0.10	0.10	0.04	0.72	0.68	0.50	0.12	0.11	0.08
	20000	0.59	0.73	0.58	0.41	0.75	0.38	0.44	0.42	0.52	0.30	0.51	0.12	0.12	0.05	0.88	0.88	0.66	0.19	0.17	0.11
	23000	0.74	0.89	0.69	0.54	0.99	0.53	0.58	0.47	0.67	0.41	0.69	0.15	0.15	0.70	1.05	N/A	0.87	0.27	0.22	0.14
73	12000	0.27	0.37	0.10	0.08	0.28	0.14	0.06	0.10	0.13	0.06	0.11	0.05	0.05	0.01	0.44	0.37	0.27	0.02	0.70	0.03
	16000	0.43	0.58	0.18	0.14	0.44	0.28	0.11	0.17	0.21	0.11	0.19	0.70	0.70	0.02	0.63	0.58	0.39	0.05	0.10	0.06
	20000	0.62	0.80	0.27	0.21	0.63	0.46	0.17	0.24	0.31	0.16	0.27	0.10	0.10	0.03	0.84	0.82	0.56	0.10	0.16	0.09
	24000	0.83	1.03	0.40	0.30	0.86	0.68	0.24	0.33	0.42	0.22	0.39	0.11	0.11	0.04	1.06	1.08	0.78	0.16	0.23	0.13
	27000	1.00	1.22	0.46	0.32	1.05	0.88	0.30	0.41	0.52	0.30	0.47	0.16	0.16	0.06	1.18	1.24	0.98	0.27	0.28	0.16
80-89	16000	0.44	0.58	0.18	0.14	0.44	0.28	0.11	0.17	0.21	0.11	0.19	0.70	0.70	0.02	0.63	0.58	0.39	0.05	0.10	0.06
	20000	0.62	0.82	0.27	0.21	0.63	0.46	0.17	0.24	0.31	0.16	0.27	0.10	0.10	0.03	0.84	0.82	0.56	0.10	0.16	0.09
	22000	0.73	0.94	0.33	0.25	0.74	0.56	0.20	0.29	0.37	0.19	0.33	0.12	0.12	0.04	0.95	0.95	0.66	0.13	0.20	0.11
	24000	0.84	1.07	0.40	0.30	0.86	0.68	0.24	0.33	0.42	0.22	0.39	0.14	0.14	0.04	1.06	1.08	0.78	0.16	0.23	0.13
	26000	0.95	1.20	0.47	0.32	0.98	0.81	0.28	0.39	0.49	0.27	0.45	0.16	0.16	0.05	1.17	1.23	0.91	0.23	0.26	0.15
	27000	1.01	1.26	0.51	0.33	1.05	0.88	0.30	0.42	0.52	0.30	0.48	0.17	0.17	0.06	1.12	1.26	0.98	0.27	0.28	0.16

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 29. 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	0.30
	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	1.20
	17000	1.60
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
80-89	12000	0.31
	16000	0.56
	20000	0.88
	22000	1.05
	24000	1.27
	26000	1.47
	28000	1.73
	31000	N/A
	33000	N/A

Fan Drive Selections

Supply Fan Performance

Table 30. FC supply air fan drive selections — 24 – 89 ton

Nom Tons	3 Hp		5 Hp		7.5 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								

Table 30. FC supply air fan drive selections — 24 – 89 ton (continued)

Nom Tons	3 Hp		5 Hp		7.5 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
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						

Exhaust Fan Performance

Table 31. Modulating 100% exhaust fan performance — 24 - 89 tons

Nom Tons	CFM Std Air	Negative Static Pressure															
		0.25		0.50		0.75		1.00		1.25		1.50		1.75		2.00	
		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

Notes:

1. Shaded areas indicate non-standard drive selections. These drive selections must be manually factory selected.
2. Refer to General Data Table for minimum and maximum HP.

Table 32. 100% Exhaust fan drive selections — 24 - 89 ton

	3 Hp		5 Hp		7.5 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	500 600 700 800 900	5 6 7 8 9										
29	500 600 700 800 900	5 6 7 8 9	700 800 900 1000	7 8 9 A								
36	500 600 700 800 900	5 6 7 8 9	700 800 900 1000	7 8 9 A	800 900 1000 1100	8 9 A B						
48			400 500 600 700 800	4 5 6 7 8	600 700 800	6 7 8	700 800	7 8				
59			400 500 600 700 800	4 5 6 7 8	600 700 800	6 7 8	700 800	7 8	700 800 900	7 8 9		
73			400	4	600	6	600	6	700	7	800	8
80			500	5	700	7	700	7	800	8		
89			600	6								

Table 33. 50% Exhaust fan performance — 24 - 89 tons

Nom Tons	CFM Std Air	Negative Static Pressure													
		0.20		0.40		0.60		0.80		1.00		1.20		1.40	
		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				

Notes:
1. Shaded areas indicate non-standard drive selections. These drive selections must be manually factory selected.
2. Refer to General Data Table for minimum and maximum HP.

Table 34. 50% Exhaust fan drive selections 24 – 89 tons

Nom Tons	3 Hp		5 Hp		7.5 Hp	
	RPM	Drive No.	RPM	Drive No.	RPM	Drive No.
24, 29	500 600 700 800 900	5 6 7 8 9				

Table 34. 50% Exhaust fan drive selections 24 – 89 tons (continued)

36	500 600 700 800 900	5 6 7 8 9	800 900 1000	8 9 A		
48, 59			500 600 700	5 6 7	600 700	6 7
73, 80, 89			400 500 600	4 5 6	700	7

Return Fan Performance

Table 35. Return fan performance—24, 29, 36 ton evaporative condensing (24.5" Fan)

CFM Std Air	Return Fan Static Pressure Including Exhaust Damper P.D.															
	0.25		0.50		0.75		1.00		1.25		1.50		1.75		2.00	
	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. See Table 28, p. 76 - exhaust damper for return fan in Performance Data.
7. Shaded area indicates nonstandard BHP or RPM selections. Contact a local Trane® representative for more information.

Table 36. Return fan performance—48 and 59 ton evaporative condensing (27" Fan)

CFM Std Air	Return Fan Static Pressure Including Exhaust Damper P.D.															
	0.25		0.50		0.75		1.00		1.25		1.50		1.75		2.00	
	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

Table 36. Return fan performance—48 and 59 ton evaporative condensing (27" Fan) (continued)

CFM Std Air	Return Fan Static Pressure Including Exhaust Damper P.D.															
	0.25		0.50		0.75		1.00		1.25		1.50		1.75		2.00	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
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 must be added to the return duct static. See Table 28, p. 76- exhaust damper for return fan in Performance Data.
8. Shaded area indicates nonstandard BHP or RPM selections. Contact a local Trane® representative for more information.

