

Tranquility® 30 Two-Stage (TT) Series

Submittal Data

Models TT/H/V 026 - 072 60Hz - HFC-410A



LC1020

Rev.: November 18, 2016



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Two- Stage TT Series



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THE TRANQUILITY® 30 TWO-STAGE (TT) SERIES

Available in sizes 2 tons (7.0 kW) through 6 tons (19.3 kW) with multiple cabinet options (vertical upflow, and horizontal) the Tranquility® 30 offers a wide range of units for most any installation. The Tranquility® 30 has an extended range refrigerant circuit, capable of ground loop (geothermal) applications as well as water loop (boiler-tower) applications. Standard features are many. Copeland UltraTech™ two-stage unloading scroll compressor, ECM variable fan motor, microprocessor controls, galvanized steel cabinet, polyester powder coat paint, stainless steel drain pan and foil-backed air handler insulation are just some of the features of the innovative Tranquility® 30 Series.

ClimateMaster's exclusive double isolation compressor mounting system makes the Tranquility® 30 the quietest unit on the market. Compressors are mounted on specially engineered sound tested EPDM grommets to a heavy gauge mounting plate, which is then isolated from the cabinet base with rubber grommets for maximized vibration/sound attenuation. The unique low profile slanted control box makes installing and maintaining the unit easier than any other water-source heat pump currently in production. Options such as a coated air coil, DDC controls, and high efficiency MERV 11 two-inch (51mm) air filters allow customized design solutions.

The Tranquility® 30 (TT) Series water-source heat pumps are designed to meet the challenges of today's HVAC demands with one of the most innovative products available on the market.

UNIT FEATURES

- Sizes 026 (2 ton, 7.0 kW) through 072 (6 tons, 19.3 kW)
- EarthPure® (HFC-410A) refrigerant
- Copeland UltraTech™ two-stage unloading scroll compressors
- ECM variable speed fan motor with soft start
- Exceeds ASHRAE 90.1 efficiencies
- Part load operation significantly lowers annual operating costs
- Galvanized steel construction with attractive black mat polyester powder coat paint and silver accents
- Stainless steel drain pan
- Foil-backed insulation in air handler section
- Unique double isolation compressor mounting with vibration isolation for quiet operation
- Insulated divider and separate compressor/air handler compartments
- TXV metering device
- Extended range (20 to 120°F, -6.7 to 48.9°C) operation
- Microprocessor controls standard (optional DXM and/or DDC controls)
- LonWorks, BACnet, Modbus and Johnson N2 compatibility options for DDC controls
- Field convertible discharge air arrangement for horizontal units
- Low profile slanted control box for easy access
- Internally trapped condensate drain line (vertical units only)
- Flush securely-mounted corner post water connections (no backup wrench required)
- Unit Performance Sentinel performance monitoring system
- Eight Safeties Standard
- Provides a dedicated ClimaDry® modulating reheat dehumidification mode.

Selection Procedure

Reference Calculations

Heating	Cooling
$\text{LWT} = \text{EWT} - \frac{\text{HE}}{\text{GPM} \times 500}$ $\text{LAT} = \text{EAT} + \frac{\text{HC}}{\text{CFM} \times 1.08}$	$\text{LWT} = \text{EWT} + \frac{\text{HR}}{\text{GPM} \times 500}$ $\text{LAT (DB)} = \text{EAT (DB)} - \frac{\text{SC}}{\text{CFM} \times 1.08}$ $\text{LC} = \text{TC} - \text{SC}$ $\text{S/T} = \frac{\text{SC}}{\text{TC}}$

Legend and Glossary of Abbreviations

BTUH = BTU(British Thermal Unit) per hour	HWC = hot water generator (desuperheater) capacity, Mbtuh
CFM = airflow, cubic feet/minute	FPT = female pipe thread
COP = coefficient of performance = BTUH output/BTUH input	KW = total power unit input, kilowatts
DB = dry bulb temperature (°F)	LAT = leaving air temperature, °F
EAT = entering air temperature, Fahrenheit (dry bulb/wet bulb)	LC = latent cooling capacity, BTUH
EER = energy efficiency ratio = BTUH output/Watt input	LWT = leaving water temperature, °F
MPT = male pipe thread	MBTUH = 1000 BTU per hour
ESP = external static pressure (inches w.g.)	S/T = sensible to total cooling ratio
EWT = entering water temperature	SC = sensible cooling capacity, BTUH
GPM = water flow in U.S. gallons/minute	TC = total cooling capacity, BTUH
HE = total heat of extraction, BTUH	WB = wet bulb temperature (°F)
HC = air heating capacity, BTUH	WPD = waterside pressure drop (psi & ft. of hd.)
HR = total heat of rejection, BTUH	

Conversion Table - to convert inch-pound (English) to S-I (Metric)

Air Flow	Water Flow	Ext Static Pressure	Water Pressure Drop
Airflow (L/s) = CFM x 0.472	Water Flow (L/s) = gpm x 0.0631	ESP (Pa) = ESP (in of wg) x 249	PD (kPa) = PD (ft of hd) x 2.99

Selection Procedure

- Step 1** Determine the actual heating and cooling loads at the desired dry bulb and wet bulb conditions.
- Step 2** Obtain the following design parameters: Entering water temperature, water flow rate in GPM, air flow in CFM, water flow pressure drop and design wet and dry bulb temperatures. Air flow CFM should be between 300 and 450 CFM per ton. Unit water pressure drop should be kept as close as possible to each other to make water balancing easier. Go to the appropriate tables and find the proper indicated water flow and water temperature.
- Step 3** Select a unit based on total and sensible cooling conditions. Select a unit which is closest to, but no larger than, the actual cooling load.
- Step 4** Enter tables at the design water flow and water temperature. Read the total and sensible cooling capacities (Note: interpolation is permissible, extrapolation is not).
- Step 5** Read the heating capacity. If it exceeds the design criteria it is acceptable. It is quite normal for Water-Source Heat Pumps to be selected on cooling capacity only since the heating output is usually greater than the cooling capacity.
- Step 6** Determine the correction factors associated with the variable factors of dry bulb and wet bulb.
- Corrected Total Cooling = tabulated total cooling x wet bulb correction.
Corrected Sensible Cooling = tabulated sensible cooling x wet/dry bulb correction.
- Step 7** Compare the corrected capacities to the load requirements. Normally if the capacities are within 10% of the loads, the equipment is acceptable. It is better to undersize than oversize, as undersizing improves humidity control, reduces sound levels and extends the life of the equipment.
- Step 8** When completed, calculate water temperature rise and assess the selection. If the units selected are not within 10% of the load calculations, then review what effect changing the GPM, water temperature and/or air flow and air temperature would have on the corrected capacities. If the desired capacity cannot be achieved, select the next larger or smaller unit and repeat the procedure. Remember, when in doubt, undersize slightly for best performance.

Example Equipment Selection For Cooling

Step 1 Load Determination:

Assume we have determined that the appropriate cooling load at the desired dry bulb 80°F and wet bulb 65°F conditions is as follows:

Total Cooling22,100 BTUH
Sensible Cooling.....16,500 BTUH
Entering Air Temp.....80°F Dry Bulb / 65°F Wet Bulb

Step 2 Design Conditions:

Similarly, we have also obtained the following design parameters:

Entering Water Temp.....90°F
Water Flow (Based upon 10°F rise in temp.)6.0 GPM
Air Flow.....730 CFM

Step 3, 4 & 5 HP Selection:

After making our preliminary selection (TTH026 - Full Load), we enter the tables at design water flow and water temperature and read Total Cooling, Sens. Cooling and Heat of Rej. capacities:

Total Cooling.....24,200 BTUH
Sensible Cooling.....16,300 BTUH
Heat of Rejection.....29,900 BTUH

Step 6 & 7 Entering Air and Airflow Corrections:

Next, we determine our correction factors.

Table	Ent Air	Air Flow	Corrected
Corrected Total Cooling = 24,200 x 0.975 x 0.978 = 23,076			
Corrected Sens Cooling = 16,300 x 1.096 x 0.926 = 16,543			
Corrected Heat of Reject = 29,900 x 0.979 x 0.978 = 28,628			

Step 8 Water Temperature Rise Calculation & Assessment:

Actual Temperature Rise.....9.5°F

When we compare the Corrected Total Cooling and Corrected Sensible Cooling figures with our load requirements stated in Step 1, we discover that our selection is within +/- 10% of our sensible load requirement. Furthermore, we see that our Corrected Total Cooling figure is within 1,000 Btuh of the actual indicated load.

