



Air-Cooled Series R™ Rotary Liquid Chiller

**Model RTAA
70 to 125 Tons**

Built for Industrial and Commercial Markets





Features and Benefits

You...

Like its chillers, Trane wants its relationships with customers to last. Trane is interested in maintaining long term, loyal relationships. This perspective means the point in time that a customer purchases a chiller is the beginning of a relationship, not the end. Your business is important, but your satisfaction is paramount.

Designed by Customers....

Trane's RTAA 70-125 was designed with the end user's requirements in mind. Reliability, efficiency, sound, and physical size were primary design concerns in expanding the RTAA product line down to 70 tons. The result is a reliable chiller that will help you achieve your bottom line goals.



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The standard ARI rating condition (54/44°F and 95°F) and IPLV are ARI certified. All other ratings, including the following, are outside the scope of the certification program and are excluded:

- Glycol.
- 50 Hz.
- Remote evaporator models.





Features and Benefits

Designed To Perform, Built To Last

RTAA 70-125 Chiller Highlights

- Years of research, testing, and successful applications. The Trane helical rotary compressor has amassed thousands of hours of testing, much of it at severe operating conditions. Not to mention, the successful application of RTAA chillers since 1994, with a developed reputation as the industry standard.
- Trouble free startup through factory testing of compressor and completed chiller and factory installation of chiller accessories.
- High compressor reliability and Adaptive Control™ to keep the chiller on line producing cold water during adverse conditions. Small footprint, with smallest required application space (operating footprint) in the industry.
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- Low sound levels and accessory options for sound sensitive applications.
- $\pm 1/2^\circ\text{F}$ leaving water temperature control (0.3°C), resulting from PID feed-forward controls, and linear load matching, also allowing for 10% flow rate change per minute while maintaining $\pm 1/2^\circ\text{F}$ leaving water temperature control.

Reliability

- Proven Trane helical rotary screw compressor design for longer life and greater dependability.
- Adaptive Control™ protects the chiller when any of the system variables approaches a limit condition that may damage the unit or cause a shutdown. The Unit Control Module takes corrective action to keep the unit running.
- Dual circuit design increases overall system reliability.
- Unlike reciprocating designs, this compressor can handle liquid slugging.

Performance

- High efficiency with all units complying with the ASHRAE 90.1 efficiency standard.
- Excellent part load performance is achieved without resorting to manifolded multiple reciprocating or scroll compressors.
- Use of an electronic expansion valve significantly improves part load performance by minimizing superheat in the evaporator and allowing the chiller to run at reduced condensing temperatures.
- Unique compressor sequencing equalizes not only starts, but operating hours as well.

Trouble-Free Operation and Start-Up

- With Adaptive Controls, there are fewer nuisance trips meaning less expense from unnecessary service calls.
- Factory installed and tested options keep start-up time and expenses minimized.
- Easy interface capability with the Trane Integrated Comfort™ system via a single twisted pair of wires.
- Enhanced interface capability with LonTalk compatible building automation systems with our expanded list LonTalk control points.
- Optional remote display panel simplifies chiller monitoring/ control.
- Packed stock availability for your quick replacement needs.

Features and Benefits

Series R™ Compressor Highlights

- Direct-drive, low speed for high efficiency and reliability.
- Simple design with only four moving parts, resulting in high reliability and low maintenance.
- Field serviceable compressor for easy maintenance.
- Precise rotor tip clearance for optimal efficiency.
- Suction gas-cooled motor, resulting in lower operating temperatures for increased motor life, and giving the capability for:
- Five-minute start-to-start/two minute stop-to-start capability, which allows for closer water loop temperature control.

Robust Parts

Helical rotary compressors are precisely machined using state of the art processes from solid metal bar stock. Tolerances are maintained within 10 micron or less than a tenth of the diameter of a human hair. The resulting compressor is a robust yet highly sophisticated assembly capable of ingesting liquid refrigerant without risk of damage. Contrast this to a reciprocating compressor, which can be destroyed by a single slug of liquid.

Precise Rotor Tip Clearances

Higher energy efficiency in a helical rotary compressor is obtained by reducing the rotor tip clearances. This reduces the leakage between high and low pressure cavities during compression. Precise rotor tip clearance is achieved with the latest manufacturing and machining technology. Trane was the first helical rotary compressor manufacturer to electronically check compressor parts machining accuracy as part of the standard production process.

Optimized Compressor Parts Profiles

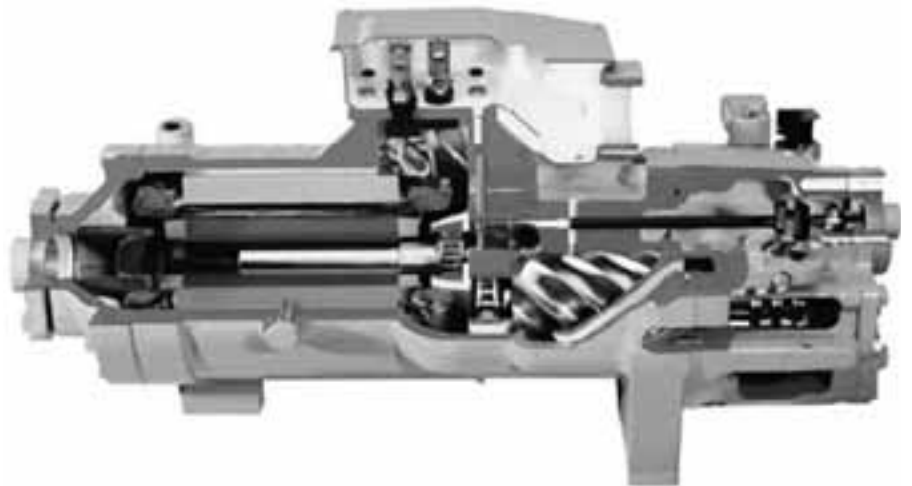
Rotor and slide valves are unique designs, optimized for the air conditioning application. The rotors are designed for the pressure ranges in the air conditioning application. The unloader valve has a unique profile that resulted from computer performance modeling in typical part-load situations.

Exceptional Part Load Performance

The air-cooled Series R™ chiller has great part-load performance. The patented combination unloading system on the compressor utilizes the variable unloading valve for the majority of the unloading function similar to that of the slide valve. The compressor also uses a step unloader valve which is a single unloading step to achieve the minimum unloading point of the compressor. The result of both of these designs is optimized part-load performance far superior to single reciprocating or scroll compressors.

Advanced Heat Transfer Surfaces

Condenser and evaporator tubes use the latest heat transfer technology for increased efficiency.



Cutaway of a helical rotary screw compressor



Features and Benefits

Efficiency

The RTAA 70-125 offers the same high reliability of its larger predecessor coupled with lowered sound levels, increased energy efficiency, and reduced physical footprint, all due to its advanced design, low speed/direct drive compressor and proven Series R™ performance.

Some of the major advantages of the Model RTAA 70-125 vs its larger predecessor are:

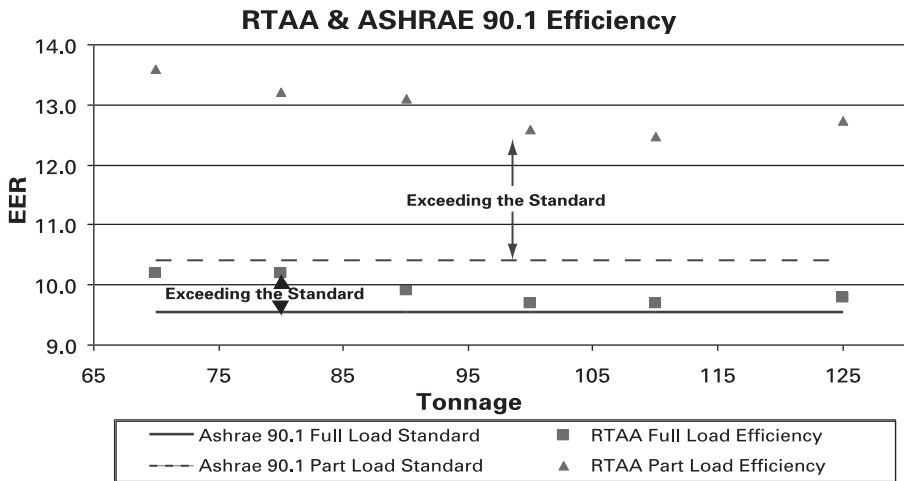
- Higher energy efficiency
- Lower sound levels
- Smaller physical footprint

The Series R™ Model RTAA 70-125 is an industrial grade design built for both the industrial and commercial markets. It is ideal for schools, hospitals, retailers, office buildings, Internet service providers and industrials.

ASHRAE Standard 90.1 and RTAA 70-125 World Class Energy Efficiency...

The importance of energy efficiency cannot be understated. Fortunately, ASHRAE has created a guideline emphasizing its importance. Nonetheless, energy is often dismissed as an operational cost over which the owner has little control. That perception results in missed opportunities for energy efficiency, reduced utility bills, and higher profits. Lower utility bills directly affect profitability. Every dollar saved in energy goes directly to the bottom line. Trane's RTAA 70-125 is one way to maximize your profits.

ASHRAE Standard 90.1 & Executive Order - New technology applied to the design, controls, and manufacturing have created superior efficiency levels in the RTAA 70-125 that are unmatched in the industry. All Trane air-cooled chillers meet the new efficiency levels mandated by ASHRAE Standard 90.1. This new standard requires higher efficiencies than past technologies can deliver. The US Federal Government has adopted standard 90.1 and, in some cases,



Efficiencies given for 60 Hz units.

requires even higher efficiencies. Federal Executive Order mandates energy consuming devices procured must be in the top 25% of their class or be at least 10% better than any product standard for that product. In the case of chillers, that product standard is ASHRAE 90.1. Trane's RTAA 70-125 meets or exceeds the efficiency requirements of 90.1, with some units meeting the "stretch goals" of Executive Order.

Risk. The US Federal Government has adopted ASHRAE 90.1, and it's expected to be adopted domestically, if not globally, in the future. Domestic acceptance has already begun. Make sure that your chillers as well as your entire HVAC system complies, or you may be caught retrofitting your project with new equipment and paying extra design dollars if the code is adopted during construction.

Features and Benefits

Installation

Trouble-Free Start-Up

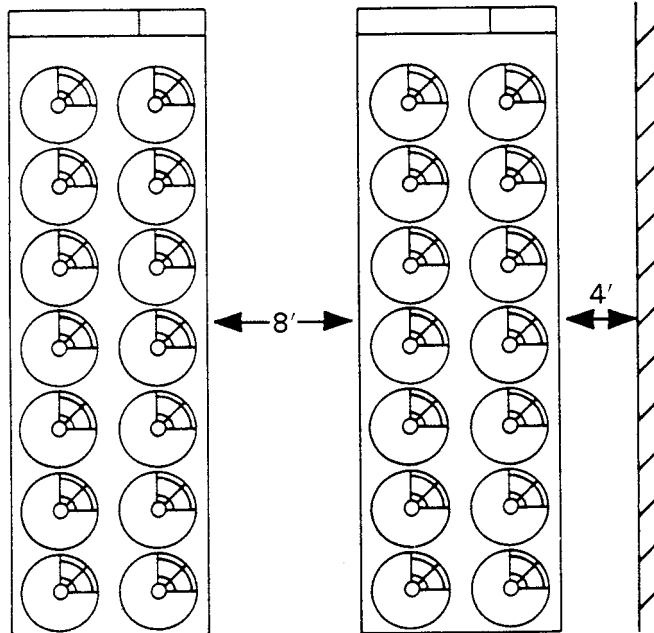
All air-cooled Series R™ chillers are given a complete functional test at the factory. This computer-based test program completely checks the sensors, wiring, electrical components, microprocessor function, communication capability, expansion valve performance and fans. In addition, each compressor is run tested to verify capacity and power consumption. The end result of this test program is that the chiller arrives at the jobsite fully tested and ready to go to work.

Quick Installation

All Series R™ chiller options, including control power transformer, starter disconnect, low ambient control, ambient temperature sensor, low ambient lockout, communication interface and ice making controls are factory installed and tested. Some manufacturers send options in pieces to be field installed. With Trane, the customer saves on installation expense and has assurance that ALL chiller controls/options have been tested and will function as expected.

Close Spacing Of Chiller

The air-cooled Series R™ chiller has the tightest recommended side clearance in the industry, four feet, but that is not all. In situations where equipment must be installed with less clearance than recommended, which frequently occurs in retrofit and rooftop applications, restricted air flow is common. Conventional chillers may not work at all. However, the air-cooled Series R™ chiller with Adaptive Control™ microprocessor will simply make as much chilled water as it can, given the actual installed conditions, stay on line during any unforeseen abnormal conditions, and optimize its performance. Consult your Trane sales engineer for more details.





Features and Benefits

Advanced Abilities

Unit Performance Testing

The ARI Certification Program has had a certification program covering air-cooled water chillers for many years. With this in mind, customers may ask, "Do I need to factory performance test my chiller?"

Trane began promoting factory performance tests for water-cooled water chillers in 1984 for the same reasons it is valid today for air-cooled water chillers, to show we stand behind the products we design and build.

The benefits of a performance test include verification of performance, prevention of operational problems, and assurance of a smooth start-up. Only a performance test conducted in a laboratory or laboratory grade facility will confirm both performance and operation of a specific chiller.

While most factory performance tests go smoothly, should problems occur, Trane personnel can quickly correct them and the chiller will ship as specified. Job site diagnosis, ordering of parts, and waiting for delivery of replacement components is significantly reduced.

A factory performance test reduces start-up time, thereby saving job site expense. A chiller that has been tested is operation and performance-proven. This allows the installing contractor to concentrate on proper electrical wiring and water piping, and the service technicians to concentrate on proper refrigerant charge, safeties diagnosis and initial logging of the chiller. Means of obtaining full load on the chiller and proving its performance do not have to be determined by engineers or contractors, thus saving time. The certified test report documents performance for the unit as built. In addition, factory testing significantly reduces commissioning time and risk by re-introducing manufacturer responsibility, where its mitigation should reside.

When a factory performance test is requested, the test can be conducted at the specified, design conditions. The test facility has the capability to control ambient test conditions to assure our customers that our chillers will perform as predicted.

Hydronic Pumping Package

The integrated pumping package option on RTAA chillers is the achievement of thoughtful design and a close, working relationship with our supplier. These pre-engineered (460/60/3 only) packages will run off of the chiller's incoming power supply and incorporate seamlessly into the unit control schemes. This option has been designed to operate over a wide range of conditions and has been tested to ensure automatic control capabilities such as lead/lag, failure/recovery and proof of flow with an incorporated differential pressure switch.

The integrated pumping package provides a time saving and cost effective solution to customers wanting ancillary equipment selected, installed and pre-tested by the factory. The correct pumping package will be chosen via the RTAA selection program based upon the total dynamid head and the specific flow rate for the application, reducing the consulting engineer's time on managing and selecting pumps for the chilled water loop. Package installation and complete unit testing are efficiently done in the factory, saving valuable time and labor at the jobsite. In addition, customers can witness the unit and pumping package being tested in the Air-cooled Run Test Facility in Pueblo, Colorado.



Air-cooled Run Test Facility shown with an RTAC 500 ton unit

Features and Benefits

Adaptive Control

The RTAA 70-125 chiller offers advanced microprocessor control and features Adaptive Control™. Adaptive Control™ means the Unit Control Module (UCM) directly senses the control variables that govern operation of the chiller and provides better control than past controls as well as several important benefits.

Adaptive Control™ Microprocessor

The microcomputer-based controller allows Trane to optimize controls around the chiller application and the specific components used in the air-cooled Series R™ chiller. For instance, the compressor protection system is specifically designed for the air-cooled Series R™ chiller. A new leaving chilled water temperature control algorithm maintains accurate temperature control, minimizes the drift from setpoint and provides better building comfort. This control, combined with linear compressor unloading, also allows the chiller to be applied in a wider array of applications, including variable primary flow.

The microcomputer control incorporates improved chiller start-up, load limiting, lead/lag, and compressor run time equalization functions into standard chiller operation. Interface with outside systems such as building automation controls is flexible and easy.

When any of the chiller control variables such as motor current draw, evaporator temperature and condenser temperature approaches a limit condition where the unit may be damaged or shut down on a safety, the UCM takes corrective action to avoid shutdown and keep the chiller operating. It does this through combined actions of compressor slide valve modulation, electronic expansion valve modulation and fan staging. Additionally, the UCM optimizes total unit power consumption during normal operating conditions. No other chiller control system in the marketplace duplicates this performance.

The End Of Most Nuisance Trips

Unnecessary service calls and unhappy tenants are reduced. Only when the UCM has exhausted the corrective actions it can take and the unit is still violating an operating limit will the unit shut down. Controls on other chillers typically shut down the chiller, quite possibly just when it is needed the most.

For example:

A typical five-year-old chiller with dirty coils might trip-out on high pressure cutout on a 100°F (37.8°C) day in August. A hot day is just when comfort cooling is needed the most. In contrast, the air-cooled Series R™ chiller with an Adaptive Control™ microprocessor will stage fans on, modulate electronic expansion valve, and modulate slide valve as it approaches a high pressure cutout. Thereby keeping the chiller on-line just when you need it the most.

Lower Service Expense

Nuisance service calls are avoided. When there is a real problem that must be corrected, the UCM's extensive diagnostics help assure that the problem is quickly identified. Down time and service expense are minimized. And with the ability to communicate with the Trane Integrated Comfort™ system or a remote display panel, service problems can be identified and diagnosed remote to the installation.





Features and Benefits

PID Control

Electronic Expansion Valve

When coupled with Trane's Adaptive Control™ microprocessor, our electronic expansion valve significantly improves part-load performance of the Series R™ chiller by minimizing superheat in the evaporator and allowing the chiller to run at reduced condensing temperatures. Chillers which use conventional TXV's must run at higher head pressures and consume more power than necessary at part-loads. Additionally, the electronic expansion valve and its controls allow much better stability and control over dynamic load and head changes. Under these conditions a conventional TXV may never achieve control stability and extended periods of TXV "hunting" and liquid slugging are common.

Precise Control

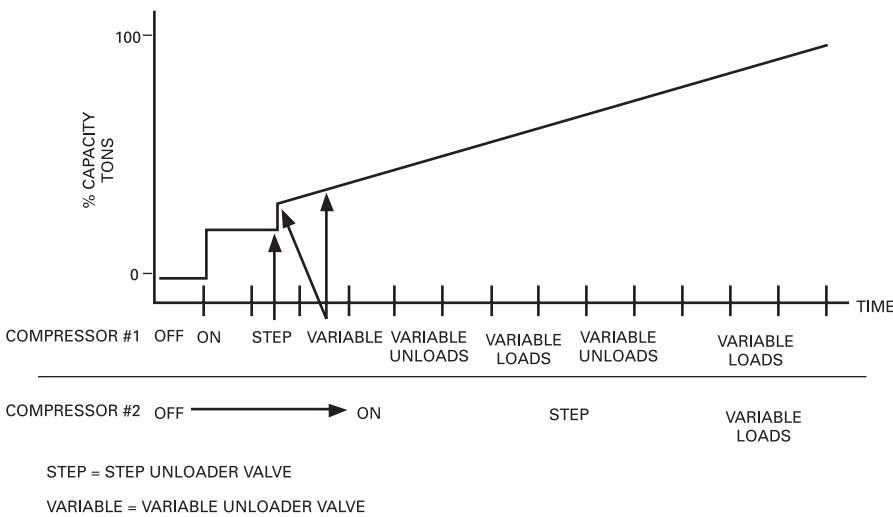
Trane's patented unloading system allows the compressor to modulate infinitely and exactly match building loads. At the same time maintaining chilled water temperature control has never been so accurate or so easy. For process cooling jobs where temperatures are critical, Trane provides chilled water within ± 1/2°F (0.3°C) of setpoint via proportional integral differential (PID) control. Reciprocating, scroll and screw chillers with stepped capacity control typically can only maintain chilled water temperatures within ± 2°F (1.1°C) of setpoint.

Stepped control also results in overcooling or undercooling your space because rarely does the capacity of the machine match the building load. The result can be 10% higher energy bills. Trane's RTAA optimizes the part load performance of your machine for energy efficiency, precise temperature control for all modes of operation, and your personal comfort regardless of changing conditions.

Reduce Compressor Cycling

Modulating capacity control offers better compressor reliability. Compressor cycling, typical of reciprocating compressors, will decrease compressor component life. Parts like motors and valves do not stand up well to excessive compressor cycling.

70-125 TON RTAA COMPRESSOR LOADING



Features and Benefits

Unit Control

Unit Control Module (UCM)

Trane's Adaptive Control™ microprocessor control system enhances the air-cooled Series R™ chiller by providing the very latest chiller control technology.

State-of-the-Art Equipment

The 70 to 125 ton air-cooled chillers offer the exclusive Trane Adaptive Control™ logic with the Clear Language Display (UCM). The Clear Language Display has various functions that allow the operator to read unit information and adjust setpoints. The Clear Language Display panel has 16 keys, the readout screen is a two-line, 40 character liquid crystal with a backlight. The backlight allows the operator to read the display in low-light conditions.

Equal Compressor Sequencing

Trane maximizes both compressor and motor life by equalizing both the number of starts and the operating hours. The UCM will start the compressor with the least number of starts and turn off the compressor with the most operating hours. Conventional "auto" lead-lag control will equalize starts, but running hours will typically be unequal. Equalizing both starts and running hours will provide equal compressor wear.

Internal "Built-In" Chiller Flow Protection

The UCM automatically detects a no waterflow condition. An external flow switch is not required, which lowers costs versus typical chillers. Built-in flow protection also eliminates nuisance flow switch problems.

Remote Display Panel

Trane air-cooled Series R™ 70-125 ton chillers are available with a twisted pair connection to an optional remote display panel. Chiller operation can be controlled similarly to the control interface on the chiller itself. Through a twisted pair of wires the unit can be turned on or off, change the chilled water setpoint, and display over 90 operating and diagnostic conditions. The remote display panel can be mounted indoors so access to chiller information is just steps away, eliminating any need to go outdoors or on the roof.

The clear language display for chiller sizes of 70-125 tons has the ability to control multiple units. In a multiple unit configuration, the Remote Clear Language Display Panel has the capability to communicate with up to four units. Each unit requires a separate communication link with the Remote Display Panel.



Remote Clear Language Display Panel for 70 to 125-ton air-cooled chillers.



