RT-DS-10
April 1999

Packaged Rooftop Air Conditioners

23 to 42 Ton (81-148 kW) Voyager™ Commercial – 50 HZ

Features and Benefits

Simply THE BEST VALUE℠

Over the years the Voyager™ product line has developed into the most complete line of commercial packaged units available. We were first with the Micro when we developed micro-electronic unit controls and we move ahead again with Voyager Commercial products.

Five new sizes from 23-42 tons (81-148 kW) meet the needs of the changing commercial rooftop marketplace.

Our customers demand units that will have exceptional reliability, meet stringent performance requirements, and be competitively priced. These same requirements drove the design of the original light commercial Voyager and have been carried forward into Voyager Commercial.

Voyager Commercial's features and benefits are comprised of cutting edge technologies like the reliable 3-D™ Scroll compressor, Trane engineered microprocessor controls, computer-aided run testing, and Integrated Comfort™ systems. So, whether you're the contractor, the engineer, or the owner you can be certain that when you've chosen Voyager Commercial, you've chosen…*Simply the best value!*

Contents

Standard Features
- Factory installed and commissioned microelectronic controls
- Trane 3-D™ Scroll compressors
- Dedicated downflow or horizontal configuration
- CV or VAV control
- FROSTAT™ coil frost protection on all units
- Supply air overpressurization protection on VAV units
- Supply airflow proving
- Emergency stop input
- Compressor lead-lag
- Occupied-unoccupied switching
- Timed override activation
- FC supply fans
- Two-inch (51 mm) standard efficiency filters
- Finish exceeds salt spray requirements of ASTM B117

Optional Features
- Electric heat
- Natural gas heat
- LP gas heat (kit only)
- Power exhaust
- Barometric relief
- High efficiency 2” (51 mm) throwaway filters
- High efficiency 4” (102 mm) throwaway filters
- High efficiency supply fan motors
- Manual fresh air damper
- Economizer with dry bulb control
- Economizer with reference enthalpy control
- Economizer with differential (comparative) enthalpy control
- Inlet guide vanes on VAV units
- Service valves
- Through-the-base electrical provision
- Factory mounted disconnect with external handle (non-fused)
- Integrated Comfort™ system control option
- Ventilation override
- Hinged service access
- Factory installed condenser coil guards

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Features and Benefits

- **Trane 3-D® Scroll Compressor**

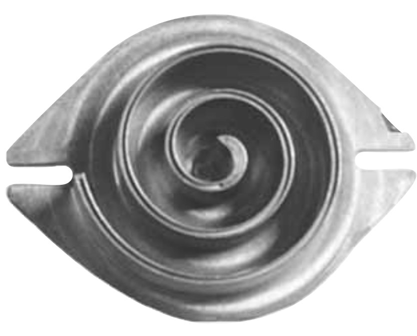
Simple Design with 70% Fewer Parts
Fewer parts than an equal capacity reciprocating compressor means significant reliability and efficiency benefits. The single orbiting scroll eliminates the need for pistons, connecting rods, wrist pins and valves. Fewer parts lead to increased reliability. Fewer moving parts, less rotating mass and less internal friction means greater efficiency than reciprocating compressors.

Patented 3-D Scroll Compliance
Trane 3-D Scroll compliance provides important reliability and efficiency benefits. 3-D compliance allows the orbiting scrolls to touch in all three dimensions, forming a completely enclosed compression chamber which leads to increased efficiency. In addition, 3-D compliance means the orbiting scrolls only touch with enough force to create a seal so there is no wear between the scroll plates. The fixed and orbiting scrolls are made of high strength cast iron which results in less thermal distortion, less leakage, and higher efficiencies. The most outstanding feature of the scroll compressor 3-D compliance is that the slugging will not cause failure. In a reciprocating compressor, however, the liquid or dirt can cause serious damage.

Low Torque Variation
The 3-D Scroll compressor has a very smooth compression cycle with torque variations that are only 30 percent of that produced by a reciprocating compressor. This means the scroll compressor imposes very little stress on the motor for greater reliability. Low torque variation means reduced noise and vibration.

Suction Gas Cooled Motor
Compressor motor efficiency and reliability is further optimized with this design. Cool suction gas keeps the motor cooler for longer life and better efficiency.

Proven Design Through Testing and Research
With over twenty years of development and testing, Trane 3-D Scroll compressors have undergone more than 400,000 hours of laboratory testing and field operation. This work combined with over 25 patents makes Trane the worldwide leader in air conditioning scroll compressor technology.



One of two matched scroll plates – the distinguishing feature of the scroll compressor.

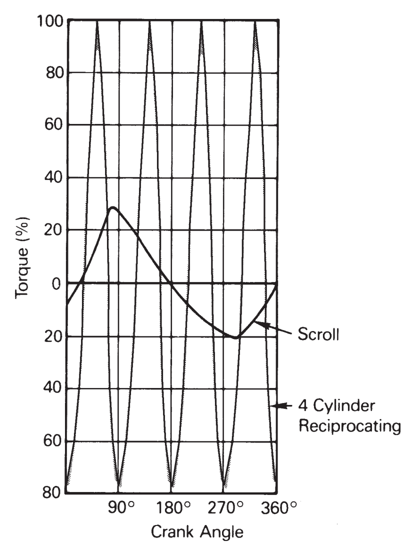
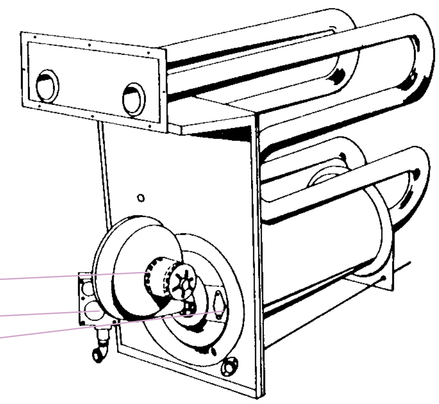


Chart illustrates low torque variation of 3-D Scroll compressors reciprocating compressor.

Features and Benefits

Quality and Reliability



Drum and Tube Heat Exchanger

Micro Controls

- For over 10 years Trane has been working with microprocessor controls in the applied equipment markets. These designs have provided the technology that has been applied to the Voyager units.
- The Micro provides unit control for heating, cooling and ventilating utilizing input from sensors that measure outdoor and indoor temperature.
- The Micro improves quality and reliability through the use of time-tested microprocessor controls and logic. The Micro:
  – prevents the unit from short cycling, considerably improving compressor life.
  – ensures that the compressor will run for a specific amount of time which allows oil to return for better lubrication, enhancing the reliability of the commercial compressor.
- The Voyager with the Micro reduces the number of components required to operate the unit, thereby reducing possibilities for component failure.

Drum and Tube Heat Exchanger

- The drum and tube heat exchanger is designed for increased efficiency and reliability and has utilized improved technology incorporated in the large roof top commercial units for almost 20 years.

  The heat exchanger is manufactured using aluminized steel with stainless steel components for maximum durability. The requirement for cycle testing of heat exchangers is 10,000 cycles by ANSI Z21.47. This is the standard required by both UL* and AGA* for cycle test requirements. Trane requires the design to be tested to 2½ times this current standard. The drum and tube design has been tested and passed over 150,000 cycles which is over 15 times the current ANSI cycling requirements.

  *Apply to 60 HZ testing standards only.

- The negative pressure gas valve will not allow gas flow unless the combustion blower is operating. This is one of our unique safety features.
- The forced combustion blower supplies premixed fuel through a single stainless steel burner screen into a sealed drum where ignition takes place. It is more reliable to operate and maintain than a multiple burner system.
- The hot surface ignitor is a gas ignition device which doubles as a safety device utilizing a continuous test to prove the flame. The design is cycle tested at the factory for quality and reliability.

Features and Benefits

Excellent Part-Load Efficiency

- The Scroll compressor's unique design allows it to be applied in a passive parallel manifolded piping scheme, something that a "recip" just doesn't do very well.

When the unit begins stage back at part load it still has the full area and circuitry of its evaporator and condenser coils available to transfer heat. In simple terms this means superior part-load efficiencies (IPLV) and lower unit operating costs.

FC Fans with Inlet Guide Vanes

- Trane's forward-curved fans with inlet guide vanes pre-rotate the air in the direction of the fan wheel, decreasing static pressure and horsepower, essentially unloading the fan wheel. The unloading characteristics of a Trane FC fan with inlet guide vanes result in superior part load performance.

Rigorous Testing

- All of Voyager's designs were rigorously rain tested at the factory to ensure water integrity.
- Actual shipping tests are performed to determine packaging requirements. Units are test shipped around the country. Factory shake and drop tested as part of the package design process to help assure that the unit will arrive at your job site in top condition.
- Rigging tests include lifting a unit into the air and letting it drop one foot, assuring that the lifting lugs and rails hold up under stress.
- We perform a 100% coil leak test at the factory. The evaporator and condenser coils are leak tested at 200 psig and pressure tested to 450 psig.
- All parts are inspected at the point of final assembly. Sub-standard parts are identified and rejected immediately.
- Every unit receives a 100% unit run test before leaving the production line to make sure it lives up to rigorous Trane requirements.

Ease of Installation

Contractors look for lower installation (jobsite) costs. Voyager's conversionless units provide many time and money saving features.

Conversionless Units

- The dedicated design units (either downflow or horizontal) require no panel removal or alteration time to convert in the field – a major cost savings during installation.

Improved Airflow

- U-shaped airflow allows for improved static capabilities. The need for high static motor conversion is minimized and time isn't spent changing to high static oversized motors.

Single Point Power

A single electrical connection powers the unit.

Micro

- The function of the Micro replaces the need for field installed anti-short-cycle timer and time delay relays. The Micro ensures that these controls are integral to the unit. The contractor no longer has to purchase these controls as options and pay to install them.
- The wiring of the low voltage connections to the unit and the zone sensors is as easy as 1-1, 2-2, and 3-3. This simplified system makes it easier for the installer to wire.

Features and Benefits

Serviceability

Today's owners are more conscious of the cost of service and maintenance. Voyager was designed with input from service contractors. Their information helped us design a unit that would get the serviceman off the job quicker and save the owner money. Here is why Voyager can save money in service.

Voyager's Simpler Design
The Voyager design uses fewer parts than previous units. Since it is simpler in design, it is easier to diagnose.

Micro

- The Micro requires no special tools to run the Voyager unit through its paces. Simply place a jumper between Test 1 and Test 2 terminals on the Low Voltage Terminal Board and the unit will walk through its operational steps automatically.
  – The unit automatically returns control to the zone sensor after stepping through the test mode a single time, even if the jumper is left on the unit.
- As long as the unit has power and the "system on" LED is lit, the Micro is operational. The light indicates that the Micro is functioning properly.
- The Micro features expanded diagnostic capabilities when utilized with Trane's Integrated Comfort™ Systems.
- Some zone sensor options have central control panel lights which indicate the mode the unit is in and possible diagnostic information (dirty filters for example).

Easy Access Low Voltage Terminal Board
Voyager's Low Voltage Terminal Board is external to the electrical control cabinet. It is extremely easy to locate and attach the thermostat wire. This is another cost and timesaving installation feature.

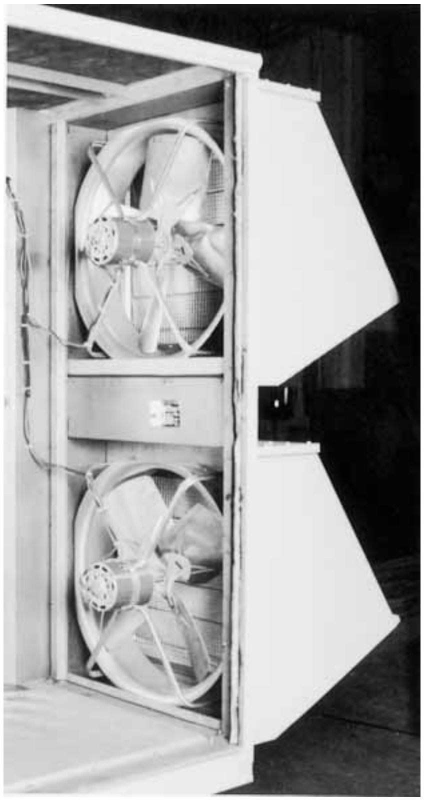
Value

Low Ambient Cooling
All Voyager Commercial units have cooling capabilities down to 0°F (-17.8°C) as standard.

Power Exhaust Option
Provides exhaust of the return air when using an economizer to maintain proper building pressurization. Great for relieving most building overpressurization problems.

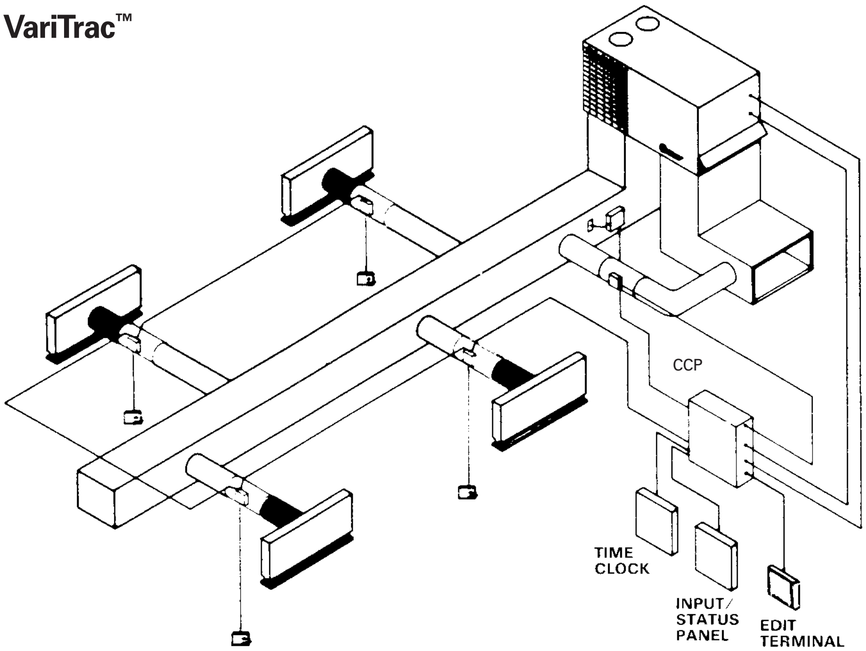
Micro Benefits

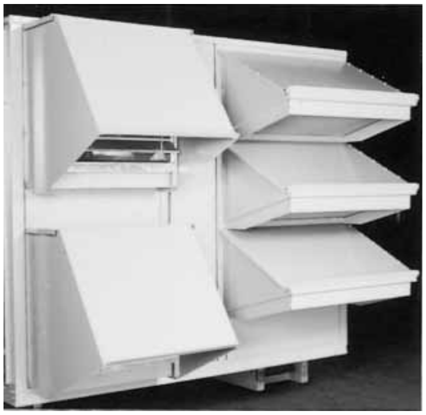
- The Micro in the Voyager units has built-in anti-short-cycle timer, time delay relay and minimum "on" time controls. These controls are functions of the Micro and are factory tested to assure proper operation.
- The Micro softens electrical "spikes" by staging on fans, compressors and heaters.
- The Intelligent Fallback or Adaptive Control is a benefit to the building occupant. If a component goes astray, the unit will continue to operate at predetermined temperature setpoint.
- Intelligent Anticipation is a standard feature of the Micro. It functions constantly as the Micro and zone sensor work together in harmony to provide tighter comfort control than conventional electromechanical thermostats.



Features and Benefits

VariTrac™





VariTrac™
Trane's changeover VAV System for light commercial applications is also available. Coupled with Voyager Commercial, it provides the latest in technological advances for comfort management systems and can allow thermostat control in every zone served by VariTrac™.

Downflow and Horizontal Economizers
The economizers come with three options of controls (dry bulb, enthalpy and differential enthalpy).

Trane Communication Interface or TCI is available factory or field installed. This module when applied with the Micro easily interfaces with Trane's Integrated Comfort™ system.

Trane factory built roof curbs are available for all units.

One of Our Finest Assets:
Trane Commercial Sales Engineers are a Support group that can assist you with:
– Product
– Application
– Service
– Training
– Special Applications
– Specifications
– Computer Programs and more

Model Number Description

TC	D	400	A	C	0	A	1	A	4	F	D	1	A
1,2	3	4,5,6	7	8	9	10	11	12	13	14	15	16	17

Digits 1, 2 – Unit Function
TC = DX Cooling, No Heat
TE = DX Cooling, Electric Heat
YC = DX Cooling, Natural Gas Heat

Digit 3 – Unit Airflow Design
D = Downflow Configuration
H = Horizontal Configuration

Digits 4, 5, 6 – Nominal Cooling Capacity
275 = 22.9 Tons (82 kW)
305 = 25.4 Tons (89 kW)
350 = 29.2 Tons (105 kW)
400 = 33.3 Tons (120 kW)
500 = 41.7 Tons (148 kW)

Digit 7 – Major Development Sequence
A = First
B = Second, Etc.

Digit 8 – Power Supply (See Note 1)
C = 380/50/3
D = 415/50/3

Digit 9 – Heating Capacity (See Note 4)
0 = No Heat (TC only)
L = Low Heat (YC only)
H = High Heat (YC only)
Note: When second digit is "E" for Electric Heat, the following values apply in the ninth digit.

	380V	415V	
A =	23	27	kW
B =	34	40	kW
C =	45	54	kW
D =	56	67	kW
E =	68	81	kW

Digit 10 – Design Sequence
A = First

Digit 11 – Exhaust
0 = None
1 = Barometric Relief
(Available w/Economizer only)
2 = Power Exhaust Fan
(Available w/Economizer only)

Digit 12 – Filter
A = Standard 2" (51 mm) Throwaway Filters
B = High Efficiency 2" (51 mm) Throwaway Filters
C = High Efficiency 4" (102 mm) Throwaway Filters

Digit 13 – Supply Fan Motor, HP
1 = 7.5 Hp Std. Eff. (5.6 kW)
2 = 10 Hp Std. Eff. (7.5 kW)
3 = 15 Hp Std. Eff. (11.2 kW)
4 = 20 Hp Std. Eff. (14.9 kW)

Digit 14 – Supply Air Fan Drive Selections
(See Note 3)

A =	458	H =	417
B =	500	J =	437
C =	541	K =	479
D =	583	L =	521
E =	625	M =	562
F =	658	N =	604
G =	664		

Digit 15 – Fresh Air Selection
A = No Fresh Air
B = 0-25% Manual Damper
C = 0-100% Economizer, Dry Bulb Control
D = 0-100% Economizer, Reference Enthalpy Control
E = 0-100% Economizer, Differential Enthalpy Control
F = "C" Option and Low Leak Fresh Air Damper
G = "D" Option and Low Leak Fresh Air Damper
H = "E" Option and Low Leak Fresh Air Damper

Digit 16 – System Control
1 = Constant Volume
2 = VAV Supply Air Temperature Control w/o Inlet Guide Vanes
3 = VAV Supply Air Temperature Control w/Inlet Guide Vanes
Note: Zone sensors are not included with option and must be ordered as a separate accessory.

Digit 17+ – Miscellaneous
A = Service Valves (See Note 2)
B = Through the Base Electrical Provision
C = Non-Fused Disconnect Switch with External Handle
D = Factory-Powered 15A GFI Convenience Outlet and Non-Fused Disconnect Switch with External Handle
E = Field-Powered 15A GFI Convenience Outlet
F = ICS Control Option – Trane Communication Interface, Supply Air Sensing and Clogged Filter Switch
G = Ventilation Override
H = Hinged Service Access
J = Condenser Coil Guards

Note:
1. All voltages are across-the-line starting only.
2. Option includes Liquid, Discharge, Suction Valves.
3. Supply air fan drives A thru G are used with 22.9-29.2 ton (82-105 kW) units only and drives H thru N are used with 33.3 and 41.7 ton (120-148 kW) units only.
4. Electric Heat kW ratings are based upon voltage ratings of 380/415 V. Heaters A, B, C, D are used with 22.9-29.2 ton (82-105 kW) units only and heaters B, C, D, E are used with 33.3-41.7 ton (120-148 kW) units only.

TRANE

General Data

Table 10-1 – General Data – 23-25 Tons

	TC*275 (23 Tons)		TC*305 (25 Tons)	
Cooling Performance[1]				
Nominal Gross Capacity(Btuh)	279,000 (81.8 kW)		304,000 (89.1 kW)	
System Power kW	26.1		30.2 kW	
Compressor				
Number/Type	2/Scroll		2/Scroll	
Nominal Motor HP (ea)	8.4/12.5		11.7	
Motor RPM	2875		2875	
Natural Gas Heat[2]	Low	High	Low	High
Heating Input(Btuh)	290,000 (85.0 kW)	500,000 (147 kW)	290,000 (85.0 kW)	500,000 (147 kW)
First Stage	250,000 (73.3 kW)	425,000 (125 kW)	250,000 (73.3 kW)	425,000 (125 kW)
Heating Output(Btuh)	243,000 (69.0 kW)	405,000 (119 kW)	243,000 (69.0 kW)	405,000 (119 kW)
First Stage	202,500 (59.4 kW)	344,250 (101 kW)	202,500 (59.4 kW)	344,250 (101 kW)
Steady State Efficiency(%) [3]	81		81	
No. Burners/No. Stages	1/2		1/2	
Gas Connect Pipe Size (in)	0.75 (19 mm)		0.75 (19 mm)	
Outdoor Coil - Type	LANCED		LANCED	
Tube Size OD (in)	0.375 (10 mm)		0.375 (10 mm)	
Face Area (sq ft)	51.3 (4.8 sq m)		51.3 (4.8 sq m)	
Rows/Fins Per Inch (25mm)	2/16		2/16	
Indoor Coil - Type	HI-PERFORM		HI-PERFORM	
Tube Size OD (in)	0.500 (13 mm)		0.500(13 mm)	
Face Area (sq ft)	31.7 (2.9 sq m)		31.7 (2.9 sq m)	
Rows/Fins Per Inch (25mm)	2/14		2/14	
Refrigerant Control	TXV		TXV	
PVC Drain Connect No./Size (in)	1/1.25 (1/32 mm)		1/1.25 (1/32 mm)	
Outdoor Fan Type	PROP FAN		PROP FAN	
No. Used	3		3	
Diameter (in.)	28.0 (711 mm)		28.0 (711 mm)	
Drive Type/No. Speeds	DIRECT/1		DIRECT/1	
Cfm	20,450 (9650 L/s)		20,450 (9650 L/s)	
No. Motors (RPM)	3 (940)		3 (940)	
Motor HP	0.75 (0.56 kW)		0.75 (0.56 kW)	
Indoor Fan Type/No. Used	FC/1		FC/1	
Diameter (in)	22.4 (568 mm)		22.4 (568 mm)	
Width (in)	22.0 (559 mm)		22.0 (559 mm)	
Drive Type	BELT		BELT	
No. Speeds/No. Motors	1/1		1/1	
Motor HP	7.5 (5.6 kW)		7.5 (5.6 kW)	
Motor RPM/Frame Size	1460/213T		1460/213T	
Filters - Type	THROWAWAY		THROWAWAY	
Furnished/No.	Yes/16		Yes/16	
Recommended Size (in)	16X 20 X2 (406X 508 X51mm)		16x20x2 (406X 508x51mm)	
Refrigerant Type	R-22		R-22	
Factory Charge (lbs) [4]	46 (21 kg)		46 (21 kg)	

Notes:
1. Cooling Performance is rated at 95°F (35°C) ambient, 80°F (27°C) entering dry bulb, 67°F (19°C) entering wet bulb. Gross capacity does not include the effect of fan motor heat.
2. Heating Performance Limit settings and ratings data were established and approved under laboratory test conditions using American National Standards.
3. Steady State Efficiency is rated in accordance with DOE test procedures.
4. Refrigerant charge is an approximate value. For a more precise value, see unit nameplate and service instructions.