Table 37. Return fan performance—73 - 89 ton evaporative condensing (36.5" fan)

CFM Std Air	Return Fan Static Pressure Including Exhaust Damper P.D.															
	0.25		0.50		0.75		1.00		1.25		1.50		1.75		2.00	
	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 & 89
4. Max CFM is 27000 for 73, 80 & 89
5. Min CFM is 12000 for73, 80 & 89
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 must be added to the return duct static per Table 28, p. 76.

Table 38. 100% Return fan drive selections — 24 - 89 ton evaporative condensing

	3 Hp		5 Hp		7.5 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	500 600 700 800 900 1000 1100 1200 1300	5 6 7 8 9 A B C D										
29	500 600 700 800 900 1000 1100 1200 1300	5 6 7 8 9 A B C D	1100 1200 1300 1400 1500 1600	B C D E F G								
36	500 600 700 800 900 1000 1100 1200 1300	5 6 7 8 9 A B C D	1100 1200 1300 1400 1500 1600	B C D E F G	1400 1500 1600	E F G						
48			700 800 900 1000 1100 1200 1300	7 8 9 A B C D	1200 1300 1400 1500	C D E F	1400 1500 1600 1700	E F G H				

Table 38. 100% Return fan drive selections — 24 - 89 ton evaporative condensing (continued)

	3 Hp		5 Hp		7.5 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.
59			700 800 900 1000 1100 1200 1300	7 8 9 A B C D	1200 1300 1400 1500	C D E F	1400 1500 1600 1700	E F G H	1600 1700 1800 1900	G H J K		
73			500 600 700 800	5 6 7 8	700 800 900	7 8 9	800 900 1000	8 9 A	900 1000 1100	9 A B	1100	B
80. 89			500 600 700 800	5 6 7 8	700 800 900	7 8 9	800 900 1000	8 9 A	900 1000 1100	9 A B	1100	B

Electrical Data

Electrical Service Sizing

To correctly size electrical service wiring for a unit, find the appropriate calculations listed below. Each type of unit has its own set of calculations for MCA (Minimum Circuit Ampacity), 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 unit type.

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

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

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

LOAD2 = Sum of the currents of all remaining motors

LOAD3 = Current of electric heaters

LOAD4 = Any other load rated at 1 AMP or more

SAH_ (Cooling Only) units

SXH_ (Extended Casing) units

SLH_ and SSH_ (Cooling with Hydronic Heat) units

SFH_ (Cooling with Gas Heat) units

Load Definitions	
LOAD 1	Current of the largest motor (compressor or fan motor)
LOAD 2	Sum of the currents of all remaining motors
LOAD 3	Current of electric heaters
LOAD 4	Any other load rated at 1 amp or more

Control Power Transformer for All Modes	
20–40 ton units	Add 3 FL Amps
50–75 ton units	Add 6 FL Amps
90–130 ton units	Add 8 FL Amps

Crankcase Heaters for Heating Mode 460/575v Only	
20–30 ton units	Add 1 Amp
40–60 ton units	Add 2 Amps
70–75 ton units	Add 3 Amps
90–130 ton unit	Add 4 Amps

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

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 select the RDE value to equal the MOP value.*

Set 2: Rooftop units with Electric Heat

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

To arrive at the correct MCA, MOP, and RDE values for these units, two sets of calculations must be performed. 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 heating mode as follows. (Keep in mind when determining LOADS that the compressors don't run while the unit is in 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 select the lowest standard maximum fuse size which is equal to or larger than the MCA, provided the selected fuse size does not exceed 800 amps.*

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.

Notes:

- *If the selected RDE is greater than the selected MOP value, then select the RDE value to equal the MOP value.*
- *On 90 to 162 ton rooftops, the selected MOP value is stamped in the MOP field on the unit nameplate.*

Service Sizing Data

Table 39. Compressor electrical service sizing data (24-89 ton)

Tonnage (AC/EC)	No. of Compres-sors	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

Note: Evaporative Condenser Units only available in 460V

Table 40. Electrical service sizing data — motors

Tonnage	200 V	230 V	460 V	575 V
	FLA	FLA	FLA	FLA
Motor Horsepower	**Supply/Exhaust/Return Fan Motor (4 pole)**			
3	9.7	8.4	4.2	3.4
5	15.3	13.2	6.6	5.3
7.5	22.8	19.5	9.8	7.8
10	29.5	25.2	12.6	10.1
15	42.4	36.0	18.0	15.0
20	56.1	49.4	24.7	19.5
25	70.1	61.0	30.5	24.8
30	82.2	73.2	36.6	29.0
40	N/A	N/A	49.0	39.0
50	N/A	N/A	59.0	47.2
Motor Horsepower	**Supply Fan Motor (6 pole)**			
3	10.1	9.0	4.5	3.7
5	17.0	14.8	7.4	5.8
7.5	25.0	22.0	11.0	8.6
10	32.0	28.6	14.3	11.5
15	47.0	41.0	20.5	16.0
20	63.0	54.0	27.0	22.0

Notes:
1. FLA is for individual motors by HP, not total unit supply fan HP.
2. Return fan motors are available in 3-20 Hp
3. 40 & 50 Hp motor available as standard in 460 & 575 volt only
4. DDP fans selected under 1,600 RPM will have 6-pole motors

Table 41. Electrical service sizing data evaporative condenser - All tonnages (24-89 tons), 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 42. Electrical service sizing data — control power transformer heating and cooling modes — 24-89 tons

Nominal Tons Evaporative Condensing	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 43. Electrical service sizing data — crankcase heaters (heating mode on 460 volt only) — 24-89 tons

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

Table 44. Voltage utilization range

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

Dimensional Data

Figure 19. Heating/cooling unit dimensions (ft. in.) — 24-89 ton evaporative condensing