TT Series Nomenclature

TT V 026 B G C 3 0 C L K S

Model Type

TT = Tranquility®
Two-Stage Scroll

Configuration

V = Vertical Upflow
H = Horizontal

Unit Size

026 - E,F,G,H
038 - E,F,G,H
049 - E,F,G,H
064 - E,F,G,H
072 - F,G,H

AVAILABLE
VOLTAGES

Revision Level

B = Current 026, 049 - 072
C = Current 038

Voltage

G = 208/230/60/1
H = 208/230/60/3
E = 265/60/1
F = 460/60/3

Controls

Control	w/o Disconnect	w/ Disconnect
DXM	D	B
DXM w/LON	M	K
DXM w/MPC	P	S

Standard

S = Standard

Supply Air & Motor Option

Option	Supply	Configuration	Motor
K	Top	TTV	ECM
P	Back	TTH	ECM
W	Straight	TTH	ECM

Return Air

L = Left Return
R = Right Return

Heat Exchanger & Valve Options

ClimaDry® Reheat	Non Coated Air Coil		Tin Plated/Micro Channel Air Coil	
	Copper	Cupro-Nickel	Copper	Cupro-Nickel
+E		+P	*D	*F

ClimaDry® reheat coil not coated

+E or P = sizes 026, 049, 064, 072 have a copper tube with aluminum fin refrigerant to air coil.

+E or P = size 038 has an all-aluminum micro channel refrigerant to air coil.

+D or F = sizes 026, 049, 064, 072 have a tin plated copper tube with aluminum fin refrigerant to air coil.

+D or F = size 038 has an all-aluminum micro channel refrigerant to air coil.

Water Circuit Options

0 = None
2 = HWG (Coil Only)

Cabinet Insulation

OPTION	RANGE	ULTRA QUIET	1" FILTER RAIL	2" FILTER RAIL	1" FILTER FRAME	2" FILTER FRAME
1	EXTENDED RANGE	NO	YES	NO		
A			NO			YES
J			NO	YES	NO	
K			NO		YES	NO
2		YES	YES	NO		
C			NO			YES
L			NO	YES	NO	
M			NO		YES	NO
3	STANDARD RANGE	NO	YES	NO		
E			NO			YES
N			NO	YES	NO	
P			NO		YES	NO
4		YES	YES	NO		
G			NO			YES
R			NO	YES	NO	
S			NO		YES	NO

ClimaDry® II Option Notes:

- Unit must have DXM control option. 460 volt unit units require a four wire power supply with neutral.
- Unit minimum entering air temperature while in the dehumidification, cooling, or continuous fan modes is **65°F DB/55°F WB**. Operation below this minimum may result in nuisance faults.
- A thermostat with dehumidification mode or thermostat and separate humidistat/dehumidistat is required for activation and control of ClimaDry® II.

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Performance Data AHRI/ASHRAE/ISO 13256-1

ASHRAE/AHRI/ISO 13256-1. English (I-P) Units

Model	Capacity Modulation	Water Loop Heat Pump				Ground Water Heat Pump				Ground Loop Heat Pump			
		Cooling 86°F		Heating 68°F		Cooling 59°F		Heating 50°F		Cooling Full Load 77°F Part Load 68°F		Heating Full Load 32°F Part Load 41°F	
		Capacity Btuh	EER Btuh/W	Capacity Btuh	COP	Capacity Btuh	EER Btuh/W	Capacity Btuh	COP	Capacity Btuh	EER Btuh/W	Capacity Btuh	COP
TTH/V 026	Part	19,100	19.6	22,100	6.5	22,000	35.3	17,700	5.3	20,900	28.0	15,300	4.6
	Full	25,300	17.7	30,400	5.7	28,700	27.3	24,800	5.0	26,300	19.9	18,900	4.0
TTH/V 038	Part	27,000	19.5	31,800	6.4	31,300	34.4	26,100	5.4	30,400	29.6	23,200	4.8
	Full	38,000	17.8	45,100	5.8	43,300	27.1	37,200	5.2	39,900	20.3	29,200	4.4
TTH/V 049	Part	36,500	19.4	43,600	6.3	42,000	34.3	35,000	5.1	40,300	27.9	30,100	4.4
	Full	48,700	17.3	59,700	5.5	55,800	26.1	48,400	4.8	50,800	19.3	37,200	4.0
TTH/V 064	Part	46,300	18.7	54,700	6.0	53,100	32.4	44,000	5.0	51,200	26.7	38,100	4.4
	Full	61,500	16.2	77,400	5.4	71,500	24.4	63,200	4.8	66,200	18.8	48,700	3.9
TTH/V 072	Part	53,000	16.8	64,600	5.2	60,800	28.6	53,200	4.5	58,100	23.2	46,000	3.9
	Full	68,300	15.1	85,300	4.8	77,700	22.5	71,400	4.4	71,700	16.9	55,800	3.7

Cooling capacities based upon 80.6°F DB, 66.2°F WB entering air temperature

Heating capacities based upon 68°F DB, 59°F WB entering air temperature

Ground Loop Heat Pump ratings based on 15% antifreeze solution

All ratings based upon operation at lower voltage of dual voltage rated models

ASHRAE/AHRI/ISO 13256-1. Metric (S-I) Units

Model	Capacity Modulation	Water Loop Heat Pump				Ground Water Heat Pump				Ground Loop Heat Pump			
		Cooling 30°C		Heating 20°C		Cooling 15°C		Heating 10°C		Cooling Full Load 25°C Part Load 20°C		Heating Full Load 0°C Part Load 5°C	
		Capacity kW	EER W/W	Capacity kW	COP	Capacity kW	EER W/W	Capacity kW	COP	Capacity kW	EER W/W	Capacity kW	COP
TTH/V 026	Part	5.60	5.7	6.48	6.5	6.45	10.3	5.19	5.3	6.13	8.2	4.48	4.6
	Full	7.42	5.2	8.91	5.7	8.41	8.0	7.27	5.0	7.71	5.8	5.54	4.0
TTH/V 038	Part	7.91	5.7	9.32	6.4	9.17	10.1	7.65	5.4	8.91	8.7	6.80	4.8
	Full	11.14	5.2	13.22	5.8	12.69	7.9	10.90	5.2	11.69	5.9	8.56	4.4
TTH/V 049	Part	10.70	5.7	12.78	6.3	12.31	10.1	10.26	5.1	11.81	8.2	8.82	4.4
	Full	14.27	5.1	17.50	5.5	16.35	7.6	14.19	4.8	14.89	5.7	10.90	4.0
TTH/V 064	Part	13.57	5.5	16.03	6.0	15.56	9.5	12.90	5.0	15.01	7.8	11.17	4.4
	Full	18.02	4.7	22.68	5.4	20.96	7.2	18.52	4.8	19.40	5.5	14.27	3.9
TTH/V 072	Part	15.53	4.9	18.93	5.2	17.82	8.4	15.59	4.5	17.03	6.8	13.48	3.9
	Full	20.02	4.4	25.00	4.8	22.77	6.6	20.93	4.4	21.01	5.0	16.35	3.7

Cooling capacities based upon 27°C DB, 19°C WB entering air temperature

Heating capacities based upon 20°C DB, 15°C WB entering air temperature

Ground Loop Heat Pump ratings based on 15% antifreeze solution

All ratings based upon operation at lower voltage of dual voltage rated models

Performance Data – Selection Notes

For operation in the shaded area when water is used in lieu of an antifreeze solution, the LWT (Leaving Water Temperature) must be calculated. Flow must be maintained to a level such that the LWT is maintained above 40°F [4.4°C] when the JW3 jumper is not clipped (see example below). Otherwise, appropriate levels of a proper antifreeze solution should be used in systems with leaving water temperatures of 40°F [4.4°C] or below and the JW3 jumper should be clipped. This is due to the potential of the refrigerant temperature being as low as 32°F [0°C] with 40°F [4.4°C] LWT, which may lead to a nuisance cutout due to the activation of the Low Temperature Protection. JW3 should never be clipped for standard range equipment or systems without antifreeze.

Example:

At 50°F EWT (Entering Water Temperature) and 1.5 gpm/ton, a 3 ton unit has a HE of 22,500 Btuh. To calculate LWT, rearrange the formula for HE as follows:

HE = TD x GPM x 500, where HE = Heat of Extraction (Btuh); TD = temperature difference (EWT - LWT) and GPM = U.S. Gallons per Minute.

$$TD = HE / (GPM \times 500)$$

$$TD = 22,500 / (4.5 \times 500)$$

$$TD = 10^\circ\text{F}$$

$$LWT = EWT - TD$$

$$LWT = 50 - 10 = 40^\circ\text{F}$$

In this example, as long as the EWT does not fall below 50°F, the system will operate as designed. For EWTs below 50°F, higher flow rates will be required (open loop systems, for example, require at least 2 gpm/ton when EWT is below 50°F).