Controls

Stand-alone

Safety Controls

A centralized microprocessor offers a higher level of machine protection. Since the safety controls are smarter, they limit compressor loading to avoid compressor or evaporator failures, thereby minimizing nuisance shutdown. The Unit Control Module (UCM) directly senses the control variables that govern the loading of the chiller: motor current draw, evaporator temperature, condenser temperature, etc. When any one of the variables approaches a limit condition where the unit may be damaged or shutdown on a safety, the UCM takes corrective action to avoid shutdown and keep the chiller operating. The UCM optimizes total chiller power consumption during normal operating conditions. During abnormal operating conditions, the UCM will continue to optimize chiller performance by taking the corrective action necessary to avoid shutdown. This keeps cooling capacity available until the problem can be solved.

Whenever possible, the chiller is allowed to perform its function; make chilled water. In addition to Adaptive Controls, microcomputer controls allow for more types of protection such as over and under voltage. Overall, the safety controls help keep the building running and out of trouble.

Monitoring And Diagnostics

Since the microcomputer provides all control functions, it can easily indicate such parameters as leaving chilled water temperature and capacity stage. If a failure does occur, one of over 90 individual diagnostic and operating codes will be used to indicate the problem, giving more specific information about the failure. All of the monitoring and diagnostic information is displayed directly on a microcomputer display.

Easy Chiller System Logging

The UCM displays data required to log the chiller system. The following information is available either as standard or as an option with the Air-Cooled Series R™ Chiller microprocessor:

- Entering and leaving chilled water temperatures
- Ambient air temperature
- Evaporator and condenser refrigerant temperatures and pressures
- Compressor suction temperature
- Percent RLA for each compressor
- Percent line voltage
- Compressor starts and running hours
- Active setpoints:
 - chilled water setpoint
 - current limit setpoint
 - ice termination setpoint
 - low ambient lockout setpoint
- Over 90 diagnostic and operating conditions
- Part failure diagnostics:
 - water temperature sensors
 - refrigerant temperature sensors
 - compressor contactors

Air-cooled Series R™ chillers can interface with many different external control systems, from simple stand-alone units to ice making systems. Each unit requires a single-source, three-phase power supply and a single-phase 115V/60Hz, 220V/50Hz power supply. The added single-phase power supply powers the evaporator heaters. For basic stand-alone applications, the interface with outside control is no different than for other Trane chillers. However, the RTAA units have many features that can be used to interface with building control systems.

Stand-alone Unit

Interface to stand-alone units is very simple; only a remote auto/stop for scheduling is required for unit operation. Signals from the chilled water pump contactor auxiliary or a flow switch are wired to the chilled waterflow interlock. Signals from a timeclock or some other remote device are wired to the external auto/stop input.

Standard Features

1. External Auto/Stop

A jobsite provided contact closure will turn the unit on and off.

Note: Do not use the chilled water pump to stop the chiller.

2. Chilled Waterflow Interlock

A jobsite provided contact closure from a chilled water pump contactor or a flow switch is required and will allow unit operation if a load exists. This feature will allow the unit to run in conjunction with the pump system.

3. External Interlock

A jobsite supplied contact opening wired to this input will turn the unit off and require a manual reset of the unit microcomputer. This closure is typically triggered by a jobsite supplied system such as a fire alarm.

4. Chilled Water Pump Control

Unit controls provide an output to control chilled water pump(s). One contact closure to the chiller is all that is required to initiate the chilled water system.

5. Remote Running and Alarm Indication Contacts

The unit provides three single-pole/double-throw contact closures to indicate that a failure has occurred, if any compressors are running, or if the compressors are running at maximum capacity. These contact closures may be used to trigger jobsite supplied alarm lights or alarm bells.

Controls

Remote Display

The remote display option allows the operator to monitor chiller operation from a remote location. Over 60 essential chiller operating parameters can be transmitted between the unit control module on the chiller and the remote display via a bi-directional communications link. Only one twisted wire pair is required between the chiller and the remote display. In addition to monitoring chiller operation, alarms and unit diagnostics can be read from the remote display. Furthermore, the chilled water temperature setpoint can be adjusted and the chiller can be turned on or off from the remote display.



Required Features

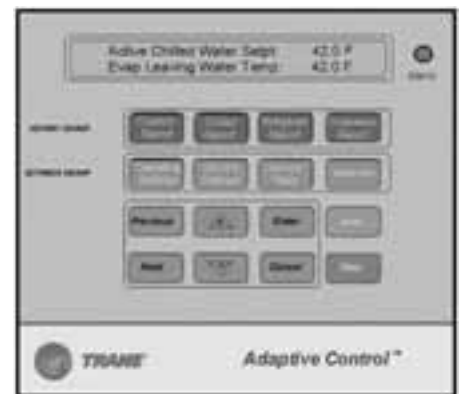
1. Communications Interface

Additional Features That May Be Used

1. External Interlock (Standard)
2. Chilled Water Temperature Reset
3. Chilled Waterflow Interlock (Standard)
4. Remote Running and Failure Indication Contacts

External Trane Devices Required

1. Remote Display Panel



Controls

Tracer Summit

Trane Chiller Plant Control

The Tracer Summit Chiller Plant Building Management System with Chiller Plant Control provides building automation and energy management functions through stand-alone control. The Chiller Plant Control is capable of monitoring and controlling your entire chiller plant system.

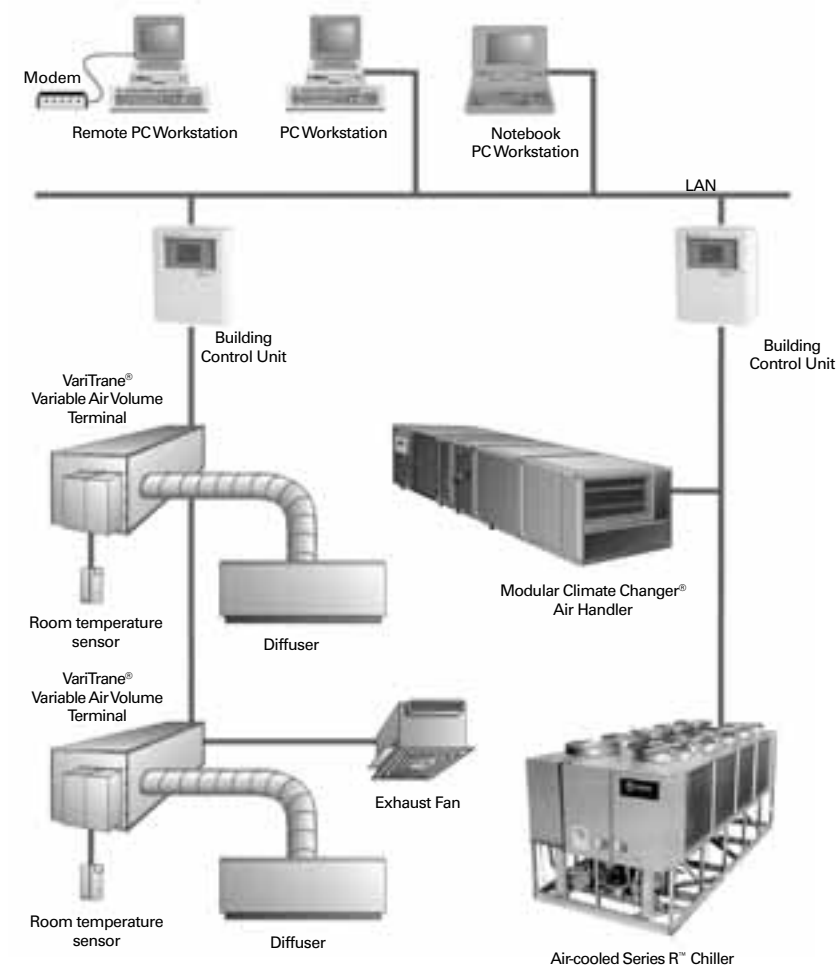
Application software available:

- Time-of-day scheduling
- Demand limiting
- Chiller sequencing
- Process control language
- Boolean (binary) processing
- Zone control
- Reports and logs
- Custom messages
- Run time and maintenance
- Trend log
- PID control loops

And of course, the Trane Chiller Plant Control can be used on a stand-alone basis or tied into a complete building automation system.

When the air-cooled Series R™ 70-125 ton chiller is used in conjunction with a Trane Tracer™ Summit system, the unit can be monitored and controlled from a remote location. The air-cooled Series R™ 70-125 ton chiller can be controlled to fit into the overall building automation strategy by using time of day scheduling, timed override, demand limiting, and chiller sequencing. A building owner can completely monitor the air-cooled Series R™ 70-125 ton chiller from the Tracer system, since all of the monitoring information indicated on the unit controller's microcomputer can be read off the Tracer system display. In addition, all the powerful diagnostic information can be read back at the Tracer system. Best of all, this powerful capability comes over a single twisted pair of wires!

Control functions include auto/stop, adjustment of leaving water temperature setpoint, compressor operation lockout for kW demand limiting and control of ice making mode. The Tracer system reads monitoring information such as entering



and leaving evaporator water temperatures and outdoor air temperature. Over 60 individual diagnostic codes can be read by the Tracer system. In addition, the Tracer system can provide sequencing control for up to 25 units on the same chilled water loop. Pump sequencing control can be provided from the Tracer system. Tracer ICS is not available in conjunction with the remote display or the external setpoint capability.

Required Features

Tracer Interface

Additional Options That May Be Used

Ice Making Control

External Trane Devices Required

Tracer Summit™, Tracer 100 System or Tracer Chiller Plant Control

Controls

Tracer Summit

Trane Chiller Plant Automation

Trane's depth of experience in chillers and controls makes us a well-qualified choice for automation of chiller plants using air-cooled Series R® chillers®. The chiller plant control capabilities of the Trane Tracer Summit® building automation system are unequaled in the industry. Our chiller plant automation software is fully pre-engineered and tested. It is a standard software application, not custom programming which can prove to be difficult to support, maintain, and modify.

Energy Efficiency

Trane chiller plant automation intelligently sequences starting of chillers to optimize the overall chiller plant energy efficiency. Individual chillers are designated to operate as base, peak, or swing based on capacity and efficiency. Sophisticated software automatically determines which chiller to run in response to current conditions. The software also automatically rotates individual chiller operation to equalize runtime and wear between chillers.

Trane chiller plant automation enables unique energy-saving strategies. An example is controlling pumps, and chillers from the perspective of overall system energy consumption. The software intelligently evaluates and selects the lowest energy consumption alternative.

Regulatory Compliance Documentation

Comprehensive documentation of refrigerant management practices is now a fact of life. Trane chiller plant automation generates the reports mandated in ASHRAE Guideline 3.

Keeping Operators Informed

A crucial part of efficiently running a chiller plant is assuring that the operations staff is instantly aware of what is happening in the plant. Graphics showing schematics of chillers, piping, pumps, and towers clearly depict the chiller plant system, enabling building operators to easily monitor overall conditions. Status screens display both current conditions and upcoming automated control actions to add or subtract chiller capacity. Series R™ and other chillers can be monitored and controlled from a remote location.

Tracer Summit features standard report templates listing key operating data for troubleshooting and verifying performance. Reports for each type of Trane chiller and three and six-chiller systems are also standard. Detailed reports showing chiller runtimes aid in planning for preventative maintenance.

Swift Emergency Response

We understand the importance of maintaining chilled water production while protecting your chillers from costly damage. If no water flow is detected to a chiller's piping, the start sequence is aborted to protect the chiller. The next chiller in the sequence is immediately started to maintain cooling.

In the event of a problem, the operator receives an alarm notification and diagnostic message to aid in quick and accurate troubleshooting. A snapshot report showing system status just prior to an emergency shutdown helps operators determine the cause. If emergency conditions justify an immediate manual shutdown, the operator can override the automatic control.

Integrated Comfort™ Capabilities

When integrated with a Tracer Summit building management system performing building control, Trane chiller plant automation coordinates with Tracer Summit applications to optimize the total building operation. With this system option, the full breadth of Trane's HVAC and controls experience are applied to offer solutions to many facility issues. If your project calls for an interface to other systems, Tracer Summit can share data via BACnet™, the ASHRAE open systems protocol.

Controls

System Integration

Microcomputer controls afford simple interface with other control systems, such as time clocks, building automation systems and ice storage systems. This means you have the flexibility to meet job requirements while not having to learn a complicated control system. This setup has the same standard features as a stand-alone water chiller, with the possibility of having the following optional features.

Easy Interface to A Generic Building Management System

Controlling the air-cooled Series R™ chiller with building management systems is state-of-the-art, yet simple with BACnet with Tracer Summit, LonTalk Chiller Interface or generic building management system hardwire points.

LonTalk Chiller Controls

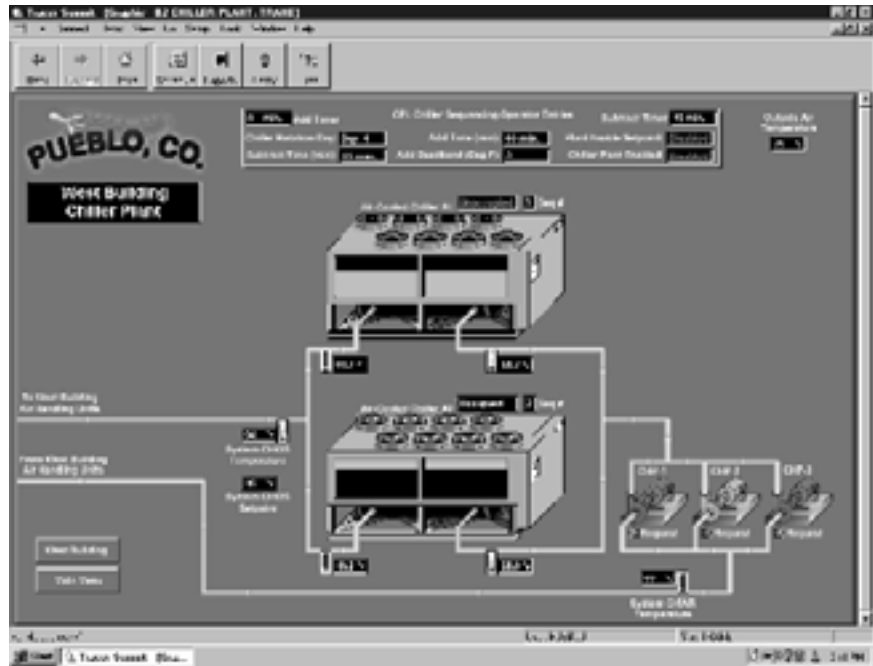
LonTalk Communications Interface for Chillers (LCI-C) provides a generic automation system with the LonMark chiller profile inputs/outputs. In addition to the standard points, Trane provides other commonly used network output variables for greater interoperability with any automation system.

LonTalk is a communications protocol developed by the Echelon Corporation. The LonMark association develops control profiles using the LonTalk communication protocol. LonTalk is a unit level communications protocol, unlike BACNet used at the system level.

Additional Outputs:

- Evaporator Water Pump Request
- Evaporator Refrigerant Temperature
- Evaporator Refrigerant Pressure
- Condenser Refrigerant Temperature
- Condenser Refrigerant Pressure
- Outdoor Air Temperature
- Condenser Air Flow
- Condenser Fan Status
- Compressor Running
- Maximum Capacity Status
- Current Per Line
- Voltage Per Phase
- Oil Temperature Per Compressor
- Compressor Starts
- Compressor RunTime

Trane controls or another vendor's system can use these points with ease to give the operator a complete picture of how the system is running.



Hardwire Points

- Chiller inputs include:
- Chiller enable/disable
 - Circuit enable/disable
 - Chilled water setpoint
 - Current limit setpoint
 - Ice making enable

- Chiller outputs include:
- Compressor running indication
 - Alarm indication (CKt 1/CKt2)
 - Maximum capacity

Alarm Indication Contacts

The unit provides three single-pole/double-throw contact closures to indicate that a failure has occurred, compressor on/off status, or if the compressors are running at maximum capacity. These contact closures may be used to trigger jobsite supplied alarm lights or alarm bells.

External Chilled Water Setpoint

Allows the external setting independent of the front panel setpoint by one of two means:

- a) 2-10 VDC input
- b) 4-20 mA input

External Current Limit Setpoint

Allows the external setting independent of the front panel setpoint by one of two means:

- a) 2-10 VDC input
- b) 4-20 mA input

Ice Making Control

Provides interface with ice making control systems.

Chilled Water Temperature Reset

Reset can be based on return water temperature or outdoor air temperature.

Controls

Thermal Storage

Ice Making Systems

Simple and smart control strategies are another advantage the Model RTAA chiller offers for ice storage applications. Trane Tracer™ building management systems can actually anticipate how much ice needs to be made at night and operate the system accordingly. The controls are integrated right into the chiller. Two wires and preprogrammed software dramatically reduce field installation cost and complex programming.

When the ice making option is ordered, the air-cooled Series R™ chiller will have two operating modes, ice making and normal daytime cooling. In the ice making mode, the air-cooled Series R™ chiller will operate at full compressor capacity until the return chilled fluid temperature entering the evaporator meets the ice making setpoint. This ice making setpoint is manually adjusted on the unit's microcomputer. Two input signals are required to the air-cooled Series R™ chiller for the ice making option. The first is an

auto/stop signal for scheduling and the second is required to switch the unit in between the ice making mode and normal daytime operation. The signals are provided by a remote job site building automation device such as a time clock or a manual switch. In addition, the signals may be provided over the twisted wire pair from a Tracer system or LonTalk Communication Interface.

Required Features

1. External Auto/Stop (Standard)
2. Ice Making Control

Additional Features That May Be Used

1. Remote Running and Failure Indication Contacts
2. Communications Interface (For Tracer Systems)
3. Chilled Water Temperature Reset (Indoor zone reset not available with ice making option).

External Trane Devices Required — None



Ice Tanks



Application Considerations

Certain application constraints should be considered when sizing, selecting and installing Trane air-cooled Series R™ chillers. Unit and system reliability is often dependent upon properly and completely complying with these considerations. Where the application varies from the guidelines presented, it should be reviewed with your local Trane sales engineer.

Unit Sizing

Unit capacities are listed in the performance data section. Intentionally oversizing a unit to assure adequate capacity is not recommended. Erratic system operation and excessive compressor cycling are often a direct result of an oversized chiller. In addition, an oversized unit is usually more expensive to purchase, install, and operate. If oversizing is desired, consider using two units.

Unit Placement

1. Setting The Unit

A base or foundation is not required if the selected unit location is level and the base is strong enough to support the unit's operating weight as listed in Tables W-1 and W-2.

2. Isolation and Sound Emission

The most effective form of isolation is to locate the unit away from any sound-sensitive area. Structurally transmitted sound can be reduced by ELASTOMERIC vibration eliminators. Spring isolators have proven to be of little benefit on air-cooled Series R™ chiller installations and are not recommended. An acoustical engineer should always be consulted in critical sound applications.

For maximum isolation effect, water lines and electrical conduit should also be isolated. Wall sleeves and rubber isolated piping hangers can be used to reduce the sound transmitted through water piping. To reduce the sound transmitted through electrical conduit, use flexible electrical conduit.

State and local codes on sound emissions should always be considered. Since the environment in which a sound source is located affects sound pressure, unit placement must be carefully evaluated. Sound power levels for Trane air-cooled Series R™ chillers are available on request.

3. Servicing

Adequate clearance for evaporator and compressor servicing should be provided. Recommended minimum space envelopes for servicing are located in the dimensional data section and can serve as a guideline for providing adequate clearance. The minimum space envelopes also allow for control panel swing and routine maintenance requirements. Local code requirements may take precedence.

4. Unit Location

a. General

Unobstructed flow of condenser air is essential to maintain chiller capacity and operating efficiency. When determining unit placement, careful consideration must be given to assuring a sufficient flow of air across the condenser heat transfer surface. Two detrimental conditions are possible and must be avoided if optimum performance is to be achieved: warm air recirculation and coil starvation.

Warm air recirculation occurs when discharge air from the condenser fans is recycled back to the condenser coil inlet. Coil starvation occurs when free airflow to (or from) the condenser is restricted.

Both warm air recirculation and coil starvation cause reductions in unit efficiency and capacity because of the higher head pressures associated with them. The air-cooled Series R™ chiller offers an advantage over competitive equipment in these situations. Performance is minimally affected in many restricted air flow situations due to its unique condensing coil geometry. Also, through its advanced Adaptive Control™ microprocessor logic, the chiller will attempt to stay on-line where competitive chillers would usually shut down.

Trane's unique Adaptive Control microprocessor has the ability to understand the operating environment of the chiller and adapt to it by first optimizing its performance and second, staying on line through abnormal conditions. For example, high ambient temperatures combined with a restricted air flow situation will generally not cause the air-cooled Series R™ chiller to shut down. Competitive chillers would typically shut down on a high pressure nuisance cut-out in these conditions.

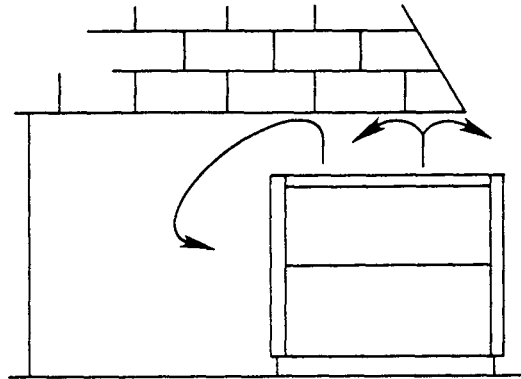
Debris, trash, supplies, etc. should not be allowed to accumulate in the vicinity of the air-cooled Series R™ chiller. Supply air movement may draw debris into the condenser coil, blocking spaces between coil fins and causing coil starvation.

Special consideration should be given to low ambient units. Condenser coils and fan discharge must be kept free of obstructions to permit adequate airflow for satisfactory unit operation.

Application Considerations

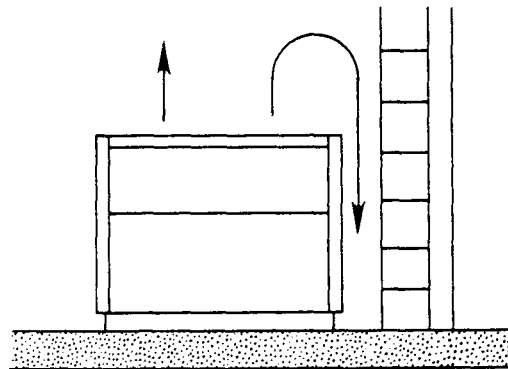
b. Provide Vertical Clearance

Vertical condenser air discharge must be unobstructed. While it is difficult to predict the degree of warm air circulation, a unit installed as shown on the left would have its capacity and efficiency significantly reduced. Performance data is based on free air discharge.