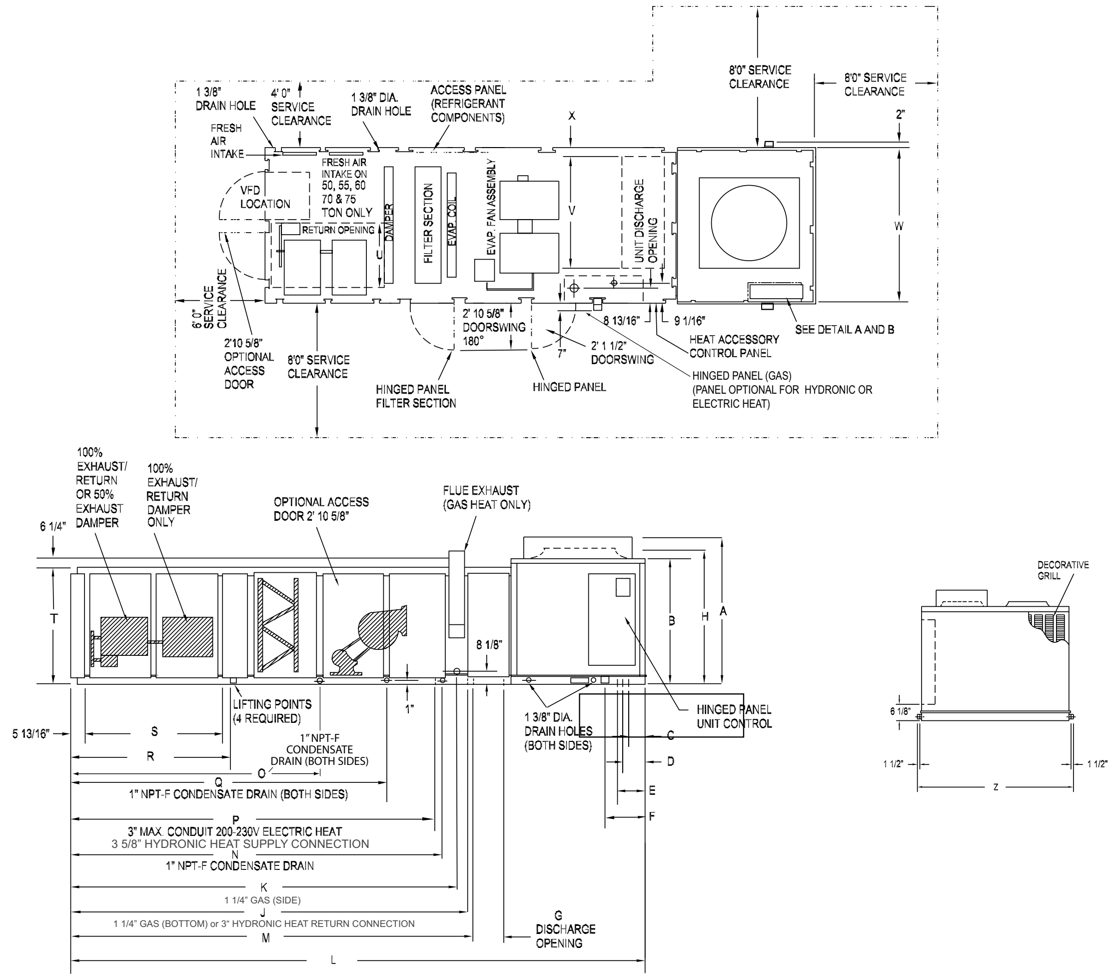


Table 45. Heating/cooling unit dimensions (ft. in.)— 24-89 ton evaporative condensing

Nom. Tons	H	L	W	A4	B	C	D	E	F
24, 29	8-4 3/4	26-5 1/2	7-6 1/2	N/A	6-9	0-9 7/8	1-5 7/8	1-10 1/8	2-2 1/2
36	8-4 3/4	26-5 1/2	7-6 1/2	N/A	6-9	0-9 7/8	1-5 7/8	1-10 1/8	2-2 1/2
48	8-4 3/4	32-10 1/2	7-6 1/2	N/A	6-9	0-9 7/8	1-5 7/8	1-10 1/8	2-2 1/2
59	8-4 3/4	32-10 1/2	7-6 1/2	N/A	6-9	0-9 7/8	1-5 7/8	1-10 1/8	2-2 1/2
73, 80, 89	8-4 3/4	32-10 1/2	9-8	N/A	6-9	0-9 7/8	1-5 7/8	1-10 1/8	2-2 1/2
Nom. Tons	**G**	**J**	**K**	**M**	**N**	**O**	**P**	**Q**	**R**
24, 29	2-2 1/2	16-9 3/4	16-6	16-3 13/16	16-7	10-7	15-5 5/16	13-3	7-0
		16-9 3/4	16-6						
36	2-2 1/2	16-9 3/4	16-6	16-3 13/16	16-7	10-7	15-5 5/16	13-3	7-0
		16-9 3/4	16-6						
48	2-5	20-1 3/4	19-6	19-10 5/16	19-7	12-1	18-11 11/16	15-4 5/16	8-0
		20-6 3/4	20-3						
59	2-5	20-1 3/4	19-6	19-10 5/16	19-7	12-1	18-11 11/16	15-4 5/16	8-0
		20-6 3/4	20-3						
73, 80, 89	2-5	20-1 3/4	19-6	19-10 5/16	19-7	12-1	18-11 11/16	15-4 5/16	8-0
		20-6 3/4	20-3						