Heating - EAT 70°F						
ER	Airflow CFM	HC	kW	HE	LAT	COP
	825	11.7	1.02	8.4	83.2	3.38
	710	13.6	1.09	10.1	87.8	3.66
38.3	825	13.8	1.06	10.3	85.5	3.81
39.2	710	14.2	1.09	10.7	88.5	3.81
39.2	825	14.4	1.06	10.9	86.1	3.97
39.8	710	14.4	1.09	10.9	88.8	3.86
39.8	825	14.6	1.06	11.1	86.3	4.02
35.3	710	16.1	1.15	12.3	90.9	4.08
35.3	825	16.2	1.12	12.6	88.2	4.25
37.9	710	16.7	1.15	13.0	91.8	4.25
37.9	825	16.9	1.12	13.3	89.0	4.42
38.3	710	16.9	1.16	13.2	92.1	4.30
38.3	825	17.1	1.12	13.5	89.2	4.47
30.7	710	18.3	1.18	14.5	93.9	4.56
30.7	825	18.5	1.14	14.8	90.8	4.75
34.4	710	19.1	1.18	15.2	94.8	4.73
34.4	825	19.3	1.15	15.5	91.6	4.93
	710	19.3	1.18	15.4	95.1	4.78
	825	19.5	1.15	15.7	91.9	4.98
40	20.4	1.21	16.5	96.6	4.9	
	20.6	1.18	16.8	93.2		
	20.2	1.22	17.3	97		

Performance Data – TT H/V 026 (Part Load)

850 CFM Nominal Airflow Heating, 750 CFM Nominal Airflow Cooling

Performance capacities shown in thousands of Btuh

EWT °F	GPM	WPD		Cooling - EAT 80/67 °F						Heating - EAT 70°F				
		PSI	FT	TC	SC	Sens/Tot Ratio	kW	HR	EER	HC	kW	HE	LAT	COP
20	4.5	2.5	5.8	Operation not recommended						11.5	1.10	7.7	80.5	3.1
30	2.3	0.7	1.7	23.3	17.9	0.77	0.59	25.3	39.2	12.7	1.10	8.9	81.8	3.4
	3.4	1.3	3.0	23.1	18.0	0.78	0.55	25.0	41.7	13.2	1.10	9.5	82.4	3.5
	4.5	2.0	4.6	22.9	18.1	0.79	0.54	24.8	42.3	13.5	1.10	9.8	82.7	3.6
40	2.3	0.5	1.2	22.9	17.7	0.77	0.67	25.2	34.4	14.7	1.11	10.9	84.0	3.9
	3.4	1.0	2.4	23.2	17.9	0.77	0.61	25.3	38.2	15.4	1.11	11.7	84.8	4.1
	4.5	1.6	3.8	23.3	17.9	0.77	0.59	25.3	39.7	15.8	1.11	12.1	85.2	4.2
50	2.3	0.4	1.0	22.2	17.4	0.78	0.76	24.8	29.0	16.8	1.11	13.0	86.3	4.4
	3.4	0.9	2.0	22.8	17.6	0.77	0.69	25.1	33.0	17.8	1.11	14.0	87.3	4.7
	4.5	1.4	3.2	23.0	17.7	0.77	0.66	25.2	35.0	18.2	1.11	14.4	87.8	4.8
60	2.3	0.4	1.0	21.1	17.0	0.81	0.88	24.1	24.1	19.0	1.12	15.2	88.7	5.0
	3.4	0.8	1.8	21.9	17.3	0.79	0.79	24.6	27.7	20.1	1.12	16.3	89.8	5.3
	4.5	1.3	2.9	22.3	17.4	0.78	0.75	24.8	29.6	20.7	1.12	16.8	90.5	5.4
70	2.3	0.4	1.0	19.9	16.6	0.83	1.01	23.3	19.7	21.2	1.12	17.4	91.0	5.5
	3.4	0.8	1.8	20.8	16.9	0.81	0.91	23.9	22.8	22.4	1.13	18.5	92.3	5.8
	4.5	1.2	2.7	21.2	17.1	0.80	0.87	24.2	24.4	23.0	1.13	19.1	93.0	6.0
80	2.3	0.5	1.1	18.6	16.0	0.86	1.16	22.5	16.0	23.3	1.13	19.4	93.3	6.0
	3.4	0.8	1.8	19.5	16.4	0.84	1.05	23.1	18.5	24.5	1.13	20.6	94.6	6.3
	4.5	1.2	2.7	20.0	16.6	0.83	1.00	23.4	19.9	25.1	1.14	21.2	95.3	6.5
90	2.3	0.5	1.2	17.2	15.4	0.89	1.32	21.7	13.1	25.2	1.14	21.3	95.4	6.5
	3.4	0.8	1.9	18.1	15.8	0.87	1.21	22.3	15.0	26.4	1.15	22.5	96.7	6.7
	4.5	1.2	2.7	18.6	16.0	0.86	1.16	22.5	16.0	26.9	1.15	23.0	97.3	6.9
100	2.3	0.5	1.2	16.0	14.8	0.92	1.50	21.1	10.7	Operation not recommended				
	3.4	0.8	1.9	16.8	15.2	0.90	1.38	21.5	12.1					
	4.5	1.2	2.7	17.2	15.4	0.89	1.33	21.7	13.0					
110	2.3	0.5	1.1	14.9	14.1	0.95	1.69	20.7	8.8					
	3.4	0.8	1.8	15.6	14.5	0.93	1.57	20.9	9.9					
	4.5	1.1	2.6	15.9	14.7	0.92	1.51	21.1	10.5					
120	2.3	0.3	0.8	14.2	13.7	0.97	1.90	20.6	7.4					
	3.4	0.6	1.5	14.6	13.9	0.96	1.77	20.6	8.2					
	4.5	1.0	2.4	14.9	14.1	0.95	1.71	20.7	8.7					

Interpolation is permissible; extrapolation is not.

All entering air conditions are 80°F DB and 67°F WB in cooling, and 70°F DB in heating.

AHRI/ISO certified conditions are 80.6°F DB and 66.2°F WB in cooling and 68°F DB in heating.

Table does not reflect fan or pump power corrections for AHRI/ISO conditions.

All performance is based upon the lower voltage of dual voltage rated units.

Performance stated is at the rated power supply; performance may vary as the power supply varies from the rated.

Operation below 40°F EWT is based upon a 15% methanol antifreeze solution.

Operation below 60°F EWT requires optional insulated water/refrigerant circuit.

See performance correction tables for operating conditions other than those listed above.

See Performance Data Selection Notes for operation in the shaded areas.

Performance Data – TT H/V 026 (Full Load)

950 CFM Nominal Airflow Heating, 850 CFM Nominal Airflow Cooling

Performance capacities shown in thousands of Btu/h

EWT °F	GPM	WPD		Cooling - EAT 80/67 °F						Heating - EAT 70°F				
		PSI	FT	TC	SC	Sens/Tot Ratio	kW	HR	EER	HC	kW	HE	LAT	COP
20	6.0	3.7	8.6	Operation not recommended						16.6	1.44	11.7	84.2	3.4
30	3.0	1.1	2.5	30.7	21.8	0.71	0.98	34.0	31.3	18.1	1.47	13.1	85.6	3.6
	4.5	2.0	4.6	30.7	21.7	0.71	0.92	33.9	33.6	18.9	1.48	13.8	86.3	3.7
	6.0	3.1	7.1	30.7	21.6	0.70	0.89	33.7	34.6	19.3	1.49	14.2	86.8	3.8
40	3.0	0.9	2.0	30.1	21.6	0.72	1.08	33.8	27.9	20.7	1.51	15.5	88.1	4.0
	4.5	1.6	3.8	30.6	21.8	0.71	1.00	34.0	30.5	21.7	1.53	16.5	89.1	4.2
	6.0	2.6	6.0	30.7	21.8	0.71	0.97	34.0	31.7	22.2	1.53	17.0	89.6	4.2
50	3.0	0.7	1.6	29.2	21.2	0.73	1.20	33.3	24.4	23.4	1.55	18.1	90.8	4.4
	4.5	1.4	3.2	29.9	21.5	0.72	1.11	33.7	27.0	24.6	1.57	19.3	92.0	4.6
	6.0	2.3	5.2	30.2	21.6	0.72	1.07	33.9	28.3	25.3	1.59	19.9	92.6	4.7
60	3.0	0.7	1.5	28.0	20.7	0.74	1.33	32.5	21.1	26.3	1.60	20.8	93.6	4.8
	4.5	1.3	2.9	28.9	21.1	0.73	1.23	33.1	23.5	27.7	1.63	22.2	94.9	5.0
	6.0	2.0	4.7	29.3	21.3	0.73	1.18	33.4	24.8	28.5	1.64	22.9	95.7	5.1
70	3.0	0.6	1.5	26.6	20.1	0.75	1.47	31.6	18.0	29.2	1.65	23.6	96.4	5.2
	4.5	1.2	2.7	27.6	20.5	0.74	1.37	32.3	20.2	30.8	1.68	25.1	98.0	5.4
	6.0	1.9	4.4	28.1	20.7	0.74	1.31	32.6	21.4	31.7	1.70	25.9	98.8	5.5
80	3.0	0.7	1.5	25.0	19.4	0.77	1.64	30.6	15.3	32.1	1.70	26.3	99.2	5.5
	4.5	1.2	2.7	26.1	19.9	0.76	1.52	31.3	17.2	33.9	1.74	28.0	101.0	5.7
	6.0	1.8	4.2	26.7	20.1	0.75	1.46	31.7	18.2	34.9	1.76	28.9	101.9	5.8
90	3.0	0.7	1.6	23.4	18.7	0.80	1.82	29.6	12.9	35.0	1.76	29.0	102.0	5.8
	4.5	1.2	2.7	24.5	19.2	0.78	1.70	30.3	14.5	36.9	1.80	30.7	103.8	6.0
	6.0	1.8	4.1	25.1	19.4	0.77	1.63	30.6	15.3	37.9	1.82	31.6	104.8	6.1
100	3.0	0.7	1.6	21.8	18.1	0.83	2.02	28.7	10.8	Operation not recommended				
	4.5	1.2	2.7	22.9	18.5	0.81	1.89	29.3	12.1					
	6.0	1.8	4.1	23.4	18.7	0.80	1.82	29.6	12.8					
110	3.0	0.7	1.5	20.3	17.7	0.87	2.25	28.0	9.0					
	4.5	1.1	2.6	21.3	17.9	0.84	2.10	28.5	10.1					
	6.0	1.7	4.0	21.8	18.1	0.83	2.03	28.7	10.7					
120	3.0	0.5	1.2	19.0	17.4	0.91	2.50	27.5	7.6					
	4.5	1.0	2.4	19.8	17.5	0.89	2.34	27.8	8.5					
	6.0	1.7	3.9	20.2	17.6	0.87	2.26	28.0	8.9					