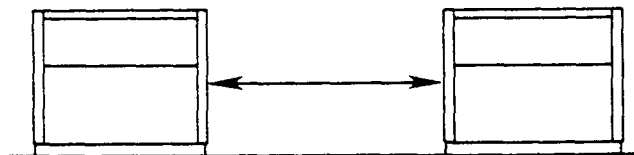
c. Provide Lateral Clearance

The condenser coil inlet must not be obstructed. A unit installed closer than the minimum recommended distance to a wall or other vertical riser may experience a combination coil starvation and warm air recirculation, resulting in unit capacity and efficiency reductions. Once again, the Adaptive Control™ microprocessor will allow the chiller to stay on line, producing the maximum available capacity, even at less than recommended lateral clearances. The recommended lateral clearances are depicted in the dimensional data section. These are estimates and should be reviewed with the local Trane sales engineer at the jobsite.



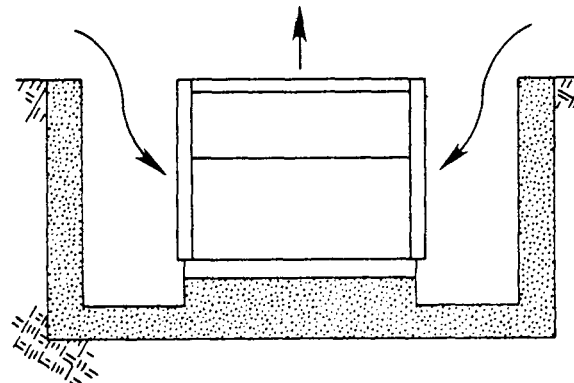
d. Provide Sufficient Unit-to-Unit Clearance

Units should be separated from each other by a sufficient distance to prevent warm air recirculation or coil starvation. The air-cooled Series R™ chiller has the lowest recommended unit-to-unit clearance in the industry, eight feet. Consult the local Trane sales engineer for applications concerning close spacing and restricted airflows.



e. Walled Enclosure Installations

When the unit is placed in an enclosure or small depression, the top of the fans should be no lower than the top of the enclosure or depression. If they are, consideration should be given to ducting the top of the unit. Ducting individual fans, however, is not recommended. Such applications should always be reviewed with the local Trane sales engineer.



Application Considerations

Effect Of Altitude On Capacity

Air-cooled Series R™ chiller capacities given in the performance data tables, P-1 through P-4, are for use at sea level. At elevations substantially above sea level, the decreased air density will decrease condenser capacity and, therefore, unit capacity and efficiency. The adjustment factors in Table F-1 can be applied directly to the catalog performance data to determine the unit's adjusted performance.

Ambient Limitations

Trane air-cooled Series R™ chillers are designed for year-round applications over a range of ambients. Chillers from 70-125 tons offer operation for ambients from 25 to 125°F (-3.9 to 51.7°C) as standard, and will operate down to -10°F (-23.3°C) with the low ambient option.

The minimum ambient temperatures are based on still conditions (winds not exceeding five mph). Greater wind velocities will result in a drop in head pressure, therefore increasing the minimum starting and operating ambient temperature. Once again, the Adaptive Control™ microprocessor will attempt to keep the chiller on-line when high or low ambient conditions exist, making every effort to avoid nuisance trip-outs and provide the maximum allowable tonnage.

Water Treatment

Dirt, scale, products of corrosion and other foreign material will adversely affect heat transfer between the water and system components. Foreign matter in the chilled water system can also increase pressure drop and, consequently, reduce waterflow. Proper water treatment must be determined locally, depending on the type of system and local water characteristics.

Neither salt nor brackish water is recommended for use in Trane air-cooled Series R™ chillers. Use of either will lead to a shortened life to an indeterminable degree. Trane encourages the employment of a reputable water treatment specialist, familiar with local water conditions, to assist in this determination and in the establishment of a proper water treatment program.

The capacities given in the performance data section of this catalog are based on water with a fouling factor of .00010 hr-sq. ft.-°F/Btu (0.0176 sq. m-°C/ton). For capacities at other fouling factors, see adjustment factors in Table F-1.

Waterflow Limits

The minimum waterflow rates are given in General Data Table G-1. Evaporator flow rates below the tabulated values will result in laminar flow causing freeze-up problems, scaling, stratification and poor control.

The maximum evaporator waterflow rate is also given in the general data section. Flow rates exceeding those listed may result in excessive tube and baffle erosion.

The evaporator can withstand up to 50 percent water flow reduction as long as this flow is equal or above the minimum gpm requirements.

Variable Evaporator Flow and Short Evaporator Water Loops

Air-cooled Series R™ chillers have the capability to handle variable evaporator flow without losing leaving water temperature control. Flow rates can be varied up to 10% of design without decreasing the leaving water temperature control capabilities.

Variable evaporator flow is an energy-saving design strategy which has quickly gained acceptance as advances in chiller and controls technology have made it possible. With its linear unloading compressor design and advanced UCM controls, the RTAA Series R chiller has excellent capability to maintain leaving water temperature control within +/- 0.5°F, even for systems with variable evaporator flow and small chilled water volumes.

Some basic rules should be followed whenever using these system design and operational savings methods. The proper location of the chilled water temperature control sensor is in the supply (outlet) water. This location allows the building to act as a buffer, and it assures a slowly changing return water temperature. If there is insufficient water volume in the system to provide an adequate buffer, temperature controls can be lost,

resulting in erratic system operation and excessive compressor cycling. To ensure consistent operation and tight temperature control, the chilled water loop should be at least two minutes. If this recommendation cannot be followed, and tight leaving water temperature control is necessary, a storage tank or larger header pipe should be installed to increase the volume of water in the system.

Temperature Limits

1. Leaving Water Temperature Range

Trane air-cooled Series R™ chillers have three distinct leaving water categories: standard, low temperature, and ice making.

The standard leaving water temperature range is 40 to 65°F (4.4 to 18.3°C). Low temperature machines produce leaving water temperatures between 0 and 39°F (-17.8 to 3.9°C). Since water supply temperature setpoints below 40°F result in suction temperatures at or below the freezing point of water, a glycol solution is required for all low temperature machines. Ice making machines have a leaving water temperature range of 20 to 65°F (-6.7 to 18.3°C). Ice making controls include dual setpoint controls and safeties for ice making and standard cooling capabilities.

The maximum water temperature that can be circulated through an evaporator when the unit is not operating is 108°F (42.2°C). The evaporator becomes thermal stress limited at this temperature.

2. Supply Water Temperature Drop

The performance data for the Trane air-cooled Series R™ chiller is based on a chilled water temperature drop of 10°F (5.6°C). Temperature drops outside this range will result in unit performance that differs from that cataloged. For performance data outside the 10°F range, see Table F-1 for adjustment factors. Chilled water temperature drops from 6 to 18°F (3.3 to 10°C) may be used as long as minimum and maximum water temperatures and flow rates are not violated. Temperature drops outside this range are beyond the optimum range for control and may adversely affect the microprocessor's ability to maintain an acceptable supply water temperature range.

Application Considerations

Typical Water Piping

All building water piping must be flushed prior to making final connections to the chiller. To reduce heat loss and prevent condensation, insulation should be installed. Expansion tanks are also usually required so that chilled water volume changes can be accommodated. A typical piping arrangement is shown in Figure A-1.

Water Pumps

Where noise limitation and vibration-free operation are important, Trane strongly encourages the use of 1750-rpm (60 Hz), 1450-rpm (50 Hz) pumps. specifying or using 3600 rpm (60 Hz), 3000-rpm (50 Hz) chilled water pumps must be avoided, because such pumps may operate with objectionable levels of noise and vibration. In addition, a low frequency beat may occur due to the slight difference in operating rpm between 3600 rpm (60 Hz) water pumps and Series R chiller motors. Note: The chilled water pump must not be used to stop the chiller.

Multiple Unit Operation

Whenever two or more units are used on one chilled water loop, Trane recommends that their operation be controlled from a single control device, such as a Trane Tracer™ system.

Series Operation

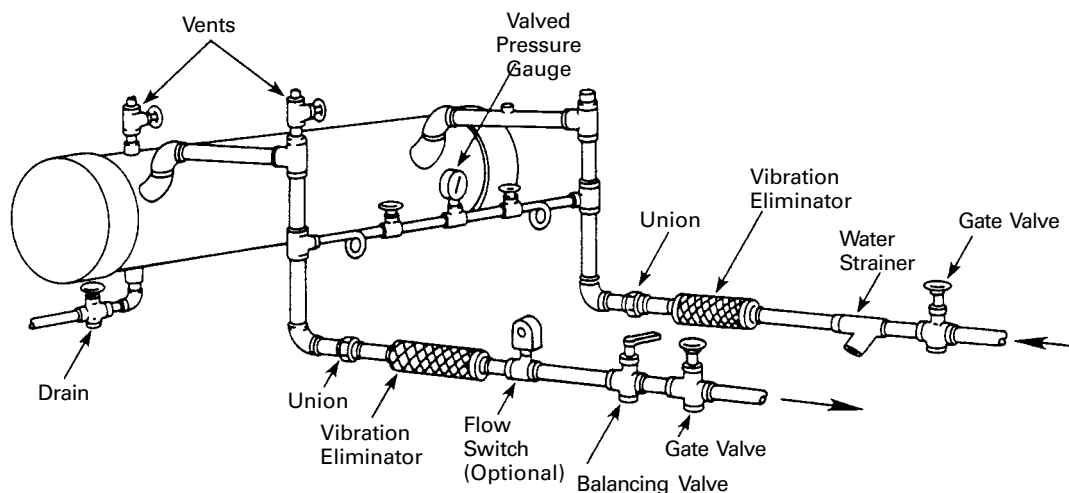
An energy-saving strategy is to design the system around chillers arranged with series evaporator flow. The actual savings possible with such a design depends on the application dynamics and should be discussed with your Trane Systems Solutions Engineer. It is possible to operate a pair of chillers more efficiently in a series chiller arrangement than in a parallel arrangement. In a series arrangement, a system design can achieve higher chilled water temperature differentials (16 to 24°F/8.9 to 13.3°C), which may, in turn, provide the opportunity for lower design chilled water temperature, lower design flow, and result in installation and operational cost savings.

For these installations, control of the units should be from a common temperature controller to prevent the separate thermostats fighting one another and continually hunting. It is possible to control from the two individual unit controls, but a common temperature controller provides a positive method for preventing control overlap, more closely matches system load, and simplifies compressor lead-lag capability.

Parallel Operation

Some systems require more capacity or standby capability than a single machine can provide. For those installations, two units with their evaporators in a parallel configuration are typical. The only effective way of controlling two units in parallel is with a single temperature controller. Two individual temperature controllers are not capable of providing reliable system control and will often result in unsatisfactory operation.

Figure A-1 — Recommended Piping Components For Typical Evaporator Installation





Model Number Description

70-125 Tons

Model Nomenclature Digit Number

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17

70-125 Tons

Digits 1,2 — Unit Model
RT = Rotary Chiller

Digit 3 — Unit Type
A = Air Cooled

Digit 4 — Development Sequence
A = First Sequence

Digit 5, 6 & 7 — Nominal Capacity
070 = 70 tons
080 = 80 tons
090 = 90 tons
100 = 100 tons
110 = 110 tons
125 = 125 tons

Digit 8 — Unit Voltage
A = 200/60/3
C = 230/60/3
D = 380/60/3
4 = 460/60/3
5 = 575/60/3
K = 400/50/3
S = Special

Digit 9 — Compressor Starter Type
Y = Y-Delta Closed Transition
X = X-Line (Across the Line)
S = Special

Digit 10, 11 — Design Sequence
** = Factory Input

Digit 12 — Evaporator Leaving Temperature
1 = Standard 40 to 65°F
2 = Low 0 to 39°F
3 = Ice-Making 20 to 65°F
S = Special

Digit 13 — Condenser Coil Fin Material
A = Aluminum
S = Special
2 = CompleteCoat
4 = Copper

Digit 14 — Agency Listing
0 = No Agency Listing
3 = C/UL Listing
4 = China Pressure Vessel Code
5 = China Pressure Vessel Code
& C/UL Listing

Digit 15 — Control Interface
C = Deluxe without Communication
D = Deluxe with Communication
L = LonTalk (LCI-C)

Digit 16 — Chilled Water Reset
0 = No Chilled Water Reset
1 = Based on Return Water Temperature
2 = Based on Outside Air Temperature

Digit 17 — Miscellaneous Factory Installed Options

A = Architectural Louvered Panels
B = Control Power Transformer
C = Convenience Outlet
D = Low Ambient Lockout Sensor
F = Mech. Disconnect Switch
G = Low Ambient Operation
K = Coil Protection
M = Access Guard
P = Circuit Breaker (Single Point Power)
0 = Size C2 HP Pump Package
1 = Size D3 HP Pump Package
2 = Size D5 HP Pump Package
3 = Size E2 HP Pump Package
4 = Size E3 HP Pump Package
5 = Size F5 HP Pump Package
6 = Size F7 HP Pump Package
7 = Size G3 HP Pump Package
8 = Size G5 HP Pump Package

Field Installed Options
N = Elastomeric Isolators
R = Remote Display Panel
J = Remote Evaporator
H = Sound Attenuator

General Data

Table G-1 – General Data RTAA – 70-125 Ton

Size		70	80	90	100	110	125
Compressor							
Quantity		2	2	2	2	2	2
Nominal Size (1)	(Tons)	35/35	40/40	50/40	50/50	60/50	60/60
Evaporator							
Water Storage	(Gallons)	39.8	37.3	34.4	32.1	53.4	45.8
	(Liters)	150.6	143.1	130.2	121.5	202.11	173.4
Min. Flow	(GPM)	84	96	108	120	132	150
	(L/Sec)	5.3	6.1	6.8	7.6	8.3	9.5
Max. Flow	(GPM)	252	288	324	360	396	450
	(L/Sec)	15.9	18.2	20.4	22.7	25.0	28.4
Condenser							
Qty of Coils		4	4	4	4	4	4
Coil Length	(In)	156/156	156/156	168/156	168/168	204/168	204/204
	(mm)	3962/3962	3962/3962	4267/3962	4267/4267	5182/4267	5182/5182
Coil Height	(In)	42	42	42	42	42	42
	(mm)	1067	1067	1067	1067	1067	1067
Fins/Ft.		192	192	192	192	192	192
Number of Rows		2	2	2	2	2	2
Condenser Fans (60 Hz)							
Quantity (1)		4/4	4/4	5/4	5/5	5/5	5/5
Diameter	(In)	30	30	30	30	30	30
	(mm)	762	762	762	762	762	762
Total Airflow	(CFM)	71750	71750	77640	83530	87505	91480
Nominal RPM	60 Hz	1140	1140	1140	1140	1140	1140
Tip Speed	(Ft/Min)	8954	8954	8954	8954	8954	8954
Motor HP (Ea)		1.25	1.25	1.25	1.25	1.25	1.25
Condenser Fans (50 Hz)							
Quantity (1)		4/4	4/4	5/4	5/5	5/5	5/5
Diameter	(In)	30	30	30	30	30	30
	(mm)	762	762	762	762	762	762
Total Airflow	(CFM)	59172	59200	63963	68724	72104	75492
Nominal RPM	50 Hz	970	970	970	970	970	970
Tip Speed	(Ft/Min)	7618	7618	7618	7618	7618	7618
Motor HP (Ea)		1.25	1.25	1.25	1.25	1.25	1.25
Min Starting/Oper Ambient (2)							
Std Unit	(Deg F)	25	25	25	25	25	25
	(Deg C)	-3.9	-3.9	-3.9	-3.9	-3.9	-3.9
Low Ambient	(Deg F)	-10	-10	-10	-10	-10	-10
	(Deg C)	-23.3	-23.3	-23.3	-23.3	-23.3	-23.3
General Unit							
Refrigerant		HCFC-22	HCFC-22	HCFC-22	HCFC-22	HCFC-22	HCFC-22
No. of Independent Refrigerant Circuits		2	2	2	2	2	2
Refrigerant Charge (1)	(Lb)	58/58	61/61	73/61	73/73	98/73	98/98
	(Kg)	26/26	28/28	34/28	34/34	44/34	44/44
Oil Charge (1)	(Gallons)	2.5/2.5	2.5/2.5	3/2.5	3/3	3/3	3/3
	(Liters)	10.6/10.6	10.6/10.6	12.7/10.6	12.7/12.7	12.7/12.7	12.7/12.7

1. Data containing information on two circuits shown as follows: ckt 1/ckt2.

2. Minimum start-up/operating ambient based on a 5 mph wind across the condenser.

Table G-2 – General Data Pump Package

Pump Package Size		C2	D3	D5	E2	E3	F5	F7	G3	G5
Pump										
Quantity		2	2	2	2	2	2	2	2	2
Motor HP	(each)	2	3	5	2	3	5	7.5	3	5
Water Storage										
4" connection	(Gallons)	13.64	13.54	16.18	16.25	16.25	23.54	23.54	23.62	23.62
	(Liters)	51.63	51.25	61.25	61.51	61.51	89.11	89.11	89.41	89.41
6" connection	(Gallons)	--	16.8	19.41	--	19.59	26.09	26.09	26.56	26.56
	(Liters)	--	64.28	73.47	--	74.16	98.76	98.76	100.54	100.54

1. Information given for 460/60/3 units only.



Selection Procedure

The chiller capacity tables, P-1 through P-4, cover the most frequently encountered leaving water temperatures. The tables reflect a 10°F (6°C) temperature drop through the evaporator. For temperature drops other than 10°F (6°C), refer to Table F-1, and apply the appropriate Performance Data Adjustment Factors. For chilled brine selections, refer to Figures F-2 and 3 for Ethylene and Propylene Glycol Adjustment Factors.

To select a Trane air-cooled Series R™ chiller, the following information is required:

1. Design load in tons of refrigeration
2. Design chilled water temperature drop
3. Design leaving chilled water temperature
4. Design ambient temperature

The following formulas can be used to determine approximate evaporator flow rates:

$$\text{GPM} = \frac{\text{Tons} \times 24}{\text{Temperature Drop (Degrees F)}}$$

OR

$$\text{L/S} = \frac{\text{kW (Capacity)} \times .239}{\text{Temperature Drop (Degrees C)}}$$

NOTE: Flow rates must fall within the limits specified in Table G-1 (for GPM or for l/s). Formulas listed above are useful tools to estimate evaporator flow rates.

For specific chiller performance, contact a local Trane sales engineer.

Selection Example

Given:

Required System Load = 115Tons
Leaving Chilled Water Temperature (LCWT) = 44°F
Chilled Water Temperature Drop = 10°F
Design Ambient Temperature = 95°F

Evaporator Fouling Factor = 0.0001

1. To calculate the required chilled water flow rate we use the formula given below:
$$\text{GPM} = \frac{115\text{Tons} \times 24}{10^\circ\text{F}} = 276 \text{ GPM}$$
2. From Table P-1 (RTAA Performance Data), an RTAA 125 at the given conditions will produce 120.0 tons with a compressor power input of 136.2 kW and a unit EER of 9.8.
3. To determine the evaporator pressure drop we use the flow rate (GPM) and the evaporator water pressure drop curves, Figure F-1. Entering the curve at 276 GPM, the pressure drop for a nominal 125 ton evaporator is 18 feet.
4. For selection of chilled brine units or applications where the altitude is significantly greater than sea level or the temperature drop is different than

10°F, the performance adjustment factors from Tables F-1, F-2, and/or F-3 should be applied at this point.

For example:

Corrected Capacity = Capacity (unadjusted) x Glycol Flow Rate Adjustment Factor

5. The final unit selection is:

- QTY (1) RTAA 125
- Cooling Capacity = 120.0 tons
- Entering/Leaving Chilled Water Temperatures = 54/44°F
- Chilled Water Flow Rate = 276 GPM
- Evaporator Water Pressure Drop = 18 feet
- Compressor Power Input = 136.2 kW
- Unit EER = 9.8

Minimum Leaving Chilled Water Temperature Setpoint

The minimum leaving chilled water temperature setpoint for water is 40°F. For those applications requiring lower setpoints, a brine solution must be used. Contact the local Trane sales engineer for additional information.

Chilled Brine Solutions

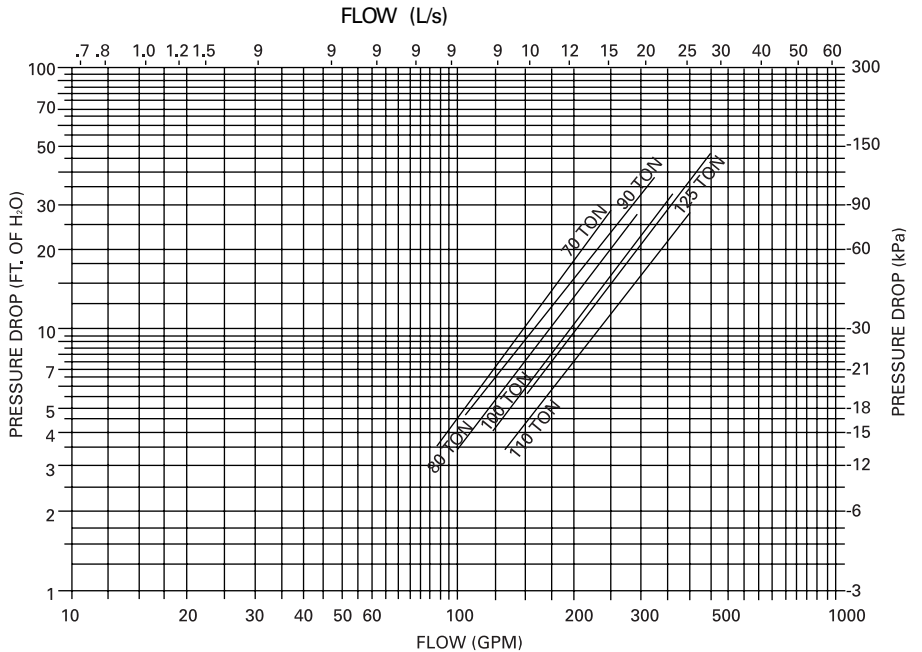
Series R chillers can utilize a wide variety of chilled fluids other than water in the evaporator, including ethylene glycol and propylene glycol. Chillers using media other than water are excluded from the ARI 550/590 Certification Program, but are rated in accordance with the ARI Standard. Trane factory performance tests are only performed with water as the chilled fluid. When considering selection of media other than water, contact the local Trane sales office for chiller selections and factory performance testing information.