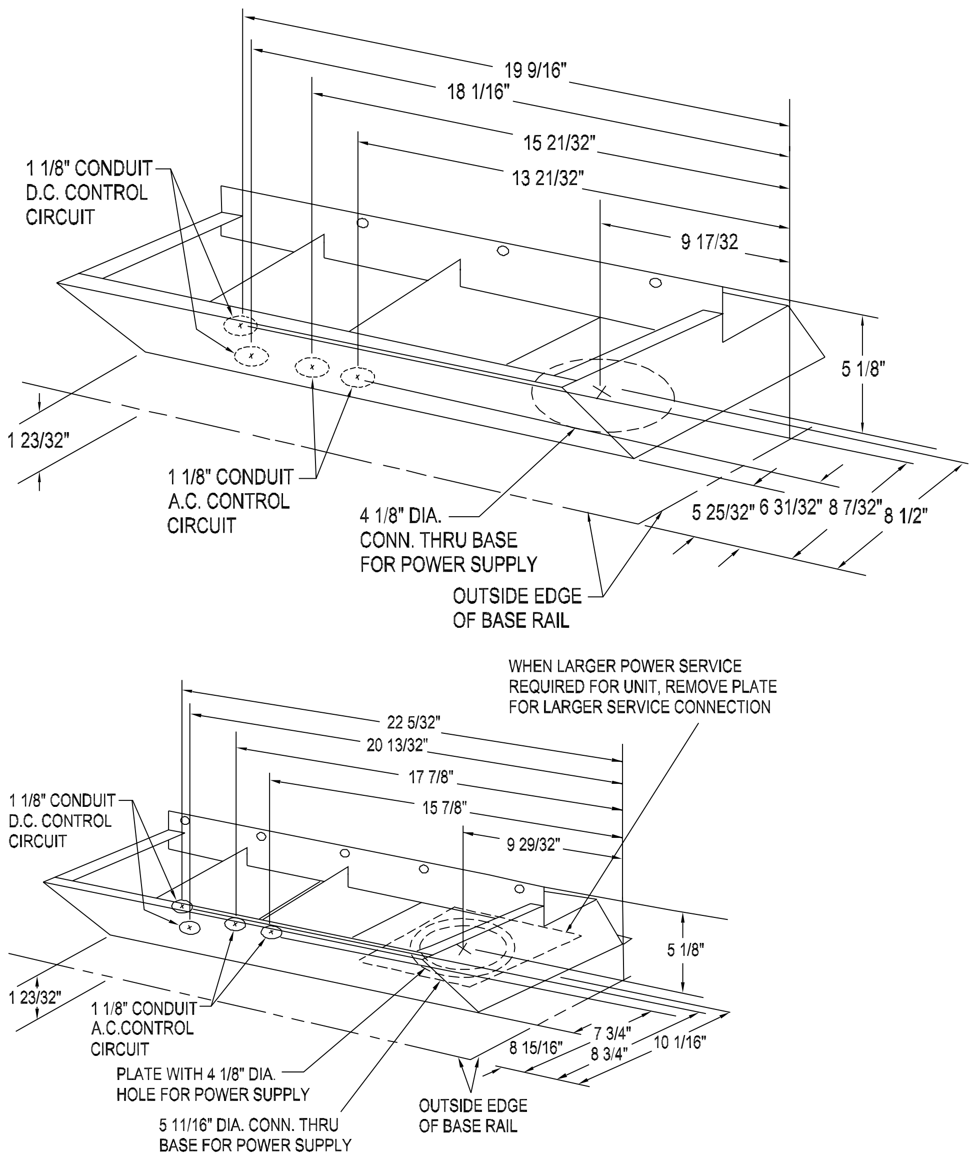
Table 45. Heating/cooling unit dimensions (ft. in.)— 24-89 ton evaporative condensing (continued)

Nom. Tons	R2	S		T	U		V	W	X
		w/ exhaust fan	w/return fan		w/ exhaust fan	w/return fan			
24, 29	N/A	6-6 15/16	3-0	3-9 5/16	3-4 3/8	2-915/16	5-7	0-5 13/16	7-9 1/2
36	N/A	6-6 15/16	3-0	4-9 5/16	3-4 3/8	2-915/16	5-7	0-5 13/16	7-9 1/2
48	16-2 5/16	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	16-2 5/16	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	16-2 5/16	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:

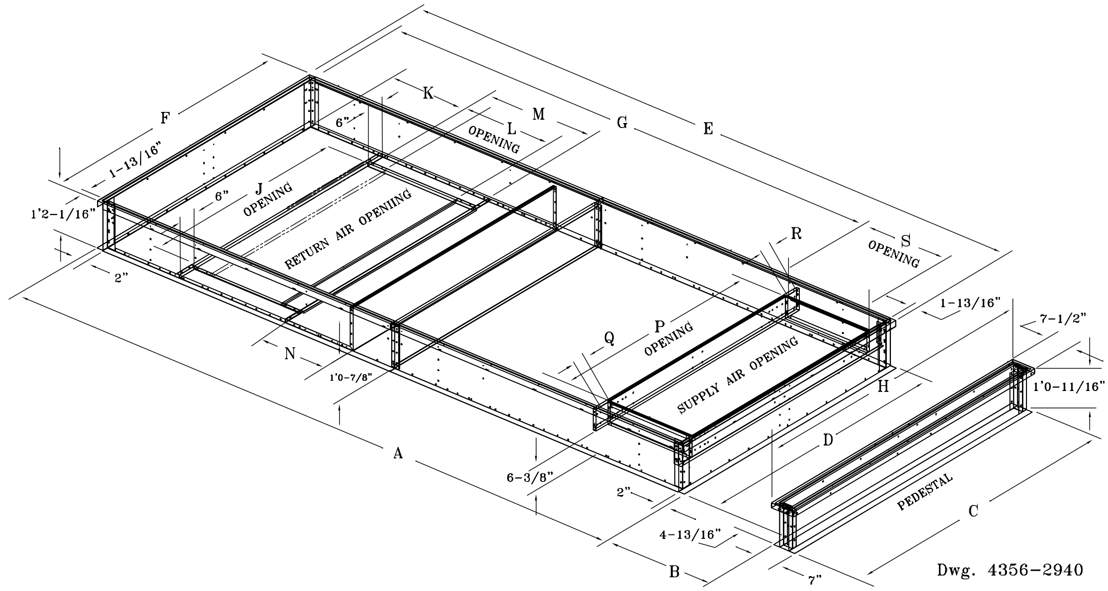
1. In columns J and K: top dimension = high gas heat, bottom dimension = low gas heat.
2. Unit drawing is representative only and may not accurately depict all models.
3. Use high gas heat J dimension for all hydronic heat connections
4. Low ambient damper (A) not used with evaporative condensing units.

Figure 20. Cooling only unit dimensions - detail A and B — 24-89 ton



Note: *Detail "A" applies to 20-59 ton units, detail “B” applies to 60–89 ton units.*

Figure 21. Optional roof curb dimensions (downflow) — 24-89 ton evaporative condensing



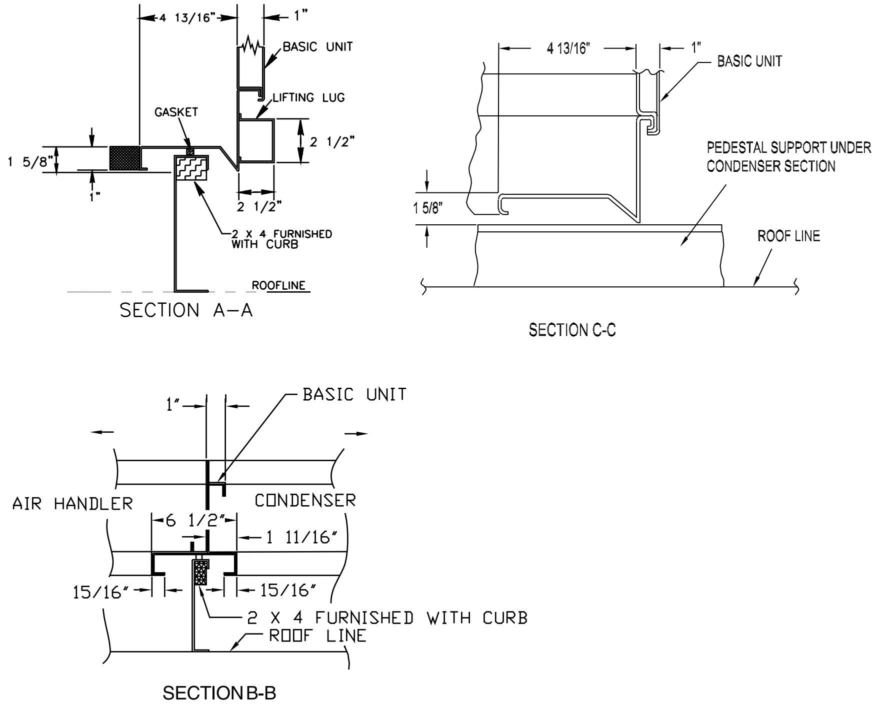
Note: *The pedestal was purposely designed 1–3/8" shorter than the curb because the unit base rails rest on the pedestal at one point and on the curb at a different point.*