Interpolation is permissible; extrapolation is not.

All entering air conditions are 80°F DB and 67°F WB in cooling, and 70°F DB in heating.

AHRI/ISO certified conditions are 80.6°F DB and 66.2°F WB in cooling and 68°F DB in heating.

Table does not reflect fan or pump power corrections for AHRI/ISO conditions.

All performance is based upon the lower voltage of dual voltage rated units.

Performance stated is at the rated power supply; performance may vary as the power supply varies from the rated.

Operation below 40°F EWT is based upon a 15% methanol antifreeze solution.

Operation below 60°F EWT requires optional insulated water/refrigerant circuit.

See performance correction tables for operating conditions other than those listed above.

See Performance Data Selection Notes for operation in the shaded areas.

Performance Data – TT H/V 038 (Part Load)

1,000 CFM Nominal Airflow Heating, 1,000 CFM Nominal Airflow Cooling

Performance capacities shown in thousands of Btuh

EWT °F	GPM	WPD		Cooling - EAT 80/67 °F						Heating - EAT 70°F				
		PSI	FT	TC	SC	Sens/Tot Ratio	kW	HR	EER	HC	kW	HE	LAT	COP
20	6.0	4.9	11.2	Operation not recommended						17.4	1.49	12.3	84.1	3.4
30	3.0	1.5	3.4	33.3	22.5	0.68	0.83	36.2	39.9	19.1	1.50	14.0	85.6	3.7
	4.5	2.6	6.0	32.8	22.1	0.68	0.80	35.5	41.2	20.1	1.51	14.9	86.5	3.9
	6.0	3.8	8.9	32.2	21.8	0.68	0.79	34.9	40.8	20.6	1.51	15.4	87.0	4.0
40	3.0	1.1	2.5	33.1	22.7	0.68	0.93	36.3	35.6	22.0	1.52	16.8	88.3	4.3
	4.5	2.0	4.7	33.3	22.6	0.68	0.85	36.2	39.2	23.2	1.52	18.0	89.4	4.5
	6.0	3.1	7.2	33.2	22.4	0.68	0.82	36.0	40.5	23.8	1.53	18.6	90.0	4.6
50	3.0	0.9	2.0	32.3	22.5	0.70	1.07	35.9	30.3	24.9	1.53	19.7	91.0	4.8
	4.5	1.7	3.9	33.0	22.6	0.69	0.95	36.3	34.6	26.3	1.54	21.1	92.3	5.0
	6.0	2.7	6.2	33.2	22.6	0.68	0.91	36.3	36.7	27.1	1.55	21.8	93.0	5.1
60	3.0	0.8	1.8	30.9	22.1	0.72	1.23	35.1	25.0	27.9	1.55	22.6	93.8	5.3
	4.5	1.5	3.5	32.0	22.4	0.70	1.10	35.8	29.2	29.5	1.56	24.2	95.3	5.5
	6.0	2.4	5.5	32.5	22.6	0.69	1.04	36.0	31.4	30.4	1.57	25.1	96.1	5.7
70	3.0	0.8	1.9	29.2	21.5	0.74	1.43	34.1	20.5	30.9	1.57	25.6	96.6	5.8
	4.5	1.5	3.4	30.5	22.0	0.72	1.28	34.9	24.0	32.8	1.58	27.4	98.3	6.1
	6.0	2.3	5.3	31.2	22.2	0.71	1.20	35.3	25.9	33.8	1.59	28.4	99.2	6.2
80	3.0	0.9	2.0	27.3	20.8	0.76	1.64	32.9	16.6	34.0	1.59	28.5	99.4	6.3
	4.5	1.5	3.4	28.7	21.4	0.74	1.48	33.8	19.4	36.1	1.61	30.6	101.3	6.6
	6.0	2.2	5.2	29.4	21.6	0.73	1.40	34.2	21.1	37.2	1.61	31.7	102.4	6.8
90	3.0	0.9	2.1	25.2	19.9	0.79	1.87	31.6	13.5	37.1	1.61	31.6	102.2	6.7
	4.5	1.5	3.5	26.7	20.6	0.77	1.70	32.5	15.7	39.4	1.63	33.8	104.4	7.1
	6.0	2.2	5.2	27.5	20.9	0.76	1.62	33.0	17.0	40.7	1.64	35.1	105.6	7.3
100	3.0	0.9	2.1	23.2	19.0	0.82	2.11	30.4	11.0	Operation not recommended				
	4.5	1.5	3.5	24.6	19.6	0.80	1.94	31.2	12.7					
	6.0	2.2	5.1	25.3	20.0	0.79	1.86	31.7	13.6					
110	3.0	0.8	1.8	21.3	18.0	0.85	2.36	29.3	9.0					
	4.5	1.4	3.2	22.5	18.7	0.83	2.19	30.0	10.3					
	6.0	2.1	4.9	23.2	19.0	0.82	2.11	30.4	11.0					
120	3.0	0.5	1.1	19.6	17.2	0.88	2.62	28.5	7.5					
	4.5	1.1	2.6	20.6	17.7	0.86	2.45	29.0	8.4					
	6.0	1.9	4.4	21.2	18.0	0.85	2.37	29.3	9.0					

Interpolation is permissible; extrapolation is not.

All entering air conditions are 80°F DB and 67°F WB in cooling, and 70°F DB in heating.

AHRI/ISO certified conditions are 80.6°F DB and 66.2°F WB in cooling and 68°F DB in heating.

Table does not reflect fan or pump power corrections for AHRI/ISO conditions.

All performance is based upon the lower voltage of dual voltage rated units.

Performance stated is at the rated power supply; performance may vary as the power supply varies from the rated.

Operation below 40°F EWT is based upon a 15% methanol antifreeze solution.

Operation below 60°F EWT requires optional insulated water/refrigerant circuit.

See performance correction tables for operating conditions other than those listed above.

See Performance Data Selection Notes for operation in the shaded areas.

Performance Data – TT H/V 038 (Full Load)