Performance Adjustment Factors

Table F-1 — Performance Data Adjustment Factors

Fouling Factor	Chilled Water Temp. Drop	Altitude											
		Sea Level			2000 Feet			4000 Feet			6000 Feet		
		CAP	GPM	KW	CAP	GPM	KW	CAP	GPM	KW	CAP	GPM	KW
0.00010	8	1.000	1.249	1.000	0.996	1.245	1.004	0.991	1.240	1.007	0.987	1.234	1.014
	10	1.000	1.000	1.000	0.997	0.996	1.004	0.993	0.992	1.007	0.988	0.988	1.015
	12	1.001	0.835	1.001	0.997	0.832	1.004	0.993	0.828	1.009	0.988	0.824	1.015
	14	1.003	0.716	1.001	0.999	0.714	1.004	0.994	0.711	1.009	0.990	0.708	1.015
	16	1.004	0.628	1.001	1.000	0.626	1.005	0.997	0.623	1.009	0.991	0.620	1.016
0.00025	8	0.988	1.235	0.996	0.984	1.230	1.000	0.980	1.225	1.004	0.975	1.220	1.010
	10	0.988	0.989	0.998	0.986	0.985	1.000	0.981	0.981	1.004	0.977	0.976	1.011
	12	0.990	0.825	0.998	0.987	0.822	1.000	0.983	0.819	1.005	0.978	0.815	1.011
	14	0.991	0.708	0.998	0.988	0.706	1.001	0.984	0.703	1.005	0.980	0.700	1.011
	16	0.993	0.621	0.999	0.990	0.619	1.001	0.986	0.617	1.006	0.981	0.614	1.012

Figure F-1 — Evaporator Water Pressure Drops, 70-125 Ton Units





Performance Adjustment Factors

Figure F-2 — Ethylene Glycol Performance Factors

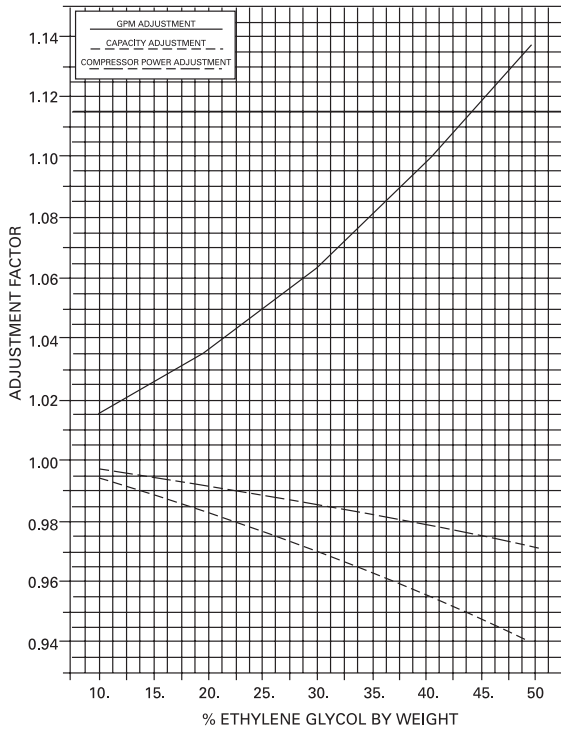


Figure F-3 — Propylene Glycol Performance Factors

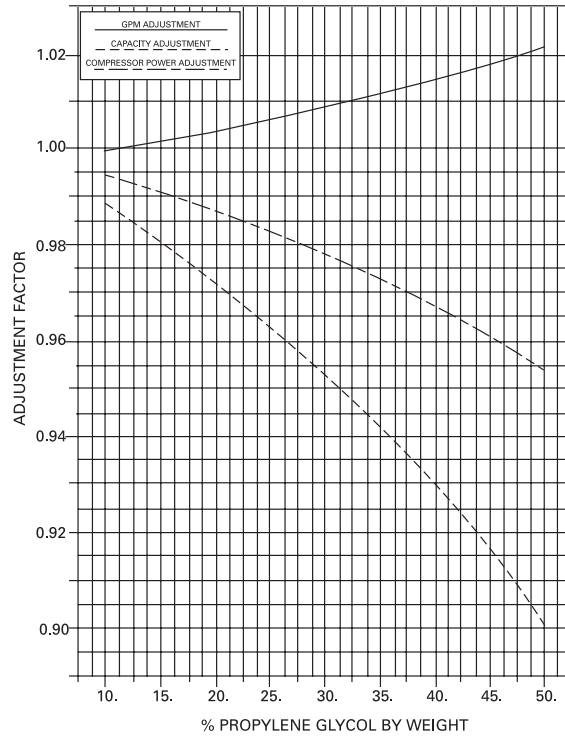
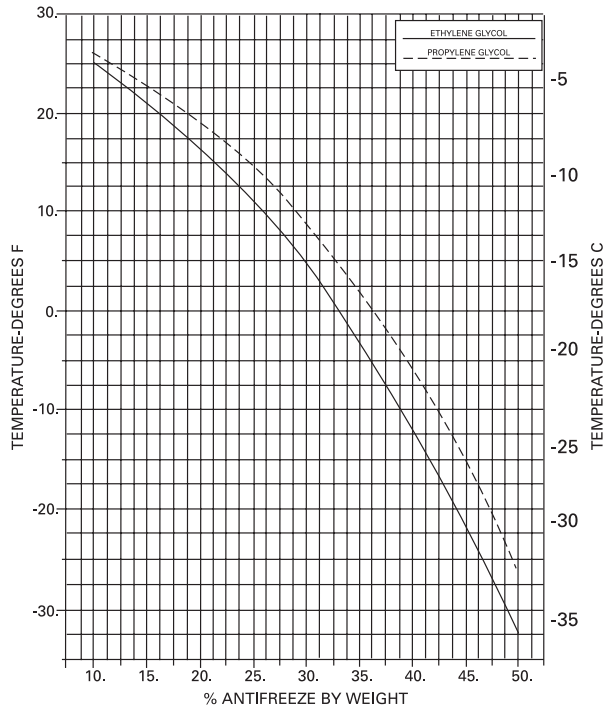


Figure F-4 — Ethylene Glycol and Propylene Glycol Freeze Point



Performance Data

Full Load

Table P-1. 60 Hz chillers in English units

Evaporator Leaving Water Temperature (F)		Condenser Entering Air Temperature (F)											
		85			95			105			115		
		Unit Size	Tons	kW input	EER	Tons	kW input	EER	Tons	kW input	EER	Tons	kW input
40	70	68.7	64.3	11.2	64.6	70.8	9.7	60.4	77.9	8.4	55.5	84.8	7.1
	80	78.8	75.6	11.2	74.4	83.1	9.7	69.8	91.3	8.4	65.0	100.4	7.2
	90	89.9	88.9	10.9	84.8	97.0	9.5	79.5	106.1	8.2	73.9	116.4	7.0
	100	99.9	101.7	10.6	94.2	110.5	9.3	88.2	120.5	8.1	81.9	131.9	6.9
	110	107.7	110.7	10.6	101.6	120.3	9.3	95.2	131.2	8.1	88.4	143.6	6.9
	125	119.3	122.0	10.8	112.4	132.3	9.4	105.2	144.1	8.2	97.5	157.5	7.0
42	70	71.1	65.1	11.5	66.9	71.6	10.0	62.6	78.7	8.6	57.1	84.8	7.3
	80	81.6	76.8	11.4	77.1	84.2	9.9	72.3	92.5	8.6	67.4	101.6	7.3
	90	93.0	90.3	11.1	87.8	98.4	9.7	82.3	107.5	8.4	76.5	117.8	7.2
	100	103.2	103.3	10.8	97.4	112.0	9.5	91.2	122.1	8.2	84.7	133.5	7.1
	110	111.3	112.4	10.8	105.0	121.9	9.5	98.4	132.9	8.2	91.5	145.3	7.0
	125	123.2	124.0	11.0	116.2	134.2	9.6	108.7	146.1	8.3	100.9	159.5	7.1
44	70	73.5	65.9	11.8	69.3	72.4	10.2	64.9	79.6	8.8	58.6	84.8	7.5
	80	84.5	78.0	11.7	79.8	85.4	10.2	74.9	93.7	8.8	69.9	102.8	7.5
	90	96.1	91.7	11.3	90.8	99.8	9.9	85.1	108.9	8.6	79.2	119.2	7.4
	100	106.6	104.9	11.0	100.6	113.6	9.7	94.3	123.7	8.4	87.6	135.1	7.2
	110	114.9	114.2	11.0	108.5	123.7	9.7	101.7	134.6	8.4	94.6	147.1	7.2
	125	127.3	126.0	11.1	120.0	136.2	9.8	112.4	148.1	8.5	104.3	161.5	7.3
46	70	76.0	66.8	12.0	71.7	73.2	10.5	67.2	80.5	9.0	60.2	84.8	7.7
	80	87.4	79.2	11.9	82.6	86.6	10.4	77.6	94.9	9.0	72.4	104.1	7.7
	90	99.4	93.1	11.6	93.8	101.2	10.1	88.0	110.4	8.8	81.7	120.4	7.5
	100	110.1	106.6	11.2	103.9	115.3	9.9	97.4	125.3	8.6	90.6	136.7	7.4
	110	118.6	116.0	11.2	112.0	125.5	9.9	105.1	136.4	8.6	97.7	148.9	7.4
	125	131.4	128.0	11.3	123.9	138.3	10.0	116.0	150.1	8.7	106.7	162.1	7.4
48	70	78.5	67.6	12.3	74.1	74.1	10.7	69.5	81.4	9.3	61.8	84.8	7.9
	80	90.4	80.4	12.1	85.4	87.9	10.6	80.3	96.2	9.2	74.4	104.7	7.9
	90	102.6	94.6	11.8	96.9	102.7	10.3	90.9	111.8	9.0	82.9	120.1	7.7
	100	113.6	108.3	11.4	107.3	117.0	10.1	100.6	127.0	8.8	92.0	136.7	7.5
	110	122.4	117.8	11.4	115.6	127.3	10.0	108.4	138.3	8.7	99.4	148.9	7.5
	125	135.6	130.2	11.5	127.9	140.4	10.1	119.8	152.2	8.8	107.2	160.2	7.5
50	70	81.1	68.5	12.6	76.5	75.0	11.0	71.8	82.3	9.5	63.4	84.8	8.1
	80	93.4	81.7	12.4	88.3	89.1	10.8	83.0	97.4	9.4	75.9	104.8	8.0
	90	106.0	96.2	12.0	100.1	104.2	10.5	93.9	113.3	9.2	84.3	120.0	7.8
	100	117.2	110.1	11.6	110.7	118.7	10.3	103.8	128.7	8.9	93.4	136.5	7.6
	110	126.2	119.7	11.6	119.2	129.2	10.2	111.9	140.1	8.9	101.0	148.7	7.6
	125	139.9	132.3	11.7	131.9	142.6	10.3	123.6	154.3	9.0	108.0	158.5	7.7

Notes:

1. Ratings based on sea level altitude and evaporator fouling factor of 0.00010 hr-sq. ft.-°F/Btu.
2. Consult Trane representative for performance at temperatures outside of the ranges shown.
3. kW input is for compressors only.
4. EER = Energy Efficiency Ratio (Btu/watt-hour). Power inputs include compressors, condenser fans and control power.
5. Ratings are based on an evaporator temperature drop of 10°F.
6. Ambient temperatures 115°F and greater reflect the high ambient condenser option.
7. Interpolation between points is permissible. Extrapolation is not permitted.
8. Rated in accordance with ARI Standard 550/590.



Performance Data

Full Load

Table P-2. 50 Hz chillers in English units

		Condenser Entering Air Temperature (F)											
		85			95			105			115		
Evaporator Leaving Water Temperature (F)	Unit Size	Tons	kW input	EER	Tons	kW input	EER	Tons	kW input	EER	Tons	kW input	EER
40	70	59.5	53.4	12.2	56.0	58.7	10.5	52.3	64.7	9.0	48.6	71.2	7.6
	80	68.4	62.9	12.0	64.5	69.0	10.4	60.5	75.9	9.0	56.4	83.4	7.7
	90	77.9	73.9	11.7	73.5	80.6	10.2	68.9	88.1	8.8	64.0	96.6	7.5
	100	86.6	84.5	11.4	81.7	91.7	10.0	76.4	100.0	8.6	70.9	109.4	7.4
	110	93.5	92.0	11.4	88.2	99.9	10.0	82.6	108.9	8.6	76.7	119.1	7.3
	125	103.2	101.1	11.5	97.2	109.6	10.1	91.0	119.4	8.7	84.3	130.5	7.4
42	70	61.6	54.1	12.4	58.0	59.4	10.8	54.3	65.4	9.2	50.4	71.9	7.9
	80	70.9	63.8	12.3	66.9	70.0	10.7	62.8	76.8	9.2	58.5	84.4	7.8
	90	80.7	75.1	12.0	76.1	81.7	10.4	71.3	89.3	9.0	66.3	97.7	7.7
	100	89.5	85.9	11.6	84.4	93.0	10.2	79.1	101.3	8.8	73.4	110.7	7.5
	110	96.6	93.4	11.6	91.2	101.3	10.2	85.4	110.3	8.8	79.4	120.6	7.5
	125	106.7	102.8	11.7	100.6	111.3	10.3	94.1	121.0	8.9	87.3	132.1	7.6
44	70	63.7	54.8	12.7	60.0	60.1	11.0	56.2	66.1	9.5	52.3	72.7	8.1
	80	73.4	64.9	12.6	69.3	71.0	10.9	65.1	77.9	9.4	60.6	85.4	8.0
	90	83.4	76.3	12.2	78.8	82.9	10.7	73.8	90.5	9.2	68.7	98.9	7.9
	100	92.5	87.3	11.8	87.3	94.4	10.4	81.8	102.7	9.0	76.0	112.1	7.7
	110	99.8	94.9	11.8	94.3	102.8	10.4	88.3	111.8	9.0	82.1	122.1	7.7
	125	110.2	104.5	11.9	103.9	112.9	10.5	97.3	122.7	9.0	90.3	133.8	7.7
46	70	65.9	55.5	13.0	62.1	60.8	11.3	58.2	66.8	9.7	54.2	73.5	8.3
	80	76.0	65.9	12.8	71.8	72.0	11.2	67.4	78.9	9.6	62.8	86.5	8.2
	90	86.3	77.5	12.4	81.4	84.1	10.9	76.4	91.7	9.4	71.1	100.2	8.1
	100	95.6	88.7	12.0	90.2	95.8	10.6	84.5	104.1	9.2	78.5	113.5	7.9
	110	103.1	96.5	12.0	97.4	104.3	10.6	91.3	113.3	9.2	84.8	123.6	7.8
	125	113.9	106.2	12.1	107.4	114.7	10.6	100.5	124.4	9.2	93.3	135.5	7.9
48	70	68.1	56.2	13.3	64.2	61.5	11.5	60.2	67.6	9.9	56.1	74.3	8.5
	80	78.7	66.9	13.1	74.3	73.1	11.4	69.8	80.0	9.8	65.1	87.5	8.4
	90	89.2	78.8	12.6	84.2	85.4	11.1	78.9	92.9	9.6	73.5	101.4	8.2
	100	98.7	90.2	12.3	93.1	97.2	10.8	87.3	105.5	9.4	81.1	114.9	8.0
	110	106.5	98.1	12.2	100.5	105.8	10.7	94.2	114.9	9.3	87.6	125.1	8.0
	125	117.6	108.0	12.3	110.8	116.4	10.8	103.8	126.2	9.4	95.7	136.4	8.1
50	70	70.3	56.9	13.6	66.4	62.3	11.8	62.3	68.4	10.2	58.1	75.2	8.7
	80	81.3	68.0	13.3	76.8	74.2	11.6	72.2	81.0	10.1	67.3	88.6	8.6
	90	92.1	80.1	12.9	87.0	86.7	11.3	81.6	94.2	9.8	75.9	102.7	8.4
	100	101.9	91.7	12.5	96.1	98.7	11.0	90.1	106.9	9.6	83.8	116.3	8.2
	110	109.9	99.7	12.4	103.7	107.4	10.9	97.3	116.4	9.5	90.5	126.7	8.2
	125	121.3	109.9	12.5	114.4	118.2	11.0	107.1	128.0	9.6	96.5	135.1	8.2

Notes:

1. Ratings based on sea level altitude and evaporator fouling factor of 0.00010hr-sq. ft.-°F/Btu .
2. Consult Trane representative for performance at temperatures outside of the ranges shown.
3. kW input is for compressors only.
4. EER = Energy Efficiency Ratio (Btu/watt-hour). Power inputs include compressors, condenser fans and control power.
5. Ratings are based on an evaporator temperature drop of 10°F.
6. Ambient temperatures 115°F and greater reflect the high ambient condenser option.
7. Interpolation between points is permissible. Extrapolation is not permitted.
8. Rated in accordance with ARI Standard 550/590.

Performance Data

Full Load

Table P-3. 60 Hz chillers in metric units

		Condenser Entering Air Temperature (C)											
		30			35			40			45		
Evaporator Leaving Water Temperature (C)	Unit Size	kW Cooling	kW input	COP	kW Cooling	kW input	COP	kW Cooling	kW input	COP	kW Cooling	kW input	COP
5	70	244.4	65.3	3.3	231.4	71.2	2.9	218.0	77.6	2.5	203.9	84.6	2.2
	80	280.2	76.9	3.3	266.2	83.6	2.9	251.4	91.0	2.5	236.3	99.1	2.2
	90	319.6	90.4	3.2	303.4	97.7	2.8	286.2	105.9	2.5	268.6	114.9	2.2
	100	355.1	103.3	3.1	336.8	111.2	2.8	317.5	120.2	2.4	297.5	130.3	2.1
	110	382.9	112.5	3.1	363.2	121.1	2.8	342.8	130.9	2.4	321.0	141.8	2.1
	125	424.0	123.9	3.1	401.9	133.3	2.8	378.7	143.9	2.5	354.4	155.7	2.1
7	70	259.5	66.8	3.4	246.1	72.7	3.0	232.1	79.1	2.6	214.1	84.7	2.3
	80	298.5	79.0	3.4	283.4	85.8	3.0	267.9	93.2	2.6	252.1	101.3	2.3
	90	339.7	92.9	3.3	322.4	100.2	2.9	304.5	108.4	2.6	285.5	117.5	2.3
	100	376.6	106.2	3.2	357.2	114.1	2.9	337.2	123.1	2.5	316.1	133.2	2.2
	110	405.8	115.6	3.2	385.4	124.2	2.9	363.6	134.0	2.5	341.1	145.0	2.2
	125	449.3	127.6	3.2	426.1	136.9	2.9	401.9	147.4	2.5	376.2	159.3	2.2
9	70	275.3	68.3	3.6	261.2	74.2	3.2	246.8	80.7	2.8	224.7	84.8	2.4
	80	317.1	81.2	3.5	301.3	88.0	3.1	285.2	95.4	2.7	268.3	103.6	2.4
	90	360.0	95.5	3.4	341.8	102.8	3.0	323.1	111.0	2.7	303.1	120.1	2.3
	100	398.7	109.3	3.3	378.3	117.1	3.0	357.2	126.1	2.6	335.1	136.2	2.3
	110	429.3	118.9	3.3	407.9	127.5	3.0	385.0	137.3	2.6	361.4	148.3	2.3
	125	475.7	131.3	3.3	451.1	140.6	3.0	425.4	151.2	2.6	398.7	163.1	2.3

Notes:

1. Ratings based on sea level altitude and evaporator fouling factor of 0.0176 sq. m-°C/kW.
2. Consult Trane representative for performance at temperatures outside of the ranges shown.
3. kW input is for compressors only.
4. EER = Energy Efficiency Ratio (Btu/watt-hour). Power inputs include compressors, condenser fans and control power.
5. Ratings are based on an evaporator temperature drop of 5.6°C.
6. Interpolation between points is permissible. Extrapolation is not permitted.
7. Rated in accordance with ARI Standard 550/590.



Performance Data

Full Load

Table P-4. 50 Hz chillers in metric units

		Condenser Entering Air Temperature (C)											
		30			35			40			45		
Evaporator Leaving Water Temperature (C)	Unit Size	kW Cooling	kW input	COP	kW Cooling	kW input	COP	kW Cooling	kW input	COP	kW Cooling	kW input	COP
5	70	211.7	54.3	3.6	200.4	59.1	3.1	188.8	64.4	2.7	176.5	70.2	2.4
	80	243.7	63.9	3.5	231.0	69.5	3.1	218.3	75.6	2.7	205.0	82.3	2.3
	90	277.4	75.1	3.4	263.0	81.1	3.0	248.2	87.9	2.7	232.8	95.4	2.3
	100	307.7	85.9	3.3	292.2	92.4	3.0	275.3	99.8	2.6	257.7	108.1	2.3
	110	332.3	93.5	3.3	315.4	100.6	3.0	297.5	108.6	2.6	278.5	117.7	2.3
	125	366.7	102.7	3.4	347.7	110.4	3.0	327.7	119.2	2.6	306.6	129.0	2.3
7	70	225.0	55.5	3.7	213.4	60.3	3.3	201.1	65.7	2.8	188.8	71.6	2.5
	80	259.5	65.8	3.7	246.5	71.3	3.2	232.8	77.5	2.8	218.7	84.2	2.5
	90	294.6	77.3	3.5	279.9	83.3	3.1	264.1	90.0	2.8	247.5	97.5	2.4
	100	326.6	88.4	3.4	310.1	94.8	3.1	292.5	102.2	2.7	273.9	110.5	2.4
	110	352.7	96.1	3.4	334.7	103.2	3.1	315.7	111.3	2.7	296.1	120.4	2.3
	125	389.2	105.8	3.5	369.2	113.5	3.1	347.7	122.2	2.7	325.6	132.0	2.4
9	70	238.7	56.8	3.9	226.8	61.6	3.4	214.1	67.0	3.0	201.1	73.0	2.6
	80	276.0	67.6	3.8	262.3	73.2	3.3	247.9	79.3	2.9	232.8	86.1	2.6
	90	312.9	79.5	3.7	297.1	85.5	3.3	280.2	92.3	2.9	263.0	99.8	2.5
	100	346.3	91.0	3.6	328.4	97.4	3.2	310.1	104.8	2.8	290.8	113.1	2.4
	110	373.4	98.9	3.5	354.4	106.0	3.2	334.7	114.1	2.8	314.0	123.1	2.4
	125	412.4	109.0	3.6	391.0	116.6	3.2	368.5	125.3	2.8	345.3	135.1	2.4

Notes:

1. Ratings based on sea level altitude and evaporator fouling factor of 0.0176 sq. m²/kW.
2. Consult Trane representative for performance at temperatures outside of the ranges shown.
3. kW input is for compressors only.
4. EER = Energy Efficiency Ratio (Btu/watt-hour). Power inputs include compressors, condenser fans and control power.
5. Ratings are based on an evaporator temperature drop of 5.6°C.
6. Interpolation between points is permissible. Extrapolation is not permitted.
7. Rated in accordance with ARI Standard 550/590.