Table 46. Downflow roof curb dimensions (ft. in.) — 24-89 ton evaporative condensing

Tons	Model	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"
4048, 505559	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"
60,70,757-3,80,89	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"

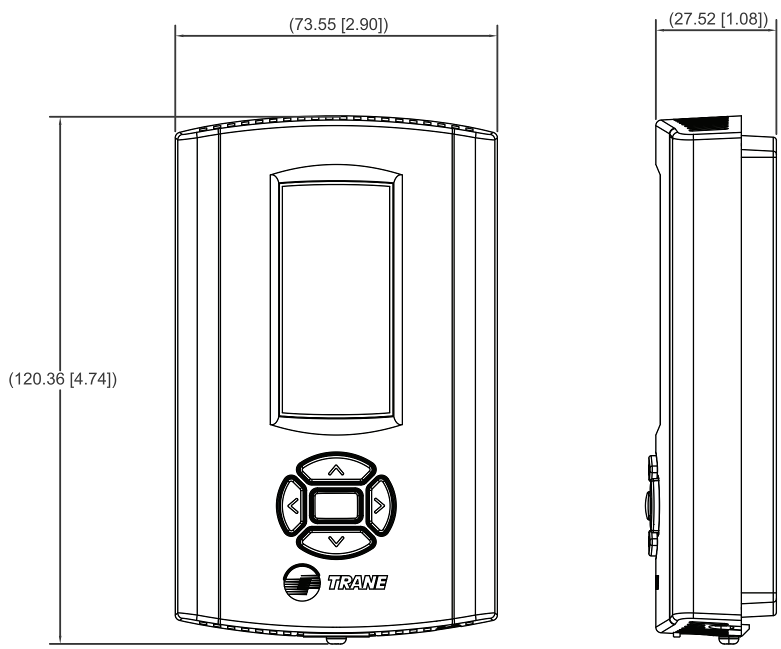
Tons	Model	K	L	M	N	P	Q	R	S
24,29,36	S*HL	2'-0"	3'-6"	4'-0"	1'-10 5/8"	5'-7 3/8"	0'-1 13/16"	0'-2 1/4"	2'-5 15/16"
4048, 505559	SAHL	2'-0"	3'-6"	4'-0"	1'-10 5/8"	5'-9 1/2"	0'-5 11/16"	0'-5 11/16"	2'-5 15/16"
	S*HL	2'-0"	3'-6	4'-0	1'-10 5/8"	5'-7 3/8"	0'-11 3/16"	0'-2 1/4"	2'-5 15/16"
60,70,757-3,80,89	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"

Figure 22. Cross section through roof curb and base pan



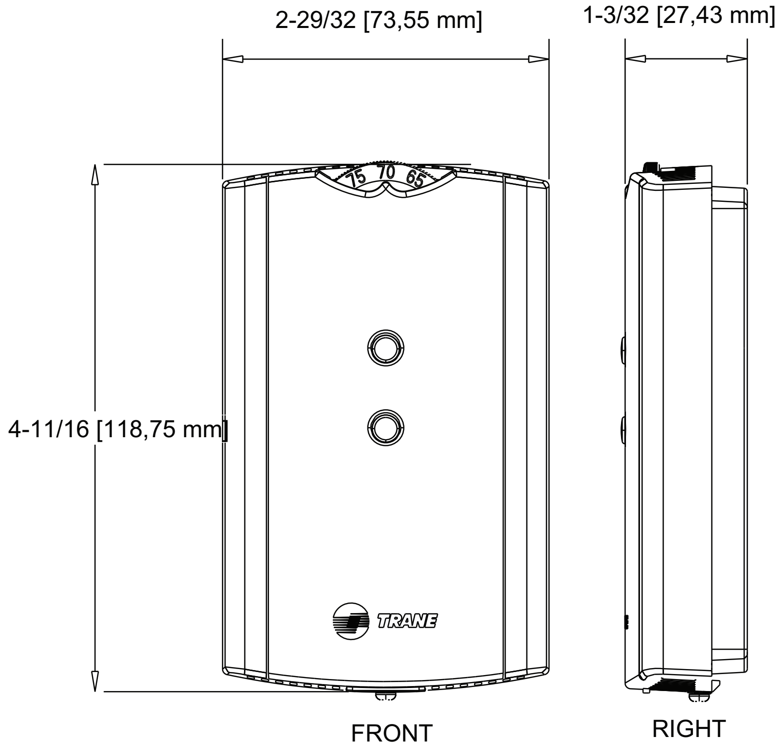
Field-Installed Sensors

Figure 23. 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.*

Figure 24. Field installed zone sensor—with timed override button and local setpoint adjustment (BAYSENS074*), with timed override only (BAYSENS073*), sensor only (BAYSENS077*)