1,250 CFM Nominal Airflow Heating, 1,250 CFM Nominal Airflow Cooling

Performance capacities shown in thousands of Btuh

EWT °F	GPM	WPD		Cooling - EAT 80/67 °F						Heating - EAT 70°F				
		PSI	FT	TC	SC	Sens/Tot Ratio	kW	HR	EER	HC	kW	HE	LAT	COP
20	9.0	8.3	19.1	Operation not recommended						26.0	2.02	19.1	87.2	3.8
30	4.5	2.6	6.0	45.6	29.7	0.65	1.49	50.6	30.5	28.3	2.05	21.3	88.9	4.0
	6.8	4.5	10.5	44.9	29.5	0.66	1.44	49.9	31.2	29.7	2.07	22.6	89.9	4.2
	9.0	6.9	16.0	44.4	29.3	0.66	1.43	49.3	31.1	30.4	2.08	23.3	90.5	4.3
40	4.5	2.0	4.7	45.4	29.6	0.65	1.60	50.9	28.4	32.4	2.12	25.2	91.9	4.5
	6.8	3.8	8.7	45.6	29.7	0.65	1.51	50.8	30.1	34.0	2.15	26.7	93.1	4.6
	9.0	5.9	13.6	45.5	29.7	0.65	1.48	50.5	30.7	34.9	2.16	27.5	93.8	4.7
50	4.5	1.7	3.9	44.5	29.3	0.66	1.75	50.4	25.5	36.5	2.20	29.0	95.0	4.9
	6.8	3.2	7.5	45.3	29.6	0.65	1.63	50.8	27.7	38.4	2.24	30.7	96.3	5.0
	9.0	5.2	11.9	45.5	29.7	0.65	1.58	50.9	28.8	39.4	2.26	31.7	97.1	5.1
60	4.5	1.5	3.5	42.9	28.8	0.67	1.93	49.5	22.3	40.6	2.29	32.8	98.0	5.2
	6.8	2.9	6.7	44.1	29.2	0.66	1.79	50.2	24.7	42.8	2.34	34.8	99.6	5.4
	9.0	4.7	10.8	44.6	29.4	0.66	1.73	50.5	25.9	43.9	2.37	35.8	100.5	5.4
70	4.5	1.5	3.4	40.9	28.0	0.68	2.14	48.2	19.2	44.8	2.39	36.6	101.1	5.5
	6.8	2.7	6.3	42.4	28.6	0.67	1.98	49.2	21.4	47.2	2.45	38.8	102.9	5.6
	9.0	4.4	10.1	43.1	28.8	0.67	1.91	49.6	22.6	48.5	2.48	40.0	103.8	5.7
80	4.5	1.5	3.4	38.6	27.1	0.70	2.37	46.7	16.3	49.0	2.50	40.4	104.2	5.7
	6.8	2.7	6.2	40.3	27.7	0.69	2.20	47.8	18.3	51.6	2.56	42.9	106.2	5.9
	9.0	4.2	9.7	41.1	28.1	0.68	2.12	48.3	19.4	53.1	2.60	44.2	107.2	6.0
90	4.5	1.5	3.5	36.2	26.0	0.72	2.64	45.2	13.7	53.2	2.60	44.3	107.3	6.0
	6.8	2.6	6.1	37.9	26.7	0.71	2.45	46.2	15.4	56.1	2.68	47.0	109.5	6.1
	9.0	4.1	9.5	38.7	27.1	0.70	2.36	46.8	16.4	57.7	2.72	48.4	110.6	6.2
100	4.5	1.5	3.5	33.7	24.8	0.73	2.92	43.7	11.6	Operation not recommended				
	6.8	2.6	6.1	35.4	25.6	0.72	2.73	44.7	13.0					
	9.0	4.1	9.4	36.2	26.0	0.72	2.63	45.2	13.7					
110	4.5	1.4	3.2	31.4	23.5	0.75	3.23	42.4	9.7					
	6.8	2.5	5.9	32.9	24.3	0.74	3.03	43.2	10.9					
	9.0	4.0	9.2	33.7	24.7	0.73	2.93	43.6	11.5					
120	4.5	1.1	2.6	29.2	22.3	0.76	3.55	41.4	8.2					
	6.8	2.4	5.4	30.5	23.1	0.76	3.35	41.9	9.1					
	9.0	3.9	8.9	31.2	23.4	0.75	3.25	42.3	9.6					

Interpolation is permissible; extrapolation is not.

All entering air conditions are 80°F DB and 67°F WB in cooling, and 70°F DB in heating.

AHRI/ISO certified conditions are 80.6°F DB and 66.2°F WB in cooling and 68°F DB in heating.

Table does not reflect fan or pump power corrections for AHRI/ISO conditions.

All performance is based upon the lower voltage of dual voltage rated units.

Performance stated is at the rated power supply; performance may vary as the power supply varies from the rated.

Operation below 40°F EWT is based upon a 15% methanol antifreeze solution.

Operation below 60°F EWT requires optional insulated water/refrigerant circuit.

See performance correction tables for operating conditions other than those listed above.

See Performance Data Selection Notes for operation in the shaded areas.

Performance Data – TT H/V 049 (Part Load)

1,350 CFM Nominal Airflow Heating, 1,350 CFM Nominal Airflow Cooling

Performance capacities shown in thousands of Btuh

EWT °F	GPM	WPD		Cooling - EAT 80/67 °F						Heating - EAT 70°F				
		PSI	FT	TC	SC	Sens/Tot Ratio	kW	HR	EER	HC	kW	HE	LAT	COP
20	9.0	3.2	7.4	Operation not recommended						23.1	2.17	15.7	83.8	3.1
30	4.5	0.6	1.4	45.3	33.4	0.74	1.10	49.1	41.2	25.4	2.18	18.0	85.4	3.4
	6.8	1.6	3.6	46.1	33.7	0.73	1.02	49.6	45.1	26.5	2.19	19.0	86.1	3.5
	9.0	2.7	6.4	46.4	33.9	0.73	0.99	49.8	46.8	27.1	2.19	19.6	86.5	3.6
40	4.5	0.5	1.1	44.0	32.9	0.75	1.24	48.2	35.4	29.3	2.20	21.8	88.1	3.9
	6.8	1.3	3.0	45.0	33.2	0.74	1.14	48.9	39.6	30.8	2.21	23.3	89.1	4.1
	9.0	2.4	5.6	45.4	33.4	0.73	1.09	49.2	41.7	31.6	2.21	24.1	89.6	4.2
50	4.5	0.4	0.9	42.2	32.4	0.77	1.42	47.1	29.7	33.6	2.21	26.1	91.0	4.5
	6.8	1.2	2.7	43.5	32.7	0.75	1.29	47.9	33.7	35.5	2.22	27.9	92.3	4.7
	9.0	2.2	5.1	44.1	32.9	0.75	1.23	48.3	35.8	36.5	2.22	28.9	93.0	4.8
60	4.5	0.4	0.8	40.3	31.7	0.79	1.64	45.9	24.6	38.1	2.22	30.5	94.1	5.0
	6.8	1.1	2.5	41.7	32.2	0.77	1.48	46.7	28.1	40.3	2.23	32.7	95.6	5.3
	9.0	2.0	4.7	42.3	32.4	0.76	1.41	47.2	30.0	41.6	2.23	33.9	96.4	5.5
70	4.5	0.4	0.9	38.1	31.0	0.81	1.89	44.5	20.2	42.7	2.24	35.1	97.2	5.6
	6.8	1.0	2.4	39.6	31.5	0.80	1.71	45.4	23.1	45.2	2.25	37.6	98.9	5.9
	9.0	2.0	4.5	40.3	31.7	0.79	1.63	45.9	24.7	46.6	2.26	38.9	99.9	6.1
80	4.5	0.4	0.9	35.8	30.0	0.84	2.17	43.2	16.5	47.2	2.26	39.5	100.3	6.1
	6.8	1.0	2.4	37.3	30.7	0.82	1.98	44.1	18.8	50.0	2.28	42.2	102.2	6.4
	9.0	1.9	4.4	38.1	31.0	0.81	1.89	44.5	20.2	51.5	2.29	43.7	103.2	6.6
90	4.5	0.4	1.0	33.5	28.9	0.86	2.50	42.0	13.4	51.6	2.29	43.8	103.3	6.6
	6.8	1.0	2.4	35.0	29.6	0.85	2.29	42.8	15.3	54.5	2.33	46.5	105.3	6.9
	9.0	1.9	4.4	35.7	30.0	0.84	2.19	43.2	16.3	56.0	2.35	47.9	106.3	7.0
100	4.5	0.4	1.0	31.1	27.6	0.89	2.86	40.9	10.9	Operation not recommended				
	6.8	1.0	2.4	32.5	28.4	0.87	2.63	41.5	12.4					
	9.0	1.9	4.3	33.3	28.8	0.87	2.52	41.9	13.2					
110	4.5	0.4	0.9	28.8	26.1	0.91	3.26	39.9	8.8					
	6.8	1.0	2.3	30.2	27.0	0.90	3.02	40.5	10.0					
	9.0	1.8	4.3	30.9	27.5	0.89	2.90	40.8	10.7					
120	4.5	0.3	0.7	26.6	24.6	0.92	3.71	39.3	7.2					
	6.8	0.9	2.1	27.9	25.5	0.91	3.44	39.6	8.1					
	9.0	1.8	4.1	28.5	26.0	0.91	3.31	39.8	8.6					

Interpolation is permissible; extrapolation is not.

All entering air conditions are 80°F DB and 67°F WB in cooling, and 70°F DB in heating.

AHRI/ISO certified conditions are 80.6°F DB and 66.2°F WB in cooling and 68°F DB in heating.

Table does not reflect fan or pump power corrections for AHRI/ISO conditions.

All performance is based upon the lower voltage of dual voltage rated units.

Performance stated is at the rated power supply; performance may vary as the power supply varies from the rated.

Operation below 40°F EWT is based upon a 15% methanol antifreeze solution.

Operation below 60°F EWT requires optional insulated water/refrigerant circuit.

See performance correction tables for operating conditions other than those listed above.

See Performance Data Selection Notes for operation in the shaded areas.