Performance Data

Part Load

Table P-5 – ARI Part-Load Values (60 Hz)

Unit	% Load	Tons	EER	IPLV
RTAA 70	100	69.3	10.2	13.7
	75	52.0	12.0	
	50	34.6	14.6	
	25	17.3	16.3	
RTAA 80	100	79.8	10.2	13.3
	75	59.8	11.7	
	50	39.9	14.9	
	25	20.0	12.7	
RTAA 90	100	90.8	9.9	13.1
	75	68.1	11.3	
	50	45.4	14.7	
	25	22.7	13.8	
RTAA 100	100	100.6	9.7	12.6
	75	75.5	11.0	
	50	50.3	13.5	
	25	25.2	15.3	
RTAA 110	100	108.5	9.7	12.5
	75	81.4	11.0	
	50	54.3	13.3	
	25	27.1	15.2	
RTAA125	100	120.0	9.8	12.7
	75	90.0	11.2	
	50	60.0	13.8	
	25	30.0	13.8	

Table P-6 – ARI Part-Load Values (50 Hz)

Unit	% Load	kW cooling	COP	IPLV
RTAA 70	100	211.1	3.2	4.4
	75	158.3	3.9	
	50	105.6	4.7	
	25	52.8	5.1	
RTAA 80	100	243.8	3.2	4.2
	75	182.8	3.7	
	50	121.9	4.8	
	25	60.9	4.0	
RTAA 90	100	276.9	3.1	4.2
	75	207.7	3.6	
	50	138.5	4.7	
	25	69.2	4.3	
RTAA 100	100	306.9	3.0	4.0
	75	230.2	3.5	
	50	153.5	4.3	
	25	76.7	4.8	
RTAA 110	100	331.4	3.0	4.0
	75	248.5	3.5	
	50	165.7	4.2	
	25	82.8	4.8	
RTAA125	100	365.4	3.1	4.0
	75	274.0	3.6	
	50	182.7	4.3	
	25	91.3	4.3	



Electrical Data Packaged Unit

Table E-1 – Electrical Data (50 & 60 Hz, 3 Phase)

Unit Size	Unit Wiring						Motor Data					
	Rated Voltage (9)	# of Power Connections (1)	MCA (3)	Max. Fuse, HACR Breaker or MOP (2,11)	Rec. Time Delay or RDE (4)	Qty	Compressor (Each)		Qty.	Fans (Each)		Control kW (7, 10)
						RLA (5)	LRA (8)	kW		FLA		
RTAA 70	200/60	1	300	400	350	2	115 - 115	800 - 800	8	1.0	5.1	0.75
	230/60	1	265	350	300	2	100 - 100	690 - 690	8	1.0	5.0	0.75
	380/60	1	163	200	200	2	61 - 61	400 - 400	8	1.0	3.2	0.75
	460/60	1	133	175	150	2	50 - 50	330 - 330	8	1.0	2.5	0.75
	575/60	1	108	125	125	2	40 - 40	270 - 270	8	1.0	2.2	0.75
	400/50	1	133	175	150	2	50 - 50	325 - 325	8	0.7	2.5	0.75
RTAA 80	200/60	1	361	500	400	2	142 - 142	800 - 800	8	1.0	5.1	0.75
	230/60	1	319	400	350	2	124 - 124	760 - 760	8	1.0	5.0	0.75
	380/60	1	194	250	225	2	75 - 75	465 - 465	8	1.0	3.2	0.75
	460/60	1	160	200	175	2	62 - 62	380 - 380	8	1.0	2.5	0.75
	575/60	1	131	175	150	2	50 - 50	304 - 304	8	1.0	2.2	0.75
	400/50	1	160	200	175	2	62 - 62	375 - 375	8	0.7	2.5	0.75
RTAA 90	200/60	1	428	600	500	2	192 - 142	990 - 800	9	1.0	5.1	0.75
	230/60	1	378	500	450	2	167 - 124	820 - 760	9	1.0	5.0	0.75
	380/60	1	230	300	300	2	101 - 75	497 - 465	9	1.0	3.2	0.75
	460/60	1	190	250	225	2	84 - 62	410 - 380	9	1.0	2.5	0.75
	575/60	1	154	200	175	2	67 - 50	328 - 304	9	1.0	2.2	0.75
	400/50	1	190	250	225	2	84 - 62	402 - 375	9	0.7	2.5	0.75
RTAA 100	200/60	1	483	600	600	2	192 - 192	990 - 990	10	1.0	5.1	0.75
	230/60	1	426	500	500	2	167 - 167	820 - 820	10	1.0	5.0	0.75
	380/60	1	259	350	300	2	101 - 101	497 - 497	10	1.0	3.2	0.75
	460/60	1	214	250	250	2	84 - 84	410 - 410	10	1.0	2.5	0.75
	575/60	1	173	225	200	2	67 - 67	328 - 328	10	1.0	2.2	0.75
	400/50	1	214	250	250	2	84 - 84	402 - 402	10	0.7	2.5	0.75
RTAA 110	200/60	1	535	700	600	2	233 - 192	1190 - 990	10	1.0	5.1	0.75
	230/60	1	471	600	600	2	203 - 167	1044 - 820	10	1.0	5.0	0.75
	380/60	1	287	400	350	2	123 - 101	632 - 497	10	1.0	3.2	0.75
	460/60	1	235	300	300	2	101 - 84	522 - 410	10	1.0	2.5	0.75
	575/60	1	191	250	225	2	81 - 67	420 - 328	10	1.0	2.2	0.75
	400/50	1	236	300	300	2	101 - 84	512 - 402	10	0.7	2.5	0.75
RTAA 125	200/60	1	576	800	700	2	233 - 233	1190 - 1190	10	1.0	5.1	0.75
	230/60	1	507	700	600	2	203 - 203	1044 - 1044	10	1.0	5.0	0.75
	380/60	1	309	400	350	2	123 - 123	632 - 632	10	1.0	3.2	0.75
	460/60	1	253	350	300	2	101 - 101	522 - 522	10	1.0	2.5	0.75
	575/60	1	205	250	225	2	81 - 81	420 - 420	10	1.0	2.2	0.75
	400/50	1	253	350	300	2	101 - 101	512 - 512	10	0.7	2.5	0.75

Notes:

1. As standard, all 70-215 ton units require a single point power connection.
2. Max Fuse or HACR type breaker = 225 percent of the largest compressor RLA plus 100 percent of the second compressor RLA, plus the sum of the condenser fan FLA per NEC 440-22. Use FLA per circuit, NOT FLA for the entire unit.
3. MCA - Minimum Circuit Ampacity - 125 percent of largest compressor RLA plus 100 percent of the second compressor RLA plus the sum of the condenser fans FLAs per NEC 440-33.
4. RECOMMENDED TIME DELAY OR DUAL ELEMENT (RDE) FUSE SIZE: 150 percent of the largest compressor RLA plus 100 percent of the second compressor RLA and the sum of the condenser fan FLAs.
5. RLA - Rated Load Amps - rated in accordance with UL Standard 1995.
6. Local codes may take precedence.
7. Control kW includes operational controls only. Does not include evaporator heat tape.
8. LRA - Locked Rotor Amps - based on full winding (x-line) start units. LRA for wye-delta starters is 1/3 of LRA of x-line units.
9. VOLTAGE UTILIZATION RANGE:

Rated Voltage	Utilization Range
200	180-220
230	208-254
380	342-418
460	414-506
575	516-633
10. A separate 115/60/1 or 220/50/1, 15 amp customer provided power connection is also needed to power the evaporator heat tape (420 watts @ 120 volts or 420 watts @ 220 volts).
11. If factory circuit breakers are supplied with the chiller, then these values represent Maximum Overcurrent Protection (MOP).



Electrical Data Pump Package Unit

Table E-2 – Electrical Data (60 Hz, 3 Phase)

Unit Size	Unit Wiring					Motor Data						
	Rated Voltage (9)	Pump HP, FLA	MCA (3)	Max. Fuse, HACR Breaker or MOP (2,11)	Rec. Time Delay or RDE (4)	Qty	Compressor (Each)		Qty.	Fans (Each)		Control kW (7, 10)
							RLA (5)	LRA (8)		kW	FLA	
RTAA 70	460/60	2 , 3.1	136	175	150	2	50 - 50	330 - 330	8	1.0	2.5	0.75
	460/60	3 , 4.1	137	175	150	2	50 - 50	330 - 330	8	1.0	2.5	0.75
	460/60	5 , 6.6	139	175	175	2	50 - 50	330 - 330	8	1.0	2.5	0.75
RTAA 80	460/60	2 , 3.1	163	200	200	2	62 - 62	380 - 380	8	1.0	2.5	0.75
	460/60	3 , 4.1	164	225	200	2	62 - 62	380 - 380	8	1.0	2.5	0.75
	460/60	5 , 6.6	166	225	200	2	62 - 62	380 - 380	8	1.0	2.5	0.75
	460/60	7.5 , 10.3	170	225	200	2	62 - 62	380 - 380	8	1.0	2.5	0.75
RTAA 90	460/60	3 , 4.1	194	250	225	2	84 - 62	410 - 380	9	1.0	2.5	0.75
	460/60	5 , 6.6	196	250	225	2	84 - 62	410 - 380	9	1.0	2.5	0.75
	460/60	7.5 , 10.3	200	250	225	2	84 - 62	410 - 380	9	1.0	2.5	0.75
RTAA 100	460/60	3 , 4.1	218	300	250	2	84 - 84	410 - 410	10	1.0	2.5	0.75
	460/60	5 , 6.6	221	300	250	2	84 - 84	410 - 410	10	1.0	2.5	0.75
	460/60	7.5 , 10.3	224	3000	250	2	84 - 84	410 - 410	10	1.0	2.5	0.75
RTAA 110	460/60	3 , 4.1	239	300	300	2	101 - 84	522 - 410	10	1.0	2.5	0.75
	460/60	5 , 6.6	242	300	300	2	101 - 84	522 - 410	10	1.0	2.5	0.75
	460/60	7.5 , 10.3	246	300	300	2	101 - 84	522 - 410	10	1.0	2.5	0.75
RTAA 125	460/60	3 , 4.1	256	350	300	2	101 - 101	522 - 522	10	1.0	2.5	0.75
	460/60	5 , 6.6	259	350	300	2	101 - 101	522 - 522	10	1.0	2.5	0.75
	460/60	7.5 , 10.3	263	350	300	2	101 - 101	522 - 522	10	0.7	2.5	0.75

Notes:

1. As standard, all 70-215 ton units require a single point power connection.
2. Max Fuse or HACR type breaker = 225 percent of the largest compressor RLA plus 100 percent of the second compressor RLA, plus the sum of the condenser fan FLA per NEC 440-22. Use FLA per circuit, NOT FLA for the entire unit).
3. MCA - Minimum Circuit Ampacity - 125 percent of largest compressor RLA plus 100 percent of the second compressor RLA plus the sum of the condenser fans FLAs per NEC 440-33.
4. RECOMMENDED TIME DELAY OR DUAL ELEMENT (RDE) FUSE SIZE: 150 percent of the largest compressor RLA plus 100 percent of the second compressor RLA and the sum of the condenser fan FLAs.
5. RLA - Rated Load Amps - rated in accordance with UL Standard 1995.
6. Local codes may take precedence.
7. Control kW includes operational controls only. Does not include evaporator heat tape.
8. LRA - Locked Rotor Amps - based on full winding (x-line) start units. LRA for wye-delta starters is 1/3 of LRA of x-line units.
9. VOLTAGE UTILIZATION RANGE:

Rated Voltage	Utilization Range
460	414-506
10. A separate 115/60/1, 15 amp customer provided power connection is also needed to power the evaporator heat tape (420 watts @ 120 volts).
11. If factory circuit breakers are supplied with the chiller, then these values represent Maximum Overcurrent Protection (MOP).



Electrical Data Wire Size

Table E-3 – Customer Wire Selection

Unit Size	Rated Voltage	Wire Selection Size to Main Terminal Block		Wire Selection Size to Disconnect (1)		Wire Selection Size to Circuit Breaker (1)	
		Terminal Size Ckt 1	Connector Wire Range Ckt 1	Disconnect Size Ckt 1	Connector Wire Range Ckt 1	Factory Mounted Internal Circuit Breaker Size (3) Ckt 1	Connector Wire Range Ckt 1
RTAA 70	200/60	760 Amp	Lug Size D	400 Amp	Lug Size B	350 Amp	Lug Size B
	230/60	760 Amp	Lug Size D	400 Amp	Lug Size B	300 Amp	Lug Size B
	380/60	335 Amp	Lug Size E	250 Amp	Lug Size A	200 Amp	Lug Size A
	460/60	335 Amp	Lug Size E	250 Amp	Lug Size A	150 Amp	Lug Size A
	575/60	335 Amp	Lug Size E	250 Amp	Lug Size A	125 Amp	Lug Size A
400/50	335 Amp	Lug Size E	250 Amp	250 Amp	Lug Size A	150 Amp	Lug Size A
RTAA 80	200/60	760 Amp	Lug Size D	400 Amp	Lug Size B	400 Amp	Lug Size B
	230/60	760 Amp	Lug Size D	400 Amp	Lug Size B	350 Amp	Lug Size B
	380/60	335 Amp	Lug Size E	250 Amp	Lug Size A	225 Amp	Lug Size A
	460/60	335 Amp	Lug Size E	250 Amp	Lug Size A	175 Amp	Lug Size A
	575/60	335 Amp	Lug Size E	250 Amp	Lug Size A	150 Amp	Lug Size A
400/50	335 Amp	Lug Size E	250 Amp	250 Amp	Lug Size A	175 Amp	Lug Size A
RTAA 90	200/60	760 Amp	Lug Size D	600 Amp	Lug Size C	500 Amp	Lug Size C
	230/60	760 Amp	Lug Size D	400 Amp	Lug Size B	450 Amp	Lug Size C
	380/60	335 Amp	Lug Size E	400 Amp	Lug Size B	300 Amp	Lug Size B
	460/60	335 Amp	Lug Size E	250 Amp	Lug Size A	225 Amp	Lug Size A
	575/60	335 Amp	Lug Size E	250 Amp	Lug Size A	175 Amp	Lug Size A
400/50	335 Amp	Lug Size E	250 Amp	250 Amp	Lug Size A	225 Amp	Lug Size A
RTAA 100	200/60	760 Amp	Lug Size D	600 Amp	Lug Size C	600 Amp	Lug Size C
	230/60	760 Amp	Lug Size D	600 Amp	Lug Size C	500 Amp	Lug Size C
	380/60	335 Amp	Lug Size E	400 Amp	Lug Size B	300 Amp	Lug Size B
	460/60	335 Amp	Lug Size E	250 Amp	Lug Size A	250 Amp	Lug Size A
	575/60	335 Amp	Lug Size E	250 Amp	Lug Size A	200 Amp	Lug Size A
400/50	335 Amp	Lug Size E	250 Amp	250 Amp	Lug Size A	250 Amp	Lug Size A
RTAA 110	200/60	760 Amp	Lug Size D	600 Amp	Lug Size C	600 Amp	Lug Size C
	230/60	760 Amp	Lug Size D	600 Amp	Lug Size C	600 Amp	Lug Size C
	380/60	335 Amp	Lug Size E	400 Amp	Lug Size B	350 Amp	Lug Size B
	460/60	335 Amp	Lug Size E	400 Amp	Lug Size B	300 Amp	Lug Size B
	575/60	335 Amp	Lug Size E	250 Amp	Lug Size A	225 Amp	Lug Size A
400/50	335 Amp	Lug Size E	400 Amp	Lug Size B	300 Amp	Lug Size B	
RTAA 125	200/60	760 Amp	Lug Size D	600 Amp	Lug Size C	N/A	N/A
	230/60	760 Amp	Lug Size D	600 Amp	Lug Size C	600 Amp	Lug Size C
	380/60	335 Amp	Lug Size E	400 Amp	Lug Size B	350 Amp	Lug Size B
	460/60	335 Amp	Lug Size E	400 Amp	Lug Size B	300 Amp	Lug Size B
	575/60	335 Amp	Lug Size E	250 Amp	Lug Size A	225 Amp	Lug Size A
400/50	335 Amp	Lug Size E	400 Amp	Lug Size B	300 Amp	Lug Size B	

Lug Size A = #4 to 350 MCM per phase
 Lug Size B = 2/0 to 250 MCM & 2/0 to 500 MCM per phase
 Lug Size C = (2) 400 MCM to 500 MCM per phase
 Lug Size D = (2) #4 to 500 MCM per phase
 Lug Size E = #6 to 400 MCM per phase
 Lug Size F = (2) #2 to 600 MCM per phase
 Lug Size G = (2) #1 to 500 MCM per phase
 Lug Size H = (4) #2 to 600 MCM per phase

Notes

1. Non-fused unit disconnect and circuit breaker are optional.
2. Copper wire only, sized per N.E.C., based on nameplate minimum circuit ampacity (MCA).
3. Circuit Breaker sizes are for factory mounted only. Field installed circuit breakers need to be sized using HACR breaker recommendations from Table E-1.

Electrical Data Field Layout

Figure E-1 — Typical Jobsite Wiring

NOTES:

1. DASHED LINES INDICATE RECOMMENDED FIELD WIRING BY OTHERS. CHECK SALES ORDER TO DETERMINE IF WIRING IS REQUIRED FOR SPECIFIC OPTIONS.
2. ALL THREE PHASE MOTORS SUPPLIED WITH THE UNIT ARE PROTECTED UNDER PRIMARY SINGLE PHASE FAILURE CONDITIONS.
3. CAUTION - DO NOT ENERGIZE UNIT UNTIL CHECK OUT AND START-UP PROCEDURES HAVE BEEN COMPLETED.
4. THE FOLLOWING CAPABILITIES ARE OPTIONAL - THEY ARE IMPLEMENTED AND WIRED AS REQUIRED FOR A SPECIFIC SYSTEM APPLICATION.

- A** ICE-MACHINE CONTROL (CANNOT BE USED WITH OPT. L)
- B** COMMUNICATIONS INTERFACE
- D** WYE-DELTA CLOSED TRANSITION STARTER
- E** CONTROL POWER TRANSFORMER.
- H** UNIT DISCONNECT, NON-FUSED
- J** CHILLED WATER RESET - RETURN WATER
- K** CHILLED WATER RESET - OUTDOOR AIR
- L** CHILLED WATER RESET - ZONE AIR (CANNOT BE USED WITH OPT. A)
- S** CHILLED WATER FLOW SWITCH (NOT REQUIRED FOR CHILLER PROTECTION)
- T** REMOTE CLEAR LANGUAGE DISPLAY. (BUFFER FOR DISPLAY LOCATED IN UNIT CONTROL PANEL.)

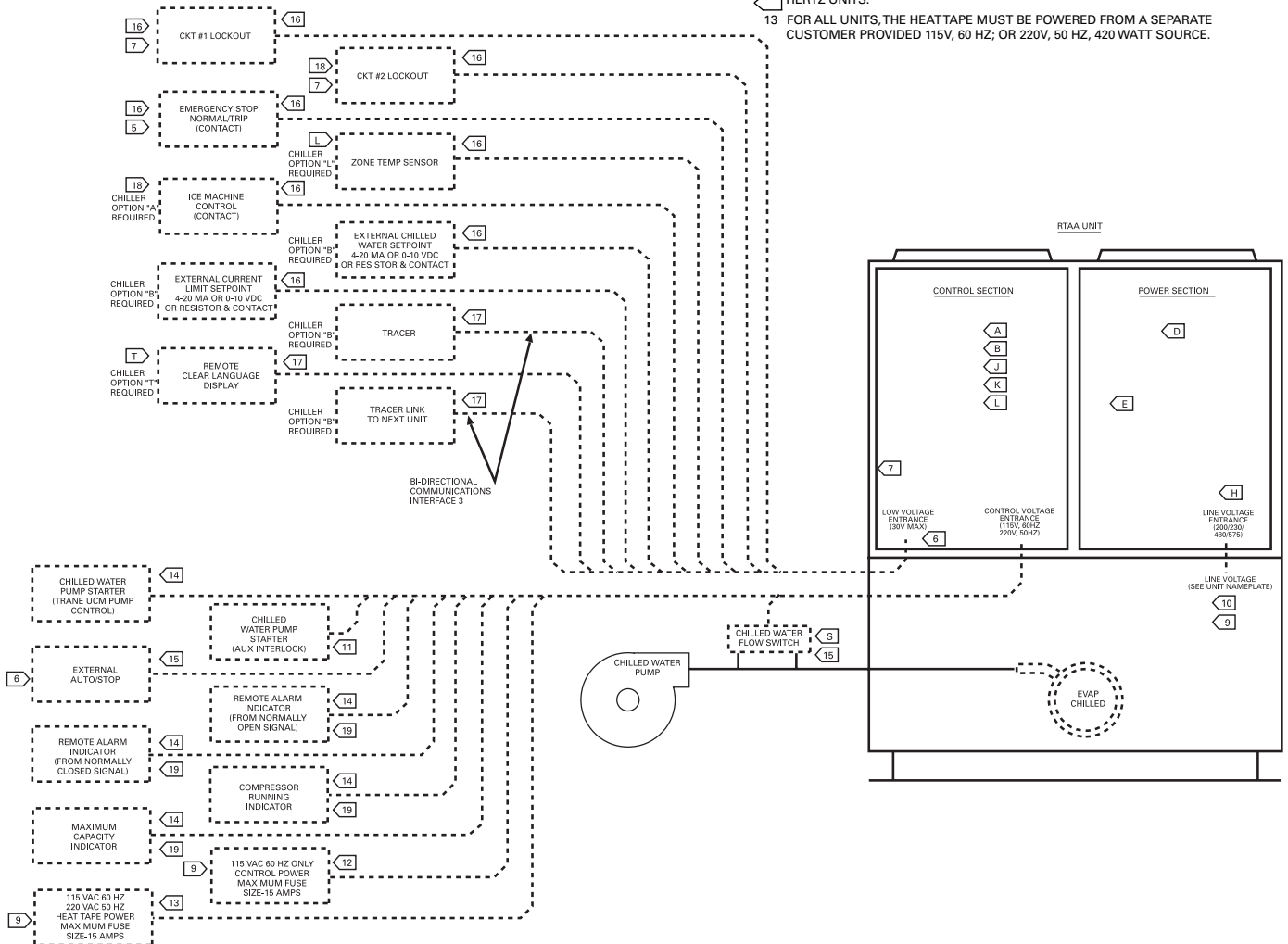
- 5** AUXILIARY CONTROLS FOR A CUSTOMER SPECIFIED OR INSTALLED LATCHING TRIP/OUT. THE CHILLER WILL RUN NORMALLY WHEN THE CONTACT IS CLOSED AND TRIP THE CHILLER OFF ON MANUALLY RESETTABLE DIAGNOSTIC WHEN THE CONTACT OPENS. MANUAL RESET IS ACCOMPLISHED AT THE LOCAL OR REMOTE CLEAR LANGUAGE DISPLAY.
- 6** AUXILIARY CONTROLS FOR A CUSTOMER SPECIFIED OR INSTALLED REMOTE AUTO/STOP FUNCTION. THE CHILLER WILL RUN NORMALLY WHEN THE CONTACT IS CLOSED AND STOP THE CHILLER WHEN THE CONTACT IS OPEN. RE-CLOSURE OF THE CONTACT WILL PERMIT THE CHILLER TO AUTOMATICALLY RETURN TO NORMAL OPERATION. TO BE IN SERIES WITH WATER PUMP RELAY (3K21).
- 7** NORMALLY OPEN CONTACTS FOR REMOTE SHUTDOWN OR REFRIGERANT CIRCUIT OPERATION. THE REFRIGERANT CIRCUIT WILL GO THRU A NORMAL SHUTDOWN WHEN THE CONTACTS ARE CLOSED AND WILL AUTOMATICALLY RESUME NORMAL START AND RUN MODES WHEN CONTACTS ARE OPEN.