General Data

Table 11-1 – General Data – 29-33 Tons

	TC*350 (29 Tons)		TC*400 (33 Tons)	
Cooling Performance[1]				
Nominal Gross Capacity(Btuh)	375,000 (105 kW)		409,000 (120 kW)	
System Power kW	34.0		42.5	
Compressor				
Number/Type	2/Scroll		3/Scroll	
Nominal Motor HP (ea)	12.5		2@11.7/8.4	
Motor RPM	2875		2875	
Natural Gas Heat[2]	Low	High	Low	High
Heating Input (Btuh)	290,000 (85.0 kW)	500,000 (147 kW)	335,000 (98.2 kW)	670,000 (196 kW)
First Stage	250,000 (73.3 kW)	425,000 (125 kW)	300,000 (87.9 kW)	600,000 (176 kW)
Heating Output(Btuh)	243,000 (69.0 kW)	405,000 (119 kW)	271,350 (80.0 kW)	542,700 (159 kW)
First Stage	202,500 (59.4 kW)	344,250 (101 kW)	243,500 (71.4 kW)	486,000 (166 kW)
Steady State Efficiency(%)[3]	81		81	
No. Burners/No. Stages	1/2		1/2	
Gas Connect Pipe Size (in)	0.75 (19 mm)		0.75 (19 mm)	
Outdoor Coil - Type	LANCED		LANCED	
Tube Size OD (in)	0.375 (10 mm)		0.375 (10 mm)	
Face Area (sq ft)	51.3 (4.8 sq m)		69.8 (6.5 sq m)	
Rows/Fins Per Inch (25mm)	2/16		2/16	
Indoor Coil - Type	HI-PERFORM		HI-PERFORM	
Tube Size (in) OD	0.500 (13 mm)		0.500 (13 mm)	
Face Area (sq ft)	31.7 (2.9 sq m)		37.5 (3.5 sq m)	
Rows/Fins Per Inch (25mm)	2/15		2/14	
Refrigerant Control	TXV		TXV	
PVC Drain Connect No./Size (in)	1/1.25 (1/32 mm)		1/1.25 (1/32 mm)	
Outdoor Fan Type	PROP FAN		PROP FAN	
No. Used	3		4	
Diameter (in.)	28.0 (711 mm)		28.0 (711 mm)	
Drive Type/No. Speeds	DIRECT/1		DIRECT/1	
Cfm	20,400 (9650 L/s)		26,200 (12,400 L/s)	
No. Motors (RPM)	3 (940)		4 (940)	
Motor HP	0.75 (0.56 kW)		0.75 (0.56 kW)	
Indoor Fan Type/No. Used	FC/1		FC/1	
Diameter (in)	22.4 (568 mm)		25.0 (635 mm)	
Width (in)	22.0 (559 mm)		25.0 (635 mm)	
Drive Type	BELT		BELT	
No. Speeds/No. Motors	1/1		1/1	
Motor HP	7.5 (5.6 kW)		10.0 (7.5 kW)	
Motor RPM/Frame Size	1460/213T		1460/215T	
Filters - Type	THROWAWAY		THROWAWAY	
Furnished/No.	Yes/16		Yes/17	
Recommended Size (in)	16x20x2 (406x508x51mm)		16X 20 X2 (406X 508 X51mm)	
Refrigerant Type	R-22		R-22	
Factory Charge Ciruit #1 (lbs) [4]	52 (24 kg)		24.5 (11.1 kg)	
Factory Charge Circuit # 2 (lbs)	–		42.5 (19.3 kg)	

Notes:
1. Cooling Performance is rated at 95°F (35°C) ambient, 80°F (27°C) entering dry bulb, 67°F (19°C) entering wet bulb. Gross capacity does not include the effect of fan motor heat.
2. Heating Performance Limit settings and ratings data were established and approved under laboratory test conditions using American National Standards.
3. Steady State Efficiency is rated in accordance with DOE test procedures.
4. Refrigerant charge is an approximate value. For a more precise value, see unit nameplate and service instructions.

General Data

Table 12-1 – General Data – 43 Tons

	TC*500 (42Tons)	
Cooling Performance [1]		
Nominal Gross Capacity(Btuh)	505,000 (148 kW)	
System Power kW	52.9	
Compressor		
Number/Type	3/Scroll	
Nominal Motor HP (ea)	12.5	
Motor RPM	2875	
Natural Gas Heat[2]	Low	High
Heating Input(Btuh)	335,000 (98.2 kW)	670,000 (196 kW)
First Stage	300,000 (87.9 kW)	600,000 (176 kW)
Heating Output(Btuh)	271,350 (79.5 kW)	542,700 (159 kW)
First Stage	243,500 (71.4 kW)	486,000 (166 kW)
Steady State Efficiency(%)[3]	81	
No. Burners/No. Stages	1/2	
Gas Connect Pipe Size (in)	0.75 (19 mm)	
Outdoor Coil - Type	LANCED	
Tube Size OD (in)	0.375 (10 mm)	
Face Area(sq ft)	69.8 (6.5 sq m)	
Rows/Fins Per Inch (25mm)	2/16	
Indoor Coil - Type	HI-PERFORM	
Tube Size OD (in)	0.500 (13 mm)	
Face Area (sq ft)	37.5 (3.5 sq m)	
Rows/Fins Per Inch (25mm)	3/13	
Refrigerant Control	TXV	
PVC Drain Connect No./Size (in)	1/1.25 (1/32 mm)	
Outdoor Fan Type	PROP FAN	
No. Used	4	
Diameter (in.)	28.0 (711 mm)	
Drive Type/No. Speeds	DIRECT/1	
Cfm	26,200 (12,400 L/s)	
No. Motors (RPM)	4 (940)	
Motor HP	0.75 (0.56 kW)	
Indoor Fan Type/No. Used	FC/1	
Diameter (in)	25.0 (635 mm)	
Width (in)	25.0 (635 mm)	
Drive Type	BELT	
No. Speeds/No. Motors	1/1	
Motor HP	10.0 (7.5 kW)	
Motor RPM/Frame Size	1460/215T	
Filters - Type	THROWAWAY	
Furnished/No.	Yes/17	
Recommended Size (in)	16x20x2 (406x508x51mm)	
Refrigerant Type	R-22	
Factory Charge Circuit #1 (lbs) [4]	23.9 (10.8 kg)	
Factory Charge Circuit #1	49.4 (22.5 kg)	

Notes:
1. Cooling Performance is rated at 95°F (35°C) ambient, 80°F (27°C) entering dry bulb, 67°F (19°C) entering wet bulb. Gross capacity does not include the effect of fan motor heat.
2. Heating Performance Limit settings and ratings data were established and approved under laboratory test conditions using American National Standards.
3. Steady State Efficiency is rated in accordance with DOE test procedures.
4. Refrigerant charge is an approximate value. For a more precise value, see unit nameplate and service instructions.

Table 12-2 – Economizer Outdoor Air Damper Leakage (Of Rated Airflow)

	ΔP Across Dampers (In. WC) (Pa)	
	0.5 In. (124.5 Pa)	1.0 In. (249 Pa)
Standard	1.5%	2.5%
Optional "Low Leak"	0.5%	1.0%

Note: Above data based on tests completed in accordance with AMCA Standard 575.

Exhaust Air Options

When is it necessary to provide building exhaust?

Whenever an outdoor air economizer is used, a building generally requires an exhaust system. The purpose of the exhaust system is to exhaust the proper amount of air to prevent over or under-pressurization of the building.

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

Voyager™ Commercial rooftop units offer two types of exhaust systems:

1
Power exhaust fan.

2
Barometric relief dampers.

Application Recommendations

Power Exhaust Fan

The exhaust fan option is a dual, non-modulating exhaust fan with approximately half the air-moving capabilities of the supply fan system. The experience of The Trane Company that a non-modulating exhaust fan selected for 40 to 50 percent of nominal supply cfm can be applied successfully.

The power exhaust fan generally should not be selected for more than 40 to 50 percent of design supply airflow. Since it is an on/off non-modulating fan, it does not vary exhaust cfm with the amount of outside air entering the building. Therefore, if selected for more than 40 to 50 percent of supply airflow, the building may become under-pressurized when economizer operation is allowing lesser amounts of outdoor air into the building. If, however, building pressure is not of a critical nature, the non-modulating exhaust fan may be sized for more than 50 percent of design supply airflow.

Barometric Relief Dampers

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

Altitude Corrections

The rooftop performance tables and curves of this catalog are based on standard air (.075 lbs/ft) (.034 kg/cm). If the rooftop airflow requirements are at other than standard conditions (sea level), an air density correction is needed to project accurate unit performance.

Figure 17-1 shows the air density ratio at various temperatures and elevations. Trane rooftops are designed to operate between 40 and 90°F (4.4 and 32.2°C) leaving air temperature.

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

1
First, determine the air density ratio using Figure 17-1.

2
Divide the static pressure at the nonstandard condition by the air density ratio to obtain the corrected static pressure.

3
Use the actual cfm and the corrected static pressure to determine the fan rpm and bhp from the rooftop performance tables or curves.

4
The fan rpm is correct as selected.

5
Bhp must be multiplied by the air density ratio to obtain the actual operating bhp.

In order to better illustrate this procedure, the following example is used:

Consider a 29-ton (105 kW) rooftop unit that is to deliver 9,160 actual cfm (4323 l/s) at 1.50 inches total static pressure (tsp) (38 mm, 373 Pa), 55°F (12.8°C) leaving air temperature, at an elevation of 5,000 ft. (1524 m).

1
From Figure 17-1, the air density ratio is 0.86.

2
Tsp = 1.50 inches/0.86 = 1.74 inches tsp.
374/.86 = 434 Pa.

3
From the performance tables: a 29-ton (105 kW) rooftop will deliver 9,160 cfm at 1.74 inches tsp 4323 l/s at 434 Pa) at 651 rpm and 5.51 bhp (4.11 kW).

4
The rpm is correct as selected – 651 rpm.

5
Bhp = 5.51 x 0.86 = 4.74 bhp actual.
kW = 4.11 x 0.86 = 3.5 kW

Compressor MBh, SHR, and kW should be calculated at standard and then converted to actual using the correction factors in Table 17-2. Apply these factors to the capacities selected at standard cfm so as to correct for the reduced mass flow rate across the condenser.

Heat selections other than gas heat will not be affected by altitude. Nominal gas capacity (output) should be multiplied by the factors given in Table 17-3 before calculating the heating supply air temperature.

Application Considerations

Acoustical Considerations

Proper placement of rooftops is critical to reducing transmitted sound levels to the building. The ideal time to make provisions to reduce sound transmissions is during the design phase. And the most economical means of avoiding an acoustical problem is to place the rooftop(s) away from acoustically critical areas. If possible, rooftops should not be located directly above areas such as: offices, conference rooms, executive office areas and classrooms. Instead, ideal locations might be over corridors, utility rooms, toilets or other areas where higher sound levels directly below the unit(s) are acceptable.

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

1
Never cantilever the compressor end of the unit. A structural cross member must support this end of the unit.

2
Locate the unit's center of gravity close to or over column or main support beam.

3
If the roof structure is very light, roof joists must be replaced by a structural shape in the critical areas described above.

4
If several units are to be placed on one span, they should be staggered to reduce deflection over that span.

It is impossible to totally quantify the effect of building structure on sound transmission, since this depends on the response of the roof and building members to the sound and vibration of the unit components. However, the guidelines listed above are experience-proven guidelines which will help reduce sound transmissions.

Clearance Requirements

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

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

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

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

1
To reduce span deflection if more than one unit is placed on a single span. Reducing deflection discourages sound transmission.

2
To assure proper diffusion of exhaust air before contact with the outside air intake of adjacent unit.

Duct Design

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

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

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

Selection Procedure

Selection of Trane commercial air conditioners is divided into five basic areas:

1
Cooling capacity
2
Heating capacity
3
Air delivery
4
Unit electrical requirements
5
Unit designation

Factors Used In Unit Cooling Selection:

1
Summer design conditions – 95 DB/76 WB (35/24.4°C), 95°F (35°C) entering air to condenser.
2
Summer room design conditions – 76 DB/66 WB (24.4/18.9°C).
3
Total peak cooling load – 270 MBh (79 kW) (22.5 tons).
4
Total peak supply cfm – 10,000 cfm (4720 l/s).
5
External static pressure – 1.0 inches wc (249 Pa).
6
Return air temperatures – 80 DB/66°F WB (26.7/18.9°C).
7
Return air cfm – 3540 cfm (1671 l/s).
8
Outside air ventilation cfm and load – 1000 cfm and 15.19 MBh (1.27 tons or 4.45 kW) 472 l/s.
9
Unit accessories include:
a
Aluminized heat exchanger – high heat module.
b
2” Hi-efficiency throwaway filters.
c
Exhaust fan.
d
Economizer cycle.

Step 1 – A summation of the peak cooling load and the outside air ventilation load shows: 22.5 tons + 1.27 tons = 23.77 (79 kW + 4.45 kW = 83.45) required unit capacity. From Table 19-1, 25 ton (89 kW) unit capacity at 80 DB/67 WB (27/19°C), 95°F entering the condenser and 10,000 total peak supply cfm (4720 l/s), is YC/TC/TE*305.

Step 2 – Having selected the correct unit, the supply fan and exhaust fan motor bhp must be determined.

Supply Air Fan:
Determine unit static pressure at design supply cfm:

External static pressure	1.25 inches (310 Pa)
Heat exchanger (Table 28-1)	.12 inches (30 Pa)
High efficiency filter 2” (25 mm) (Table 28-1)	.07 inches (17 Pa)
Economizer (Table 28-1)	.07 inches (17 Pa)
Unit total static pressure	1.50 inches (374 Pa)

Using total cfm of 10,000 (4720 l/s) and total static pressure of 1.50 inches (38 mm), enter Table 24-1. Table 24-1 shows 5.35 bhp (4 kW) with 616 rpm.

Step 3 – Determine evaporator coil entering air conditions. Mixed air dry bulb temperature determination.

Using the minimum percent of OA (1,000 cfm ÷ 10,000 cfm = 10 percent), determine the mixture dry bulb to the evaporator. RADB + % OA (OADB - RADB) = 80 + (0.10) (95 - 80) = 80 + 1.5 = 81.5°F [26.7 + 1.5 = 28°C).

Approximate wet bulb mixture temperature:

RAWB + OA (OAWB - RAWB) =
66 + (0.10) (76-66) = 68 + 1 = 67°F.

A psychrometric chart can be used to more accurately determine the mixture temperature to the evaporator coil.

Step 4 – Determine total required unit cooling capacity:
Required capacity = total peak load + O.A. load + supply air fan motor heat.

From Figure 16-1, the supply air fan motor heat for 5.85 bhp = 15 MBh.

Capacity = 270 + 15 + 15 =
300 MBh (89 kW)

Step 5 – Determine unit capacity:
From Table 19-2 unit capacity at 81.5 DB/67 WB entering the evaporator, 10,000 supply air cfm, 95°F (35°C) entering the condenser about 305.6 MBh (89.5 kW) with 241 MBh (70.6 kW) sensible.

Step 6 – Determine leaving air temperature:
Unit sensible heat capacity, corrected for supply air fan motor heat 241 - 15 = 226 MBh (66.2 kW).

Supply air dry bulb temperature difference = 226 MBh ÷ (1.085 x 10,000 cfm) = 20.8°F (-6.2°C)

Supply air dry bulb: 81.5-20.8 = 60.7 (15.9°C)

Unit enthalpy difference = 305.6 ÷ (4.5 x 10,000) = 6.79
Btu/lb leaving enthalpy = h (ent WB) = 31.62
Leaving enthalpy = 31.62 Btu/lb - 6.79 Btu/lb = 24.83 Btu/lb.

From Table 17-1, the leaving air wet bulb temperature corresponding to an enthalpy of 24.8 Btu/lb = 57.5.
Leaving air temperatures = 61.7 DB/57.5 WB (15.9/13.9°C).

Selection Procedure

1
Winter outdoor design conditions – 0°F (17.7°C).
2
Total return air temperature – 72°F (22.2°C).
3
Winter outside air minimum ventilation load and cfm – 1,000 cfm and 87.2 MBh.
4
Peak heating load 150 MBh.

Utilizing unit selection in the cooling capacity procedure.
Mixed air temperature = RADB + % O.A. (OADB - RADB) = 72 + (0.10) (0-72) = 64.8°F.
Supply air fan motor heat temperature rise = 20,600 Btu ÷ (1.085 x 10,000) cfm = 1.38°F.
Mixed air temperature entering heat module = 64.8 + 1.58 = 65.38°F.
Total winter heating load = peak heating + ventilation load - total fan motor heat = 150 + 87.2 - 15 = 222.2 MBh.

Electric Heating System
Unit operating on 415 power supply. From Table 23-1, kW may be selected for TC*305 unit to satisfy the winter heating load. The 67 kW module will do the job.

Table 23-1 also shows an air temperature rise of 21.2°F for 10,000 cfm through the 90 kW heat module.

Unit supply temperature at design heating conditions = mixed air temperature + air temperature rise = 65.38 + 21.2 = 86.58°F.

Natural Gas Heating System
Assume natural gas supply – 1000 Btu/ft^3. From Table 23-4, select the low heat module (243 MBh output) to satisfy 222 at unit cfm.

Table 23-4 also shows air temperature rise of 37.3°F for 10,000 cfm through heating module.

Unit supply temperature design heating conditions = mixed air temperature + air temperature rise = 65.38 + 33.5 = 98.89°F.

Air Delivery Procedure
Supply air fan bhp and rpm selection. Unit supply air fan performance shown in Table 23-1 includes pressure drops for dampers and casing losses. Static pressure drops of accessory components such as heating systems, and filters if used, must be added to external unit static pressure for total static pressure determination.

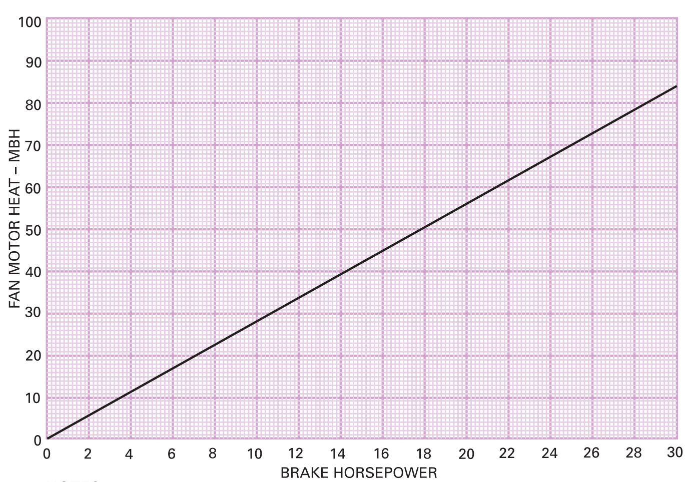
The supply air fan motor selected in the previous cooling capacity determination example was 5.35 bhp with 656 rpm. Thus, the supply fan motor selected is .5 hp.

To select the drive, enter Table 29-1 for a 305 unit. Select the appropriate drive for the applicable rpm range. Drive selection letter E with a range of 625 rpm, is required for 616 rpm. Where altitude is significantly above sea level, use Table 17-2 and 17-3, and Figure 17-1 for applicable correction factors.

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

Unit Designation
After determining specific unit characteristics utilizing the selection procedure and additional job information, the complete unit model number can be developed. Use the model number nomenclature on page 9.

Chart 16-1 – Fan Motor Heat



NOTES:
1. Fan motor heat (MBh) includes 1.1 correction factor for motor efficiency.
2. Capacities shown. Table 12-1 are gross values; heat gain from evaporator fan motor must be included in unit capacity determination.