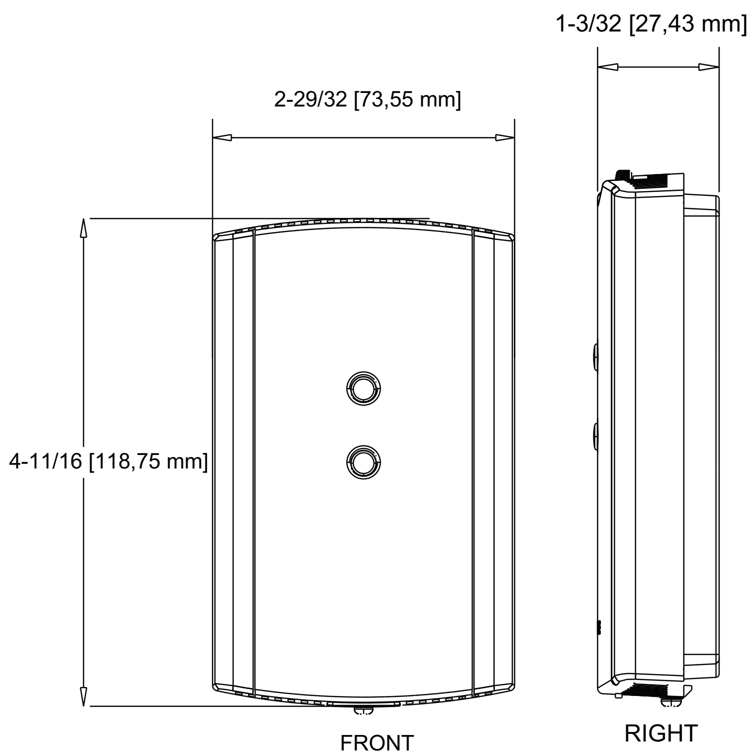


Figure 25. Field installed temperature sensor (BAYSENS016*)

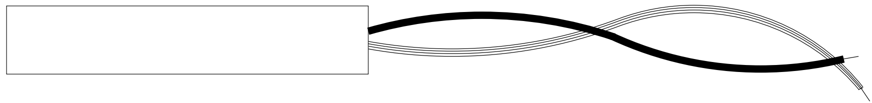


Figure 26. Field installed remote minimum position potentiometer control (BAYSTAT023*)

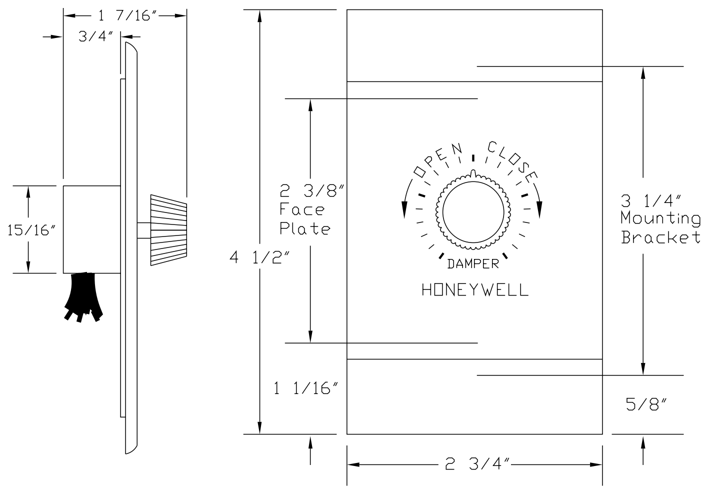
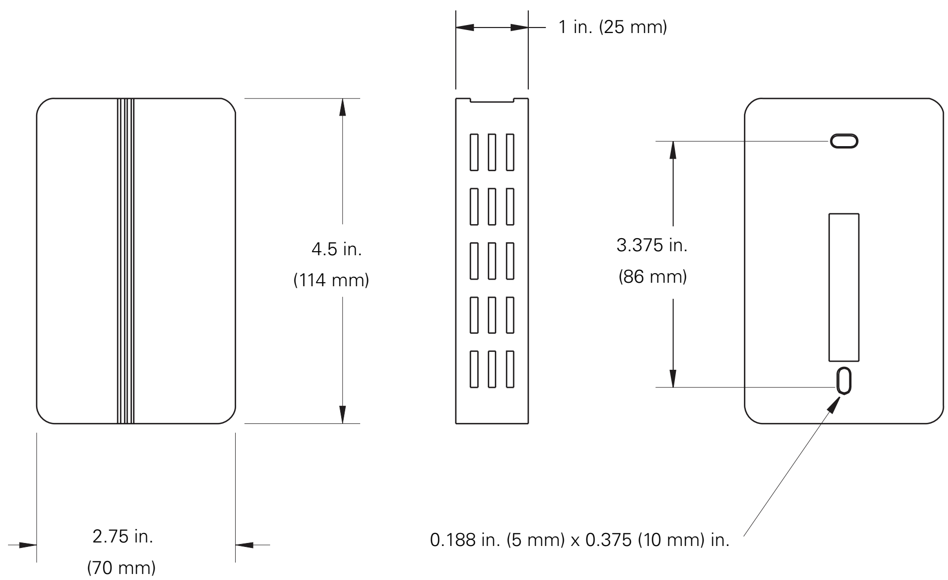


Figure 27. Field installed humidity sensor—wall (BAYSENS036*) or duct mount (BAYSENS037*)



Weights

Table 47. Evaporative Condenser - approximate operating weight (lbs.)

Unit	Without Exhaust Fan				With Exhaust Fan			
	SX	SE	SF	SL/SS	SX	SE	SF	SL/SS
24	6549	6679	6944	6763	6907	7037	7302	7121
29	6599	6729	6994	6813	6963	7093	7358	7177
36	7121	7251	7513	7335	7538	7668	7933	7752
48	9001	9156	9631	9359	9585	9740	10215	9943
59	9213	9368	9843	9571	9856	10011	10486	10214
73	11303	11458	11933	11691	12128	12283	12758	12516
80	11430	11585	12060	11818	12255	12410	12885	12643
89	11820	11975	12450	12208	12645	12800	13275	13033

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 ±10% 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.

Table 48. Roof curb max weight (lbs./kg.)

Unit	Roof Curb Max. Weight	
	SAHL	S*HL
20, 25, 30	490	510
40, 50, 55	515	550
60, 70, 75	610	640

Note: Roof curb weights include the curb and pedestal.