WIRING

- 8** ALL CUSTOMER CONTROL CIRCUIT WIRING MUST HAVE A MINIMUM RATING OF 150 VOLTS.
- 9** ALL FIELD WIRING MUST BE IN ACCORDANCE WITH THE NATIONAL ELECTRICAL CODE (NEC), STATE, AND LOCAL REQUIREMENTS. OUTSIDE THE UNITED STATES, OTHER COUNTRIES APPLICABLE NATIONAL AND/OR LOCAL REQUIREMENTS SHALL APPLY.

REQUIRED WIRING

- 10** COPPER WIRE ONLY - SIZED PER N.E.C. - BASED ON NAMEPLATE MINIMUM CIRCUIT AMPACITY (MCA). SEE CUSTOMER WIRE SELECTION TABLE.
- 11** 2 WIRES, 115 VAC CIRCUIT. MINIMUM CONTACT RATING AT 115 VAC - 5.9 VA INRUSH. 1.3 VA SEALED.
- 12** FOR UNITS WITHOUT THE CONTROL POWER TRANSFORMER (1T1) OPTION, THE CUSTOMER MUST PROVIDE CONTROL POWER OF 115 VAC, 60 HERTZ, SINGLE PHASE, 750 VA. THE CONTROL POWER TRANSFORMER (1T1) IS STANDARD ON 50 HERTZ UNITS.
- 13** FOR ALL UNITS, THE HEATTAPE MUST BE POWERED FROM A SEPARATE CUSTOMER PROVIDED 115V, 60 HZ; OR 220V, 50 HZ, 420 WATT SOURCE.



Electrical Data

Typical Wiring Diagram

NOTES:

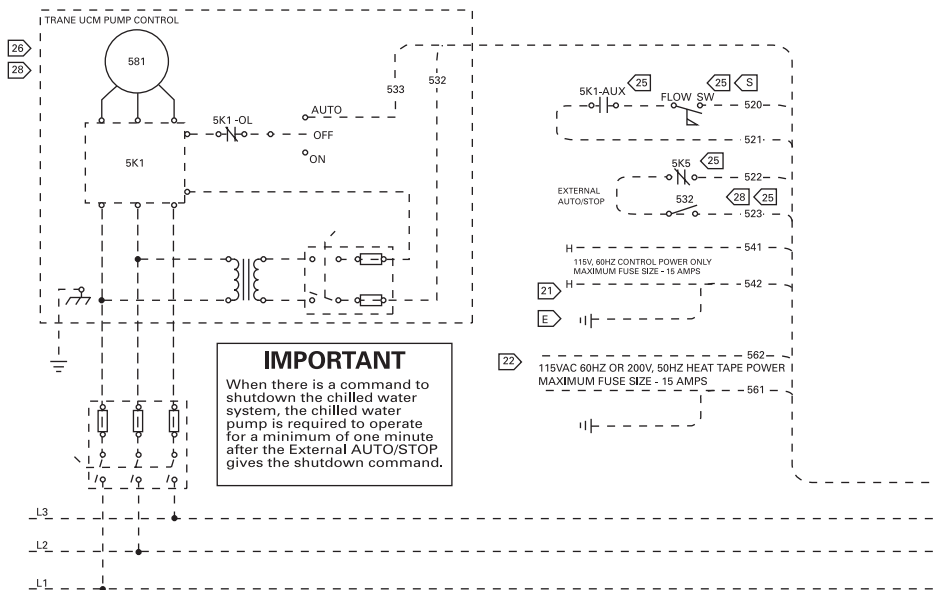
1. DASHED LINES INDICATE RECOMMENDED FIELD WIRING BY OTHERS. PHANTOM LINES INDICATE ALTERNATE CIRCUITRY OR AVAILABLE SALES OPTION. CHECK SALES ORDER TO DETERMINE IF WIRING IS REQUIRED FOR SPECIFIC OPTIONS.
2. ALL THREE PHASE MOTORS SUPPLIED WITH THE UNIT ARE PROTECTED UNDER PRIMARY SINGLE PHASE FAILURE CONDITIONS.
3. CAUTION - DO NOT ENERGIZE UNIT UNTIL CHECK OUT AND START-UP PROCEDURES HAVE BEEN COMPLETED.
4. SEE INSERT "A" FOR RESISTOR CONNECTIONS TO PROGRAM AN EXTERNAL CHILLED WATER SETPOINT WHEN 4 - 20 mA OR A 2 - 10 VDC SIGNAL IS NOT USED. SEE THE OPERATORS MANUAL FOR RESISTOR VALUES.
5. SEE INSERT "B" FOR RESISTOR CONNECTIONS TO PROGRAM AN EXTERNAL CURRENT LIMIT SETPOINT WHEN 4 - 20 mA OR A 2 - 10 VDC SIGNAL IS NOT USED. SEE THE OPERATORS MANUAL FOR RESISTOR VALUES.
6. SEE INSERT "C" FOR CONTACTS (IN PLACE OF THE ZONE TEMP. SENSOR) FOR OPTIONAL ICE MACHINE CONTROL - OPTION "A"
7. THE FOLLOWING CAPABILITIES ARE OPTIONAL - THEY ARE IMPLEMENTED AND WIRED AS REQUIRED FOR A SPECIFIC SYSTEM APPLICATION.
 - A ICE-MACHINE CONTROL (CANNOT BE USED WITH OPT. L)
 - B COMMUNICATIONS INTERFACE
 - D WYE-DELTA CLOSED TRANSITION STARTER
 - E CONTROL POWER TRANSFORMER.
 - H UNIT DISCONNECT, NON-FUSED
 - J CHILLED WATER RESET - RETURN WATER
 - K CHILLED WATER RESET - OUTDOOR AIR
 - L CHILLED WATER RESET - ZONE AIR (CANNOT BE USED WITH OPT. A)
 - O LOW AMBIENT LOCKOUT
 - S CHILLED WATER FLOW SWITCH (NOT REQUIRED FOR CHILLER PROTECTION)
 - T REMOTE CLEAR LANGUAGE DISPLAY

WIRING AND CONTACT REQUIREMENTS:

20. ALL FIELD WIRING MUST BE IN ACCORDANCE WITH THE NATIONAL ELECTRICAL CODE (NEC), STATE, AND LOCAL REQUIREMENTS. OUTSIDE THE UNITED STATES, OTHER COUNTRIES APPLICABLE NATIONAL AND/OR LOCAL REQUIREMENTS SHALL APPLY.
21. FOR UNITS WITHOUT THE CONTROL POWER TRANSFORMER (1T1) OPTION, THE CUSTOMER MUST PROVIDE CONTROL POWER OF 115 VAC, 60 HERTZ, SINGLE PHASE, 750 VA ON 130 THRU 215 TON UNITS. THE CONTROL POWER TRANSFORMER (1T1) IS STANDARD ON 50 HERTZ UNITS.
22. FOR ALL UNITS, THE HEAT TAPE MUST BE POWERED FROM A SEPARATE CUSTOMER PROVIDED 115 VAC, 420 WATT SOURCE FOR 200/230/420/575 60 HZ UNITS; 220 VAC, 420 WATT SOURCE FOR 346/1380/415 50 HZ UNITS. FOR THE OPTIONAL HEAT RECOVERY HEAT TAPE IS 420 WATTS.
23. CUSTOMER SUPPLIED CONTACTS MUST BE COMPATIBLE WITH DRY CIRCUIT 12 VDC, 45 mA RESISTIVE LOAD. SILVER OR GOLD PLATED CONTACTS ARE RECOMMENDED.
24. 30 VOLT OR LESS CIRCUIT. DO NOT RUN IN CONDUIT WITH HIGHER VOLTAGE CIRCUITS. USE #14-18 AWG. SEE SELECTION TABLE.
25. MINIMUM PILOT DUTY CONTACT RATING AT 115 VAC; 5.9 VA INRUSH, 1.3 VA SEALED.
26. FIELD WIRED ELECTRICAL LOADING IS NOT TO EXCEED THE FOLLOWING RATINGS:

TERMINALS	DEVICE	VOLTAGE	SEALED VA	INRUSH VA
1U1-TB4-1,2	1U1K1,NO	115	180	1150*
1U1-TB4-3	1U1K1,NC	115	180	1150*
1U1-TB4-5,4	1U1K2,NO	115	180	1150*
1U1-TB4-6,7	1U1K3,NC	115	180	1150*
1U1-TB4-8,9	1U1K2,NO	115	250	1150*
1U1-TB4-10,11	1U1K3,NC	115	180	1150*

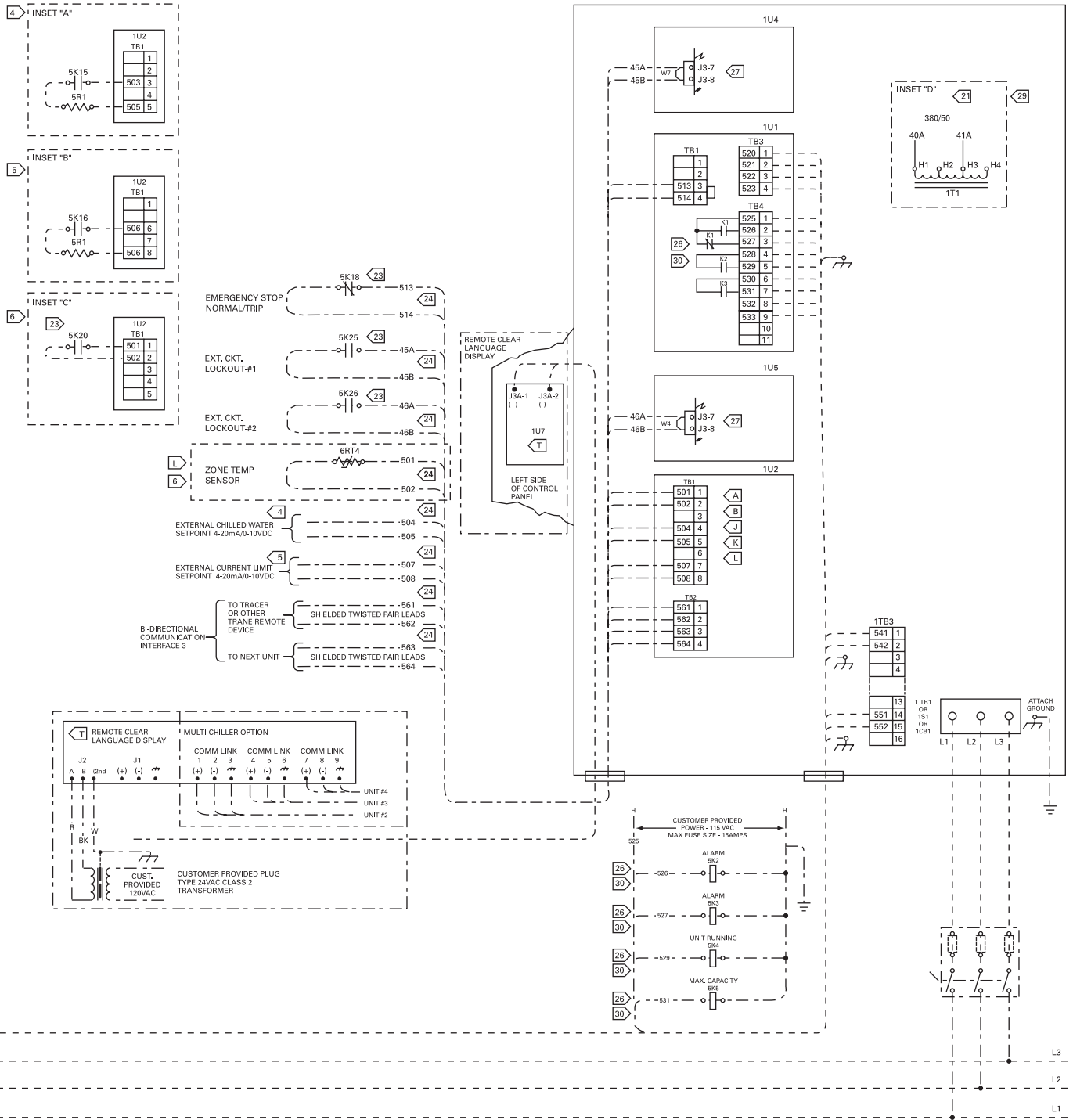
- *STANDARD PILOT DUTY RATING (35% POWER FACTOR).
27. WHEN CUSTOMER INPUT IS REQUIRED, REMOVE JUMPER AND INSTALL CUSTOMER WIRING.
28. CHILLED WATER PUMP CONTROL FROM TRANE UNIT UCM MODULE CHILLED WATER PUMP IS REQUIRED TO OPERATE A MINIMUM OF 1 MINUTE AFTER A COMMAND TO TERMINATE CHILLER OPERATION (UCM WILL PROVIDE THE DELAY CONTACTS). CHILLED WATER SYSTEM DEMAND SWITCH (5S2) IS CONNECTED TO THE UCM EXTERNAL AUTO/STOP INPUT. NOTE: DO NOT USE THE CHILLED WATER PUMP TO STOP THE CHILLER.
29. AS SHIPPED 380/415 50 HZ VOLT UNIT TRANSFORMER 1T1-(OPTIONAL) IS WIRED FOR 415 VOLT OPERATION. IF UNIT IS TO BE OPERATED ON A 380 VOLT POWER SUPPLY, RE-CONNECT AS SHOWN IN INSET "D". REPROGRAM "UNIT LINE VOLTAGE" IN SERVICE SETTING MENU OF CLEAR LANGUAGE DISPLAY FROM 415 TO 380.
30. K1, K2, K3 RELAY OUTPUTS CAN BE PROGRAMMED TO PERFORM ALTERNATE FUNCTIONS. SEE INSTALLATION, OPERATION AND MAINTENANCE MANUAL FOR DETAILS. FUNCTION #1 IS SHOWN.



IMPORTANT
When there is a command to shutdown the chilled water system, the chilled water pump is required to operate for a minimum of one minute after the External AUTO/STOP gives the shutdown command.

Electrical Data

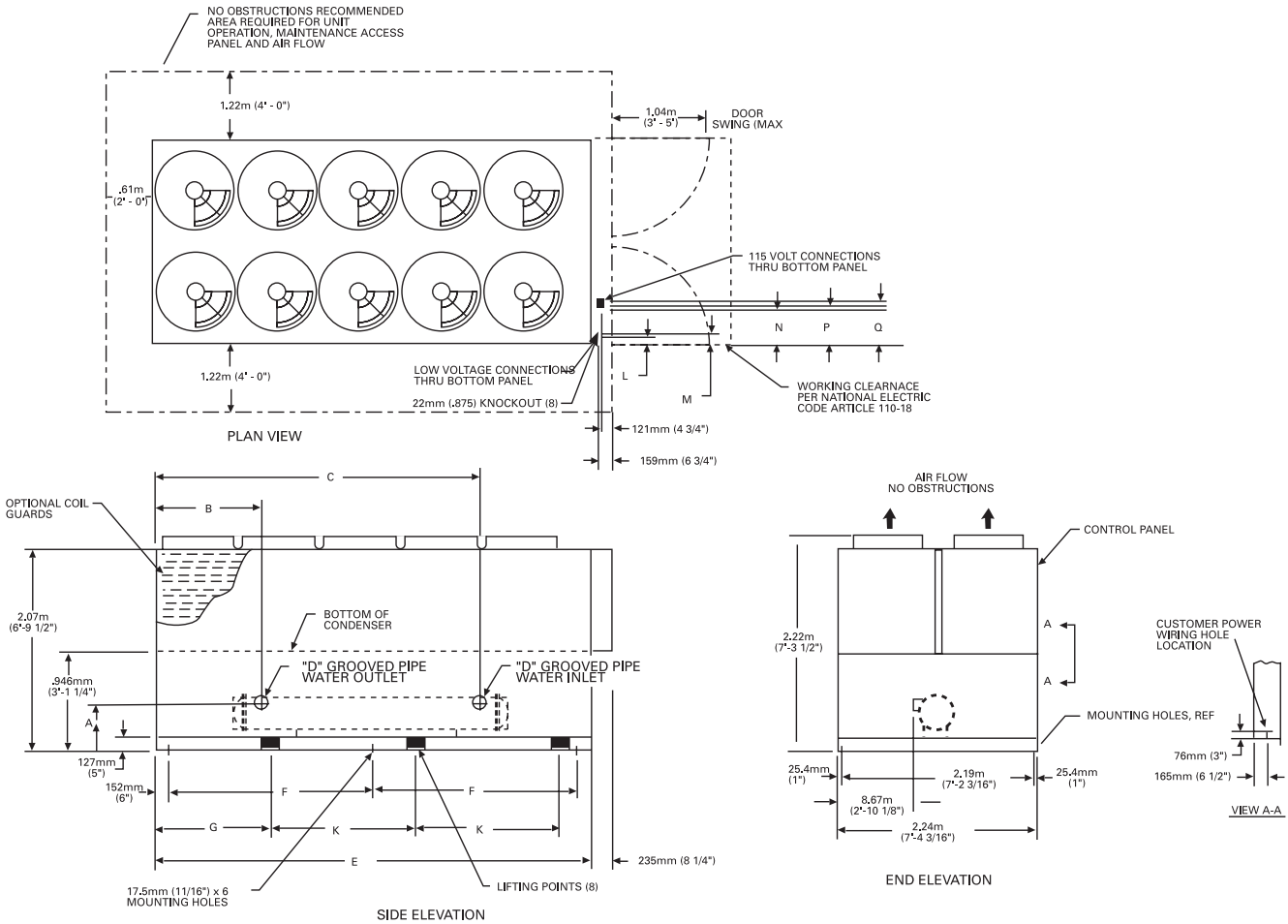
Typical Wiring Diagram



Dimensional Data

Packaged Unit

Figure D-1 — RTAA 70-125 Unit Dimensions



UNIT SIZE	A	B	C	D	E	F	G	K
70-100	.492m (1'-7 3/8")	1.213m (3'-11 3/4")	2.851m (9'-4 1/4")	102mm (4")	4.940m (16'-2 1/2")	2.317m (7'-7 1/4")	1.549m (5'-1")	1.626m (5'-4")
110-125	.479m (1'-6 7/8")	1.032m (3'-4 5/8")	3.499m (11'-5 3/4")	152mm (6")	5.626m (18'-5 1/2")	2.661m (8'-8 3/4")	1.511m (4'-11 1/2")	1.930m (6'-4")

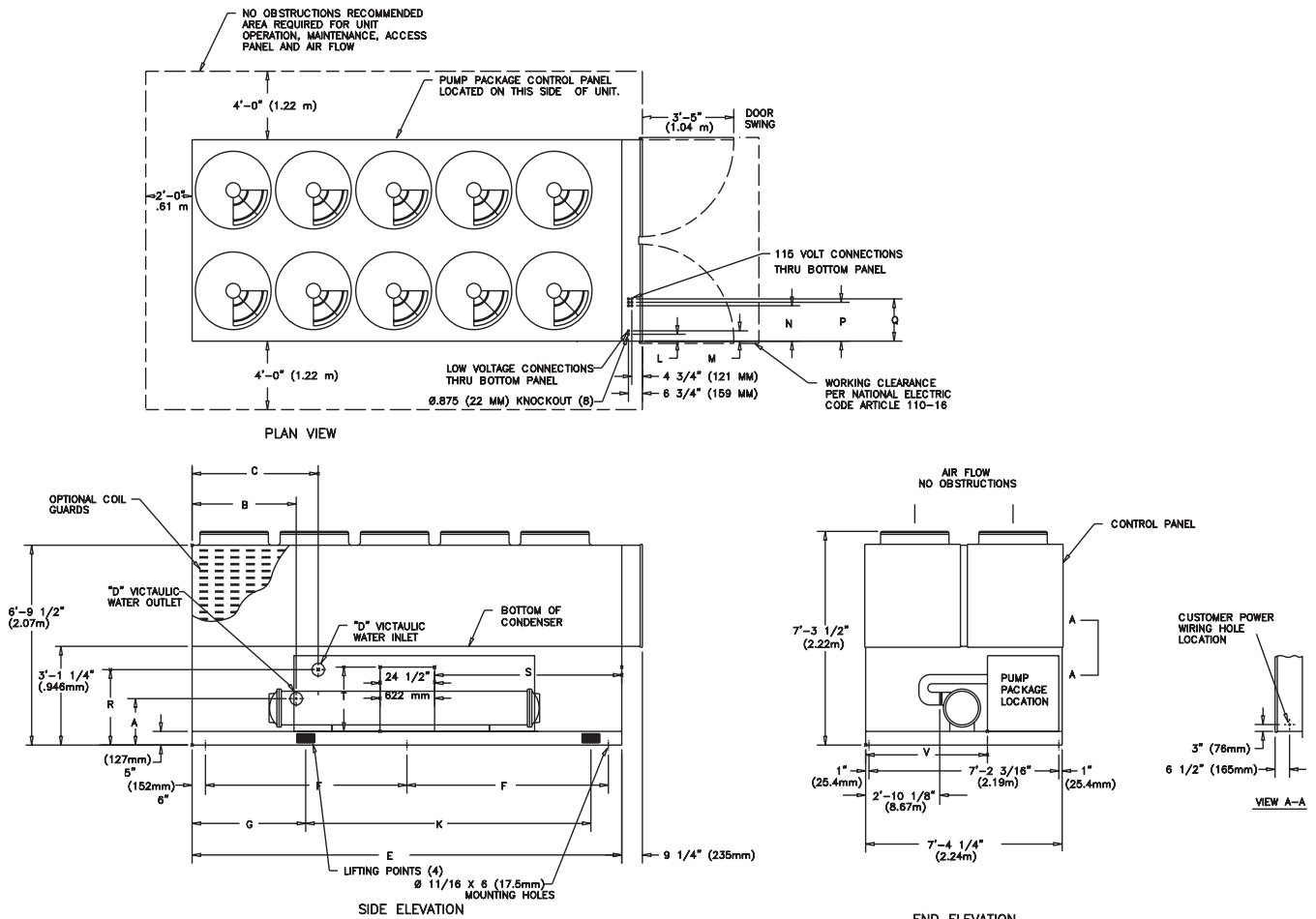
UNIT SIZE	NO. OF FANS PER UNIT					
	70	80	90	100	110	125
NO. FANS						
STD UNIT	8	8	9	10	10	10