Performance Adjustment Factors

Table 17-1 – Enthalpy of Saturated Air

Wet Bulb Temperature °F	°C	Btu Per Lb.
40	4.4	15.23
41	5.0	15.70
42	5.5	16.17
43	6.1	16.66
44	6.7	17.15
45	7.2	17.65
46	7.8	18.16
47	8.3	18.68
48	8.9	19.21
49	9.4	19.75
50	10.0	20.30
51	10.6	20.86
52	11.1	21.44
53	11.7	22.02
54	12.2	22.62
55	12.8	23.22
56	13.3	23.84
57	13.9	24.48
58	14.4	25.12
59	15.0	25.78
60	15.6	26.46
61	16.1	27.15
62	16.7	27.85
63	17.2	28.57
64	17.8	29.31
65	18.3	30.06
66	18.9	30.83
67	19.4	31.62
68	20.0	32.42
69	20.6	33.25
70	21.1	34.09
71	21.7	34.95
72	22.2	35.83
73	22.8	36.74
74	23.3	37.66
75	23.9	38.61

Figure 17-1 – Air Density Ratios

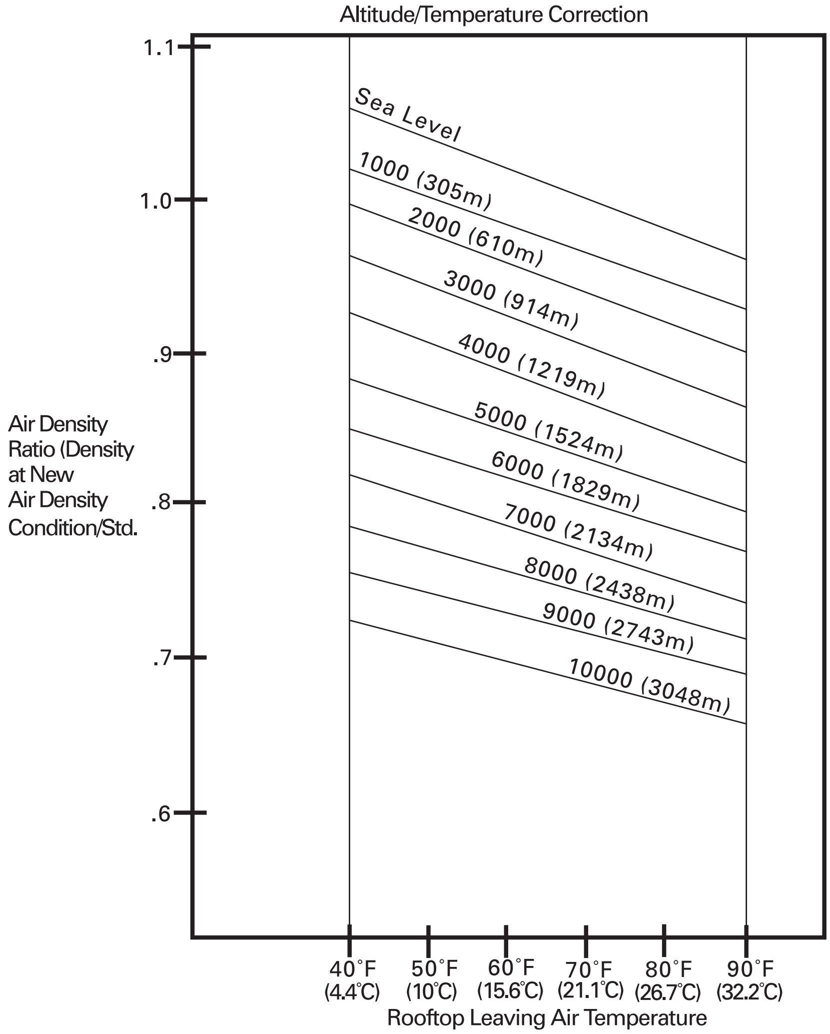


Table 17-2 – Cooling Capacity Altitude Correction Factors

	Altitude ft. (m)							
	Sea Level	1000 (304.8)	2000 (609.6)	3000 (914.4)	4000 (1219.2)	5000 (1524.0)	6000 (1828.8)	7000 (2133.6)
Cooling Capacity Multiplier	1.00	0.99	0.99	0.98	0.97	0.96	0.95	0.94
KW Correction Multiplier (Compressors)	1.00	1.01	1.02	1.03	1.04	1.05	1.06	1.07
SHR Correction Multiplier	1.00	.98	.95	.93	.91	.89	.87	.85
Maximum Condenser Ambient	115°F (46.1°C)	114°F (45.6°C)	113°F (45.0°C)	112°F (44.4°C)	111°F (43.9°C)	110°F (43.3°C)	109°F (42.8°C)	108°F (42.2°C)

Note:
SHR = Sensible Heat Ratio

Table 17-3 – Gas Heating Capacity Altitude Correction Factors

	Altitude ft. (m)						
	Sea Level To 2000 (Sea Level To 609.6)	200 To 2500 (609.9 To 762.0)	2501 To 3500 (762.3 To 1066.8)	3501 To 4500 (1067.1 To 1674.4)	4501 To 5500 (1371.9 To 1675.4)	5501 To 6500 (1676.7 To 1981.2)	6501 To 7500 (1981.5 To 2286.0)
Capacity Multiplier	1.00	.92	.88	.84	.80	.76	.72

Note:
Correction factors are per AGA Std 221.30 – 1964, Part VI, 6.12. Local codes may supersede.

TRANE

Performance Data

Table 18-1 – 23 Ton Gross Cooling Capacities (MBh) **English**

		Ambient Temperature – Deg F																							
		85						95						105						115					
	Ent	Entering Wet Bulb Temperature – Deg F																							
	DB	61		67		73		61		67		73		61		67		73		61		67		73	
CFM	(F)	TGC	SHC	TGC	SHC	TGC	SHC	TGC	SHC	TGC	SHC	TGC	SHC	TGC	SHC	TGC	SHC	TGC	SHC	TGC	SHC	TGC	SHC	TGC	SHC
	75	249	197	277	160	307	111	238	191	264	154	294	105	226	184	251	148	280	99	213	177	238	141	265	93
6900	80	251	232	278	190	308	147	240	226	265	183	295	141	229	219	252	177	280	135	216	212	239	170	266	128
	85	258	258	279	224	309	182	249	249	267	217	295	176	238	238	254	211	281	169	228	228	240	204	267	162
	90	273	273	281	259	310	215	263	263	269	252	297	209	252	252	257	246	283	202	241	241	244	239	268	196
	75	253	205	281	166	312	113	242	199	268	160	298	107	229	192	255	154	283	101	216	185	241	147	268	94
7500	80	256	243	282	197	313	151	245	237	270	191	299	145	233	230	256	184	284	139	220	220	242	177	269	132
	85	266	266	283	234	313	188	256	256	271	227	300	182	245	245	258	220	285	175	234	234	244	214	270	169
	90	281	281	287	271	315	225	270	270	275	265	301	218	259	259	262	258	287	211	248	248	248	248	272	205
	75	256	212	284	170	315	114	244	205	271	164	301	108	232	198	257	157	286	102	219	191	243	150	271	96
8000	80	260	252	285	203	316	155	248	245	273	196	302	149	236	236	259	190	287	142	224	224	245	182	272	136
	85	271	271	287	242	317	194	261	261	274	235	303	187	250	250	261	228	288	181	239	239	247	221	273	174
	90	287	287	291	282	318	232	276	276	279	275	304	225	265	265	265	265	290	219	253	253	253	253	275	212
	75	262	224	290	172	321	117	250	217	276	166	306	111	237	210	262	158	291	105	224	203	248	151	275	98
9000	80	266	266	291	214	322	162	255	255	278	208	307	155	244	244	264	201	292	149	232	232	249	194	277	142
	85	282	282	293	257	323	204	271	271	280	251	309	197	259	259	267	244	294	193	247	247	252	237	278	184
	90	298	298	297	297	324	246	286	286	286	286	310	240	275	275	275	275	295	233	262	262	262	262	280	226
	75	266	236	294	180	326	120	254	229	281	173	311	113	241	222	266	167	295	107	228	215	251	158	279	100
10000	80	274	274	296	225	327	168	263	263	282	218	312	162	251	251	268	211	296	155	239	239	253	204	280	148
	85	290	290	299	272	328	214	279	279	285	266	313	207	267	267	272	259	298	200	255	255	257	252	282	193
	90	307	307	307	307	330	260	295	295	295	295	315	253	283	283	283	283	300	247	270	270	270	270	284	240

Notes:
1. All capacities shown are gross and have not considered indoor fan heat. To obtain net cooling, subtract indoor fan heat.
2. TGC= Total gross capacity.
3. SHC= Sensible heat capacity.

Table 18-2 – 82 kW (23 Tons) Gross Cooling Capacity (kW) **Metric**

		Ambient Temperature – Deg C																							
		29.4						35.0						40.6						46.1					
	Ent	Entering Wet Bulb Temperature – Deg C																							
	DB	16.1		19.4		22.8		16.1		19.4		22.8		16.1		19.4		22.8		16.1		19.4		22.8	
L/s	(C)	TGC	SHC	TGC	SHC	TGC	SHC	TGC	SHC	TGC	SHC	TGC	SHC	TGC	SHC	TGC	SHC	TGC	SHC	TGC	SHC	TGC	SHC	TGC	SHC
	23.9	73.0	57.7	81.2	46.9	90.0	32.5	69.8	56.0	77.4	45.1	86.2	30.8	66.2	53.9	73.6	43.4	82.1	29.0	62.4	51.9	69.8	41.3	77.7	27.2
3260	26.7	73.6	68.0	81.5	55.7	90.3	43.1	70.3	66.2	77.7	53.6	86.5	41.3	67.1	64.2	73.9	51.9	82.1	39.6	63.3	62.1	70.1	49.8	78.0	37.5
	29.4	75.6	75.6	81.8	65.7	90.6	53.3	73.0	73.0	78.3	63.6	86.5	51.6	69.8	69.8	74.4	61.8	82.4	49.5	66.8	66.8	70.3	59.8	78.3	47.5
	32.2	80.0	80.0	82.4	75.9	90.9	63.0	77.1	77.1	78.8	73.9	87.1	61.3	73.9	73.9	75.3	72.1	82.9	59.2	70.6	70.6	71.5	70.1	78.6	57.4
	23.9	74.2	60.1	82.4	48.7	91.4	33.1	70.9	58.3	78.6	46.9	87.3	31.4	67.1	56.3	74.7	45.1	82.9	29.6	63.3	54.2	70.6	43.1	78.6	27.7
3540	26.7	75.0	71.2	82.7	57.7	91.7	44.3	71.8	69.5	79.1	56.0	87.6	42.5	68.3	67.4	75.0	53.9	83.2	40.7	64.5	64.5	70.9	51.9	78.8	38.7
	29.4	78.0	78.0	82.9	68.6	91.7	55.1	75.0	75.0	79.4	66.5	87.9	53.3	71.8	71.8	75.6	64.5	83.5	51.3	68.6	68.6	71.5	62.7	79.1	49.5
	32.2	82.4	82.4	84.1	79.4	92.3	65.9	79.1	79.1	80.6	77.7	88.2	63.9	75.9	75.9	76.8	75.6	84.1	61.8	72.7	72.7	72.7	72.7	79.7	60.1
	23.9	75.0	62.1	83.2	49.8	92.3	33.4	71.5	60.1	79.4	48.1	88.2	31.7	68.0	58.0	75.3	46.0	83.8	29.9	64.2	56.0	71.2	44.0	79.4	28.1
3780	26.7	76.2	73.9	83.5	59.5	92.6	45.4	72.7	71.8	80.0	57.4	88.5	43.7	69.2	69.2	75.9	55.7	84.1	41.6	65.7	65.7	71.8	53.3	79.7	39.9
	29.4	79.4	79.4	84.1	70.9	92.9	56.9	76.5	76.5	80.3	68.9	88.8	54.8	73.3	73.3	76.5	66.8	84.4	53.1	70.1	70.1	72.4	64.8	80.0	51.0
	32.2	84.1	84.1	85.3	82.7	93.2	68.0	80.9	80.9	81.8	80.6	89.1	65.9	77.7	77.7	77.7	77.7	85.0	64.2	74.2	74.2	74.2	74.2	80.6	62.1
	23.9	76.8	65.7	85.0	50.4	94.1	34.3	73.3	63.6	80.9	48.7	89.7	32.5	69.5	61.6	76.8	46.3	85.3	30.8	65.7	59.5	72.7	44.3	80.6	28.8
4250	26.7	78.0	78.0	85.3	62.7	94.4	47.5	74.7	74.7	81.5	61.0	90.0	45.4	71.5	71.5	77.4	58.9	85.6	43.7	68.0	68.0	73.0	56.9	81.2	41.6
	29.4	82.7	82.7	85.9	75.3	94.7	59.8	79.4	79.4	82.1	73.6	90.6	57.7	75.9	75.9	78.3	71.5	86.2	56.6	72.4	72.4	73.9	69.5	81.5	53.9
	32.2	87.3	87.3	87.1	87.1	95.0	72.1	83.8	83.8	83.8	83.8	90.9	70.3	80.6	80.6	80.6	80.6	86.5	68.3	76.8	76.8	76.8	76.8	82.1	66.2
	23.9	78.0	69.2	86.2	52.8	95.6	35.2	74.4	67.1	82.4	50.7	91.2	33.1	70.6	65.1	78.0	48.9	86.5	31.4	66.8	63.0	73.6	46.3	81.8	29.3
4720	26.7	80.3	80.3	86.8	65.9	95.8	49.2	77.1	77.1	82.7	63.9	91.4	47.5	73.6	73.6	78.6	61.8	86.8	45.4	70.1	70.1	74.2	59.8	82.1	43.4
	29.4	85.0	85.0	87.6	79.7	96.1	62.7	81.8	81.8	83.5	78.0	91.7	60.7	78.3	78.3	79.7	75.9	87.3	58.6	74.7	74.7	75.3	73.9	82.7	56.6
	32.2	90.0	90.0	90.0	90.0	96.7	76.2	86.5	86.5	86.5	86.5	92.3	74.2	82.9	82.9	82.9	82.9	87.9	72.4	79.1	79.1	79.1	79.1	83.2	70.3

Notes:
1. All capacities shown are gross and have not considered indoor fan heat. To obtain net cooling, subtract indoor fan heat.
2. TGC= Total gross capacity.
3. SHC= Sensible heat capacity.

Performance Data

Table 19-1 – 25 Ton Gross Cooling Capacities (MBh) **English**

		Ambient Temperature – Deg F: 85						95						105						115					
	Ent	Entering Wet Bulb Temperature – Deg F																							
	DB	61		67		73		61		67		73		61		67		73		61		67		73	
CFM	(F)	TGC	SHC	TGC	SHC	TGC	SHC	TGC	SHC	TGC	SHC	TGC	SHC	TGC	SHC	TGC	SHC	TGC	SHC	TGC	SHC	TGC	SHC	TGC	SHC
	75	273	215	303	175	336	122	260	208	289	168	321	115	247	200	275	161	305	108	233	193	260	155	289	102
7500	80	275	252	304	207	337	160	263	245	290	200	322	154	250	238	276	192	306	147	237	231	261	185	290	140
	85	282	282	305	243	338	198	271	271	291	236	323	191	260	260	277	229	307	184	248	248	263	221	291	177
	90	297	297	308	281	339	234	286	286	294	273	324	227	275	275	280	266	308	220	263	263	266	259	293	212
	75	276	221	307	174	340	123	263	214	293	167	325	117	250	207	278	160	309	110	236	199	263	153	292	103
8000	80	279	261	308	213	341	164	266	254	294	205	325	157	254	247	279	198	310	150	241	239	264	191	293	143
	85	288	288	309	251	341	203	277	277	295	244	326	196	266	266	281	237	310	189	254	254	266	229	294	182
	90	304	304	312	291	343	242	293	293	298	284	328	234	281	281	285	277	312	227	269	269	271	269	296	220
	75	282	234	313	182	347	126	269	227	298	175	331	119	256	219	283	167	314	113	242	211	268	160	297	106
9000	80	286	278	314	224	348	171	274	271	300	217	332	164	260	260	285	209	315	157	248	248	269	202	299	150
	85	299	299	316	267	349	214	288	288	301	260	333	208	276	276	287	252	317	201	263	263	272	245	300	194
	90	316	316	320	311	350	256	304	304	306	304	334	249	292	292	291	291	318	241	279	279	279	279	301	234
	75	288	246	318	189	352	129	274	239	303	182	336	122	260	231	288	175	319	115	246	223	272	166	301	108
10000	80	292	292	320	235	353	177	280	280	305	228	337	170	268	268	289	220	320	163	255	255	274	212	303	156
	85	309	309	322	282	354	224	297	297	307	275	338	216	284	284	292	267	321	211	271	271	277	260	304	202
	90	326	326	326	326	356	270	314	314	314	314	340	263	301	301	301	301	323	255	288	288	287	287	306	248
	75	292	258	323	196	357	131	279	250	307	189	340	124	264	242	292	182	323	117	250	235	276	175	305	110
11000	80	300	300	324	246	358	184	287	287	309	238	341	177	275	275	293	230	324	169	262	262	277	223	307	162
	85	317	317	327	297	359	233	305	305	312	289	343	226	292	292	297	282	326	219	278	278	282	274	308	211
	90	336	336	336	336	361	283	323	323	323	323	344	276	309	309	309	309	328	268	295	295	295	295	310	261

Notes:
1. All capacities shown are gross and have not considered indoor fan heat. To obtain net cooling, subtract indoor fan heat.
2. TGC = Total gross capacity.
3. SHC = Sensible heat capacity.

Table 19-2 – 89 kW (25 Tons) Gross Cooling Capacity (kW) **Metric**

		Ambient Temperature – Deg C: 29.4						35.0						40.6						46.1					
	Ent	Entering Wet Bulb Temperature – Deg C																							
	DB	16.1		19.4		22.8		16.1		19.4		22.8		16.1		19.4		22.8		16.1		19.4		22.8	
L/s	(C)	TGC	SHC	TGC	SHC	TGC	SHC	TGC	SHC	TGC	SHC	TGC	SHC	TGC	SHC	TGC	SHC	TGC	SHC	TGC	SHC	TGC	SHC	TGC	SHC
	23.9	80.0	63.0	88.8	51.3	98.5	35.8	76.2	61.0	84.7	49.2	94.1	33.7	72.4	58.6	80.6	47.2	89.4	31.7	68.3	56.6	76.2	45.4	84.7	29.9
3540	26.7	80.6	73.9	89.1	60.7	98.8	46.9	77.1	71.8	85.0	58.6	94.4	45.1	73.3	69.8	80.9	56.3	89.7	43.1	69.5	67.7	76.5	54.2	85.0	41.0
	29.4	82.7	82.7	89.4	71.2	99.1	58.0	79.4	79.4	85.3	69.2	94.7	56.0	76.2	76.2	81.2	67.1	90.0	53.9	72.7	72.7	77.1	64.8	85.3	51.9
	32.2	87.1	87.1	90.3	82.4	99.4	68.6	83.8	83.8	86.2	80.0	95.0	66.5	80.6	80.6	82.1	78.0	90.3	64.5	77.1	77.1	78.0	75.9	85.9	62.1
	23.9	80.9	64.8	90.0	51.0	99.7	36.1	77.1	62.7	85.9	48.9	95.3	34.3	73.3	60.7	81.5	46.9	90.6	32.2	69.2	58.3	77.1	44.8	85.6	30.2
3780	26.7	81.8	76.5	90.3	62.4	99.9	48.1	78.0	74.4	86.2	60.1	95.3	46.0	74.4	72.4	81.8	58.0	90.9	44.0	70.6	70.1	77.4	56.0	85.9	41.9
	29.4	84.4	84.4	90.6	73.6	99.9	59.5	81.2	81.2	86.5	71.5	95.6	57.4	78.0	78.0	82.4	69.5	90.9	55.4	74.4	74.4	78.0	67.1	86.2	53.3
	32.2	89.1	89.1	91.4	85.3	100.5	70.9	85.9	85.9	87.3	83.2	96.1	68.6	82.4	82.4	83.5	81.2	91.4	66.5	78.8	78.8	79.4	78.8	86.8	64.5
	23.9	82.7	68.6	91.7	53.3	101.7	36.9	78.8	66.5	87.3	51.3	97.0	34.9	75.0	64.2	82.9	48.9	92.0	33.1	70.9	61.8	78.6	46.9	87.1	31.1
4250	26.7	83.8	81.5	92.0	65.7	102.0	50.1	80.3	79.4	87.9	63.6	97.3	48.1	76.2	76.2	83.5	61.3	92.3	46.0	72.7	72.7	78.8	59.2	87.6	44.0
	29.4	87.6	87.6	92.6	78.3	102.3	62.7	84.4	84.4	88.2	76.2	97.6	61.0	80.9	80.9	84.1	73.9	92.9	58.9	77.1	77.1	79.7	71.8	87.9	56.9
	32.2	92.6	92.6	93.8	91.2	102.6	75.0	89.1	89.1	89.7	89.1	97.9	73.0	85.6	85.6	85.3	85.3	93.2	70.6	81.8	81.8	81.8	81.8	88.2	68.6
	23.9	84.4	72.1	93.2	55.4	103.2	37.8	80.3	70.1	88.8	53.3	98.5	35.8	76.2	67.7	84.4	51.3	93.5	33.7	72.1	65.4	79.7	48.7	88.2	31.7
4720	26.7	85.6	85.6	93.8	68.9	103.5	51.9	82.1	82.1	89.4	66.8	98.8	49.8	78.6	78.6	84.7	64.5	93.8	47.8	74.7	74.7	80.3	62.1	88.8	45.7
	29.4	90.6	90.6	94.4	82.7	103.8	65.7	87.1	87.1	90.0	80.6	99.1	63.3	83.2	83.2	85.6	78.3	94.1	61.8	79.4	79.4	81.2	76.2	89.1	59.2
	32.2	95.6	95.6	95.6	95.6	104.3	79.1	92.0	92.0	92.0	92.0	99.7	77.1	88.2	88.2	88.2	88.2	94.7	74.7	84.4	84.4	84.1	84.1	89.7	72.7
	23.9	85.6	75.6	94.7	57.4	104.6	38.4	81.8	73.3	90.0	55.4	99.7	36.3	77.4	70.9	85.6	53.3	94.7	34.3	73.3	68.9	80.9	51.3	89.4	32.2
5190	26.7	87.9	87.9	95.0	72.1	104.9	53.9	84.1	84.1	90.6	69.8	99.9	51.9	80.6	80.6	85.9	67.4	95.0	49.5	76.8	76.8	81.2	65.4	90.0	47.5
	29.4	92.9	92.9	95.8	87.1	105.2	68.3	89.4	89.4	91.4	84.7	100.5	66.2	85.6	85.6	87.1	82.7	95.6	64.2	81.5	81.5	82.7	80.3	90.3	61.8
	32.2	98.5	98.5	98.5	98.5	105.8	82.9	94.7	94.7	94.7	94.7	100.8	80.9	90.6	90.6	90.6	90.6	96.1	78.6	86.5	86.5	86.5	86.5	90.9	76.5

Notes:
1. All capacities shown are gross and have not considered indoor fan heat. To obtain net cooling, subtract indoor fan heat.
2. TGC = Total gross capacity.
3. SHC = Sensible heat capacity.