Performance Data – TT H/V 049 (Full Load)

1,650 CFM Nominal Airflow Heating, 1,550 CFM Nominal Airflow Cooling

Performance capacities shown in thousands of Btuh

EWT °F	GPM	WPD		Cooling - EAT 80/67 °F						Heating - EAT 70°F				
		PSI	FT	TC	SC	Sens/Tot Ratio	kW	HR	EER	HC	kW	HE	LAT	COP
20	12.0	5.2	12.1	Operation not recommended						33.5	2.85	23.8	86.8	3.4
30	6.0	1.2	2.8	59.6	42.6	0.72	1.96	66.3	30.4	36.1	2.94	26.1	88.2	3.6
	9.0	2.7	6.4	59.4	43.8	0.74	1.85	65.7	32.2	37.5	2.98	27.4	89.0	3.7
	12.0	4.7	10.8	59.0	44.4	0.75	1.80	65.2	32.9	38.3	3.00	28.1	89.4	3.7
40	6.0	1.0	2.3	58.8	41.3	0.70	2.13	66.1	27.6	40.9	3.07	30.4	90.9	3.9
	9.0	2.4	5.6	59.5	42.3	0.71	2.00	66.3	29.7	42.8	3.11	32.1	91.9	4.0
	12.0	4.2	9.7	59.6	42.8	0.72	1.94	66.2	30.7	43.8	3.14	33.1	92.5	4.1
50	6.0	0.9	2.0	57.1	40.2	0.70	2.33	65.0	24.4	46.2	3.20	35.3	93.9	4.2
	9.0	2.2	5.1	58.4	41.0	0.70	2.18	65.9	26.7	48.5	3.25	37.5	95.2	4.4
	12.0	3.9	9.0	58.9	41.4	0.70	2.11	66.1	27.9	49.8	3.28	38.7	95.9	4.5
60	6.0	0.8	1.9	54.7	39.2	0.72	2.57	63.4	21.3	51.9	3.33	40.5	97.0	4.6
	9.0	2.0	4.7	56.4	39.9	0.71	2.40	64.6	23.6	54.7	3.39	43.1	98.6	4.7
	12.0	3.6	8.4	57.2	40.3	0.70	2.32	65.1	24.7	56.2	3.43	44.5	99.5	4.8
70	6.0	0.8	1.8	51.8	38.2	0.74	2.83	61.5	18.3	57.7	3.46	45.9	100.3	4.9
	9.0	2.0	4.5	53.9	38.9	0.72	2.64	62.9	20.4	61.0	3.54	48.9	102.1	5.0
	12.0	3.5	8.1	54.8	39.3	0.72	2.55	63.5	21.5	62.7	3.59	50.5	103.1	5.1
80	6.0	0.8	1.8	48.7	37.2	0.76	3.13	59.4	15.5	63.7	3.62	51.3	103.6	5.2
	9.0	1.9	4.4	50.8	37.9	0.75	2.92	60.8	17.4	67.2	3.72	54.5	105.6	5.3
	12.0	3.4	7.8	51.9	38.3	0.74	2.82	61.5	18.4	69.2	3.78	56.3	106.7	5.4
90	6.0	0.8	1.9	45.5	36.0	0.79	3.48	57.4	13.1	69.5	3.79	56.6	106.9	5.4
	9.0	1.9	4.4	47.6	36.8	0.77	3.25	58.7	14.6	73.3	3.92	60.0	109.1	5.5
	12.0	3.3	7.7	48.7	37.2	0.76	3.14	59.4	15.5	75.4	4.00	61.7	110.2	5.5
100	6.0	0.8	1.9	42.4	34.6	0.82	3.88	55.6	10.9	Operation not recommended				
	9.0	1.9	4.3	44.3	35.5	0.80	3.62	56.7	12.2					
	12.0	3.3	7.6	45.4	35.9	0.79	3.50	57.3	13.0					
110	6.0	0.8	1.8	39.5	33.2	0.84	4.35	54.3	9.1					
	9.0	1.8	4.3	41.2	34.1	0.83	4.06	55.0	10.2					
	12.0	3.3	7.5	42.1	34.5	0.82	3.92	55.5	10.8					
120	6.0	0.7	1.6	37.0	31.8	0.86	4.88	53.7	7.6					
	9.0	1.8	4.1	38.4	32.6	0.85	4.55	53.9	8.4					
	12.0	3.2	7.4	39.2	33.1	0.84	4.39	54.2	8.9					

Interpolation is permissible; extrapolation is not.

All entering air conditions are 80°F DB and 67°F WB in cooling, and 70°F DB in heating.

AHRI/ISO certified conditions are 80.6°F DB and 66.2°F WB in cooling and 68°F DB in heating.

Table does not reflect fan or pump power corrections for AHRI/ISO conditions.

All performance is based upon the lower voltage of dual voltage rated units.

Performance stated is at the rated power supply; performance may vary as the power supply varies from the rated.

Operation below 40°F EWT is based upon a 15% methanol antifreeze solution.

Operation below 60°F EWT requires optional insulated water/refrigerant circuit.

See performance correction tables for operating conditions other than those listed above.

See Performance Data Selection Notes for operation in the shaded areas.

Performance Data – TT H/V 064 (Part Load)

1,650 CFM Nominal Airflow Heating, 1,500 CFM Nominal Airflow Cooling

Performance capacities shown in thousands of Btuh

EWT °F	GPM	WPD		Cooling - EAT 80/67 °F						Heating - EAT 70°F				
		PSI	FT	TC	SC	Sens/Tot Ratio	kW	HR	EER	HC	kW	HE	LAT	COP
20	12.0	5.2	11.9	Operation not recommended						28.6	2.75	19.3	84.0	3.1
30	6.0	0.9	2.1	57.1	41.6	0.73	1.50	62.2	38.1	32.2	2.76	22.7	86.0	3.4
	9.0	2.5	5.7	56.9	42.3	0.74	1.45	61.8	39.2	33.6	2.77	24.1	86.8	3.6
	12.0	4.1	9.6	56.5	42.6	0.75	1.44	61.4	39.1	34.4	2.77	24.9	87.2	3.6
40	6.0	0.5	1.1	56.4	40.7	0.72	1.64	62.0	34.4	37.6	2.79	28.0	89.0	3.9
	9.0	1.9	4.3	57.0	41.3	0.73	1.54	62.3	37.1	39.4	2.80	29.8	90.0	4.1
	12.0	3.4	7.9	57.1	41.7	0.73	1.50	62.2	38.1	40.4	2.81	30.8	90.6	4.2
50	6.0	0.2	0.6	54.8	39.8	0.73	1.85	61.1	29.7	43.1	2.82	33.5	92.1	4.5
	9.0	1.5	3.5	56.0	40.4	0.72	1.70	61.8	33.0	45.3	2.84	35.7	93.4	4.7
	12.0	3.0	6.9	56.5	40.8	0.72	1.63	62.0	34.6	46.6	2.85	36.9	94.1	4.8
60	6.0	0.2	0.4	52.4	38.9	0.74	2.11	59.6	24.8	48.8	2.86	39.0	95.3	5.0
	9.0	1.4	3.1	54.1	39.5	0.73	1.93	60.6	28.1	51.4	2.89	41.5	96.8	5.2
	12.0	2.7	6.3	54.8	39.9	0.73	1.84	61.1	29.8	52.8	2.90	42.9	97.6	5.3
70	6.0	0.2	0.4	49.6	37.9	0.76	2.42	57.8	20.4	54.4	2.91	44.5	98.5	5.5
	9.0	1.3	3.0	51.5	38.6	0.75	2.21	59.0	23.3	57.3	2.94	47.3	100.1	5.7
	12.0	2.6	6.0	52.4	38.9	0.74	2.11	59.6	24.8	58.9	2.96	48.8	101.0	5.8
80	6.0	0.2	0.6	46.5	36.7	0.79	2.78	56.0	16.7	59.9	2.97	49.8	101.6	5.9
	9.0	1.3	3.1	48.5	37.5	0.77	2.55	57.2	19.0	63.1	3.00	52.9	103.3	6.2
	12.0	2.6	5.9	49.5	37.8	0.76	2.44	57.8	20.3	64.8	3.03	54.5	104.3	6.3
90	6.0	0.3	0.7	43.3	35.3	0.82	3.18	54.1	13.6	65.3	3.03	55.0	104.6	6.3
	9.0	1.4	3.2	45.2	36.2	0.80	2.93	55.2	15.4	68.7	3.08	58.1	106.4	6.5
	12.0	2.6	6.0	46.2	36.6	0.79	2.81	55.8	16.5	70.4	3.11	59.8	107.4	6.6
100	6.0	0.3	0.8	40.2	33.9	0.84	3.62	52.5	11.1	Operation not recommended				
	9.0	1.4	3.2	42.0	34.7	0.83	3.36	53.4	12.5					
	12.0	2.6	6.0	43.0	35.2	0.82	3.23	54.0	13.3					
110	6.0	0.3	0.6	37.4	32.4	0.87	4.09	51.3	9.1					
	9.0	1.3	3.1	38.9	33.2	0.85	3.81	52.0	10.2					
	12.0	2.5	5.8	39.8	33.7	0.85	3.68	52.3	10.8					
120	6.0	0.0	0.0	35.1	31.0	0.88	4.59	50.8	7.6					
	9.0	1.1	2.6	36.3	31.7	0.87	4.30	51.0	8.4					
	12.0	2.3	5.4	37.0	32.2	0.87	4.16	51.2	8.9					

Interpolation is permissible; extrapolation is not.