PANELTYPE	115 VOLT & LOW VOLTAGE CONNECTIONS				
	L	M	N	P	Q
X-LINE CONTROL PANEL	.889m (2'-11")	.927m (3'-0 1/2")	1.206m (3'-11 1/2")	1.245m (4'-1")	1.283m (4'-2 1/2")
WYE DELTA CONTROL PANEL	76mm (3")	114mm (4 1/2")	.39m (1'-3 1/2")	.43m (1'-5")	.47m (1'-8 1/2")

Dimensional Data

Pump Package Unit

Figure D-2 – RTAA 70-125 with Pump Package Unit Dimensions



UNIT SIZE	A	B	D	E	F	G	K	S	T
70-100	1'-7 3/8" .492 m	3'-11 3/4" 1.213 m	4" 102 mm	16'-2 1/2" 4.940 m	7'-7 1/4" 2.317 m	5'-1" 1.549 m	12'-9" 3.901 m	7'-1/4" 2.141 m	2'-4 1/8" 715 mm
110-125	1'-6 7/8" .479 m	3'-4 5/8" 1.032 m	6" 152 mm	18'-5 1/2" 5.626 m	8'-8 3/4" 2.661 m	4'-11 1/2" 1.511 m	15'-3" 4.633 m	7" 2.134 m	2'-9 1/8" 842 mm

115 VOLT & LOW VOLTAGE CONNECTIONS					
PANEL TYPE	L	M	N	P	Q
X-LINE CONTROL PANEL	2'-11" (.889m)	3'-1/2" (.927m)	3'-11/12" (1.206m)	4'-1" (1.245m)	4'-2 1/2" (1.283m)
WYE-DELTA CONTROL PANEL	3" (76mm)	4 1/2" (114mm)	1'-3 1/2" (.39 m)	1'-5" (.43m)	1'-8 1/2" (.52m)

NO. OF FANS PER UNIT						
UNIT SIZE	70	80	90	100	110	125
NO. FANS STD UNIT	8	8	9	10	10	10

70-100T UNITS	
PUMP SIZE	C
C2, D3	2'-6 1/4" 767 mm
D5, E2, E3	2'-5 7/8" 758 mm
F5, F7.5	2'-8 1/8" 816 mm
G3, G5	2'-4 7/8" 735 mm

PUMP SIZE	R
C2, D3	2'-4 3/4" 732 mm
F5, F7.5	2'-2 1/2" 673 mm
D5	2'-2 1/2" 673 mm
E2, E3	2'-1 1/4" 641 mm
G3, G5	2'-4 1/4" 717 mm

PUMP SIZE	V
C2, D3, D5, E2	4'-6 1/2" 1384 mm
E3, G3, G5	3'-10 1/4" 1175 mm

110-125T UNITS	
PUMP SIZE	C
D3	4'-1 3/4" 1248 mm
D5, E3	4'-1 1/8" 1248 mm
F5, F7.5	3'-9 3/4" 1248 mm
G3, G5	3'-9 3/4" 1248 mm

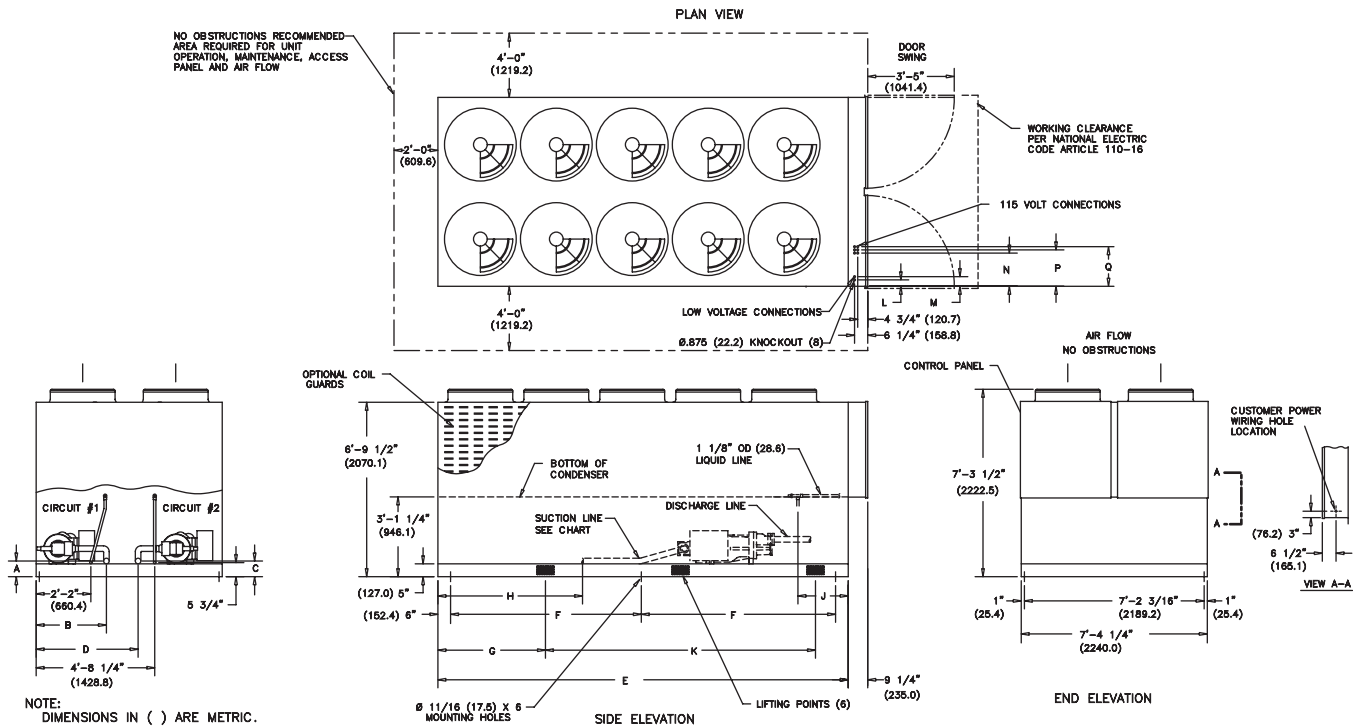
PUMP SIZE	R
D3, F5	2'-4 3/4" 730 mm
D5, E3	2'-2 1/2" 673 mm
F7.5	2'-2 3/4" 679 mm
G3, G5	2'-4 1/4" 718 mm

PUMP SIZE	V
ALL	4'-6 1/2" 1384 mm

Dimensional Data

Remote Evaporator Unit

Figure D-3 — RTAA 70-125 Condensing Unit Dimensions for Remote Evaporator Option



UNIT SIZE	SUCTION LINE		
	CIRCUIT #1		
	O.D.	A	B
70-80	2 1/8" (54.0)	6 1/4" (158.8)	3'-3 5/8" (1006.5)
90	2 5/8" (66.7)	6 5/16" (160.3)	3'-4 1/8" (1019.2)
100-125	2 5/8" (66.7)	6 5/16" (160.3)	3'-4 1/8" (1019.2)
UNIT SIZE	CIRCUIT #2		
	O.D.	C	D
70-80	2 1/8" (54.0)	6 1/4" (158.8)	4'-0 5/8" (1235.1)
90	2 1/8" (54.0)	6 1/4" (158.8)	4'-0 5/8" (1235.1)
100-125	2 5/8" (66.7)	6 5/16" (160.3)	4'-0 1/8" (1222.4)

UNIT SIZE	E	F	G	H	J	K
70-100	16'-2 1/2" (4940.3)	7'-7 1/4" (2317.8)	4'-7" (1397.0)	8'-0" (2438.4)	5'-3" (1600.2)	12'-9" (3901.4)
110-125	18'-5 1/2" (5626.1)	8'-8 3/4" (2660.7)	4'-11 1/2" (1511.3)	10'-0" (3048.0)	6'-5" (1955.8)	15'-3" (4633.0)

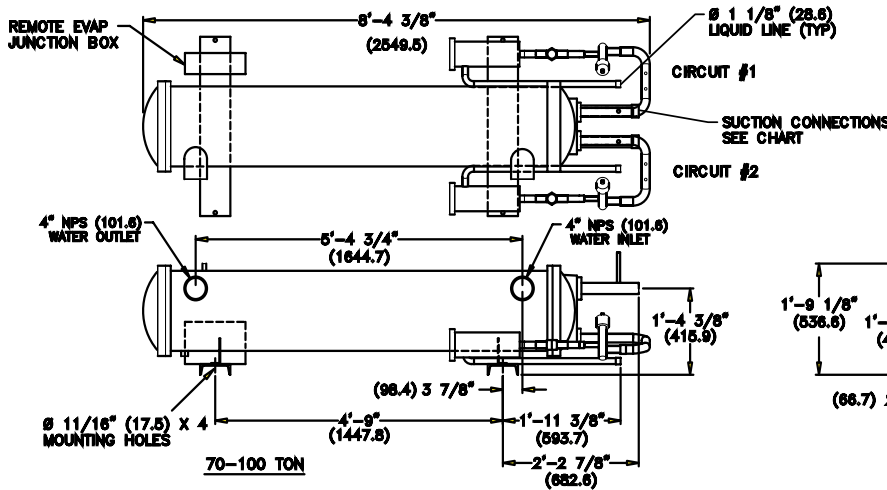
115 VOLT & LOW VOLTAGE CONNECTIONS					
PANEL TYPE	L	M	N	P	Q
X-LINE CONTROL PANEL	2'-11" (889.0)	3'-0 1/2" (927.1)	3'-11 1/2" (1206.5)	4'-1" (1244.6)	4'-2 1/2" (1282.7)
WYE DELTA CONTROL PANEL	3" (76.2)	4 1/2" (114.3)	1'-3 1/2" (393.7)	1'-5" (431.8)	1'-6 1/2" (469.9)

NO. OF FANS PER UNIT			
UNIT SIZE	70-80	90	100-125
NO. FANS STD UNIT	8	9	10

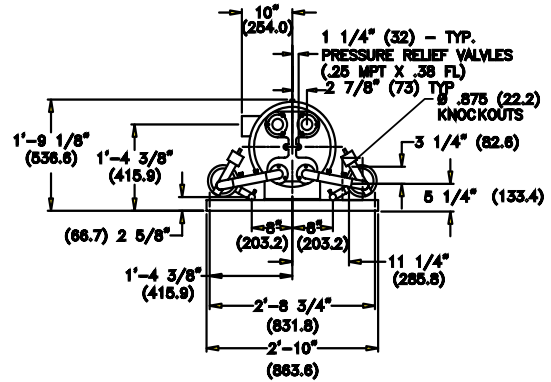
Dimensional Data

Remote Evaporator Unit

Figure D-4 – RTAA 70-100 Evaporator Dimensions for Remote Evaporator Option



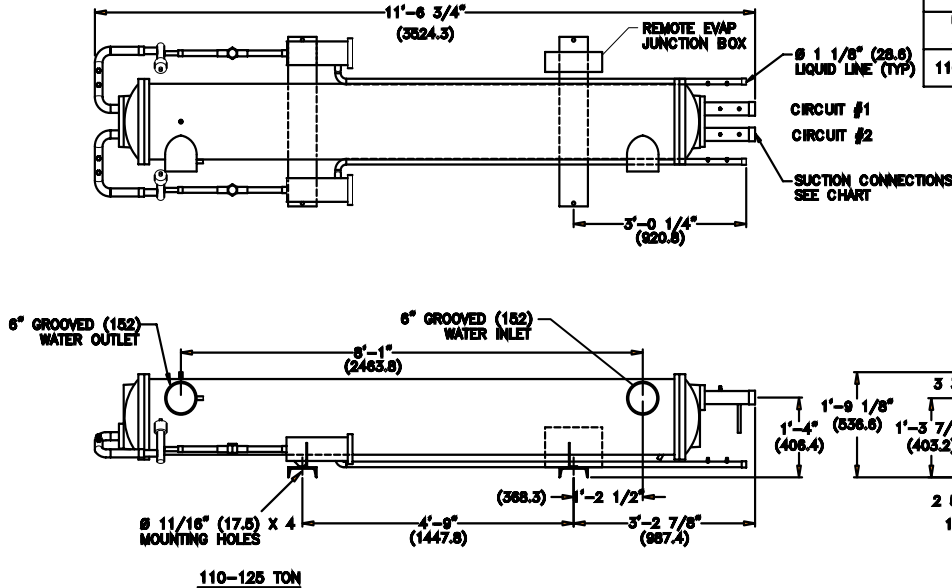
SUCTION CONNECTIONS			EVAPORATOR WEIGHTS	
UNIT SIZE	CIRCUIT #1 O.D.	CIRCUIT #2 O.D.	UNIT SIZE	LBS.
70-80	2 1/8" (54.0)	2 1/8" (54.0)	70	710
90	2 5/8" (66.7)	2 1/8" (54.0)	80	731
100	2 5/8" (66.7)	2 5/8" (66.7)	90	764
			100	796



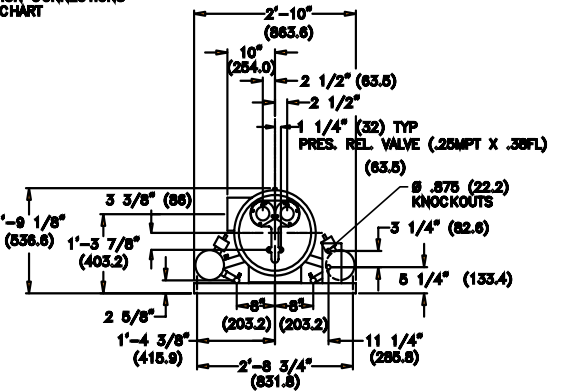
NOTE: DIMENSIONS IN () ARE METRIC.

AIR COOLED SERIES R[®]
 ROTARY LIQUID CHILLER[®]
 REMOTE EVAPORATOR
 RTAA 70 - 100 TON

Figure D-5 – RTAA 110-125 Evaporator Dimensions for Remote Evaporator Option



SUCTION CONNECTIONS			EVAPORATOR WEIGHTS	
UNIT SIZE	CIRCUIT #1 O.D.	CIRCUIT #2 O.D.	UNIT SIZE	LBS.
110-125	2 5/8" (66.7)	2 5/8" (66.7)	110	960
			125	1030



NOTE: DIMENSIONS IN () ARE METRIC.

AIR COOLED SERIES R[®]
 ROTARY LIQUID CHILLER[®]
 REMOTE EVAPORATOR
 RTAA 110 - 125 TON



Weights

Packaged Unit

Table W-1 — Packaged Unit Weights (Aluminum)

Unit Size	Units	Isolator Location						Operating Weight	Shipping Weight
		1	2	3	4	5	6		
RTAA 70	lbs.	1622	1636	1215	1229	808	822	7332	6507
	kg	737	744	552	559	367	374	3333	2952
RTAA 80	lbs.	1624	1638	1220	1235	817	831	7364	6556
	kg	738	745	555	561	371	378	3347	2974
RTAA 90	lbs.	1667	1623	1275	1232	884	840	7521	6741
	kg	758	738	580	560	402	382	3419	3058
RTAA 100	lbs.	1672	1687	1284	1299	897	912	7751	6990
	kg	760	767	584	591	408	414	3523	3171
RTAA 110	lbs.	2033	1755	1622	1344	1211	933	8772	7706
	kg	924	798	737	611	550	424	3987	3495
RTAA 125	lbs.	2043	1759	1635	1351	1227	943	8742	7740
	kg	929	800	743	614	558	429	3974	3511

Notes:

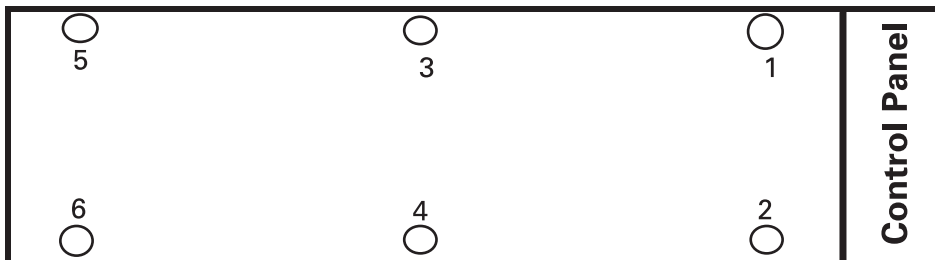
1. Operating weight includes the weight of accessory panels and water.
2. Shipping weight does not include the weight of accessory panels or water.

Table W-2 — Packaged Unit Weights (Copper)

Unit Size	Units	Isolator Location						Operating Weight	Shipping Weight
		1	2	3	4	5	6		
RTAA 70	lbs.	1769	1784	1325	1341	881	897	7997	7172
	kg	804	811	602	609	401	408	3335	3253
RTAA 80	lbs.	1770	1786	1331	1346	891	906	8029	7221
	kg	805	832	605	612	405	412	3650	3275
RTAA 90	lbs.	1819	1772	1392	1345	965	917	8210	7430
	kg	827	805	633	611	438	417	3732	3370
RTAA 100	lbs.	1826	1842	1403	1419	979	996	8465	7704
	kg	830	837	638	645	445	453	3848	3495
RTAA 110	lbs.	2161	2106	1622	1566	1082	1027	9564	8498
	kg	982	957	737	712	492	467	4347	3855
RTAA 125	lbs.	2109	2127	1593	1611	1077	1095	9612	8610
	kg	959	967	724	732	489	498	4369	3905

Notes:

1. Operating weight includes the weight of accessory panels and water.
2. Shipping weight does not include the weight of accessory panels or water.



Weights

Pump Package Unit

Table W-3 — Packaged Unit Weights with Pump Package (Aluminum)

Unit Size	Units	Isolator Location						Operating Weight	Shipping Weight
		1	2	3	4	5	6		
RTAA 70	lbs.	2041	1757	1630	1345	1219	934	8926	7966
	kg	928	798	741	612	554	425	4057	3613
RTAA 80	lbs.	2132	1794	1745	1407	1358	1020	9455	8450
	kg	969	815	793	639	617	464	4298	3833
RTAA 90	lbs.	2175	1780	1799	1404	1424	1029	9612	8635
	kg	989	809	818	638	647	468	4369	3917
RTAA 100	lbs.	2179	1844	1808	1473	1436	1101	9841	8884
	kg	991	838	822	669	653	501	4473	4030
RTAA 110	lbs.	2577	2136	2042	1601	1508	1068	10931	9648
	kg	1171	971	928	728	686	485	4969	4376
RTAA 125	lbs.	2511	2141	2002	1632	1493	1123	10902	9682
	kg	1142	973	910	742	679	511	4955	4392

Notes:

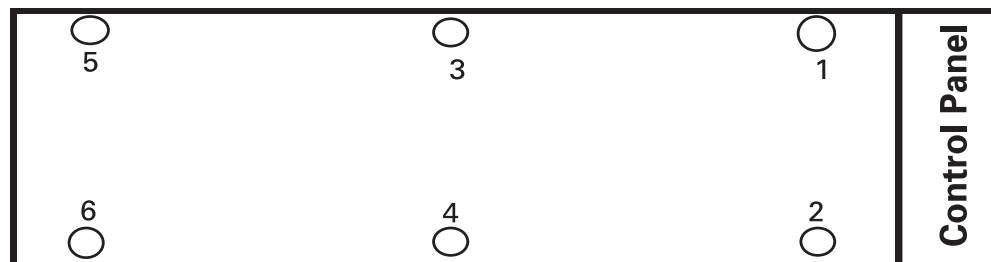
1. Operating weight includes the weight of largest pumping package, accessory panels and water.
2. Shipping weight includes the weight of the largest pumping package but does not include the weight of accessory panels or water.

Table W-4 — Packaged Unit Weights with Pump Package (Copper)

Unit Size	Units	Isolator Location						Operating Weight	Shipping Weight
		1	2	3	4	5	6		
RTAA 70	lbs.	2188	1906	1740	1457	1291	1009	9591	8631
	kg	995	866	791	662	587	459	4360	3915
RTAA 80	lbs.	2278	1943	1854	1519	1430	1095	10120	9115
	kg	1036	883	843	690	650	598	4600	4135
RTAA 90	lbs.	2327	1929	1916	1518	1504	1106	10301	9324
	kg	1058	877	871	690	684	503	4682	4229
RTAA 100	lbs.	2333	2001	1925	1593	1518	1185	10555	9598
	kg	1060	909	875	724	690	539	4798	4354
RTAA 110	lbs.	2755	2311	2176	1732	1597	1153	11723	10440
	kg	1252	1051	989	787	726	524	5329	4736
RTAA 125	lbs.	2702	2335	2145	1779	1589	1223	11772	10552
	kg	1228	1061	975	808	722	556	5351	4786

Notes:

1. Operating weight includes the weight of largest pumping package, accessory panels and water.
2. Shipping weight includes the weight of the largest pumping package but does not include the weight of accessory panels or water.





Weights

Remote Evaporator Unit

Table W-5 — Condensing Unit Weights (Aluminum)

Unit Size	Units	Isolator Location						Operating Weight	Shipping Weight
		1	2	3	4	5	6		
RTAA 70	lbs.	1461	1473	1040	1052	619	631	5275	5782
	kg	664	670	473	478	281	287	2852	2623
RTAA 80	lbs.	1468	1480	1045	1057	622	634	6306	5813
	kg	667	673	475	480	283	288	2866	2637
RTAA 90	lbs.	1513	1470	1099	1056	685	642	6465	5972
	kg	688	668	500	480	311	292	2939	2709
RTAA 100	lbs.	1519	1532	1107	1120	695	708	6680	6187
	kg	690	696	503	509	316	322	3036	2806
RTAA 110	lbs.	1769	1727	1250	1208	731	688	7373	6753
	kg	804	785	568	549	332	313	3351	3063
RTAA 125	lbs.	1715	1729	1214	1229	714	728	7329	6709
	kg	780	786	552	558	324	331	3331	3043

Notes:

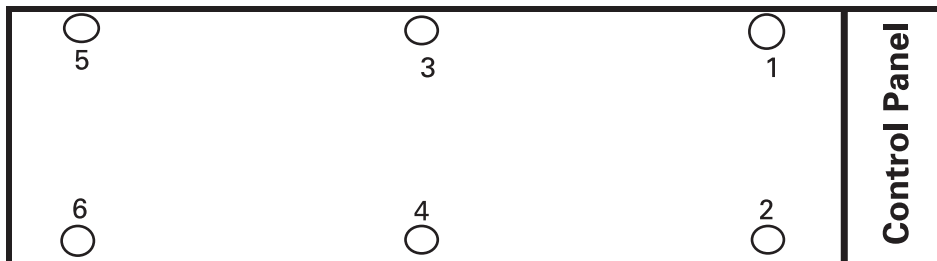
1. Operating weight includes the weight of accessory panels.
2. Shipping weight does not include the weight of accessory panels.