Performance Data

Table 20-1 – 29 Ton Gross Cooling Capacities (MBh) **English**

		Ambient Temperature – Deg F																							
		85						95						105						115					
	Ent	Entering Wet Bulb Temperature – Deg F																							
	DB	61		67		73		61		67		73		61		67		73		61		67		73	
CFM	(F)	TGC	SHC	TGC	SHC	TGC	SHC	TGC	SHC	TGC	SHC	TGC	SHC	TGC	SHC	TGC	SHC	TGC	SHC	TGC	SHC	TGC	SHC	TGC	SHC
	75	322	264	356	207	394	143	307	256	340	200	376	135	292	248	324	192	358	128	276	239	306	184	339	120
8750	81	327	324	357	262	395	202	313	313	341	255	378	195	299	299	325	246	359	187	285	285	308	238	341	179
	87	347	347	360	320	396	260	334	334	345	312	379	252	321	321	329	304	360	244	306	306	312	296	342	236
	93	369	369	369	369	398	317	356	356	356	356	381	309	342	342	342	342	363	301	327	327	327	327	345	292
	75	323	268	358	207	396	143	309	260	342	200	378	136	294	252	325	192	360	128	277	243	307	187	341	121
9000	81	330	330	359	266	397	204	315	315	343	258	379	197	302	302	326	250	361	189	288	288	309	242	342	181
	87	350	350	362	325	398	263	337	337	347	318	380	255	324	324	331	310	362	247	309	309	314	301	343	239
	93	373	373	373	373	400	322	359	359	359	359	383	314	345	345	345	345	365	306	330	330	330	330	346	297
	75	330	283	364	216	402	146	315	275	347	208	384	139	299	266	330	201	365	131	283	258	312	192	345	123
10000	81	339	339	365	280	403	213	326	326	349	272	385	205	312	312	332	264	366	198	297	297	314	256	347	190
	87	362	362	370	346	405	277	348	348	354	338	387	269	334	334	338	330	368	261	319	319	319	319	349	253
	93	386	386	386	386	408	342	372	372	372	372	390	334	357	357	357	357	371	325	341	341	341	341	352	317
	75	335	297	369	225	407	149	320	289	352	217	388	141	304	281	335	209	369	134	287	272	316	201	349	126
11000	81	348	348	371	294	409	222	335	335	354	286	390	214	320	320	337	278	371	206	305	305	319	269	351	198
	87	372	372	377	366	410	291	358	358	361	358	392	283	344	344	343	343	373	275	328	328	328	328	353	266
	93	398	398	397	397	414	361	383	383	383	383	396	353	367	367	367	367	377	345	351	351	351	351	358	336
	75	340	311	373	233	411	151	325	303	356	225	392	144	309	295	338	217	373	136	292	286	320	209	353	129
12000	81	357	357	376	308	413	230	343	343	359	300	395	222	328	328	341	291	375	214	312	312	323	283	355	206
	87	382	382	382	382	415	304	367	367	367	367	397	296	352	352	352	352	377	288	336	336	336	336	357	279
	93	408	408	408	408	420	380	393	393	393	393	402	372	376	376	376	376	383	364	360	360	360	360	363	356

Notes:
1. All capacities shown are gross and have not considered indoor fan heat. To obtain net cooling, subtract indoor fan heat.
2. TGC = Total gross capacity.
3. SHC = Sensible heat capacity.

Table 20-2 – 105 kW (29 Ton) Gross Cooling Capacity (kW) **Metric**

		Ambient Temperature – Deg C																							
		29.4						35.0						40.6						46.1					
	Ent	Entering Wet Bulb Temperature – Deg C																							
	DB	16.1		19.4		22.8		16.1		19.4		22.8		16.1		19.4		22.8		16.1		19.4		22.8	
L/s	(C)	TGC	SHC	TGC	SHC	TGC	SHC	TGC	SHC	TGC	SHC	TGC	SHC	TGC	SHC	TGC	SHC	TGC	SHC	TGC	SHC	TGC	SHC	TGC	SHC
	23.9	94.4	77.4	104.3	60.7	115.5	41.9	90.0	75.0	99.7	58.6	110.2	39.6	85.6	72.7	95.0	56.3	104.9	37.5	80.9	70.1	89.7	53.9	99.4	35.2
4130	27.2	95.8	95.0	104.6	76.8	115.8	59.2	91.7	91.7	99.9	74.7	110.8	57.2	87.6	87.6	95.3	72.1	105.2	54.8	83.5	83.5	90.3	69.8	99.9	52.5
	30.6	101.7	101.7	105.5	93.8	116.1	76.2	97.9	97.9	101.1	91.4	111.1	73.9	94.1	94.1	96.4	89.1	105.5	71.5	89.7	89.7	91.4	86.8	100.2	69.2
	33.9	108.2	108.2	108.2	108.2	116.7	92.9	104.3	104.3	104.3	104.3	111.7	90.6	100.2	100.2	100.2	100.2	106.4	88.2	95.8	95.8	95.8	95.8	101.1	85.6
	23.9	94.7	78.6	104.9	60.7	116.1	41.9	90.6	76.2	100.2	58.6	110.8	39.9	86.2	73.9	95.3	56.3	105.5	37.5	81.2	71.2	90.0	54.8	99.9	35.5
4250	27.2	96.7	96.7	105.2	78.0	116.4	59.8	92.3	92.3	100.5	75.6	111.1	57.7	88.5	88.5	95.6	73.3	105.8	55.4	84.4	84.4	90.6	70.9	100.2	53.1
	30.6	102.6	102.6	106.1	95.3	116.7	77.1	98.8	98.8	101.7	93.2	111.4	74.7	95.0	95.0	97.0	90.9	106.1	72.4	90.6	90.6	92.0	88.2	100.5	70.1
	33.9	109.3	109.3	109.3	109.3	117.2	94.4	105.2	105.2	105.2	105.2	112.3	92.0	101.1	101.1	101.1	101.1	107.0	89.7	96.7	96.7	96.7	96.7	101.4	87.1
	23.9	96.7	82.9	106.7	63.3	117.8	42.8	92.3	80.6	101.7	61.0	112.6	40.7	87.6	78.0	96.7	58.9	107.0	38.4	82.9	75.6	91.4	56.3	101.1	36.1
4720	27.2	99.4	99.4	107.0	82.1	118.1	62.4	95.6	95.6	102.3	79.7	112.8	60.1	91.4	91.4	97.3	77.4	107.3	58.0	87.1	87.1	92.0	75.0	101.7	55.7
	30.6	106.1	106.1	108.4	101.4	118.7	81.2	102.0	102.0	103.8	99.1	113.4	78.8	97.9	97.9	99.1	96.7	107.9	76.5	93.5	93.5	93.5	93.5	102.3	74.2
	33.9	113.1	113.1	113.1	113.1	119.6	100.2	109.0	109.0	109.0	109.0	114.3	97.9	104.6	104.6	104.6	104.6	108.7	95.3	99.9	99.9	99.9	99.9	103.2	92.9
	23.9	98.2	87.1	108.2	65.9	119.3	43.7	93.8	84.7	103.2	63.6	113.7	41.3	89.1	82.4	98.2	61.3	108.2	39.3	84.1	79.7	92.6	58.9	102.3	36.9
5190	27.2	102.0	102.0	108.7	86.2	119.9	65.1	98.2	98.2	103.8	83.8	114.3	62.7	93.8	93.8	98.8	81.5	108.7	60.4	89.4	89.4	93.5	78.8	102.9	58.0
	30.6	109.0	109.0	110.5	107.3	120.2	85.3	104.9	104.9	105.8	104.9	114.9	82.9	100.8	100.8	100.5	100.5	109.3	80.6	96.1	96.1	96.1	96.1	103.5	78.0
	33.9	116.7	116.7	116.4	116.4	121.3	105.8	112.3	112.3	112.3	112.3	116.1	103.5	107.6	107.6	107.6	107.6	110.5	101.1	102.9	102.9	102.9	102.9	104.9	98.5
	23.9	99.7	91.2	109.3	68.3	120.5	44.3	95.3	88.8	104.3	65.9	114.9	42.2	90.6	86.5	99.1	63.6	109.3	39.9	85.6	83.8	93.8	61.3	103.5	37.8
5660	27.2	104.6	104.6	110.2	90.3	121.1	67.4	100.5	100.5	105.2	87.9	115.8	65.1	96.1	96.1	99.9	85.3	109.9	62.7	91.4	91.4	94.7	82.9	104.1	60.4
	30.6	112.0	112.0	112.0	112.0	121.6	89.1	107.6	107.6	107.6	107.6	116.4	86.8	103.2	103.2	103.2	103.2	110.5	84.4	98.5	98.5	98.5	98.5	104.6	81.8
	33.9	119.6	119.6	119.6	119.6	123.1	111.4	115.2	115.2	115.2	115.2	117.8	109.0	110.2	110.2	110.2	110.2	112.3	106.7	105.5	105.5	105.5	105.5	106.4	104.3

Notes:
1. All capacities shown are gross and have not considered indoor fan heat. To obtain net cooling, subtract indoor fan heat.
2. TGC = Total gross capacity.
3. SHC = Sensible heat capacity.

Performance Data

Table 21-1 – 33 Ton Gross Cooling Capacities (MBh) **English**

		Ambient Temperature – Deg F																							
		85						95						105						115					
	Ent	Entering Wet Bulb Temperature – Deg F																							
	DB	61		67		73		61		67		73		61		67		73		61		67		73	
CFM	(F)	TGC	SHC	TGC	SHC	TGC	SHC	TGC	SHC	TGC	SHC	TGC	SHC	TGC	SHC	TGC	SHC	TGC	SHC	TGC	SHC	TGC	SHC	TGC	SHC
	75	365	283	407	231	453	161	347	273	387	221	431	151	328	261	367	211	409	141	309	250	346	200	386	131
10000	80	368	333	408	274	454	213	350	322	389	263	432	203	332	311	368	252	410	192	313	300	348	241	388	181
	85	377	377	410	322	455	263	360	360	390	311	433	252	344	344	370	300	411	241	328	328	350	289	389	230
	90	397	397	413	371	457	311	381	381	394	361	435	300	365	365	375	350	414	289	347	347	355	338	391	278
	75	372	296	414	233	461	164	354	285	394	222	439	154	334	274	373	211	416	144	315	263	351	200	392	134
11000	80	376	351	416	286	462	220	358	340	396	275	440	210	334	334	375	263	417	199	318	318	354	252	394	188
	85	388	388	418	338	463	274	372	372	398	327	441	263	356	356	377	316	418	252	338	338	356	304	395	240
	90	411	411	422	392	465	326	394	394	403	381	443	315	377	377	377	377	421	303	359	359	359	359	398	292
	75	378	309	421	241	467	167	359	298	399	230	445	157	340	286	378	218	421	147	320	275	356	207	397	136
12000	80	384	367	423	297	468	227	361	361	402	286	446	216	344	344	381	274	423	205	328	326	359	263	399	194
	85	400	400	425	354	470	284	383	383	405	342	448	273	366	366	384	331	425	262	348	348	362	320	401	250
	90	423	423	431	412	472	340	406	406	405	405	450	329	388	388	388	388	427	317	370	370	371	368	403	306
	75	384	321	426	248	473	170	365	310	405	237	450	160	345	298	383	225	426	149	325	286	361	214	402	138
13000	80	386	386	429	308	474	233	370	370	408	297	452	223	354	352	386	285	428	212	335	335	364	273	404	201
	85	410	410	431	368	476	294	393	393	411	357	453	283	375	375	389	346	430	271	357	357	368	334	406	260
	90	434	434	433	433	478	354	416	416	416	416	456	342	398	398	399	398	432	331	379	379	379	379	408	319
	75	392	339	434	275	481	175	372	328	412	264	457	164	352	316	390	253	433	153	331	304	367	241	408	144
14600	80	402	400	437	325	482	243	382	382	415	313	459	232	364	364	393	302	435	221	346	346	370	290	409	210
	85	424	424	440	392	484	309	406	406	419	380	461	298	388	388	398	369	437	286	369	369	375	357	412	275
	90	449	449	451	450	487	375	431	431	431	431	463	363	412	412	411	411	440	352	392	392	392	392	415	340

Notes:
1. All capacities shown are gross and have not considered indoor fan heat. To obtain net cooling, subtract indoor fan heat.
2. TGC = Total gross capacity.
3. SHC = Sensible heat capacity.

Table 21-2 – 120 kW (33 Ton) Gross Cooling Capacity (kW) **Metric**

		Ambient Temperature – Deg C																							
		29.4						35.0						40.6						46.1					
	Ent	Entering Wet Bulb Temperature – Deg C																							
	DB	16.1		19.4		22.8		16.1		19.4		22.8		16.1		19.4		22.8		16.1		19.4		22.8	
L/s	(C)	TGC	SHC	TGC	SHC	TGC	SHC	TGC	SHC	TGC	SHC	TGC	SHC	TGC	SHC	TGC	SHC	TGC	SHC	TGC	SHC	TGC	SHC	TGC	SHC
	23.9	107.0	82.9	119.3	67.7	132.8	47.2	101.7	80.0	113.4	64.8	126.3	44.3	96.1	76.5	107.6	61.8	119.9	41.3	90.6	73.3	101.4	58.6	113.1	38.4
4720	26.7	107.9	97.6	119.6	80.3	133.1	62.4	102.6	94.4	114.0	77.1	126.6	59.5	97.3	91.2	107.9	73.9	120.2	56.3	91.7	87.9	102.0	70.6	113.7	53.1
	29.4	110.5	110.5	120.2	94.4	133.4	77.1	105.5	105.5	114.3	91.2	126.9	73.9	100.8	100.8	108.4	87.9	120.5	70.6	96.1	96.1	102.6	84.7	114.0	67.4
	32.2	116.4	116.4	121.1	108.7	133.9	91.2	111.7	111.7	115.5	105.8	127.5	87.9	107.0	107.0	109.9	102.6	121.3	84.7	101.7	101.7	104.1	99.1	114.6	81.5
	23.9	109.0	86.8	121.3	68.3	135.1	48.1	103.8	83.5	115.5	65.1	128.7	45.1	97.9	80.3	109.3	61.8	121.9	42.2	92.3	77.1	102.9	58.6	114.9	39.3
5190	26.7	110.2	102.9	121.9	83.8	135.4	64.5	104.9	99.7	116.1	80.6	129.0	61.6	97.9	97.9	109.9	77.1	122.2	58.3	93.2	93.2	103.8	73.9	115.5	55.1
	29.4	113.7	113.7	122.5	99.1	135.7	80.3	109.0	109.0	116.7	95.8	129.3	77.1	104.3	104.3	110.5	92.6	122.5	73.9	99.1	99.1	104.3	89.1	115.8	70.3
	32.2	120.5	120.5	123.7	114.9	136.3	95.6	115.5	115.5	118.1	111.7	129.8	92.3	110.5	110.5	110.5	110.5	123.4	88.8	105.2	105.2	105.2	105.2	116.7	85.6
	23.9	110.8	90.6	123.4	70.6	136.9	48.9	105.2	87.3	116.9	67.4	130.4	46.0	99.7	83.8	110.8	63.9	123.4	43.1	93.8	80.6	104.3	60.7	116.4	39.9
5660	26.7	112.6	107.6	124.0	87.1	137.2	66.5	105.8	105.8	117.8	83.8	130.7	63.3	100.8	100.8	111.7	80.3	124.0	60.1	96.1	95.6	105.2	77.1	116.9	56.9
	29.4	117.2	117.2	124.6	103.8	137.8	83.2	112.3	112.3	118.7	100.2	131.3	80.0	107.3	107.3	112.6	97.0	124.6	76.8	102.0	102.0	106.1	93.8	117.5	73.3
	32.2	124.0	124.0	126.3	120.8	138.3	99.7	119.0	119.0	118.7	118.7	131.9	96.4	113.7	113.7	113.7	113.7	125.2	92.9	108.4	108.4	108.7	107.9	118.1	89.7
	23.9	112.6	94.1	124.9	72.7	138.6	49.8	107.0	90.9	118.7	69.5	131.9	46.9	101.1	87.3	112.3	65.9	124.9	43.7	95.3	83.8	105.8	62.7	117.8	40.4
6140	26.7	113.1	113.1	125.7	90.3	138.9	68.3	108.4	108.4	119.6	87.1	132.5	65.4	103.8	103.2	113.1	83.5	125.4	62.1	98.2	98.2	106.7	80.0	118.4	58.9
	29.4	120.2	120.2	126.3	107.9	139.5	86.2	115.2	115.2	120.5	104.6	132.8	82.9	109.9	109.9	114.0	101.4	126.0	79.4	104.6	104.6	107.9	97.9	119.0	76.2
	32.2	127.2	127.2	126.9	126.9	140.1	103.8	121.9	121.9	121.9	121.9	133.7	100.2	116.7	116.7	116.9	116.7	126.6	97.0	111.1	111.1	111.1	111.1	119.6	93.5
	23.9	114.9	99.4	127.2	80.6	141.0	51.3	109.0	96.1	120.8	77.4	133.9	48.1	103.2	92.6	114.3	74.2	126.9	44.8	97.0	89.1	107.6	70.6	119.6	42.2
6890	26.7	117.8	117.2	128.1	95.3	141.3	71.2	112.0	112.0	121.6	91.7	134.5	68.0	106.7	106.7	115.2	88.5	127.5	64.8	101.4	101.4	108.4	85.0	119.9	61.6
	29.4	124.3	124.3	129.0	114.9	141.9	90.6	119.0	119.0	122.8	111.4	135.1	87.3	113.7	113.7	116.7	108.2	128.1	83.8	108.2	108.2	109.9	104.6	120.8	80.6
	32.2	131.6	131.6	132.2	131.9	142.7	109.9	126.3	126.3	126.3	126.3	135.7	106.4	120.8	120.8	120.5	120.5	129.0	103.2	114.9	114.9	114.9	114.9	121.6	99.7

Notes:
1. All capacities shown are gross and have not considered indoor fan heat. To obtain net cooling, subtract indoor fan heat.
2. TGC = Total gross capacity.
3. SHC = Sensible heat capacity.

Performance Data

Table 22-1 – 42 Ton Gross Cooling Capacities (MBh) **English**

		Ambient Temperature – Deg F																							
		85						95						105						115					
	Ent	Entering Wet Bulb Temperature – Deg F																							
	DB	61		67		73		61		67		73		61		67		73		61		67		73	
CFM	(F)	TGC	SHC	TGC	SHC	TGC	SHC	TGC	SHC	TGC	SHC	TGC	SHC	TGC	SHC	TGC	SHC	TGC	SHC	TGC	SHC	TGC	SHC	TGC	SHC
	75	455	365	505	292	559	200	433	353	481	277	533	188	411	340	456	260	505	176	387	326	430	247	477	164
12500	80	461	433	506	351	560	268	440	420	482	338	534	256	418	407	458	325	507	243	394	394	432	312	479	231
	85	476	476	509	416	561	334	457	457	486	403	536	322	437	437	461	390	508	309	416	416	435	377	480	296
	90	502	502	515	482	563	398	483	483	492	470	537	386	462	462	468	457	510	373	440	440	440	440	482	360
	75	462	379	512	293	566	203	440	367	487	281	539	191	417	353	462	268	511	179	392	340	435	255	482	167
13500	80	469	451	513	363	567	275	448	439	489	350	540	263	422	422	464	337	513	250	401	401	437	324	484	238
	85	488	488	516	433	569	346	469	469	493	420	542	333	448	448	468	407	514	321	426	426	442	394	486	308
	90	515	515	524	504	570	414	495	495	501	492	544	402	474	474	473	473	516	389	451	451	451	451	488	375
	75	468	393	517	301	572	205	446	380	493	289	545	194	422	367	467	276	516	182	398	353	440	263	487	169
14500	80	477	470	519	375	573	282	452	452	494	362	546	270	431	431	469	349	518	257	410	410	442	336	489	244
	85	499	499	523	450	575	357	479	479	499	437	548	345	458	458	474	424	519	331	435	435	447	410	490	318
	90	527	527	532	526	577	430	506	506	506	506	550	417	484	484	484	484	522	404	461	461	461	461	493	390
	75	474	406	523	309	577	208	451	393	498	297	550	196	427	380	471	284	521	184	402	366	444	271	491	171
15500	80	481	481	524	387	579	289	461	461	499	374	551	276	440	440	473	361	522	264	417	417	446	347	493	251
	85	509	509	529	466	580	368	488	488	505	453	552	355	467	467	479	440	524	342	444	444	453	426	494	328
	90	537	537	537	537	583	445	516	516	516	516	556	432	494	494	493	493	527	419	470	470	470	470	498	405
	75	479	419	527	317	582	211	456	406	502	304	554	199	432	393	475	292	525	186	407	379	447	277	494	174
16500	80	489	489	529	399	583	295	469	469	504	386	556	283	447	447	478	373	527	270	425	425	450	359	496	258
	85	518	518	535	482	585	378	497	497	510	469	557	365	475	475	485	456	528	352	451	451	458	442	498	339
	90	547	547	547	547	588	460	525	525	525	525	561	447	502	502	502	502	532	434	478	478	478	478	503	420

Notes:
1. All capacities shown are gross and have not considered indoor fan heat. To obtain net cooling, subtract indoor fan heat.
2. TGC = Total gross capacity.
3. SHC = Sensible heat capacity.