Options

Table 49. Comprehensive listing of available options and accessories

Option or Accessory[a]	Option	Factory Design Special[b] [c]	Standard Field-Installed Accessory
Coils			
Corrosion Protected evaporator coils		X	
Copper finned evaporator coils		X	
Controls			
LonTalk® Communication Interface (LCI)	X		X
BACnet® Communication Interface (BCI)	X		X
Trane® Air-Fi™ Wireless Communications Interface (WCI)	X		
Generic BAS (Building Automation System) interface	X		
Inter-Processor Communication Bridge	X		X
Remote Human Interface Panel (controls up to four units)	X		
Remote minimum position control for economizer			X
Fault detection and diagnostics with ultra low leak economizer option	X		
Single Zone VAV	X		
Outside Air Measurement (Traq™)	X		
Variable frequency drive (VFD) control of supply/exhaust/return fan motor	X		
Ventilation override module (five ventilation override sequences)	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		
Ultra low leak economizer and exhaust	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		
Low or ultra low modulating outside air economizer option	X		
Electrical			
Convenience outlet (factory-powered 15A GFI)	X		
Dual power source		X	
Non-fused unit disconnect - through-the-door with external handle	X		
Phase monitors	X		
Power factor correction capacitors - compressors and fans		X	

Table 49. Comprehensive listing of available options and accessories (continued)

Option or Accessory[a]	Option	Factory Design Special[b] [c]	Standard Field-Installed Accessory
High fault SCCR (short circuit current rating)	X		
Evaporative Condenser			
Evaporative condenser	X		
Sump heater	X		
Dolphin WaterCare® system	X		
Conductivity controller	X		
Fans			
100 percent modulating exhaust with or without Statitrac™ space pressure control	X		
100 percent modulating return with or without Statitrac™ space pressure control	X		
50 percent modulating exhaust	X		
eDrive™ direct drive plenum 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	
HEPA filters		X	
Filter rack - 4" deep panel rack placed in standard rack location		X	
High efficiency throwaway filters	X		
Differential pressure gauge		X	
Heat			
Heating options: natural gas, electric, hot water or steam	X		
Modulating Gas Heat - 4:1 or ultra	X		
Propane (LP) conversion / Modulating LP heat		X	
Insulation			
Double wall with perforated interior liner	X	X	
Solid double wall		X	
Motors			
Totally enclosed motors		X	
Motors with internal shaft grounding ring for VFD applications	X		
Other			
Extended grease lines	X		
Hinged access doors	X		
Horizontal supply and return openings (SX,SL,SS,SL models)		X	
Hot gas bypass to the evaporator inlet	X		
Outside air CFM compensation on VAV units with VFD and economizer	X		

Table 49. Comprehensive listing of available options and accessories (continued)

Option or Accessory[a]	Option	Factory Design Special[b] [c]	Standard Field-Installed Accessory
Replaceable core filter driers		X	
Roof curbs			X
Special paint colors		X	
Spring isolators	X		
Suction service valves		X	
Vertical discharge, S_HL 24 to 89 tons (SX,SL,SS,SL models only)		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 and Ultra 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 gray air-dry finish durable enough to withstand a minimum of 672 hours consecutive salt spray application in accordance with standard ASTM B117. Screws shall be zinc-plus-zinc chromate coated.

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 double wall 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 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 tie down points.

Refrigeration System

Compressors

The Trane Scroll compressor shall be industrial grade, direct drive 3600 RPM maximum speed scroll type. The motor shall be suction gas-cooled hermetic design. Compressor shall have centrifugal oil pump with dirt separator, oil sight glass, and oil charging valve. Compressor shall also be provided with thermostatic motor winding temperature control to protect against excessive motor temperatures resulting from over-/under-voltage or loss of charge, high and low pressure cutouts, and reset relay.

Phase Monitor

Standard on all evaporative condensing units. Phase monitor shall protect 3-phase equipment from phase loss, phase reversal and phase imbalance. Any fault condition shall produce a Failure Indicator LED and send the unit into an auto stop condition. cULus approved.

Power Supplies

The evaporative condenser units shall be available with 460 voltage power supply.

Evaporator Coil

Evaporator coil shall have internally enhanced copper tubing of 3/8 or 1/2-inch O.D. 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.

Air-Cooled Condensing

Air-Cooled Condenser Coil

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

Air-Cooled Condenser Fans and Motors

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

Air Handling System

Supply Fan

Supply fan motors shall be 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 shall 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 Options

Constant Volume Zone Temperature Control

Option shall provide 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

Option shall provide 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 shall coordinate 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.

Constant Volume Zone Temperature Control and Exhaust/Return Fan Variable Frequency Drives w/o Bypass (with Statitrac Only)

Option shall provide all the necessary controls to control/maintain building space pressure through a CV rooftop. The Variable Frequency Drive (VFD) shall modulate the speed of the exhaust/return fan motor in response to building pressure.

A differential pressure control system, called Statitrac, shall use a differential pressure transducer to compare indoor building pressure to atmospheric pressure. The VFD shall receive a 0-10 VDC signal from the unit microprocessor based upon the space static pressure and cause the drive to accelerate or decelerate as required to maintain the space pressure within the deadband.

Constant Volume Zone Temperature Control and Exhaust/Return Fan Variable Frequency Drives and Bypass (with Statitrac Only)

Bypass control shall provide full nominal airflow in the event of drive failure.

Variable Air Volume Discharge Temperature Control with Variable Frequency Drives without Bypass

Option shall provide 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 shall coordinate the economizer control and the stages of cooling with discharge air temperature reset capabilities. Option shall include factory installed and tested VFDs to provide supply fan motor speed modulation.

VFD shall receive 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. Optional bypass control shall provide full nominal airflow in the event of drive failure.

Single Zone Variable Air Volume

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

VAV Supply Air Temperature Control with Variable Frequency Drives and Bypass

Bypass control shall provide full nominal airflow in the event of drive failure.

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.

- 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 standalone DDC controls not dependent on communications with an on-site PC or a Building Management Network. The microprocessors shall be equipped with onboard diagnostics, indicating that all hardware, software and interconnected wiring are in proper operating condition. The modules (boards) shall be protected to prevent RFI and voltage transients from affecting the board 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.

- Zone sensors shall be available in several combinations with selectable features depending on sensor.
- The Human Interface Panel 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.
- 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 pre-filter filter rack)

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

Pre-Evaporator Filter Options (Available for all units)

Throwaway Filters, MERV 4

Filters shall be two-inch [50.8 mm] thick, UL Class 2, glass fiber type and rated at 80% average synthetic dust weight arrestment when tested in accordance with ASHRAE 52-76 and 52.1 test methods. Filters shall be 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 pre-filters 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 pre-filters 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 shall be 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 plenum 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 outside air for "free" cooling. Automatically modulated return and outside air 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. Standard economizer dampers leakage rate shall be 2.5 percent of nominal airflow (400 cfm/ton) at 1 inch wg. static pressure.

Low-Leak Economizer Dampers Option

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. 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.

Ultra Low-Leak Economizer Dampers Option

Economizer return and outside air dampers shall be provided with horizontal airfoil blades and spring-return actuators. The economizer shall have a functional life of 60,000 opening and closing cycles. Dampers shallbe AMCA 511 Class 1A certified with a maximum leakage rate of 3 CFM/sq-ft at 1.0 in WC pressure differential thus exceeding requirements of ASHRAE 90.1-2013, California Title 24-2013, and IECC-2012.