All entering air conditions are 80°F DB and 67°F WB in cooling, and 70°F DB in heating.

AHRI/ISO certified conditions are 80.6°F DB and 66.2°F WB in cooling and 68°F DB in heating.

Table does not reflect fan or pump power corrections for AHRI/ISO conditions.

All performance is based upon the lower voltage of dual voltage rated units.

Performance stated is at the rated power supply; performance may vary as the power supply varies from the rated.

Operation below 40°F EWT is based upon a 15% methanol antifreeze solution.

Operation below 60°F EWT requires optional insulated water/refrigerant circuit.

See performance correction tables for operating conditions other than those listed above.

See Performance Data Selection Notes for operation in the shaded areas.

Performance Data – TT H/V 064 (Full Load)

2,050 CFM Nominal Airflow Heating, 1,850 CFM Nominal Airflow Cooling

Performance capacities shown in thousands of Btuh

EWT °F	GPM	WPD		Cooling - EAT 80/67 °F						Heating - EAT 70°F				
		PSI	FT	TC	SC	Sens/Tot Ratio	kW	HR	EER	HC	kW	HE	LAT	COP
20	15.0	7.3	16.8	Operation not recommended						43.4	3.77	30.6	87.6	3.4
30	7.5	1.7	3.9	76.6	53.4	0.70	2.78	86.1	27.5	47.6	3.82	34.5	89.4	3.6
	11.3	3.7	8.6	76.2	54.0	0.71	2.67	85.3	28.5	49.9	3.86	36.7	90.5	3.8
	15.0	6.1	14.1	75.5	54.3	0.72	2.62	84.5	28.8	51.2	3.88	37.9	91.1	3.9
40	7.5	1.2	2.7	75.7	52.5	0.69	2.97	85.8	25.5	54.7	3.94	41.3	92.7	4.1
	11.3	3.0	7.0	76.5	53.2	0.70	2.82	86.1	27.1	57.6	3.99	44.0	94.0	4.2
	15.0	5.3	12.2	76.6	53.6	0.70	2.76	86.0	27.8	59.2	4.02	45.5	94.7	4.3
50	7.5	0.9	2.0	73.6	51.4	0.70	3.20	84.5	23.0	62.1	4.08	48.2	96.0	4.5
	11.3	2.6	6.0	75.3	52.2	0.69	3.02	85.6	25.0	65.5	4.15	51.3	97.5	4.6
	15.0	4.7	10.8	75.9	52.6	0.69	2.94	85.9	25.9	67.3	4.19	53.0	98.3	4.7
60	7.5	0.7	1.7	70.7	50.3	0.71	3.47	82.6	20.4	69.5	4.24	55.1	99.3	4.8
	11.3	2.4	5.4	73.0	51.1	0.70	3.26	84.1	22.4	73.4	4.33	58.6	101.1	5.0
	15.0	4.3	10.0	74.0	51.6	0.70	3.16	84.8	23.4	75.5	4.38	60.6	102.0	5.1
70	7.5	0.7	1.7	67.3	48.9	0.73	3.81	80.3	17.7	77.0	4.41	61.9	102.7	5.1
	11.3	2.3	5.2	69.8	49.9	0.71	3.56	82.0	19.6	81.3	4.52	65.9	104.6	5.3
	15.0	4.1	9.5	71.1	50.4	0.71	3.44	82.8	20.6	83.7	4.59	68.0	105.7	5.3
80	7.5	0.8	1.8	63.5	47.5	0.75	4.19	77.8	15.1	84.4	4.61	68.7	106.0	5.4
	11.3	2.2	5.2	66.2	48.5	0.73	3.91	79.6	16.9	89.1	4.74	73.0	108.2	5.5
	15.0	4.1	9.4	67.5	49.0	0.73	3.78	80.4	17.9	91.7	4.81	75.3	109.3	5.6
90	7.5	0.8	2.0	59.8	45.8	0.77	4.65	75.6	12.9	91.7	4.81	75.2	109.3	5.6
	11.3	2.3	5.2	62.3	47.0	0.75	4.33	77.1	14.4	96.7	4.96	79.7	111.6	5.7
	15.0	4.0	9.3	63.7	47.5	0.75	4.18	77.9	15.2	99.4	5.05	82.1	112.8	5.8
100	7.5	0.9	2.0	56.2	44.2	0.79	5.18	73.9	10.8	Operation not recommended				
	11.3	2.3	5.2	58.5	45.3	0.77	4.82	75.0	12.1					
	15.0	4.0	9.3	59.8	45.9	0.77	4.65	75.6	12.9					
110	7.5	0.8	1.8	53.1	42.6	0.80	5.80	72.9	9.2					
	11.3	2.2	5.1	55.0	43.6	0.79	5.39	73.4	10.2					
	15.0	4.0	9.2	56.1	44.2	0.79	5.19	73.8	10.8					
120	7.5	0.6	1.3	50.8	41.4	0.81	6.53	73.1	7.8					
	11.3	2.0	4.7	52.2	42.1	0.81	6.04	72.8	8.6					
	15.0	3.8	8.8	53.0	42.6	0.80	5.82	72.9	9.1					

Interpolation is permissible; extrapolation is not.

All entering air conditions are 80°F DB and 67°F WB in cooling, and 70°F DB in heating.

AHRI/ISO certified conditions are 80.6°F DB and 66.2°F WB in cooling and 68°F DB in heating.

Table does not reflect fan or pump power corrections for AHRI/ISO conditions.

All performance is based upon the lower voltage of dual voltage rated units.

Performance stated is at the rated power supply; performance may vary as the power supply varies from the rated.

Operation below 40°F EWT is based upon a 15% methanol antifreeze solution.

Operation below 60°F EWT requires optional insulated water/refrigerant circuit.

See performance correction tables for operating conditions other than those listed above.

See Performance Data Selection Notes for operation in the shaded areas.

Performance Data – TT H/V 072 (Part Load)

1,650 CFM Nominal Airflow Heating, 1,550 CFM Nominal Airflow Cooling

Performance capacities shown in thousands of Btuh

EWT °F	GPM	WPD		Cooling - EAT 80/67 °F						Heating - EAT 70°F				
		PSI	FT	TC	SC	Sens/Tot Ratio	kW	HR	EER	HC	kW	HE	LAT	COP
20	14.0	6.5	15.1	Operation not recommended						33.4	3.51	21.4	86.7	2.8
30	7.0	1.4	3.3	66.4	43.8	0.66	1.85	72.7	35.9	37.7	3.57	25.5	89.1	3.1
	10.5	3.3	7.6	66.7	44.2	0.66	1.75	72.7	38.1	39.3	3.59	27.0	90.0	3.2
	14.0	5.4	12.5	66.7	44.4	0.66	1.71	72.6	38.9	40.1	3.60	27.8	90.5	3.3
40	7.0	0.9	2.2	65.0	43.0	0.66	2.05	72.0	31.7	43.9	3.65	31.4	92.6	3.5
	10.5	2.6	6.1	66.0	43.6	0.66	1.91	72.5	34.6	45.8	3.68	33.3	93.7	3.7
	14.0	4.6	10.7	66.4	43.8	0.66	1.84	72.7	36.0	46.9	3.69	34.3	94.3	3.7
50	7.0	0.7	1.5	62.9	41.9	0.67	2.32	70.8	27.1	50.1	3.74	37.4	96.1	3.9
	10.5	2.2	5.1	64.4	42.7	0.66	2.13	71.7	30.2	52.5	3.77	39.6	97.4	4.1
	14.0	4.1	9.4	65.1	43.0	0.66	2.05	72.1	31.8	53.8	3.78	40.8	98.1	4.2
60	7.0	0.5	1.3	60.2	40.8	0.68	2.65	69.3	22.7	56.4	3.82	43.3	99.6	4.3
	10.5	2.0	4.6	62.1	41.6	0.67	2.42	70.4	25.6	59.1	3.86	46.0	101.1	4.5
	14.0	3.8	8.7	63.0	42.0	0.67	2.32	70.9	27.2	60.6	3.88	47.4	101.9	4.6
70	7.0	0.5	1.3	57.1	39.5	0.69	3.04	67.5	18.8	62.6	3.90	49.3	103.1	4.7
	10.5	1.9	4.5	59.2	40.3	0.68	2.78	68.7	21.3	65.8	3.95	52.3	104.8	4.9
	14.0	3.6	8.3	60.2	40.7	0.68	2.65	69.3	22.7	67.5	3.97	53.9	105.8	5.0
80	7.0	0.6	1.4	53.7	38.1	0.71	3.48	65.6	15.4	68.9	3.99	55.3	106.6	5.1
	10.5	1.9	4.5	55.9	39.0	0.70	3.19	66.8	17.5	72.4	4.05	58.6	108.5	5.2
	14.0	3.5	8.1	57.0	39.4	0.69	3.05	67.4	18.7	74.3	4.08	60.4	109.6	5.3
90	7.0	0.7	1.5	50.1	36.6	0.73	3.98	63.7	12.6	75.2	4.09	61.2	110.1	5.4
	10.5	2.0	4.5	52.3	37.5	0.72	3.67	64.8	14.3	79.1	4.15	64.9	112.3	5.6
	14.0	3.5	8.1	53.5	38.0	0.71	3.51	65.4	15.2	81.2	4.19	66.9	113.5	5.7
100	7.0	0.7	1.6	46.4	35.2	0.76	4.54	61.9	10.2	Operation not recommended				
	10.5	2.0	4.5	48.6	36.0	0.74	4.20	62.9	11.6					
	14.0	3.5	8.1	49.7	36.5	0.73	4.03	63.5	12.3					
110	7.0	0.6	1.4	42.9	33.8	0.79	5.15	60.4	8.3					
	10.5	1.9	4.4	44.9	34.6	0.77	4.78	61.2	9.4					
	14.0	3.5	8.0	46.0	35.0	0.76	4.61	61.7	10.0					
120	7.0	0.4	0.9	39.5	32.5	0.82	5.82	59.4	6.8					
	10.5	1.7	3.9	41.4	33.2	0.80	5.43	59.9	7.6					
	14.0	3.3	7.6	42.4	33.6	0.79	5.24	60.2	8.1					