Table 22-2 – 148 kW (42 Ton) Gross Cooling Capacity (kW) **Metric**

		Ambient Temperature – Deg C																							
		29.4						35.0						40.6						46.1					
	Ent	Entering Wet Bulb Temperature – Deg C																							
	DB	16.1		19.4		22.8		16.1		19.4		22.8		16.1		19.4		22.8		16.1		19.4		22.8	
L/s	(C)	TGC	SHC	TGC	SHC	TGC	SHC	TGC	SHC	TGC	SHC	TGC	SHC	TGC	SHC	TGC	SHC	TGC	SHC	TGC	SHC	TGC	SHC	TGC	SHC
	23.9	133.4	107.0	148.0	85.6	163.8	58.6	126.9	103.5	141.0	81.2	156.2	55.1	120.5	99.7	133.7	76.2	148.0	51.6	113.4	95.6	126.0	72.4	139.8	48.1
5900	26.7	135.1	126.9	148.3	102.9	164.1	78.6	129.0	123.1	141.3	99.1	156.5	75.0	122.5	119.3	134.2	95.3	148.6	71.2	115.5	115.5	126.6	91.4	140.4	67.7
	29.4	139.5	139.5	149.2	121.9	164.4	97.9	133.9	133.9	142.4	118.1	157.1	94.4	128.1	128.1	135.1	114.3	148.9	90.6	121.9	121.9	127.5	110.5	140.7	86.8
	32.2	147.1	147.1	150.9	141.3	165.0	116.7	141.6	141.6	144.2	137.8	157.4	113.1	135.4	135.4	137.2	133.9	149.5	109.3	129.0	129.0	129.0	129.0	141.3	105.5
	23.9	135.4	111.1	150.1	85.9	165.9	59.5	129.0	107.6	142.7	82.4	158.0	56.0	122.2	103.5	135.4	78.6	149.8	52.5	114.9	99.7	127.5	74.7	141.3	48.9
6370	26.7	137.5	132.2	150.4	106.4	166.2	80.6	131.3	128.7	143.3	102.6	158.3	77.1	123.7	123.7	136.0	98.8	150.4	73.3	117.5	117.5	128.1	95.0	141.9	69.8
	29.4	143.0	143.0	151.2	126.9	166.8	101.4	137.5	137.5	144.5	123.1	158.9	97.6	131.3	131.3	137.2	119.3	150.7	94.1	124.9	124.9	129.6	115.5	142.4	90.3
	32.2	150.9	150.9	153.6	147.7	167.1	121.3	145.1	145.1	146.8	144.2	159.4	117.8	138.9	138.9	138.6	138.6	151.2	114.0	132.2	132.2	132.2	132.2	143.0	109.9
	23.9	137.2	115.2	151.5	88.2	167.7	60.1	130.7	111.4	144.5	84.7	159.7	56.9	123.7	107.6	136.9	80.9	151.2	53.3	116.7	103.5	129.0	77.1	142.7	49.5
6840	26.7	139.8	137.8	152.1	109.9	167.9	82.7	132.5	132.5	144.8	106.1	160.0	79.1	126.3	126.3	137.5	102.3	151.8	75.3	120.2	120.2	129.6	98.5	143.3	71.5
	29.4	146.3	146.3	153.3	131.9	168.5	104.6	140.4	140.4	146.3	128.1	160.6	101.1	134.2	134.2	138.9	124.3	152.1	97.0	127.5	127.5	131.0	120.2	143.6	93.2
	32.2	154.5	154.5	155.9	154.2	169.1	126.0	148.3	148.3	148.3	148.3	161.2	122.2	141.9	141.9	141.9	141.9	153.0	118.4	135.1	135.1	135.1	135.1	144.5	114.3
	23.9	138.9	119.0	153.3	90.6	169.1	61.0	132.2	115.2	146.0	87.1	161.2	57.4	125.2	111.4	138.1	83.2	152.7	53.9	117.8	107.3	130.1	79.4	143.9	50.1
7320	26.7	141.0	141.0	153.6	113.4	169.7	84.7	135.1	135.1	146.3	109.6	161.5	80.9	129.0	129.0	138.6	105.8	153.0	77.4	122.2	122.2	130.7	101.7	144.5	73.6
	29.4	149.2	149.2	155.0	136.6	170.0	107.9	143.0	143.0	148.0	132.8	161.8	104.1	136.9	136.9	140.4	129.0	153.6	100.2	130.1	130.1	132.8	124.9	144.8	96.1
	32.2	157.4	157.4	157.4	157.4	170.9	130.4	151.2	151.2	151.2	151.2	163.0	126.6	144.8	144.8	144.5	144.5	154.5	122.8	137.8	137.8	137.8	137.8	146.0	118.7
	23.9	140.4	122.8	154.5	92.9	170.6	61.8	133.7	119.0	147.1	89.1	162.4	58.3	126.6	115.2	139.2	85.6	153.9	54.5	119.3	111.1	131.0	81.2	144.8	51.0
7790	26.7	143.3	143.3	155.0	116.9	170.9	86.5	137.5	137.5	147.7	113.1	163.0	82.9	131.0	131.0	140.1	109.3	154.5	79.1	124.6	124.6	131.9	105.2	145.4	75.6
	29.4	151.8	151.8	156.8	141.3	171.5	110.8	145.7	145.7	149.5	137.5	163.3	107.0	139.2	139.2	142.2	133.7	154.8	103.2	132.2	132.2	134.2	129.6	146.0	99.4
	32.2	160.3	160.3	160.3	160.3	172.3	134.8	153.9	153.9	153.9	153.9	164.4	131.0	147.1	147.1	147.1	147.1	155.9	127.2	140.1	140.1	140.1	140.1	147.4	123.1

Notes:
1. All capacities shown are gross and have not considered indoor fan heat. To obtain net cooling, subtract indoor fan heat.
2. TGC = Total gross capacity.
3. SHC = Sensible heat capacity.

Performance Data

Table 23-1 – Electric Heat Air Temperature Rise (Degrees F) **English**

Heater	Total	CFM										
Input (kW)	MBh	7000	8000	9000	10000	11000	12000	13000	14000	15000	16000	17000
26.9	92	12.1	10.6	9.4	8.5	7.7	7.1	–	–	–	–	–
40.4	138	18.2	15.9	14.1	12.7	11.6	10.6	9.8	9.1	8.5	7.9	7.5
53.8	184	24.2	21.2	18.8	16.9	15.4	14.1	13.0	12.1	11.3	10.6	10.0
67.3	230	30.2	26.5	23.5	21.2	19.2	17.6	16.3	15.1	14.1	13.2	12.5
80.7	276	–	–	–	25.4	23.1	21.2	19.5	18.1	16.9	15.9	14.9

Notes:
1. Air temperature rise = (kW x 3413)/(scfm x 1.085).
2. All heaters on constant volume units provide 2 increments of capacity.
3. Air temperature rise in this table are based on heater operating at 415 volts.

Table 23-2 – Electric Heat Air Temperature Rise (Degrees Celsius) **Metric**

Heater	L/s										
Input (kW)	3300	3780	4250	4720	5190	5660	6140	6610	7080	7550	8020
26.9	6.8	5.9	5.3	4.7	4.3	4.0	—	—	—	—	—
40.4	10.2	8.9	7.9	7.1	6.5	5.9	5.5	5.1	4.8	4.5	4.2
53.8	13.6	11.9	10.5	9.5	8.6	7.9	7.3	6.8	6.3	5.9	5.6
67.3	17.0	14.8	13.2	11.9	10.8	9.9	9.1	8.5	7.9	7.4	7.0
80.7	—	—	—	14.2	13.0	11.9	11.0	10.2	9.5	8.9	8.4

Notes:
1. Air temperature rise in this table are based on heater operating at 415 volts.
2. All heaters on constant volume units provide 2 increments of capacity.

Table 23-3 – Available Electric Heat KW Ranges

Nominal Unit Size Tons	Nominal Voltage (v) 380	415
22.9	23-56	27-67
25.0	23-56	27-67
29.2	23-56	27-67
33.3	34-68	40-81
42.7	34-68	40-81

Notes:
1. KW ranges in this table are based on heater operating at nominal voltages 380 or 415.

Table 23-4 – Natural Gas Heating Capacities

Tons	Unit Model No.	Heat Input MBh (KW) (See Note 1)	Heating Output MBh (KW) (See Note 1)	Air Temp. Rise, F (C)
22.9-29.2	YCD/YCH275**L YCD/YCH300**L YCD/YCH350**L	290,000 (85)	243,000 (69)	10-40 (-12.2 , 4.4)
22.9-29.2	YCD/YCH275**H YCD/YCH300**H YCD/YCH350**H	500,000 (147)	405,000 (119)	25-55 (-3.9 , 12.8)
33.3-42.7	YCD/YCH400**L YCD/YCH500**L	335,000 (98)	271,350 (80)	5-35 (-15 , 1.6)
33.3-42.7	YCD/YCH400**H YCD/YCH500**H	670,000 (196)	542,700 (159)	20-50 (-6.7 , 10)

Note:
1. Total heating capacity.

Performance Data

Table 24-1 – Supply Fan Performance – 23-29 Ton **English**

	Static Pressure (in. wg)																	
	0.25		0.50		0.75		1.00		1.25		1.50		1.75		2.00		2.25	
SCFM	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
6670.	307.	0.92	371.	1.30	431.	1.75	490.	2.29	544.	2.86	593.	3.46	639.	4.08	681.	4.71	720.	5.36
7085.	317.	1.05	380.	1.46	436.	1.90	493.	2.44	546.	3.03	595.	3.65	640.	4.30	683.	4.96	722.	5.63
7500.	328.	1.20	390.	1.63	442.	2.07	496.	2.61	548.	3.21	597.	3.85	642.	4.52	684.	5.21	724.	5.91
7915.	339.	1.36	399.	1.81	449.	2.26	500.	2.80	551.	3.41	599.	4.06	644.	4.75	686.	5.46	726.	6.18
8330.	350.	1.53	408.	2.00	458.	2.48	505.	3.00	554.	3.62	601.	4.29	646.	4.99	687.	5.72	727.	6.47
8745.	361.	1.72	417.	2.21	467.	2.72	511.	3.23	558.	3.85	604.	4.53	648.	5.24	689.	5.99	729.	6.76
9160.	372.	1.92	427.	2.44	477.	2.98	519.	3.49	563.	4.10	608.	4.78	651.	5.51	691.	6.27	731.	7.06
9575.	384.	2.14	437.	2.68	486.	3.24	528.	3.79	569.	4.37	611.	5.05	654.	5.80	694.	6.57	733.	7.37
9990.	395.	2.38	448.	2.95	495.	3.52	537.	4.11	575.	4.68	616.	5.35	657.	6.10	697.	6.89	735.	7.70
10405.	407.	2.65	459.	3.24	504.	3.82	547.	4.45	583.	5.02	622.	5.68	661.	6.42	700.	7.22	738.	8.05
10820.	419.	2.94	470.	3.54	514.	4.14	556.	4.79	593.	5.40	628.	6.04	666.	6.77	704.	7.57	741.	8.42
11235.	432.	3.25	481.	3.87	524.	4.49	565.	5.15	602.	5.81	636.	6.43	671.	7.15	708.	7.95	744.	8.80
11650.	444.	3.59	492.	4.21	534.	4.86	574.	5.53	612.	6.23	645.	6.87	678.	7.57	713.	8.36	748.	9.21
12065.	457.	3.94	503.	4.57	544.	5.26	583.	5.93	621.	6.67	654.	7.35	685.	8.02	719.	8.80	753.	9.64

Notes:
1. Fan performance table includes internal resistances of cabinet, wet coil and 2” (50 mm) standard filters. For other components refer to component pressure drop table.
2. The pressure drops from the supply fan to the space should not exceed 2.25” positive.
3. Maximum air flow for 23 ton unit is 10080 CFM, 25 ton is 11000 CFM, 29 ton is 12000 CFM.
4. Maximum motor HP 23 ton unit is 10 HP, 25 ton is 10 HP, 29 ton unit is 15 HP.

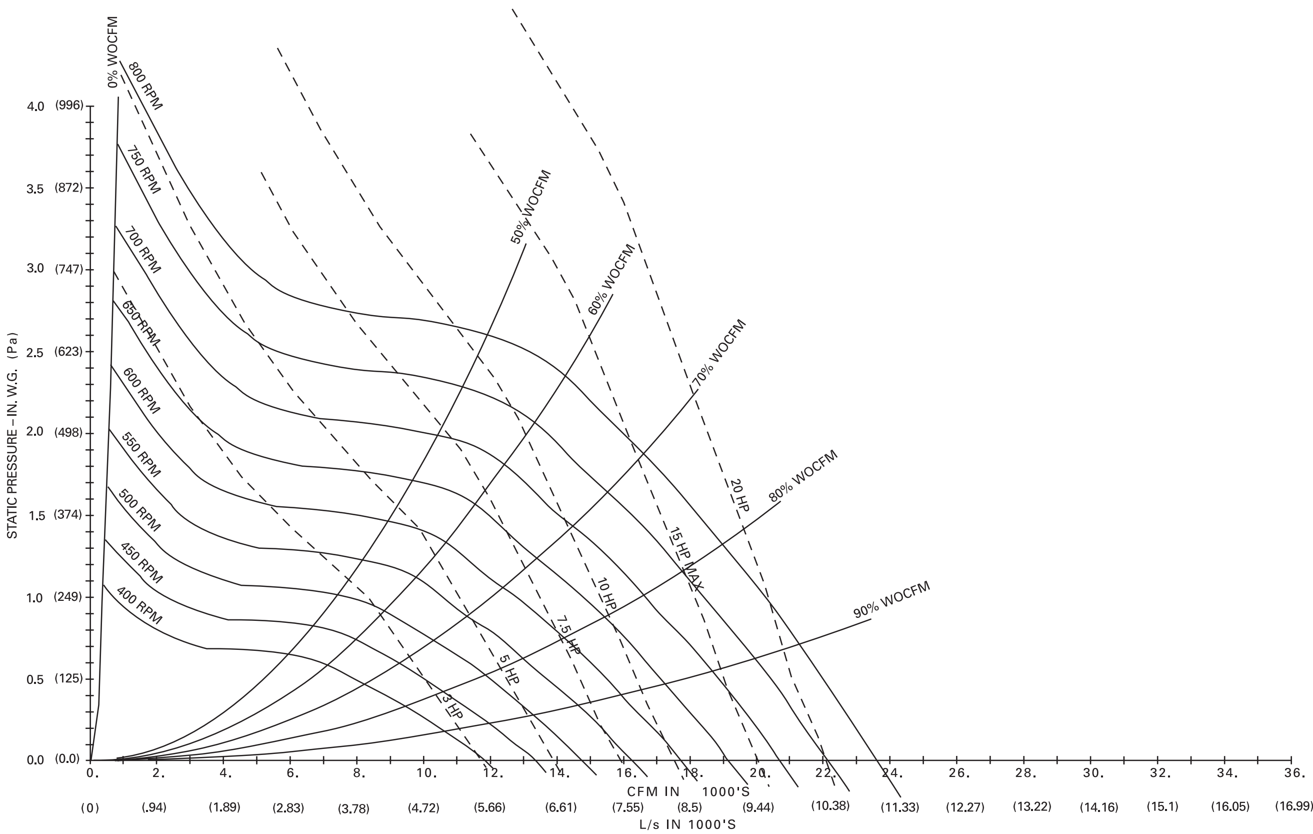
Table 24-2 – Supply Fan Performance – 82-105 KW **Metric**

	Static Pressure (Pascals)																	
	62.9		124.1		186.2		248.3		310.4		372.5		434.6		496.7		558.8	
(L/s)	RPM	(kW)	RPM	(kW)	RPM	(kW)	RPM	(kW)	RPM	(kW)	RPM	(kW)	RPM	(kW)	RPM	(kW)	RPM	(kW)
3148.	307.	0.68	371.	0.97	431.	1.31	490.	1.70	544.	2.13	593.	2.58	639.	3.04	681.	3.51	720.	4.00
3344.	317.	0.78	380.	1.09	436.	1.42	493.	1.82	546.	2.26	595.	2.72	640.	3.20	683.	3.70	722.	4.20
3539.	328.	0.89	390.	1.22	442.	1.54	496.	1.95	548.	2.40	597.	2.87	642.	3.37	684.	3.88	724.	4.40
3735.	339.	1.01	399.	1.35	449.	1.68	500.	2.09	551.	2.54	599.	3.03	644.	3.54	686.	4.07	726.	4.61
3931.	350.	1.14	408.	1.49	458.	1.85	505.	2.24	554.	2.70	601.	3.20	646.	3.72	687.	4.26	727.	4.82
4127.	361.	1.28	417.	1.64	467.	2.03	511.	2.41	558.	2.87	604.	3.38	648.	3.91	689.	4.46	729.	5.04
4323.	372.	1.43	427.	1.82	477.	2.22	519.	2.60	563.	3.06	608.	3.57	651.	4.11	691.	4.68	731.	5.26
4519.	384.	1.59	437.	2.00	486.	2.42	528.	2.82	569.	3.26	611.	3.77	654.	4.32	694.	4.90	733.	5.50
4715.	395.	1.77	448.	2.20	495.	2.63	537.	3.06	575.	3.49	616.	3.99	657.	4.55	697.	5.13	735.	5.74
4910.	407.	1.97	459.	2.41	504.	2.85	547.	3.32	583.	3.74	622.	4.23	661.	4.79	700.	5.39	738.	6.00
5106.	419.	2.19	470.	2.64	514.	3.09	556.	3.58	593.	4.03	628.	4.50	666.	5.05	704.	5.65	741.	6.28
5302.	432.	2.42	481.	2.88	524.	3.35	565.	3.84	602.	4.33	636.	4.79	671.	5.33	708.	5.93	744.	6.56
5498.	444.	2.67	492.	3.14	534.	3.62	574.	4.12	612.	4.65	645.	5.13	678.	5.64	713.	6.23	748.	6.87
5694.	457.	2.94	503.	3.41	544.	3.92	583.	4.42	621.	4.97	654.	5.48	685.	5.98	719.	6.56	753.	7.19

Notes:
1. Fan performance table includes internal resistances of cabinet, wet coil and 2” (50 mm) standard filters. For other components refer to component pressure drop table.
2. The pressure drops from the supply fan to the space should not exceed 2.25” (558.8 Pa) positive.
3. Maximum air flow 23 ton (80 kW) is 4756 L/s, 25 ton is 5190 l/s, 29 ton is 5663 L/s
4. Maximum motor kW for 23 ton unit is 7.5 (10 hp), 25 ton is 7.5 kW (10 HP), 29 ton is 11.2 kW (15 hp).

Performance Data

Figure 25-1



Performance Data

Table 26-1 – Supply Fan Performance – 33 and 42 Ton **English**

	Static Pressure (in. wg)																			
	0.25		0.50		0.75		1.00		1.25		1.50		1.75		2.00		2.25		2.50	
SCFM	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
9996.	309.	1.80	360.	2.34	404.	2.88	447.	3.48	487.	4.10	525.	4.75	562.	5.41	597.	6.07	630.	6.75	662.	7.47
10829.	326.	2.19	374.	2.76	416.	3.35	458.	3.97	496.	4.62	532.	5.30	567.	6.01	602.	6.72	634.	7.44	666.	8.16
11662.	344.	2.64	388.	3.24	430.	3.88	468.	4.53	506.	5.21	541.	5.92	574.	6.65	607.	7.41	639.	8.18	670.	8.95
12495.	362.	3.15	403.	3.79	445.	4.48	480.	5.15	517.	5.86	551.	6.60	583.	7.37	614.	8.16	645.	8.97	675.	9.78
13328.	381.	3.72	420.	4.41	459.	5.12	494.	5.85	527.	6.58	562.	7.35	593.	8.15	623.	8.97	652.	9.81	681.	10.68
14161.	399.	4.37	437.	5.11	473.	5.84	509.	6.63	539.	7.39	572.	8.18	604.	9.01	633.	9.86	661.	10.73	688.	11.62
14994.	418.	5.09	454.	5.87	488.	6.64	524.	7.47	554.	8.28	583.	9.10	614.	9.95	643.	10.83	671.	11.73	698.	12.65
15827.	437.	5.89	472.	6.72	504.	7.53	537.	8.37	569.	9.26	596.	10.11	625.	10.98	654.	11.88	681.	12.81	708.	13.77
16660.	457.	6.79	490.	7.65	521.	8.51	551.	9.36	584.	10.31	611.	11.21	637.	12.11	664.	13.04	692.	13.99	718.	14.97

Notes:
1. Fan performance table includes internal resistances of cabinet, wet coil and 2” (50 mm) standard filters. For other components refer to component static pressure drop table to arrive at available external static pressure.
2. The pressure drops from the supply fan to the space should not exceed 2.5” Wg (620.9 Pa) positive.
3. Max CFM for 33 ton unit - 14660, 42 ton - 16660.
4. Max motor HP for 33 ton unit-(15 HP), 42 ton (20 HP).

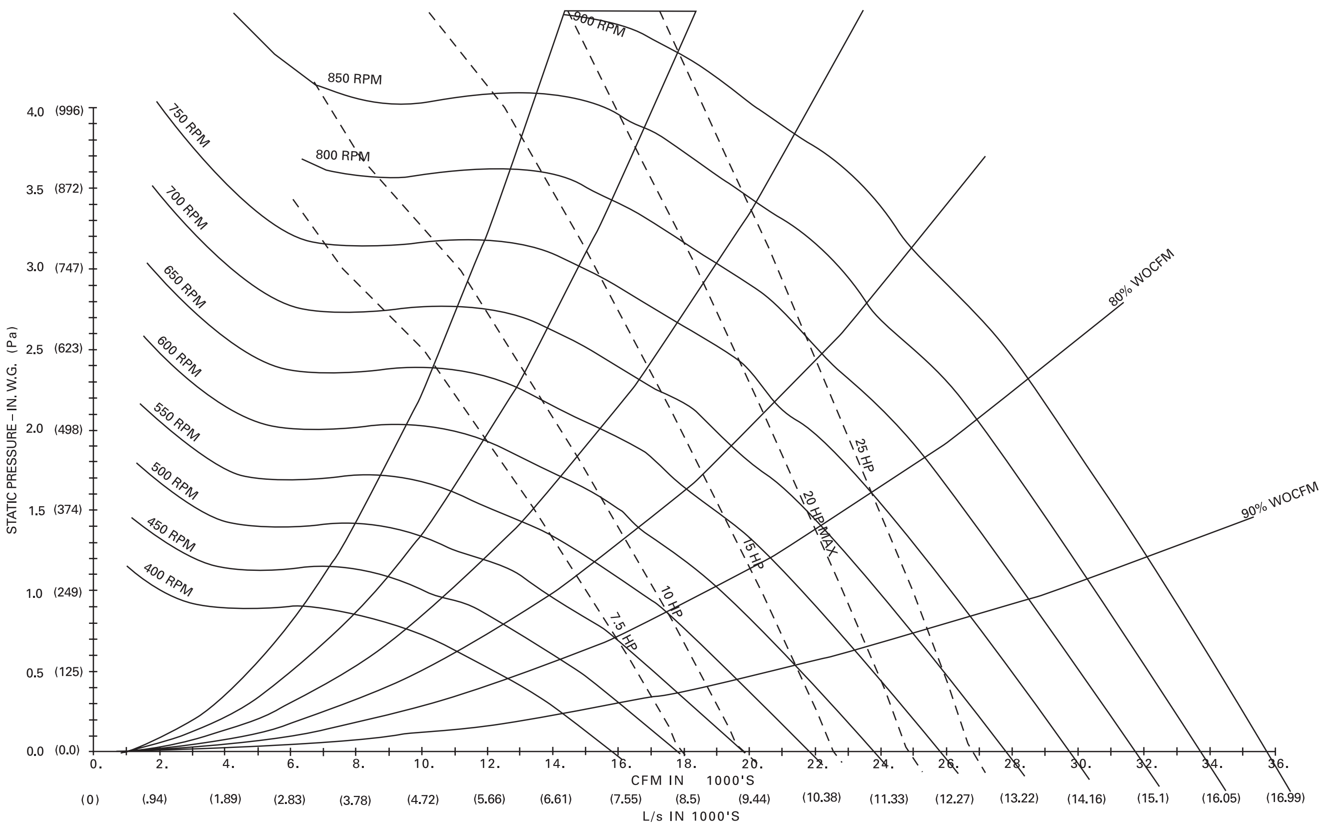
Table 26-2 – Supply Fan Performance – 105-148 KW **Metric**