IntelliPak® units ordered with ultra low leak economizers shall be listed on the California Energy Commission Registry for factory compliance with Title 24 Economizer and FDD requirements. A label shall be applied to the unit identifying construction with the ultra low leak economizer and FDD controls.

Ultra low leak motorized exhaust dampers shall be provided when the ultra low leak economizer is ordered with an exhaust/return option that includes motorized dampers. Ultra low leak motorized exhaust dampers shall be AMCA 511 Class 1A certified with a maximum leakage rate of 3 cfm/sq-ft at 1.0 in WC pressure differential. This exceeds the most stringent requirements of ASHRAE 90.1 and IECC (4 CFM/sq-ft at 1.0 in WC pressure differential).

Economizer Control with Comparative Enthalpy

Two enthalpy sensors shall be 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

An outdoor enthalpy sensor shall be provided to compare the total heat content of outdoor air to a locally adjustable setpoint. The setpoint shall be 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

An outdoor temperature sensor shall be included for comparing the outdoor dry bulb temperature to a locally adjustable temperature setpoint. The setpoint shall be 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 (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 shall augment 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 primary contactors and a manual reset high limit control, located in the electric heat control box, 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, have a wired, gas-fired heating system integral within unit, and fire tested prior to shipment. Units shall be cULus approved specifically for outdoor applications downstream from refrigerant cooling coils.

All gas piping shall be threaded connection with a pipe cap provided. Gas supply connection shall be provided through the side or bottom of unit.

Heat exchangers shall be tubular two pass design with stainless steel primary and secondary surfaces. Direct spark ignition shall be provided. 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. Staged and full modulating burners have a ceramic cone that shapes the flame to prevent impingement on sides of heat exchanger drum. Ultra modulating 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 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.

4 to 1 and ultra modulating gas heaters shall be made from grades of stainless steel suitable for condensing situations. The 4 to 1 modulating heater shall have turn down ratios of 4 to 1 for all heat inputs. The ultra modulating turn down ratios will have 14 to 1 for 500MBh, 18 to 1 for 850MBh, and 21 to 1 for 1000MBh.

Miscellaneous Options

- Non-Fused Disconnect Switch with External Handle — External handle shall enable the operator to disconnect unit power with the control box door closed for safety.
- Hot Gas Bypass — Valve, piping and controls shall all be 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 shall modulate hot gas to the inlet of the evaporator.
- High Duct Temperature Thermostats — Option shall consist of 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 shall shut down if the thermostats are tripped.
- High Capacity Units— Units shall be made high capacity through the use of larger compressors that provide higher refrigerant mass flow rates.
- Stainless Steel Drain Pan — The double sloping stainless steel drain pan shall promote runoff of standing water from condensation inside the unit. Two drain pipes shall be installed through the base channel on each side of the unit. The evaporator drain pan shall be constructed of 14 gauge stainless steel. On units 40 tons and larger, the intermediate drain pan shall be constructed of 16 gauge stainless steel. This shall provide protection in corrosive environments.
- Internal Shaft Grounding Ring — Motors shall have internal bearing protection for use with VFDs to provide a conductive discharge path away from the motor bearings to ground. Bearing Protection Rings shall be 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) — Shall be available for those cases where non-Tracer® building management system is used. The GBAS module shall provide a binary input for Demand Limiting, four (4) analog inputs for setpoint adjustment and five (5) relay outputs for diagnostic reporting. Inputs shall use a potentiometer or 0-5 VDC signal.
- Generic Building Automation System Module (GBAS 0-10 VDC) — Option shall provide broad control capabilities for building automation systems other than Trane's Tracer® system. The GBAS module shall provide 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 shall use a potentiometer or 0-10 VDC signal.
- Remote Human Interface Panel (RHI) — Remote human interface panel shall perform all the same functions as unit-mounted human interface panel, except for the Service Mode. Up to 4 rooftop units shall be monitored and controlled with a single remote human interface panel. Option shall include 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 16–key keypad that is used in conjunction with the display to prompt the infrequent user when making desired changes, and a hinged door to make the RHI suitable for mounting on any wall. The RHI can be mounted inside a building, up to 5,000 feet from the unit. The RHI shall be wired to the IPCB mounted in the rooftop with twisted wire pair communication wiring and 24V control wiring.
- Ventilation Override Module (VOM) — Option shall 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 shall occur 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 shall allow greasing of supply and exhaust fan bearings through the filter access door.

- Access Doors — Hinged access doors shall provide easy access to supply fan, filters, exhaust/return fan, and the heating section. These access doors shall 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 shall provide 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 shall have a IPCB installed.
- Tracer® LonTalk® Communication Interface Module — Shall provide control and monitoring of the rooftop by Tracer® or to a 3rd party building management system utilizing LonTalk® protocol.
- BACnet® Communication Interface Module — Shall provide 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/return fan (if applicable) assemblies shall be isolated with two-inch nominal deflection to reduce transmission of vibrations.
- Special Unit Paint Colors — Shall allow matching of HVAC equipment to customer specified color. This option shall be for standard paint compound in different colors only.

Accessories

Roof Mounting Curb

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

Electronic Zone Sensors

- Zone Sensor 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. This sensor shall be used with CV and SZVAV units.
- Programmable Night Setback Sensor shall be electronic programmable 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 (1) Override program per day. Sensors shall be available for CV zone temperature control and VAV 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 with VAV 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 economizer.
- Humidity Sensor - Monitors the humidity levels in the space for 1) Humidification and/or 2) Modulating Hot Gas Reheat.

- 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
- Trane® Air-Fi® Wireless Communications Interface (Field Installed) — Trane® Air-Fi Wireless Communications Interface (WCI) provides wireless communication between the Tracer® SC, Tracer® Unit Controllers, and BACnet® Communication Interface (BCI) modules.

Note: *BCI required for operation*

Certified AHRI Performance

Packaged Rooftop units cooling, heating capacities and efficiencies shall be rated within the scope of the Air-Conditioning, Heating & Refrigeration Institute (AHRI) Certification Program and display the AHRI Certified® mark as a visual confirmation of conformance to the certification sections of AHRI Standard 340-360 (I-P) and ANSIZ21.47 and 10 CFR Part 431 pertaining to Commercial Warm Air Furnaces. The applications in this catalog specifically excluded from the AHRI certification program are:

- Ventilation modes
- Heat Recovery
- Units larger than nominal 63 tons
- Evaporative Condensers

The AHRI Certified mark indicates Trane U.S. Inc. participation in the AHRI Certification program. For verification of individual certified products, go to ahridirectory.org.

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