Table W-6 — Condensing Unit Weights (Copper)

Unit Size	Units	Isolator Location						Operating Weight	Shipping Weight
		1	2	3	4	5	6		
RTAA 70	lbs.	1616	1629	1150	1163	684	698	6940	6447
	kg	734	741	523	529	311	317	3155	2924
RTAA 80	lbs.	1623	1639	1155	1169	687	701	6971	6478
	kg	738	744	525	531	312	318	3169	2938
RTAA 90	lbs.	1675	1626	1216	1168	758	710	7154	6661
	kg	761	739	553	531	345	323	3252	3021
RTAA 100	lbs.	1681	1695	1225	1239	769	784	7394	6901
	kg	764	771	557	563	350	356	3361	3130
RTAA 110	lbs.	1959	1912	1384	1337	810	762	8165	7545
	kg	891	869	629	608	368	347	3711	3422
RTAA 125	lbs.	1919	1935	1359	1374	810	814	8199	7579
	kg	872	879	618	625	363	370	3727	3438

Notes:

1. Operating weight includes the weight of accessory panels and water.
2. Shipping weight does not include the weight of accessory panels or water.



Options

Low Temperature Brine

The unit controls can be factory set to handle low temperature brine applications from 0°F to 39°F (-17.8 to 3.9°C).

Ice Making

The unit controls can be factory set to handle ice making for thermal storage applications.

Building Automation System Communication Interface

Permits either bi-directional communication to the Trane Integrated Comfort™ system or permits remote access by another building automation system to the chilled water setpoint and demand limiting by accepting a 4-20 mA or 2-10Vdc analog signal.

LonTalk Communication Interface

Allows bi-directional communication to the Trane Integrated Comfort system or another LonTalk compatible building automation system.

Remote Display

In addition to controlling chiller operation from remote location, the remote display can provide the capability to monitor unit alarms and diagnostics. Only one twisted line piping next to the evaporator connections.

Remote Evaporator

The remote evaporator is available as a standard option.

This option provides an easily installed, pre-engineered method of installing the evaporator remotely indoors.

The remote evaporator is skid-mounted and is shipped separately from the outdoor condensing unit. Refrigerant accessories, including electronic expansion valve, moisture-indicating sightglass and removable core filter drier, are shipped with the evaporator skid. All refrigerant connections are routed to one end of the evaporator skid for easy connection. All electrical wiring is factory installed and routed to a terminal box (entering and leaving water temperature sensors, evaporator refrigerant temperature sensor and electronic expansion valve control wiring). Suction refrigerant temperature sensors (two) must be field installed in the field suction line piping next to the evaporator connections.

Chilled Water Reset

This option provides the control logic and field installed sensors for either load based (return water temperature) or temperature based (ambient or zone) reset of leaving chilled water temperature (requires Communication Interface).

Architectural Louvered Panels

Louvered panels cover the complete condensing coil and the service area beneath the coils.

Coil Protection

Louvered panels which protect the condenser coils only.

Access Protection

A coated wire mesh which covers access area underneath the condenser coils.

Low Ambient Option

The low ambient option consists of a variable speed drive on the first fan of each circuit and special control logic to permit low temperature operation.

Low Ambient Lockout

A factory installed ambient sensor and control logic can prevent starting below the recommended temperature.

Non-Fused Power Disconnect Switch

A non-fused disconnect switch with a through the door handle is provided to disconnect main power.

Circuit Breaker

A standard interrupting molded case capacity circuit breaker (UL approved) is available. The circuit breaker can also be used to disconnect the chiller from main power with a through the door handle and comes pre-wired from the factory with terminal block power connections.

Elastomeric Isolators

Isolators provide isolation between chiller and structure to help eliminate frequency transmission. Elastomeric isolators are more effective and recommended over spring isolators.

Condenser Corrosion Protection

Copper fins and CompleteCoat are available on all size units for corrosion protection. Job site conditions should be matched with the appropriate condenser fin materials to inhibit coil corrosion and ensure extended equipment life. The CompleteCoat option provides fully assembled coils with a flexible dip and bake epoxy coating.

Convenience Outlet

Provides a 15 amp, 115 volt (60 Hz) convenience outlet on the unit.



Mechanical Specifications

General

Units are leak and pressure tested at 450 psig high side, 300 psig low side, then evacuated and charged. Packaged units ship with a full operating charge of oil and refrigerant. Unit panels, structural elements and control boxes are constructed of galvanized steel and mounted on a welded structural steel base. Unit panels and control boxes are finished with a baked on powder paint, and the structural base with an air dry paint. All paint meets the requirement for outdoor equipment of the U.S. Navy and other federal government agencies.

Refrigeration Circuits

Each unit has two refrigerant circuits, with one rotary screw compressor per circuit. Each refrigerant circuit includes a compressor suction and discharge service valve, liquid line shutoff valve, removable core filter drier, liquid line sight glass with moisture indicator, charging port and an electronic expansion valve. Fully modulating compressors and electronic expansion valves provide variable capacity modulation over the entire operating range.

Compressor and Lube Oil System

The rotary screw compressor is semi-hermetic, direct drive, 3600 rpm (3000 rpm at 50 Hz), with capacity control slide valve, rolling element bearings, differential refrigerant pressure oil pump and oil heater. The motor is a suction gas cooled, hermetically sealed, two-pole squirrel cage induction motor. Oil separator and filtration devices are provided separate from the compressor. Check valves in the compressor discharge and lube oil system and a solenoid valve in the lube system are provided.

Evaporator

The evaporator is a tube-in-shell heat exchanger design with internally finned copper tubes roller expanded into the tube sheet. The evaporator is designed, tested and stamped in accordance with ASME for a refrigerant side working pressure of 300 psig. The evaporator is designed for a water side working pressure of 215 psig. Water connections are grooved pipe. The evaporator has one water pass with a series of internal baffles. Each shell includes a vent, a drain and fittings for temperature control sensors and is insulated with $\frac{3}{4}$ -inch Armaflex II or equal insulation ($K=0.26$). Heat tape with thermostat is provided to protect the evaporator from freezing at ambient temperatures down to -20°F (-28.9°C).

Remote Evaporator (Optional)

The evaporator is a tube-in-shell heat exchanger, designed with internally-finned copper tubes that are rolled expanded into the tube sheet. The evaporator is designed, tested and stamped for a refrigerant side working pressure of 300 psig, in accordance with ASME. The evaporator is designed for a water side working pressure of 215 psig. Water connections are victaulic. The evaporator has one water pass, with a series of internal baffles.

Each shell includes a vent and drain connection, as well as factory-mounted entering and leaving water temperature control sensors and evaporator refrigerant temperature sensors. The evaporator is insulated with $\frac{3}{4}$ -inch Armaflex II or equal insulation ($K=0.26$).

The evaporator is skid-mounted and is shipped separately from the outdoor (condensing) unit. Refrigerant accessories, including electronic expansion valve, moisture indicating sightglass and removable core filter drier, are shipped with the evaporator skid. All refrigerant connections are routed to one end of evaporator skid for easy connection. All electrical wiring is factory installed and routed to a terminal box (entering and leaving water temperature sensor, evaporator refrigerant temperature sensor and electronic expansion valve control wiring). Suction refrigerant temperature sensors (two) must be field installed in the field suction line piping next to the evaporator connections.

Condenser and Fans

Air-cooled condenser coils have aluminum fins mechanically bonded to internally finned seamless copper tubing. The condenser coil has an integral subcooling circuit and also provides oil cooling for the compressor bearing and injection oil. Condensers are factory proof and leak tested at 506 psig.

Direct-drive vertical discharge condenser fans are dynamically balanced. Three-phase condenser fan motors with permanently lubricated ball bearing and internal thermal overload protection are provided. Standard units will start and operate down to 25°F (-3.9°C) ambient.

Mechanical Specifications

Unit Controls

All unit controls are housed in a weathertight enclosure with removable plates to allow for customer connection of power wiring and remote interlocks. All controls, including sensors, are factory mounted and tested prior to shipment. All cataloged units are UL listed.

Microcomputer controls provide all control functions including start-up and shut down, leaving chilled water temperature control, compressor and electronic expansion valve modulation, fan sequencing, antirecycle logic, automatic lead/lag compressor starting and load limiting.

The unit control module, utilizing Adaptive Control™ microprocessor, automatically takes action to avoid unit shutdown due to abnormal operating conditions associated with low refrigerant temperature, high condensing temperature and motor current overload. Should the abnormal operating condition continue until a protective limit is violated, the unit will be shut down.

Unit protective functions include loss of chilled water flow, evaporator freezing, loss of refrigerant, low refrigerant pressure, high refrigerant pressure, reverse rotation, compressor starting and running over current, phase loss, phase imbalance, phase reversal, and loss of oil flow.

A menu driven digital display indicates over 20 operating data points including chilled water setpoint, current limit setpoint, leaving chilled water temperature, evaporator and condenser refrigerant pressures and temperatures. Over 60 diagnostic checks are made and displayed when a problem is detected. The digital display can be read and advanced on the unit without opening any control panel doors.

Standard power connections include main three phase power and two 115 volt single phase power connections for control power and heat tape.

Starters

Starters are housed in a weathertight enclosure with removable cover plate to allow for customer connection of power wiring. Across-the-line starters are standard on all 460-575 volt units. An optional Wye Delta closed transition starter (33 percent of LRA inrush) is available. Typically, Trane helical rotary compressors are up to full speed in one second when started across-the-line and have equivalent inrush with similar size reciprocating compressor with part wind starters.

Control Power Transformer

This option eliminates the need to run separate 115 volt control power to the unit. A control power transformer is factory installed and wired. A separate 115 volt power source is required for 60 Hz heat tape or 220 volt power for 50 Hz heat tape.

Pump Package (Optional)

The chiller/pump assembly is a single point power connection (for the condenser fan motors, compressor motors, and pump motors) and two piping connections (supply and return). The complete Packaged Pumping System, including pumps, motors, control equipment, valves, fittings and manifolds are UL Listed under Category QCZJ (Packaged Pumping Systems). In addition to the UL Listing for the complete system, the pump control panel assembly is separately listed under UL 508A (Industrial Control Panels). The pumping system is fully insulated and heat-taped. Pumps are end suction-type with ANSI flanged connections, cast iron casing, bronze impeller, shaft sleeve or stainless steel shaft and mechanical seal. Motors are 1750 RPM energy efficient TEFC with a minimum 1.15 service factor. Butterfly valves are furnished on the suction and discharge of each pump. A suction strainer is installed on the suction of the system. The strainer is of the inline "Y" type and includes a mounted blow-down valve. A multiple-purpose valve is installed on the discharge of the system.

This valve serves as a shutoff, a check and a throttling valve.

3½" diameter gauges are furnished, mounted on a gauge board for indication of system suction and discharge pressures. All control sensing lines and gauge connections will be piped with diaphragm seals and filled with silicon for freeze protection.

The packaged pumping system includes all controls necessary to operate the system. The operator is capable of starting and stopping each pump manually or to allow the pumps to start/stop automatically via signal from the chiller. The NEMA-3R pump control panel includes disconnect switches with thru-the-door handles, FVNR magnetic starters with overloads, H-O-A's, alternation and elapsed time meters. Pumps are mechanically and electrically interlocked.

The control system includes a flow failure alarm. The alarm includes a differential pressure switch, adjustable time delay, alarm light and manual reset. Upon a flow failure alarm, the lead pump is stopped and locked-out of service until the alarm is manually reset via a panel mounted reset push button. A flow failure alarm shall automatically replace the failed pump with the next pump in the sequence.

Each pump is individually tested for performance. Pump performance measurements include shut-off pressure, pump TDH and motor full load amps at 25%, 50%, 75% and 100% of pump design capacity. Each pump control panel is designed, built and tested per UL508A prior to integrating with the chiller. The testing includes verification of wiring, component operation, programming and sequence testing. All sequencing controls, alarms and system operation must be tested and verified prior to integration with the chiller. All testing must be performed with NIST Traceable instrumentation. The NIST Traceable instrumentation must be independently calibrated in accordance with NIST and Hydraulic Institute Standards.

To Convert From:	To:	Multiply By:	To Convert From:	To:	Multiply By:
Length			Energy and Power and Capacity		
Feet (ft)	meters (m)	.30481	British Thermal Units (BTUH)	Kilowatt (kW)	.000293
Inches (In)	millimeters (mm)	25.4	British Thermal Units (BTU)	KCalorie (Kcal)	.252
Area			Tons (refrig. effect)	Kilowatt (refrig. effect)	3.516
Square Feet (ft ²)	square meters (m ²)	.093	Tons (refrig. effect)	Kilocalories per hour (Kcal/hr)	3024
Square Inches (In ²)	square millimeters (mm ²)	645.2	Horsepower	Kilowatt (kW)	.7457
Volume			Pressure		
Cubic Feet (ft ³)	Cubic meters (m ³)	.0283	Feet of water (ftH ₂ O)	Pascals (PA)	2990
Cubic Inches (In ³)	Cubic mm (mm ³)	16387	Inches of water (inH ₂ O)	Pascals (PA)	249
Gallons (gal)	litres (l)	3.785	Pounds per square inch (PSI)	Pascals (PA)	6895
Gallons (gal)	cubic meters (m ³)	.003785	PSI	Bar or KG/CM ²	6.895 × 10 ⁻²
Flow			Weight		
Cubic feet/min (cfm)	cubic meters/second (m ³ /s)	.000472	Ounces (oz)	Kilograms (kg)	.02835
Cubic feet/min (cfm)	cubic meters/hr (m ³ /hr)	1.69884	Pounds (lbs)	Kilograms (Kg)	.4536
Gallons/minute (GPM)	cubic meters/hr (m ³ /hr)	.2271	Fouling factors for heat exchangers		
Gallons/minute (GPM)	litres/second (l/s)	.06308	.00010 ft ² °F hr/BTU	= .0176 m ² ° K/kW	
Velocity			.00025 ft ² °F hr/BTU	= .044 m ² ° K/kW	
Feet per minute (ft/m)	meters per second (m/s)	.00508			
Feet per second (ft/s)	meters per second (m/s)	.3048			

Temperature — Centigrade (°C) Versus Fahrenheit (°F)

Note: The center columns of numbers, referred to as **BASE TEMP.**, is the temperature in either degrees Fahrenheit (°F) or Centigrade (°C), whichever is desired to convert into the other. If degrees Centigrade is given, read degrees Fahrenheit to the right. If degrees Fahrenheit is given, read degrees Centigrade to the left.

Temperature			Temperature			Temperature			Temperature			Temperature		
°C	C or F	°F	°C	C or F	°F	°C	C or F	°F	°C	C or F	°F	°C	C or F	°F
-40.0	-40	-40.0	-15.0	+5	+41.0	+10.0	+50	+122.0	+35.0	+95	+203.0	+60.0	+140	+284.0
-39.4	-39	-38.2	-14.4	+6	+42.8	+10.6	+51	+123.8	+35.6	+96	+204.8	+60.6	+141	+285.8
-38.9	-38	-36.4	-13.9	+7	+44.6	+11.1	+52	+125.6	+36.1	+97	+206.6	+61.1	+142	+287.6
-38.3	-37	-34.6	-13.3	+8	+46.4	+11.7	+53	+127.4	+36.7	+98	+208.4	+61.7	+143	+289.4
-37.8	-36	-32.8	-12.8	+9	+48.2	+12.2	+54	+129.2	+37.2	+99	+210.2	+62.2	+144	+291.2
-37.2	-35	-31.0	-12.2	+10	+50.0	+12.8	+55	+131.0	+37.8	+100	+212.0	+62.8	+145	+293.0
-36.7	-34	-29.2	-11.7	+11	+51.8	+13.3	+56	+132.8	+38.3	+101	+213.8	+63.3	+146	+294.8
-36.1	-33	-27.4	-11.1	+12	+53.6	+13.9	+57	+134.6	+38.9	+102	+215.6	+63.9	+147	+296.6
-35.6	-32	-25.6	-10.6	+13	+55.4	+14.4	+58	+136.4	+39.4	+103	+217.4	+64.4	+148	+298.4
-35.0	-31	-23.8	-10.0	+14	+57.2	+15.0	+59	+138.2	+40.0	+104	+219.2	+65.0	+149	+300.2
-34.4	-30	-22.0	-9.4	+15	+59.0	+15.6	+60	+140.0	+40.6	+105	+221.0	+65.6	+150	+302.0
-33.9	-29	-20.2	-8.9	+16	+60.8	+16.1	+61	+141.8	+41.1	+106	+222.8	+66.1	+151	+303.8
-33.3	-28	-18.4	-8.3	+17	+62.6	+16.7	+62	+143.6	+41.7	+107	+224.6	+66.7	+152	+305.6
-32.8	-27	-16.6	-7.8	+18	+64.4	+17.2	+63	+145.4	+42.2	+108	+226.4	+67.2	+153	+307.4
-32.2	-26	-14.8	-7.2	+19	+66.2	+17.8	+64	+147.2	+42.8	+109	+228.2	+67.8	+154	+309.2
-31.7	-25	-13.0	-6.7	+20	+68.0	+18.3	+65	+149.0	+43.3	+110	+230.0	+68.3	+155	+311.0
-31.1	-24	-11.2	-6.1	+21	+69.8	+18.9	+66	+150.8	+43.9	+111	+231.8	+68.9	+156	+312.8
-30.6	-23	-9.4	-5.5	+22	+71.6	+19.4	+67	+152.6	+44.4	+112	+233.6	+69.4	+157	+314.6
-30.0	-22	-7.6	-5.0	+23	+73.4	+20.0	+68	+154.4	+45.0	+113	+235.4	+70.0	+158	+316.4
-29.4	-21	-5.8	-4.4	+24	+75.2	+20.6	+69	+156.2	+45.6	+114	+237.2	+70.6	+159	+318.2
-28.9	-20	-4.0	-3.9	+25	+77.0	+21.1	+70	+158.0	+46.1	+115	+239.0	+71.1	+160	+320.0
-28.3	-19	-2.2	-3.3	+26	+78.8	+21.7	+71	+159.8	+46.7	+116	+240.8	+71.7	+161	+321.8
-27.8	-18	-0.4	-2.8	+27	+80.6	+22.2	+72	+161.6	+47.2	+117	+242.6	+72.2	+162	+323.6
-27.2	-17	+1.4	-2.2	+28	+82.4	+22.8	+73	+163.4	+47.8	+118	+244.4	+72.8	+163	+325.4
-26.7	-16	+3.2	-1.7	+29	+84.2	+23.3	+74	+165.2	+48.3	+119	+246.2	+73.3	+164	+327.2
-26.1	-15	+5.0	-1.1	+30	+86.0	+23.9	+75	+167.0	+48.9	+120	+248.0	+73.9	+165	+329.0
-25.6	-14	+6.8	-0.6	+31	+87.8	+24.4	+76	+168.8	+49.4	+121	+249.8	+74.4	+166	+330.8
-25.0	-13	+8.6	.0	+32	+89.6	+25.0	+77	+170.6	+50.0	+122	+251.6	+75.0	+167	+332.6
-24.4	-12	+10.4	+0.6	+33	+91.4	+25.6	+78	+172.4	+50.6	+123	+253.4	+75.6	+168	+334.4
-23.9	-11	+12.2	+1.1	+34	+93.2	+26.1	+79	+174.2	+51.1	+124	+255.2	+76.1	+169	+336.2
-23.3	-10	+14.0	+1.7	+35	+95.0	+26.7	+80	+176.0	+51.7	+125	+257.0	+76.7	+170	+338.0
-22.8	-9	+15.8	+2.2	+36	+96.8	+27.2	+81	+177.8	+52.2	+126	+258.8	+77.2	+171	+339.8
-22.2	-8	+17.6	+2.8	+37	+98.6	+27.8	+82	+179.6	+52.8	+127	+260.6	+77.8	+172	+341.6
-21.7	-7	+19.4	+3.3	+38	+100.4	+28.3	+83	+181.4	+53.3	+128	+262.4	+78.3	+173	+343.4
-21.1	-6	+21.2	+3.9	+39	+102.2	+28.9	+84	+183.2	+53.9	+129	+264.2	+78.9	+174	+345.2
20.6	-5	+23.0	+4.4	+40	+104.0	+29.4	+85	+185.0	+54.4	+130	+266.0	+79.4	+175	+347.0
-20.0	-4	+24.8	+5.0	+41	+105.8	+30.0	+86	+186.8	+55.0	+131	+267.8	+80.0	+176	+348.8
-19.4	-3	+26.6	+5.5	+42	+107.6	+30.6	+87	+188.6	+55.6	+132	+269.6	+80.6	+177	+350.6
-18.9	-2	+28.4	+6.1	+43	+109.4	+31.1	+88	+190.4	+56.1	+133	+271.4	+81.1	+178	+352.4
-18.3	-1	+30.2	+6.7	+44	+111.2	+31.7	+89	+192.2	+56.7	+134	+273.2	+81.7	+179	+354.2
-17.8	0	+32.0	+7.2	+45	+113.0	+32.2	+90	+194.0	+57.2	+135	+275.0	+82.2	+180	+356.0
-17.2	+1	+33.8	+7.8	+46	+114.8	+32.8	+91	+195.8	+57.8	+136	+276.8	+82.8	+181	+357.8
-16.7	+2	+35.6	+8.3	+47	+116.6	+33.3	+92	+197.6	+58.3	+137	+278.6	+83.3	+182	+359.6
-16.1	+3	+37.4	+8.9	+48	+118.4	+33.9	+93	+199.4	+58.9	+138	+280.4	+83.9	+183	+361.4
-15.6	+4	+39.2	+9.4	+49	+120.2	+34.4	+94	+201.2	+59.4	+139	+282.2	+84.4	+184	+363.2

FOR INTERPOLATION IN THE ABOVE TABLE USE:
 BASE TEMPERATURE (°F or °C): 1
 DEGREES CENTIGRADE: 0.56
 DEGREES FAHRENHEIT: 1.8

2 3 4 5 6 7 8 9 10
 1.1 1.67 2.22 2.78 3.33 3.89 4.44 5.00 5.56
 3.6 5.4 7.2 9.0 10.8 12.6 14.4 16.2 18.0



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