	Static Pressure (Pascals)																			
	62.1		124,2		186.3		248.1		310.4		372.5		434.6		496.7		558.8		620.9	
(L/s)	RPM	(kW)	RPM	(kW)	RPM	(kW)	RPM	(kW)	RPM	(kW)	RPM	(kW)	RPM	(kW)	RPM	(kW)	RPM	(kW)	RPM	(kW)
4717.	309.	1.34	360.	1.74	404.	2.15	447.	2.59	487.	3.06	525.	3.54	562.	4.03	597.	4.53	630.	5.03	662.	5.57
5111.	326.	1.63	374.	2.06	416.	2.50	458.	2.96	496.	3.45	532.	3.96	567.	4.48	602.	5.01	634.	5.54	666.	6.09
5504.	344.	1.97	388.	2.41	430.	2.90	468.	3.37	506.	3.88	541.	4.41	574.	4.96	607.	5.53	639.	6.10	670.	6.67
5897.	362.	2.35	403.	2.82	445.	3.34	480.	3.84	517.	4.37	551.	4.92	583.	5.49	614.	6.08	645.	6.69	675.	7.30
6290.	381.	2.77	420.	3.29	459.	3.82	494.	4.37	527.	4.91	562.	5.48	593.	6.08	623.	6.69	652.	7.32	681.	7.96
6683.	399.	3.26	437.	3.81	473.	4.35	509.	4.95	539.	5.51	572.	6.10	604.	6.72	633.	7.35	661.	8.00	688.	8.67
7076.	418.	3.80	454.	4.38	488.	4.95	524.	5.57	554.	6.18	583.	6.79	614.	7.42	643.	8.07	671.	8.75	698.	9.44
7469.	437.	4.40	472.	5.01	504.	5.62	537.	6.24	569.	6.91	596.	7.54	625.	8.19	654.	8.86	681.	9.55	708.	10.27
7862.	457.	5.06	490.	5.71	521.	6.35	551.	6.98	584.	7.68	611.	8.36	637.	9.03	664.	9.72	692.	10.43	718.	11.17

Notes:
1. Fan performance table includes internal resistances of cabinet, wet coil and 2” (50 mm) standard filters. For other components refer to component static pressure drop table to arrive at available external static pressure.
2. The pressure drops from the supply fan to the space should not exceed 2.5” Wg (620.9 Pa) positive.
3. Max CFM for 33 ton unit 6825 L/s, 42 ton -7860 L/s
4. Max motor HP for 33 ton unit-11.2 kW (15 HP), 42 ton 14.9 kW (20 HP)

Performance Data

Figure 27-1



Performance Data

Table 28-1 – Component Static Pressure Drops (in wg) 50 Hz English

Nominal Std.Tons (kW)	CFM Std Air	Heating System: Gas Heat Low	Gas Heat High	Electric Heat 1 Element	Electric Heat 2 Element	ID Coil Adder	Filters: High Eff. Filters 2″	High Eff. Filters 4″	Inlet Guide Vanes	Economizer
23 (80)	6670	0.07	0.05	0.04	0.05	0	0.03	0.02	0.04	0.331
	7500	0.08	0.07	0.06	0.06	0	0.04	0.03	0.06	0.040
	8330	0.10	0.08	0.07	0.08	0	0.05	0.04	0.07	0.049
	9170	0.13	0.10	0.08	0.09	0	0.06	0.05	0.08	0.059
	10000	0.15	0.12	0.10	0.11	0	0.07	0.05	0.10	0.070
25 (88)	7500	0.08	0.07	0.06	0.06	0	0.04	0.03	0.06	0.040
	8330	0.10	0.08	0.07	0.08	0	0.05	0.04	0.07	0.049
	9170	0.13	0.10	0.08	0.09	0	0.06	0.05	0.08	0.059
	10000	0.15	0.12	0.10	0.11	0	0.07	0.06	0.12	0.070
29 (103)	8750	0.11	0.09	0.08	0.08	0.09	0.06	0.04	0.08	0.054
	9580	0.14	0.11	0.09	0.10	0.10	0.07	0.06	0.11	0.065
	11200	0.19	0.15	0.13	0.14	0.13	0.09	0.07	0.13	0.077
	12100	0.22	0.17	0.15	0.16	0.15	0.11	0.08	0.15	0.091
33 (118)	10000	0.01	0.03	0.07	0.11	0	0.07	0.05	0.03	0070
	10800	0.01	0.03	0.08	0.13	0	0.09	0.06	0.04	0.076
	11700	0.01	0.04	0.10	0.15	0	0.10	0.07	0.04	0.085
	12500	0.01	0.04	0.11	0.17	0	0.12	0.09	0.05	0.096
	13300	0.02	0.05	0.12	0.19	0	0.13	0.10	0.06	0.107
	14200	0.02	0.06	0.14	0.22	0	0.15	0.11	0.07	0.120
42 (146)	12500	0.01	0.04	0.11	0.17	0.08	0.12	0.09	0.05	0.095
	13300	0.02	0.05	0.12	0.19	0.08	0.13	0.10	0.06	0.108
	14200	0.02	0.06	0.16	0.24	0.10	0.17	0.12	0.07	0.120
	15800	0.02	0.07	0.18	0.27	0.11	0.19	0.14	0.08	0.136
	16700	0.03	0.08	0.20	0.30	0.12	0.21	0.15	0.09	0.155

Please note: Standard fan performance table includes pressure drops of wet coil and std. filters.

Table 28-2 – Component Static Pressure Drops (Pa) 50 Hz Metric

Nominal Std.kW (Tons)	L/s Std Air	Heating System: Gas Heat Low	Gas Heat High	Electric Heat 1 Element	Electric Heat 2 Element	ID Coil Adder	Filters: High Eff. Filters 50 mm	High Eff. Filters 100 mm	Inlet Guide Vanes	Economizer
80 (23)	3150	17	13	11	12	0	8	6	11	0.05
	3540	21	16	14	15	0	11	8	14	0.07
	3930	26	20	17	19	0	13	9	17	0.08
	4320	31	24	21	23	0	16	11	21	0.10
	4720	37	29	25	27	0	19	14	25	0.12
88 (25)	3540	21	16	14	15	0	11	8	14	0.07
	3930	26	20	17	19	0	13	9	17	0.08
	4320	31	24	21	23	0	16	11	25	0.12
	5120	44	34	29	32	0	22	16	29	0.14
103 (29)	4130	29	22	19	21	22	14	10	19	0.09
	4520	34	27	23	25	26	17	12	23	0.11
	4920	41	32	27	29	29	20	15	27	0.13
	5310	47	37	32	34	33	24	17	32	0.15
118 (33)	4720	2	7	18	27	0	19	14	8	0.12
	5120	3	8	21	32	0	22	16	10	0.14
	5510	3	10	24	37	0	25	18	11	0.16
	5900	4	11	27	42	0	29	21	13	0.18
	6290	4	12	31	48	0	33	24	15	0.21
	6680	5	14	35	54	0	38	27	16	0.24
146 (42)	5900	4	11	27	42	19	29	21	13	0.18
	6290	4	12	31	48	21	33	24	15	0.21
	6680	5	14	35	54	23	38	27	16	0.24
	7070	5	16	39	60	25	42	31	18	0.27
	7470	6	18	44	67	27	47	34	21	0.30

Please note: Standard fan performance table includes pressure drops of wet coil and std. filters.

Performance Data

Table 29-1 – Supply Air Fan Drive Selections

Nominal Tons (kW)	5 HP RPM	5 HP Drive No	7.5 HP RPM	7.5 HP Drive No	10 HP RPM	10 HP Drive No	15 HP RPM	15 HP Drive No
23 (80)	458	A						
	500	B						
	541	C						
	583		583	D				
	625		625*	E				
25 (88)	458	A						
	500	B						
	541	C						
	583		583	D				
	625		625	E				
29 (103)	500	B						
	541		541	C				
	583		583	D				
	658				658**	F		
	664				664*	G		
33 (118)	417		417	H				
	437		437	J				
	479		479	K				
	521				521	L		
	562				562	M		
	604				604	N		
42 (146)	437		437	J				
	479		479	K				
	521				521	L		
	562				562	M		
	604						604	N

Note:
*For YC gas/electrics only.
**For TC and TE Cooling only and with electric Heat units only.

Table 29-2 – Power Exhaust Fan Performance - 50 Hz English

Exhaust Airflow (Cfm)	External Static Pressure – Inches of Water: High Speed ESP	Med Speed ESP	Low Speed ESP
1000	0.800	–	–
1500	0.780	–	–
2000	0.750	–	0.400
2500	0.720	–	0.380
3000	0.680	–	0.370
3500	0.650	0.420	0.360
4000	0.610	0.380	0.340
4500	0.560	0.360	0.320
5000	0.520	0.330	0.300
5500	0.460	0.310	0.280
6000	0.420	0.290	0.250
6500	0.360	0.270	0.230
7000	0.310	0.240	0.190
7500	0.250	0.200	0.150
8000	0.200	0.160	0.120
8500	0.150	0.120	0.070
9000	0.100	0.060	0.000
9500	0.040	0.000	–
10000	0.000	–	–

Table 29-3 – Power Exhaust Fan Performance - 50 Hz Metric

Exhaust Airflow (L/s)	External Static Pressure – Pa: High Speed ESP	Med Speed ESP	Low Speed ESP
470	199.3	–	–
710	194.3	–	–
940	186.8	–	99.6
1180	179.4	–	94.7
1420	169.4	–	92.2
1650	161.9	104.6	89.7
1890	152.0	94.7	84.7
2120	139.5	89.7	79.7
2360	129.5	82.2	74.7
2600	114.6	77.2	69.7
2830	104.6	72.2	62.3
3070	89.7	67.3	57.3
3300	77.2	59.8	47.3
3540	62.3	49.8	37.4
3780	49.8	39.9	29.9
4010	37.4	29.9	17.4
4250	24.9	14.9	0.0
4480	10.0	0.0	–
4720	0.0	–	–

Notes:
1. Performance in table is with both motors operating.
2. High speed = both motors on high speed. Medium speed is one motor on high speed and one on low speed. Low speed is both motors on low speed.
3. Power Exhaust option is not to be applied on systems that have more return air static pressure drop than the maximum shown in the table for each motor speed tap.

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

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

Load Definitions

LOAD1 = CURRENT OF THE LARGEST MOTOR (COMPRESSOR OR FAN MOTOR)

LOAD2 = SUM OF THE CURRENTS OF ALL REMAINING MOTORS

LOAD3 = CURRENT OF ELECTRIC HEATERS

LOAD4 = ANY OTHER LOAD RATED AT 1 AMP OR MORE

Set 1. Cooling Only Rooftop Units and Cooling with Gas Heat Rooftop Units

MCA = (1.25 x LOAD1) + LOAD2 + LOAD4

MOP = (2.25 x LOAD1) + LOAD2 + LOAD4

Select a fuse rating equal to the MOP value. If the MOP value does not equal a standard fuse size as listed in NEC 240-6, select the next lower standard fuse rating. NOTE: If selected MOP is less than the MCA, then reselect the lowest standard maximum fuse size which is equal to or larger than the MCA, provided the reselected fuse size does not exceed 800 amps.

RDE = (1.5 x LOAD1) + LOAD2 + LOAD4

Select a fuse rating equal to the RDE value. If the RDE value does not equal a standard fuse size as listed in NEC 240-6, select the next higher standard fuse rating. NOTE: If the selected RDE is greater than the selected MOP value, then reselect the RDE value to equal the MOP value.

DSS = 1.15 x (LOAD1 + LOAD2 + LOAD4)

Select a disconnect switch size equal to or larger than the DSS value calculated.

Set 2. Rooftop units with Electric Heat

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

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

For units using heaters less than 50 kW.

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

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

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

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

MOP = (2.25 x LOAD1) + LOAD2 + LOAD3 + LOAD4

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

Select a fuse rating equal to the MOP value. If the MOP value does not equal a standard fuse size as listed in NEC 240-6, select the next lower standard fuse rating. NOTE: If selected MOP is less than the MCA, then reselect the lowest standard maximum fuse size which is equal to or larger than the MCA, provided the reselected fuse size does not exceed 800 amps.

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

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

Select a fuse rating equal to the RDE value. If the RDE value does not equal a standard fuse size as listed in NEC 240-6, select the next higher standard fuse rating. NOTE: If the selected RDE is greater than the selected MOP value, then reselect the RDE value to equal the MOP value.

DSS = 1.15 x (LOAD1 + LOAD2 + LOAD3 + LOAD4)

NOTE: Keep in mind when determining LOADS that the compressors and condenser fans don't run while the unit is in the heating mode.

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

Select a disconnect switch size equal to or larger than the DSS value calculated.

Electrical Data

Table 31-1 – Electrical Service Sizing Data

Model	Electrical[2] Characteristics	Compressor Qty./ Nominal HP	Compressor RLA (Ea.)	Compressor LRA Ea.)	Fan Motors Supply HP	Fan Motors Supply FLA	Fan Motors Condenser No.	Fan Motors Condenser HP	Fan Motors Condenser FLA (Ea.)	MCA*	Max. Fuse Size
TC/TE/YC*275	380-415/50/3	2/10,15	18.1/27.3	110/174	5	13.1	3	.75	4.4	79	100
TC/TE/YC*305	380-415/50/3	2/15,15	27.3	174	5	13.1	3	.75	4.4	93	110
TC/TE/YC*350	380-415/50/3	2/15,15	27.3	174	5	13.1	3	.75	4.4	93	110
TC/TE/YC*400	380-415/50/3	2/15,15 1/10	27.3 18.1	174 110	7.5	16.6	4	.75	4.4	119	125
TC/TE/YC*500	380-415/50/3	3/15	27.3	174	7.5	16.6	4	.75	4.4	128	150

Notes:
1. All customer wiring and devices must be installed in accordance with local and national electrical codes.
2. Allowable voltage range for the 380V unit is 342-418V, allowable voltage range for the 415V unit is 373-456.
* Minimum Circuit Ampacity.

Table 31-2 – Electrical Service Sizing Data – Electric Heat Module (Electric Heat Units Only)

Models: TED/TEH 275 thru 500
Electric Heat FLA

Nominal Unit Size (Tons)	Nominal Unit Voltage	KW Heater (380/415V) 23/27	34/40	45/54	56/67	68/81
23-29	380	34.5	51.1	68.9	85.5	–
	415	37.6	55.6	–	–	–
33, 43	380	–	51.1	68.9	85.5	103.4
	415	–	55.6	75.1	93.2	112.7

Notes:
1. All FLA in this table are based on heater operating at 380 or 415 volts as shown above.

Sequence of Operation

1
Supply Air Pressure Control

- **Inlet Guide Vane Control**
Inlet guide vanes are driven by a modulating 2-10 vdc signal from the VAV Module. A pressure transducer measures duct static pressure, and the inlet guide vanes are modulated to maintain the supply air static pressure within an adjustable user-defined range. The range is determined by the supply air pressure setpoint and supply air pressure deadband, which are set through a unit mounted potentiometer.

Inlet guide vane assemblies installed on the supply fan inlets regulate fan capacity and limit horsepower at lower system air requirements. When in any position other than full open, the vanes pre-spin intake air in the same direction as supply fan rotation. As the vanes approach the full-closed position, the amount of "spin" induced by the vanes increases at the same time that intake airflow and fan horsepower diminish. The inlet guide vanes will close when the supply fan is shut down.

- **Supply Air Static Pressure Limit**
The opening of the inlet guide vanes and VAV boxes are coordinated during unit start up and transition to/from Occupied/Unoccupied modes to prevent overpressurization of the supply air ductwork. However, if for any reason the supply air pressure exceeds the fixed supply air static pressure limit of 3.5" (89 mm) W.C., the supply fan is shut down and the inlet guide vanes are closed. The unit is then allowed to restart four times. If the overpressurization condition occurs on the fifth time, the unit is shut down and a manual reset diagnostic is set and displayed at any of the remote panels with LED status lights or communicated to the Integrated Comfort system.

2
Supply Air Temperature Controls

- **Cooling/Economizer**
During occupied cooling mode of operation, the economizer (if available) and primary cooling are used to control the supply air temperature. The supply air temperature setpoint is user-defined at the unit mounted VAV Setpoint Panel or at the remote panel. If the enthalpy of the outside air is appropriate to use "free cooling," the economizer will be used first to attempt to satisfy the supply setpoint.

On units with economizer, a call for cooling will modulate the fresh air dampers open. The rate of economizer modulation is based on deviation of the discharge temperature from setpoint, i.e., the further away from setpoint, the faster the fresh air damper will open. Note that the economizer is only allowed to function freely if ambient conditions are below the enthalpy control setting or below the return air enthalpy if unit has comparative enthalpy installed. If outside air is not suitable for "economizing," the fresh air dampers drive to the minimum open position. A field adjustable potentiometer on the Unitary Economizer Module, Tracer®, or a remote potentiometer can provide the input to establish the minimum damper position.

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

If the unit does not include an economizer, primary cooling only is used to satisfy cooling requirements.

- **Supply Air Setpoint Reset**
Supply air reset can be used to adjust the supply air temperature setpoint on the basis of a zone temperature, return air temperature, or on outdoor air temperature. Supply air reset adjustment is available on the unit mounted VAV Setpoint Panel for supply air cooling control.

a
reset based on outdoor air temperature
Outdoor air cooling reset is sometimes used in applications where the outdoor temperature has a large effect on building load. When the outside air temperature is low and the building cooling load is low, the supply air setpoint can be raised, thereby preventing subcooling of critical zones. This reset can lower usage of primary cooling and result in a reduction in primary cooling energy usage.

There are two user-defined parameters that are adjustable through the VAV Setpoint Panel: reset temperature setpoint and reset amount. The amount of reset applied is dependent upon how far the outdoor air temperature is below the supply air reset setpoint. The amount is zero where they are equal and increases linearly toward the value set at the reset amount input. The maximum value is 20°F (-6.7°C). If the outdoor air temperature is more than 20°F (-6.7°C) below the reset temperature setpoint the amount of rest is equal to the reset amount setpoint.

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

Logic for zone or return reset control is the same except that the origins of the temperature inputs are the zone sensor or return sensor respectively. The amount of reset applied is dependent upon how far the zone or return air temperature is below the supply air reset setpoint. The amount is zero where they are equal and increases linearly toward the value set at the reset amount potentiometer on the VAV Setpoint panel. The maximum value is 3°F (-16.1°C). If the return or zone temperature is more than 3°F (-16.1°C) below the reset temperature setpoint the amount of reset is equal to the reset amount setpoint.

3
Zone Temperature Control

Unoccupied Zone Heating and Cooling
During Unoccupied mode, the unit is operated as a CV unit. Inlet guide vanes and VAV boxes are driven full open. The unit controls zone temperature to the Unoccupied zone cooling and heating (heating units only) setpoints.

Daytime Warm-Up
During occupied mode, if the zone temperature falls to a temperature three degrees below the Morning Warm-up setpoint, Daytime Warm-up is initiated. The system changes to CV heating (full unit airflow), the VAV boxes are fully opened and the CV heating algorithm is in control until the Morning Warm-up setpoint is reached. The unit is then returned to VAV cooling mode. The Morning Warm-up setpoint is set at the unit mounted VAV Setpoint panel or at a remote panel.

VAV Units Only

Morning Warm-up (MWU)
Morning warm-up control (MWU) is activated whenever the unit switches from unoccupied to occupied and the zone temperature is at least 1.5°F below the MWU setpoint. When MWU is activated the VAV box output will be energized for at least 6 minutes to drive all boxes open, the inlet guide vanes are driven full open, and all stages of heat (gas or electric) are energized. When MWU is activated the economizer damper is driven fully closed. When the zone temperature meets or exceeds the MWU setpoint minus 1.5°F, the heat will be staged down. When the zone temperature meets or exceeds the MWU setpoint then MWU will be terminated and the unit will switch over to VAV cooling.

CV Units Only

Sequence of Operation
1
Occupied Zone Temperature Control

Cooling/Economizer
During occupied cooling mode, the economizer (if provided) and primary cooling are used to control zone temperature. If the enthalpy of outside air is appropriate to use "free cooling," the economizer will be used first to attempt to satisfy the cooling zone temperature setpoint; then primary cooling will be staged up as necessary.

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

Note that the economizer is allowed to function freely only if ambient conditions are below the enthalpy control setting or below the return air enthalpy if unit has comparative enthalpy. If outside air is not suitable for "economizing," the fresh air dampers drive to the minimum open position. A field adjustable potentiometer on the Unitary Economizer Module (UEM), Tracer or a remote potentiometer can provide the input to establish the minimum damper position.

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

If the unit does not include an economizer, primary cooling only is used to satisfy cooling requirements.

Heating

Gas Heating
When heating is required the UCP initiates the heating cycle by energizing the K5 relay, heating relay(s), and the ignition control module(s). The K5 relay brings on the combustion fan motor. The ignition control module(s) begin the ignition process by preheating the hot surface ignitor(s). After the hot surface ignitor is preheated the gas valve is opened to ignite first stage. If ignition does not take place the ignition control module(s) will attempt to ignite 2 more times before locking out. When ignition does occur the hot surface ignitor is de-energized and then functions as a flame sensor. The UCP will energize the supply fan contactor 45 seconds after the initiation of the heat cycle. If more capacity is needed to satisfy the heating setpoint, the UCP will call for the second stage of heat by driving the combustion blower motor to high speed.

When the space temperature rises above the heating setpoint, the UCP de-energizes the K5 relay, the heating relays, and the ignition control module, terminating the heat cycle.

Electric Heating
When heat is required, the UCP initiates first stage heating by energizing the first stage electric heat contactor. The first stage electric heater bank(s) will be energized if the appropriate limits are closed. The UCP will cycle first stage heat on and off as required to maintain zone temperature. If first stage cannot satisfy the requirement, the UCP will energize the second stage electric heat contactor(s) if the appropriate limits are closed. The UCP will cycle second stage on and off as required while keeping stage one energized.

The supply fan is energized approximately 1 second before the electric heat contactors. When the space temperature rises above the heating setpoint, the UCP de-energizes the supply fan and all electric heat contactors.

Supply Air Tempering
This feature is available only with TRACER or with systems using programmable zone sensors (CV only with economizer). For gas and electric heat units in the Heat mode but not actively heating, if the supply air temperature drops to 10°F (-12.2°C) below the occupied zone heating temperature setpoint, one stage of heat will be brought on to maintain a minimum supply air temperature. The heat stage is dropped if the supply air temperature rises to 10°F (-12.2°C) above the occupied zone heating temperature setpoint.

Auto Changeover
When the System Mode is "Auto," the mode will change to cooling or heating as necessary to satisfy the zone cooling and heating setpoints. The zone cooling and heating setpoints can be as close as 2°F (-16.7°C) apart.

Unoccupied Zone Temperature Control Cooling and Heating
Both cooling or heating modes can be selected to maintain Unoccupied zone temperature setpoints. For Unoccupied periods, heating or primary cooling operation can be selectively locked out at the remote panels or TRACER.

Control Sequences of Operation That are Common to Both VAV and CV Units

Ventilation Override (VOM)
Ventilation override allows an external system to assume control of the unit for the purpose of exhaust or pressurization. There are two inputs associated with ventilation override, the initiate input and the select input. When the UCP senses a continuous closed condition on the initiate input at the low voltage terminal board the unit will begin ventilation override depending on the condition of the select input. The default condition of the select input is exhaust (input open). A closed select input will yield pressurization. The component state matrix for ventilation override is as follows:

System Component	Exhaust	Pressurization
Heat/Cool	off	off
IGV	closed	open
Supply Fan	off	on
Exhaust Fan	on	off
Outside Air Damper	closed	open
Return Air Damper	open	closed
VAV Boxes	n/a	open

Coil Freeze Protection FROSTAT™
The FROSTAT system eliminates the need for hot gas bypass and adds a suction line surface temperature sensor to determine if the coil is in a condition of impending frost. If impending frost is detected primary cooling capacity is shed as necessary to prevent icing. All compressors are turned off after they have met their minimum three minute on times. The supply fan is forced on until the FROSTAT device no longer senses a frosting condition or for 60 seconds after the last compressor is shut off, which ever is longer.

Occupied/Unoccupied Switching
There are three ways to switch Occupied/Unoccupied:

1
NSB Panel

2
Field-supplied contact closure

3
TRACER

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

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

When using the night setback options with a VAV heating/cooling rooftop, airflow must be maintained through the rooftop unit. This can be accomplished by electrically tying the VAV boxes to the VAV heat relay contacts on the Low voltage terminal board or by using changeover thermostats. Either of these methods will assure adequate airflow through the unit and satisfactory temperature control of the building.

Timed Override Activation – ICS
When this function is initiated by pushing the override button on the ICS sensor, TRACER will switch the unit to the occupied mode. Unit operation (occupied mode) during timed override is terminated by a signal from TRACER.

Timed Override Activation – Non-ICS
When this function is initiated by the push of an override button on the programmable zone sensor, the unit will switch to the occupied mode. Automatic Cancellation of the Timed override Mode occurs after three hours of operation.

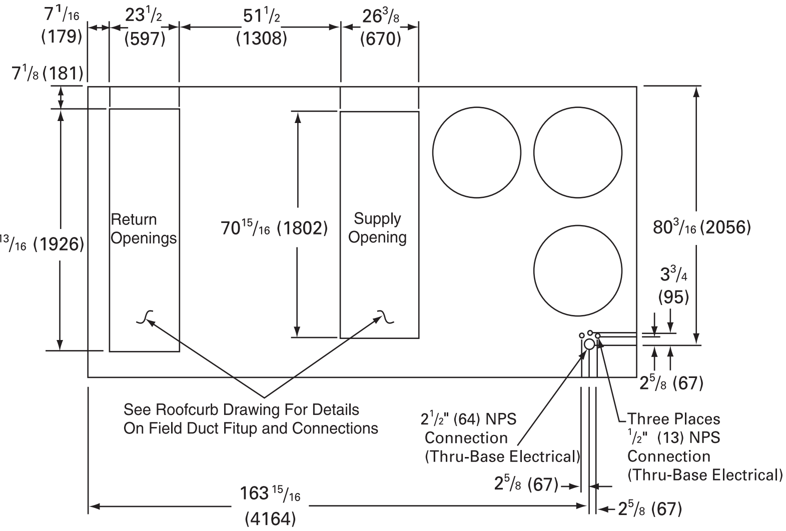
Comparative Enthalpy Control of Economizer
The Unitary Economizer Module (UEM) receives inputs from optional return air humidity and temperature sensors and determines whether or not it is feasible to economize. If the outdoor air enthalpy is greater than the return air enthalpy then it is not feasible to economize and the economizer damper will not open past its minimum position.

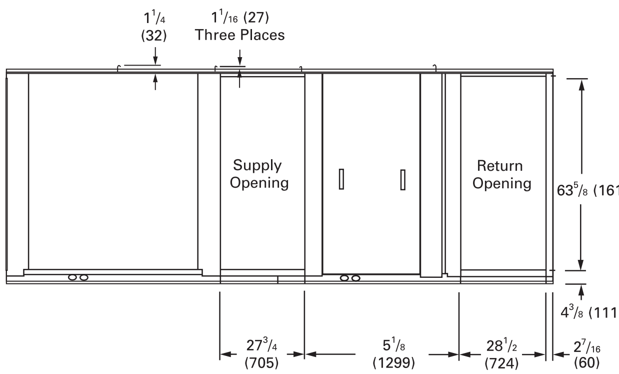
Emergency Stop Input
A binary input is provided on the UCP for installation of field provided switch or contacts for immediate shutdown of all unit functions. The binary input is brought out to Low Voltage Terminal Board One (LTB1).

Conventional Thermostat Interface (CV ONLY)
An interface is required to use a conventional thermostat instead of a zone sensor module with the UCP. The Conventional Thermostat Interface (CTI) is connected between conventional thermostat and the UCP and will allow only two steps of heating or cooling. The CTI provides zone temperature control only and is mutually exclusive of the Trane Communications Interface.

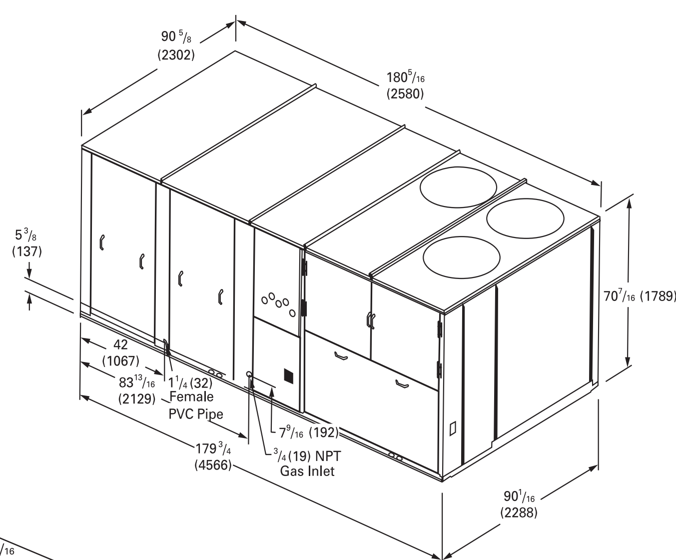
Dimensional Data

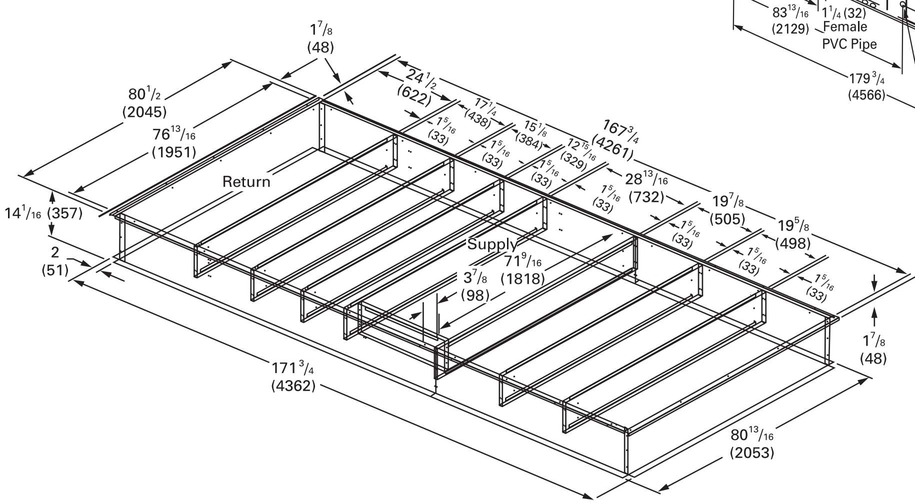
Figure 35-1 – 23-29 Tons (TC, TE, YC Low Heat)





REAR VIEW SHOWING DUCT OPENINGS FOR HORIZONTAL UNIT

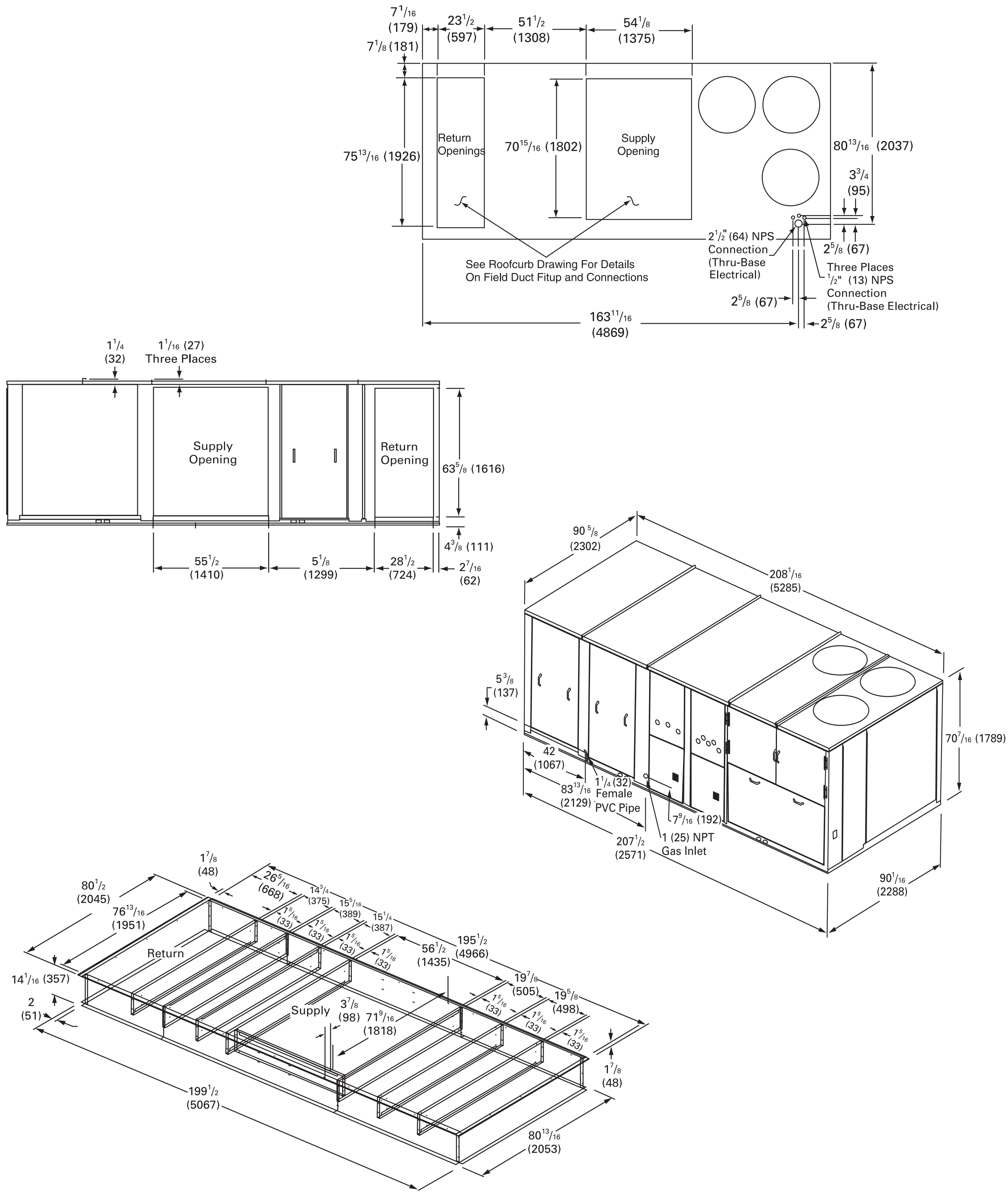




Note:
Dimensions in ( ) are mm
1" = 25.4 mm

Dimensional Data

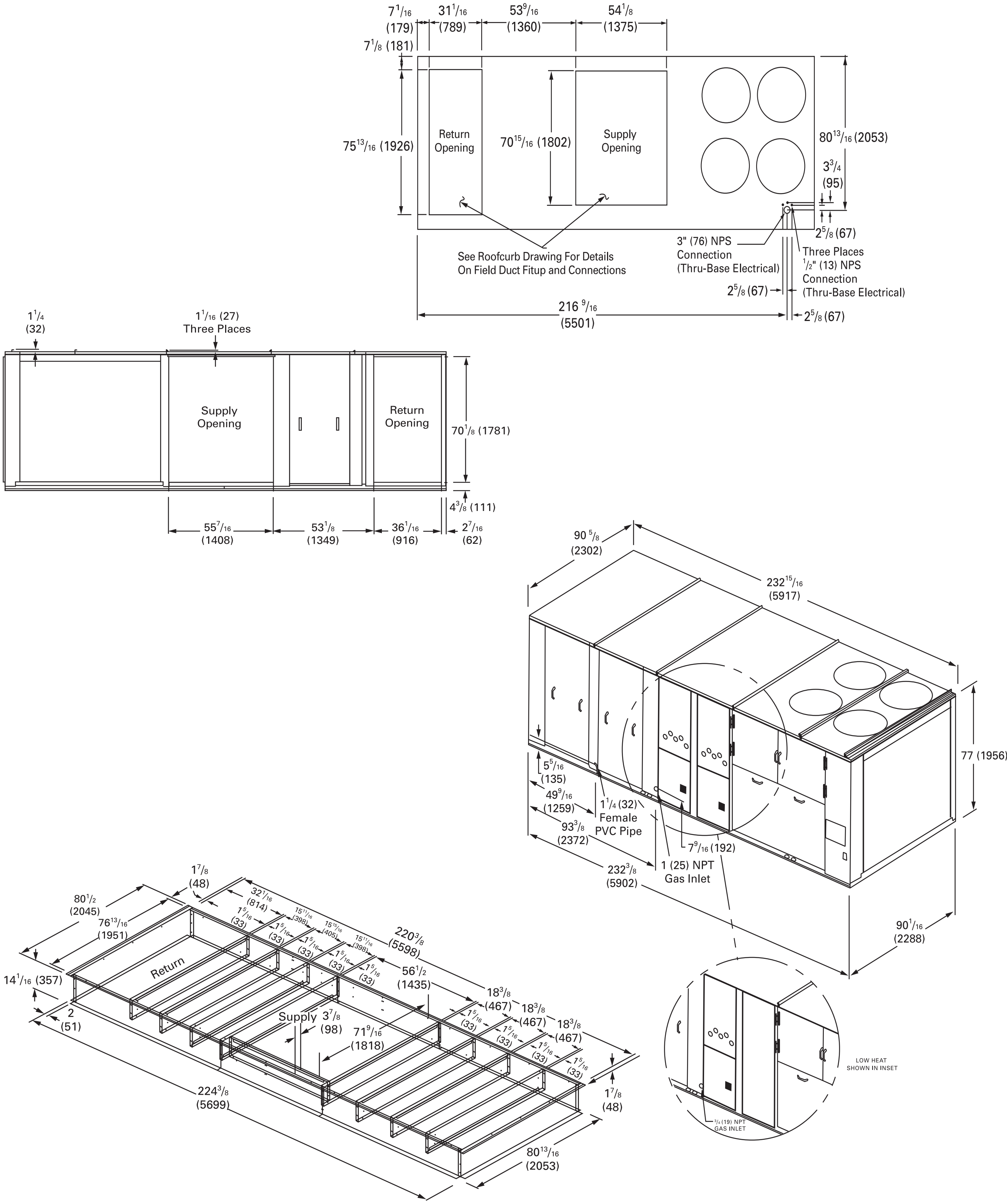
Figure 36-1 – 23-29 Tons (YC High Heat)



Note:
Dimensions in ( ) are mm
1″ = 25.4 mm

Dimensional Data

Figure 37-1 – 33-42 Tons (TC, TE, YC Low & High Heat)



Note:
Dimensions in ( ) are mm
1" = 25.4 mm

Weights

Table 38-1 — Approximate Operating Weights — Lbs.

Basic Unit Weights[1]					Weight of Optional Components									
Unit Model	YC Low Heat	YC High Heat	TC	TE	Baro. Relief	Power Exhaust	Hi-Stat/ Hi Eff. Sup Fan Motor[2]	0-25% Man Damper	Econ.	Inlet Guide Vanes	Serv Valves	Thru-the base Elec.	Non-Fused Discon. Switch	Fact. GFI with Discon. Switch
**D275	3650	4012	3520	3553	110	165	120	50	260	55	11	6	30	85
**H275	3650	4077	3565	3598	145	200	120	50	285	55	11	6	30	85
**D305	3730	4092	3600	3633	110	165	120	50	260	55	11	6	30	85
**H305	3730	4142	3600	3633	145	200	120	50	285	55	11	6	30	85
**D350	3815	4177	3685	3718	110	165	120	50	260	55	11	6	30	85
**H350	3815	4227	3685	3718	145	200	120	50	285	55	11	6	30	85
**D400	4665	4785	4440	4475	110	165	125	50	290	70	18	6	30	85
**H400	4690	4815	4440	4475	145	200	125	50	300	70	18	6	30	85
**D500	4835	4955	4610	4645	110	165	125	50	290	70	18	6	30	85
**H500	4860	4985	4610	4645	145	200	125	50	300	70	18	6	30	85

Notes:
1. Basic unit weight includes minimum HP Supply Fan Motor.
2. Optional high static and high efficiency motor weights are in addition to the standard motor weight included in the basic unit weight.

Table 38-2 — Approximate Operating Weights — Kgs.

Basic Unit Weights[1]					Weight of Optional Components									
Unit Model	YC Low Heat	YC High Heat	TC	TE	Baro. Relief	Power Exhaust	Hi-Stat/ Hi Eff. Sup Fan Motor[2]	0-25% Man Damper	Econ.	Inlet Guide Vanes	Serv Valves	Thru-the base Elec.	Non-Fused Discon. Switch	Fact. GFI with Discon. Switch
**D275	1643	1805	1584	1599	50	74	54	23	117	25	5	3	14	38
**H275	1643	1835	1604	1619	65	90	54	23	128	25	5	3	14	38
**D305	1679	1841	1620	1635	50	74	54	23	117	25	5	3	14	38
**H305	1679	1864	1620	1635	65	90	54	23	128	25	5	3	14	38
**D350	1717	1880	1658	1673	50	74	54	23	117	25	5	3	14	38
**H350	1717	1902	1658	1673	65	90	54	23	128	25	5	3	14	38
**D400	2099	2153	1998	2014	50	74	56	23	131	32	8	3	14	38
**H400	2111	2167	1998	2014	65	90	56	23	135	32	8	3	14	38
**D500	2176	2230	2075	2090	50	74	56	23	131	32	8	3	14	38
**H500	2187	2243	2075	2090	65	90	56	23	135	32	8	3	14	38

Notes:
1. Basic unit weight includes minimum HP Supply Fan Motor.
2. Optional high static and high efficiency motor weights are in addition to the standard motor weight included in the basic unit weight.

Table 38-3 — Point Loading Percentage of Total Unit Weight[1]

POINT LOADING - % OF TOTAL UNIT WEIGHT					
A	B	C	D	E	F
21	23	12	16	17	12

1. Point Loading is identified with corner A being the corner with the compressors. As you move clockwise around the unit as viewed from the top, mid-point B, corner C, corner D, mid-point E and corner F.

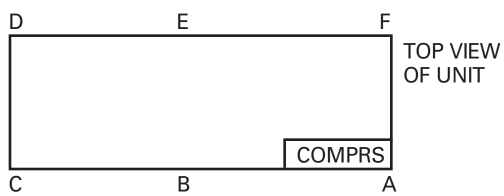
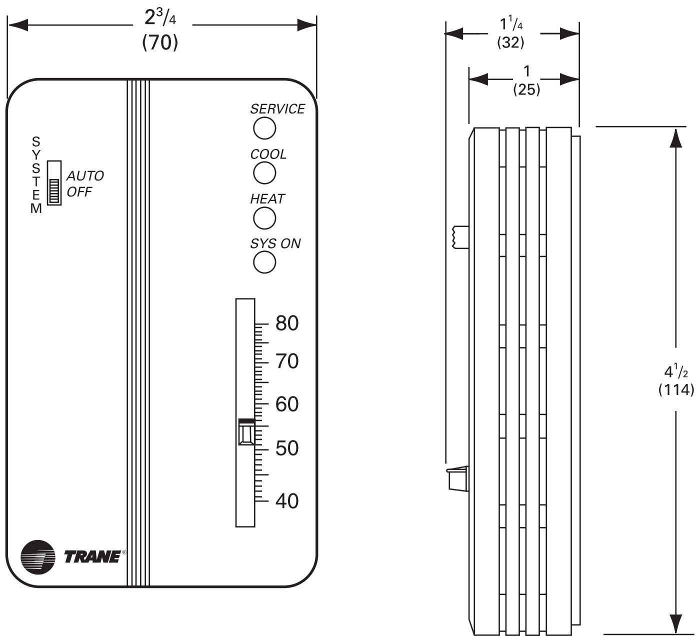


Table 38-4 — Minimum Operating Clearances for Unit Installation

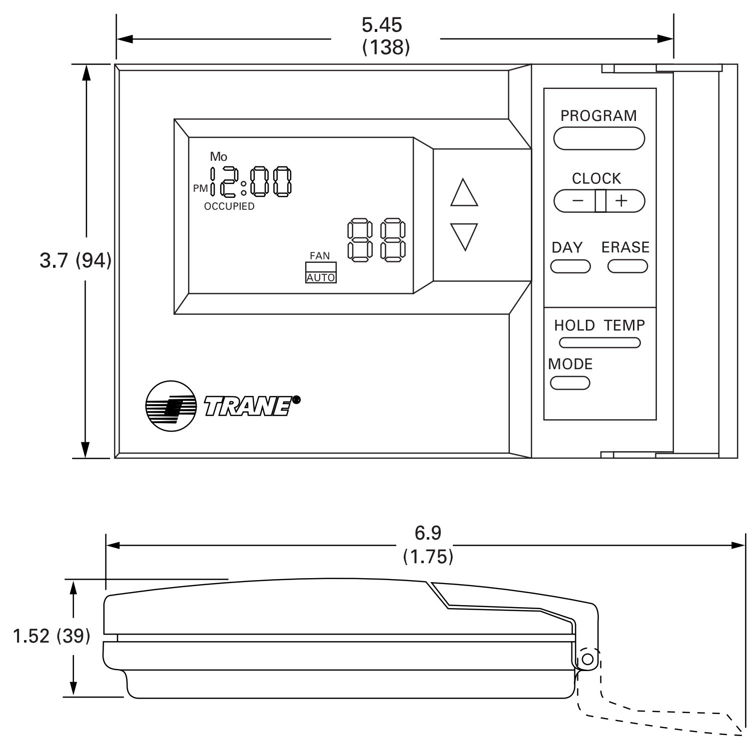
	Econo / Exhaust End	Condenser Coil[2] End / Side	Service Side Access
Single Unit[1]	6 Feet (1.82 M)	8 Feet / 4 Feet (2.43/1.21 M)	4 Feet (1.21 M)
Multiple Unit[1,3]	12 Feet (3.65 M)	16 Feet / 8 Feet (4.87/2.43 M)	8 Feet (2.43 M)

Notes:
1. Horizontal and Downflow Units, all sizes.
2. Condenser coil is located at the end and side of the unit.
3. Clearances on multiple unit installations are distances between units.

SINGLE SETPOINT SENSOR WITH SYSTEM FUNCTION LIGHTS (BAYSENS021*)



PROGRAMMABLE NIGHT-SETBACK SENSOR (BAYSENS020*)



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

Note:
Dimensions in ( ) are mm
1″ = 25.4 mm

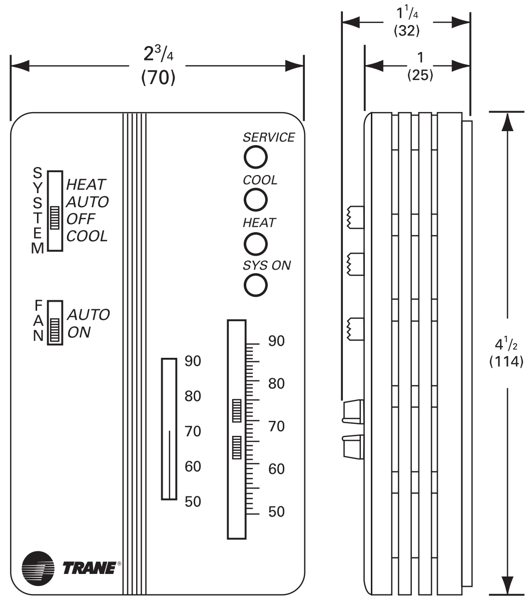
Field Installed Sensors

Constant Volume

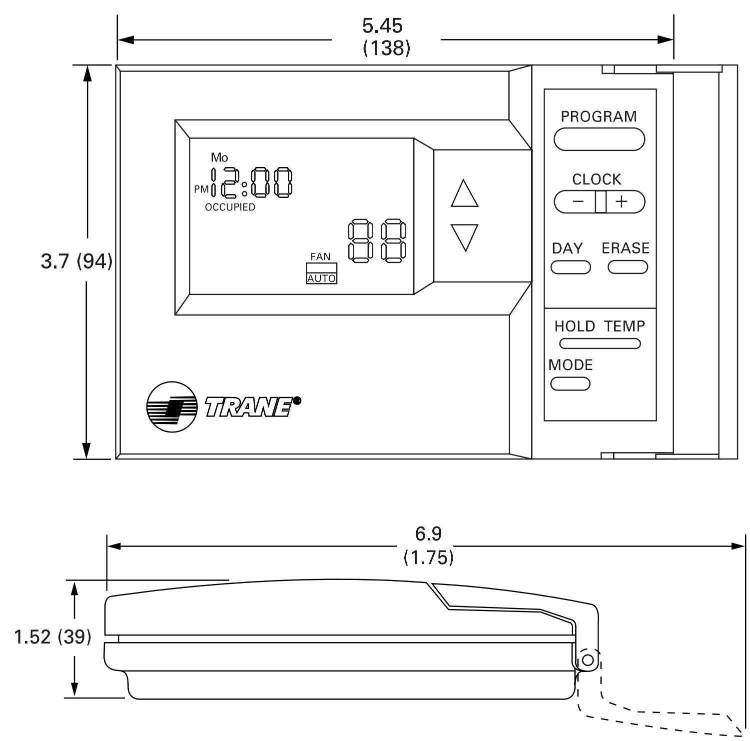
DUAL SETPOINT, MANUAL/AUTOMATIC CHANGEOVER SENSOR WITH SYSTEM FUNCTION LIGHTS (BAYSENS010*)

WITHOUT LED STATUS INDICATORS (BAYSENS008*)

SINGLE SETPOINT WITHOUT LED STATUS INDICATORS (BAYSENS006*)



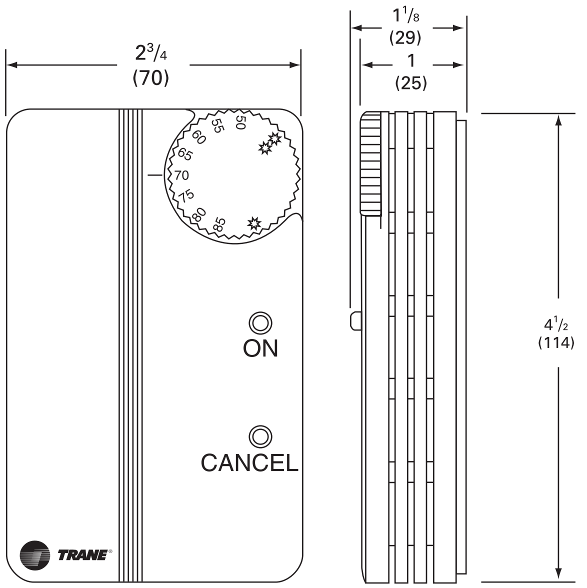
PROGRAMMABLE NIGHT-SETBACK SENSOR (BAYSENS019*)



Note:
Dimensions in ( ) are mm
1″ = 25.4 mm

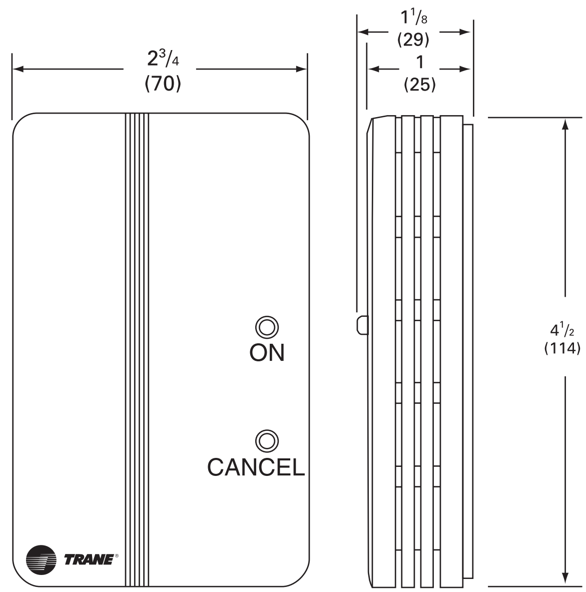
Integrated Comfort™ System Sensors

ZONE TEMPERATURE SENSOR W/TIMED OVERRIDE BUTTON AND LOCAL SETPOINT ADJUSTMENT (BAYSENS014*)



ZONE TEMPERATURE SENSOR W/TIMED OVERRIDE BUTTON (BAYSENS013*)

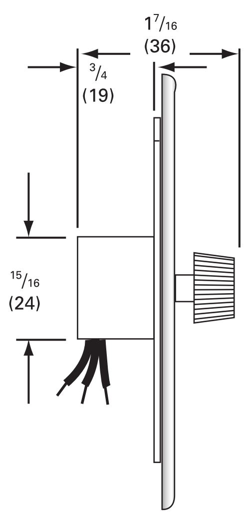
ALSO AVAILABLE SENSOR ONLY (BAYSENS017*)

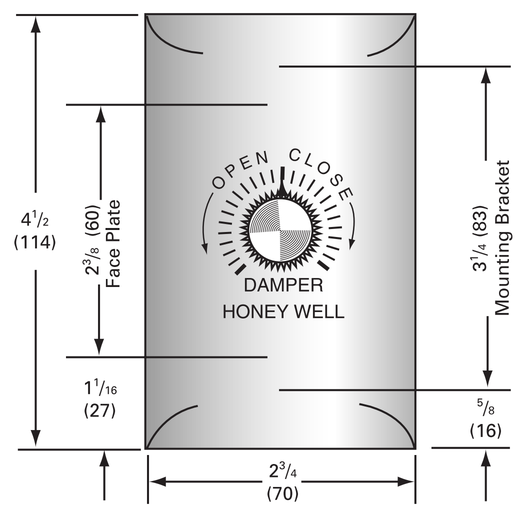


Color: Cool Pantone Gray

TEMPERATURE SENSOR (BAYSENS016*)

REMOTE MINIMUM POSITION POTENTIOMETER CONTROL (BAYSTAT023)





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

Note:
Dimensions in ( ) are mm
1″ = 25.4 mm

Mechanical Specifications

General
The units shall be dedicated downflow or horizontal airflow. The operating range shall be between 115°F and 0°F (46.1°C and -17.8°C) in cooling as standard from the factory for all units. 60 HZ cooling performance shall be rated in accordance with ARI testing procedures. All units shall be factory assembled, internally wired, fully charged with HCFC-22 and 100 percent run tested to check cooling operation, fan and blower rotation and control sequence before leaving the factory. Wiring internal to the unit shall be numbered for simplified identification.

Casing
Unit casing shall be constructed of zinc coated, heavy-gauge, galvanized steel. All components shall be mounted in a weather resistant steel cabinet with a painted exterior. Where top cover seams exist, they shall be double hemmed and gasket sealed to prevent water leakage. Cabinet construction shall allow for all maintenance on one side of the unit. Service panels shall have handles and shall be removable while providing a water and air tight seal. Control box access shall be hinged. The indoor air section shall be completely insulated with fire resistant, permanent, odorless glass fiber material. The base of the unit shall have provisions for crane lifting.

Filters
Two-inch (51 mm), throwaway filters shall be standard on all size units. Two-inch (51 mm) "high efficiency," and four-inch (102 mm) "high efficiency" filters shall be optional.

Compressors
All units shall have direct-drive, hermetic, scroll type compressors with centrifugal type oil pump providing positive lubrication to moving parts. Motor shall be suction gas-cooled and shall have a voltage utilization range of plus or minus 10 percent of unit nameplate voltage. Internal temperature and current sensitive motor overloads shall be included for maximum protection. Shall have internal sound muffling to minimize vibration transmission and noise. External discharge temperature limit, winding temperature limit and compressor overload shall be provided.

Refrigerant Circuits
Each refrigerant circuit shall have independent thermostatic expansion devices, service pressure ports and refrigerant line filter driers factory-installed as standard. An area shall be provided for replacement suction line driers.

Evaporator and Condenser Coils
Condenser coils shall have 3/8" (10 mm) copper tubes mechanically bonded to lanced aluminum plate fins. Evaporator coils shall be 1/2" (13 mm) internally finned copper tubes mechanically bonded to high performance aluminum plate fins. All coils shall be leak tested at the factory to ensure pressure integrity. All coils shall be leak tested to 200 psig and pressure tested to 450 psig. All evaporator coils shall be of intermingled configuration.

Outdoor Fans
The outdoor fan shall be direct-drive, statically and dynamically balanced, draw through in the vertical discharge position. The fan motor(s) shall be permanently lubricated and have built-in thermal overload protection.

Indoor Fan
Units shall have belt driven, FC, centrifugal fans with fixed motor sheaves. All motors shall be circuit breaker protected.

Electric Heaters
Electric heat shall be available for factory installation within basic unit. Electric heater elements shall be constructed of heavy-duty nickel chromium elements wye connected for 380 and 415 volt. Staging shall be achieved through the unitary control processor (UCP). Each heater package shall have automatically reset high limit control operating through heating element contactors. All heaters shall be individually fused from factory, where required, and meet all NEC and CEC requirements. Power assemblies shall provide single-point connection.

Gas Heating Section
The heating section shall have a drum and tube heat exchanger(s) design using corrosion resistant steel components. A forced combustion blower shall supply premixed fuel to a single burner ignited by a pilotless hot surface ignition system. In order to provide reliable operation, a negative pressure gas valve shall be used that requires blower operation to initiate gas flow. On an initial call for heat, the combustion blower shall purge the heat exchanger(s) 45 seconds before ignition. After three unsuccessful ignition attempts, the entire heating system shall be locked out until manually reset at the thermostat. Units shall be suitable for use with natural gas or propane (field installed kit). All units shall have two stage heating.

Controls
Unit shall be completely factory wired with necessary controls and terminal block for power wiring. Units shall provide an external location for mounting fused disconnect device. Microprocessor controls shall be provided for all 24 volt control functions. The resident control algorithms shall make all heating, cooling and/or ventilating decisions in response to electronic signals from sensors measuring indoor and outdoor temperatures. The control algorithm maintains accurate temperature control, minimizes drift from set point and provides better building comfort. A centralized microprocessor shall provide anti-short cycle timing and time delay between compressors to provide a higher level of machine protection.

Control Options

Inlet Guide Vanes shall be installed on each fan inlet to regulate capacity and limit horsepower at lower system requirements. When in any position other than full open they shall pre-spin intake air in the same direction as fan rotation. The inlet guide vanes shall close when supply fan is off, except in night setback.

The inlet guide vane actuator motor shall be driven by a modulating dc signal from the unit microprocessor. A pressure transducer shall measure duct static pressure and modulate the inlet guide vanes to maintain the required supply air static pressure within a predetermined range.

Mechanical Specifications

Variable Frequency Drives (VFDs) shall be factory installed and tested to provide supply fan motor speed modulation. The VFD shall receive a 2-10 VDC signal from the unit microprocessor based upon supply static pressure and shall cause the drive to accelerate or decelerate as required to maintain the supply static pressure setpoint. When subjected to high ambient return conditions (>100°F) (>37.3°C) the VFD shall be limited to a maximum output of 48 hertz until the temperature drops below 100°F (37.3°C). Bypass control to provide full nominal air flow in the event of drive failure shall be optional.

Ventilation Override shall allow a binary input from the fire/life safety panel to cause the unit to override standard operation and assume one of two factory preset ventilation sequences, exhaust or pressurization. The two sequences shall be selectable based open a binary select input.

Outside Air

Manual Outside Air
A manually controllable outside air damper shall be adjustable for up to 25 percent outside air. Manual damper is set at desired position at unit start up.

Economizer shall be factory installed. The assembly includes: fully modulating 0-100 percent motor and dampers, minimum position setting, preset linkage, wiring harness, and fixed dry bulb control. Solid-state enthalpy and differential enthalpy control shall be as a factory or field installed option.

Exhaust Air

Barometric Relief
The barometric relief damper shall be optional with the economizer. Option shall provide a pressure operated damper for the purpose of space pressure equalization and be gravity closing to prohibit entrance of outside air during the equipment "off" cycle.

Power Exhaust Fan
Power exhaust shall be available on all units and shall be factory installed. It shall assist the barometric relief damper in maintaining building pressurization.

Unit Options

Service Valves
Service valves shall be provided factory installed and include suction, liquid, and discharge three-way shutoff valves.

Through-The-Base Electrical Provision
An electrical service entrance shall be provided which allows access to route all high and low voltage electrical wiring inside the curb, through the bottom of the outdoor section of the unit and into the control box area.

Non-Fused Disconnect Switch
A factory installed non-fused disconnect switch with external handle shall be provided and shall satisfy NEC requirements for a service disconnect. The non-fused disconnect shall be mounted inside the unit control box.

GFI Convenience Outlet (Factory Powered)
A 15A, 115V Ground Fault Interrupter convenience outlet shall be factory installed. It shall be wired and powered from a factory mounted transformer or field powered through a separate 115V circuit. Unit mounted non-fused disconnect with external handle shall be furnished with factory powered outlet.

GFI Convenience Outlet (Field Powered)
A 15A, 115V Ground Fault Interrupter convenience outlet shall be factory installed and shall be powered by customer provided 115V circuit.

Hinged Service Access
Filter access panel and supply fan access panel shall be hinged for ease of unit service.

Condenser Coil Guards
Factory installed condenser vinyl coated wire mesh coil guards shall be available to provide full area protection against debris and vandalism.

Accessories

Roof Curb
The roof curb shall be designed to mate with the unit and provide support and a water tight installation when installed properly. The roof curb design shall allow field-fabricated rectangular supply/return ductwork to be connected directly to the curb when used with downflow units. Curb design shall comply with NRCA requirements. Curb shall ship knocked down for field assembly and include wood nailer strips.

Trane Communication Interface (TCI)
Shall be provided to interface with the Trane Integrated Comfort™ system and shall be available factory installed. The TCI shall allow control and monitoring of the rooftop unit via a two-wire communication link.

The following alarm and diagnostic information shall be available:

UCP Originated Data
- Unit operating mode
- Unit failure status
  Cooling failure
  Heating failure
  Emergency service stop indication
  Supply fan proving
  Timed override activation
  High temperature thermostat status
- Zone temperature
- Supply air temperature
- Cooling status (all stages)
- Stage activated or not
- Stage locked out by UCP
- HCP status for that stage
- Compressor disable inputs
- Heating status
- Number of stages activated
- High temperature limit status
- Economizer status
- Enthalpy favorability status
- Requested minimum position
- Damper position
- Dry bulb/enthalpy input status
- Outside air temperature
- Outside relative humidity
- Sensor Failure
  Humidity sensor
  OAT sensor
  SAT sensor
  RAT sensor
  Zone temperature sensor
  Mode input
  Cooling/heating setpoints from sensors
  Static pressure transducer
  Unit mounted potentiometer
  SAT from potentiometer
  Air reset setpoint from potentiometer
- Unit configuration data
  Gas or electric heat
  Economizer present
- High temp input status
- Local setpoint
- Local mode setting
- Inlet guide vane position

Tracer® Originated Data

- Command operating mode
- Host controllable functions:
  Supply fan
  Economizer
  Cooling stages enabled
  Heating stages enabled
  Emergency shutdown
- Minimum damper position
- Heating setpoint
- Cooling setpoint
- Supply air tempering enable/disable
- Slave mode (CV only)
- Tracer/local operation
- SAT setpoint
- Reset setpoint
- Reset amount
- MWU setpoint
- MWU enable/disable
- SAT reset type select
- Static pressure setpoint
- Static pressure deadband
- Daytime warm-up enable/disable
- Power exhaust setpoint

Zone Sensors
Shall be provided to interface with the Micro unit controls and shall be available in either manual, automatic programmable with night setback, with system malfunction lights or remote sensor options.

Conventional Thermostat Interface (CTI)
This field installed circuit board shall provide interface with electromechanical thermostats or automation systems. Not available with VAV system control.

Differential Pressure Switches
This field installed option allows individual fan failure and dirty filter indication. The fan failure switch will disable all unit functions and "flash" the Service LED on the zone sensor. The dirty filter switch will light the Service LED on the zone sensor and will allow continued unit operation.

Electronic Time Clock
This field installed accessory kit will allow the unit to operate in the unoccupied mode or perform night set up/set back functions utilizing a standard individual scheduling.

Remote Potentiometer
A remote potentiometer shall be available to remotely adjust the unit economizer minimum position.

High Temperature Thermostats
Field installed, manually resettable high temperature thermostats shall provide input to the unit controls to shut down the system if the temperature sensed at the return is 135°F (57°C) or at the discharge 240°F (115°C).

Reference Enthalpy Kit
Field installed enthalpy kit shall provide inputs for economizer control based upon comparison of the outside air stream to a definable enthalpy reference point. May also be factory installed.

Comparative Enthalpy Kit
Field installed enthalpy kit shall provide inputs for economizer control based upon comparison of the enthalpies of the return and outdoor air streams. Also available factory installed.

LP Conversion Kit
Field installed conversion kit shall provide orifice(s) for simplified conversion to liquefied propane gas. No change of gas valve shall be required.

BAYSENS006* – Zone sensor has one temperature setpoint lever, heat, off or cool system switch, fan auto or fan on switch. Manual changeover. These sensors are for CV units only.

BAYSENS008* – Zone sensor has two temperature setpoint levers, heat, auto, off, or cool system switch, fan auto or fan on switch. Auto changeover. These sensors are used with CV units.

BAYSENS010* – Zone sensor has two temperature set point levers, heat, auto, off, or cool system switch, fan auto or fan on switch. Status indication LED lights, System on, Heat, Cool, and Service are provided. These sensors are used with CV units.

BAYSENS013* – Zone temperature sensor with timed override buttons used with Tracer® Integrated Comfort system.

BAYSENS014* – Zone temperature sensor with local temperature adjustment control and timed override buttons used with Tracer Integrated Comfort system. May also be used for Morning Warm-up setpoint and sensor.

BAYSENS016* – Temperature sensor is a bullet or pencil type sensor that could be used for temperature input such as return air duct temperature.

BAYSENS017* – Remote sensor can be used for remote zone temperature sensing capabilities when zone sensors are used as remote panels or as a morning warm-up sensor for use with VAV units or as a zone sensor with Tracer Integrated Comfort system.

BAYSENS019* and BAYSENS020* – Electronic programmable sensors with auto or manual changeover with seven day programming. Keyboard selection of heat, cool, auto fan or on. All programmable sensors have System on, Heat, Cool, Service LED/LCD indicators as standard. Night setback sensors have two occupied, and two unoccupied programs per day. Sensors are available for CV zone temperature control and VAV zone temperature control.

BAYSENS021* – Zone sensor with supply air single temperature setpoint and AUTO/OFF system switch. Status indication LED lights, System ON, Heat, Cool, and Service are provided. Sensors are available to be used with VAV units.

BAYSENS022* – Sensor is an electronic digital zone sensor that can be used as a Heat Auto/Cool thermostat. The sensor has a large, easily read continuous digital display of the space temperature with setpoint temperature displayed at the touch of a button.

BAYSTAT023* – Remote Minimum Position Potentiometer is used to remotely specify the minimum economizer position.

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Library	**Product Literature**
Product Section	**Unitary**
Product	**Rooftop**
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