Interpolation is permissible; extrapolation is not.

All entering air conditions are 80°F DB and 67°F WB in cooling, and 70°F DB in heating.

AHRI/ISO certified conditions are 80.6°F DB and 66.2°F WB in cooling and 68°F DB in heating.

Table does not reflect fan or pump power corrections for AHRI/ISO conditions.

All performance is based upon the lower voltage of dual voltage rated units.

Performance stated is at the rated power supply; performance may vary as the power supply varies from the rated.

Operation below 40°F EWT is based upon a 15% methanol antifreeze solution.

Operation below 60°F EWT requires optional insulated water/refrigerant circuit.

See performance correction tables for operating conditions other than those listed above.

See Performance Data Selection Notes for operation in the shaded areas.

Performance Data – TT H/V 072 (Full Load)

2,050 CFM Nominal Airflow Heating, 1,850 CFM Nominal Airflow Cooling

Performance capacities shown in thousands of Btuh

EWT °F	GPM	WPD		Cooling - EAT 80/67 °F						Heating - EAT 70°F				
		PSI	FT	TC	SC	Sens/Tot Ratio	kW	HR	EER	HC	kW	HE	LAT	COP
20	17.0	8.9	20.6	Operation not recommended						47.3	4.52	31.9	89.3	3.1
30	8.5	2.2	5.1	83.8	53.9	0.64	3.15	94.6	26.6	52.4	4.63	36.6	91.6	3.3
	12.8	4.6	10.6	83.7	53.8	0.64	3.00	93.9	27.9	54.8	4.68	38.8	92.7	3.4
	17.0	7.6	17.6	83.3	53.5	0.64	2.94	93.3	28.3	56.1	4.71	40.1	93.3	3.5
40	8.5	1.6	3.8	82.7	53.5	0.65	3.39	94.3	24.4	60.3	4.80	43.9	95.2	3.7
	12.8	3.9	8.9	83.6	53.9	0.64	3.21	94.6	26.1	63.1	4.87	46.5	96.4	3.8
	17.0	6.7	15.5	83.8	53.9	0.64	3.13	94.5	26.8	64.6	4.90	47.9	97.1	3.9
50	8.5	1.3	3.0	80.5	52.6	0.65	3.67	93.0	21.9	67.9	4.99	50.9	98.6	4.0
	12.8	3.4	7.8	82.2	53.3	0.65	3.46	94.0	23.8	71.2	5.07	53.9	100.1	4.1
	17.0	6.0	13.9	82.9	53.6	0.65	3.36	94.3	24.7	72.9	5.11	55.5	100.9	4.2
60	8.5	1.2	2.7	77.4	51.4	0.66	4.01	91.1	19.3	75.5	5.18	57.9	102.0	4.3
	12.8	3.1	7.1	79.7	52.3	0.66	3.76	92.5	21.2	79.2	5.28	61.2	103.7	4.4
	17.0	5.6	13.0	80.7	52.7	0.65	3.64	93.1	22.2	81.2	5.33	63.0	104.6	4.5
70	8.5	1.1	2.6	73.7	49.8	0.68	4.42	88.7	16.7	83.2	5.38	64.8	105.5	4.5
	12.8	3.0	6.8	76.3	50.9	0.67	4.12	90.4	18.5	87.3	5.50	68.5	107.3	4.6
	17.0	5.4	12.4	77.6	51.5	0.66	3.99	91.2	19.5	89.5	5.57	70.5	108.3	4.7
80	8.5	1.2	2.7	69.5	48.1	0.69	4.89	86.2	14.2	90.9	5.61	71.7	108.9	4.7
	12.8	2.9	6.7	72.4	49.3	0.68	4.56	88.0	15.9	95.5	5.75	75.9	111.1	4.9
	17.0	5.2	12.1	73.8	49.9	0.68	4.40	88.8	16.8	98.1	5.83	78.2	112.2	4.9
90	8.5	1.2	2.8	65.2	46.2	0.71	5.45	83.8	12.0	98.8	5.85	78.8	112.5	4.9
	12.8	2.9	6.7	68.1	47.4	0.70	5.07	85.4	13.4	104.1	6.03	83.6	114.9	5.1
	17.0	5.2	12.0	69.6	48.1	0.69	4.88	86.3	14.2	107.1	6.12	86.2	116.3	5.1
100	8.5	1.2	2.8	60.9	44.3	0.73	6.09	81.6	10.0	Operation not recommended				
	12.8	2.9	6.7	63.7	45.5	0.71	5.66	83.0	11.2					
	17.0	5.2	12.0	65.1	46.2	0.71	5.46	83.8	11.9					
110	8.5	1.1	2.6	56.7	42.5	0.75	6.85	80.0	8.3					
	12.8	2.9	6.6	59.3	43.6	0.74	6.36	81.0	9.3					
	17.0	5.1	11.8	60.7	44.2	0.73	6.12	81.6	9.9					
120	8.5	0.9	2.1	52.9	41.0	0.78	7.72	79.2	6.8	Operation not recommended				
	12.8	2.7	6.2	55.2	41.9	0.76	7.16	79.6	7.7					
	17.0	5.0	11.5	56.4	42.4	0.75	6.90	80.0	8.2					

Interpolation is permissible; extrapolation is not.

All entering air conditions are 80°F DB and 67°F WB in cooling, and 70°F DB in heating.

AHRI/ISO certified conditions are 80.6°F DB and 66.2°F WB in cooling and 68°F DB in heating.

Table does not reflect fan or pump power corrections for AHRI/ISO conditions.

All performance is based upon the lower voltage of dual voltage rated units.

Performance stated is at the rated power supply; performance may vary as the power supply varies from the rated.

Operation below 40°F EWT is based upon a 15% methanol antifreeze solution.

Operation below 60°F EWT requires optional insulated water/refrigerant circuit.

See performance correction tables for operating conditions other than those listed above.

See Performance Data Selection Notes for operation in the shaded areas.

Part Load Performance Data – Correction Tables

Air Flow Correction Table

Airflow	Cooling				Heating		
% of Rated	Total Capacity	Sensible Capacity	Power	Heat of Rejection	Heating Capacity	Power	Heat of Extraction
60%	0.920	0.781	0.959	0.927	0.946	1.241	0.881
69%	0.942	0.832	0.964	0.946	0.960	1.163	0.915
75%	0.956	0.867	0.696	0.959	0.969	1.115	0.937
81%	0.969	0.901	0.975	0.970	0.978	1.076	0.956
88%	0.981	0.934	0.982	0.981	0.986	1.043	0.973
94%	0.991	0.967	0.990	0.991	0.993	1.018	0.988
100%	1.000	1.000	1.000	1.000	1.000	1.000	1.000
106%	1.007	1.033	1.011	1.008	1.006	0.990	1.010
113%	1.013	1.065	1.023	1.015	1.012	0.986	1.017
119%	1.018	1.098	1.036	1.021	1.017	0.983	1.024
125%	1.021	1.131	1.051	1.026	1.021	0.981	1.030
130%	1.023	1.159	1.063	1.030	1.024	0.979	1.034

Entering Air Correction Table

Heating			
Entering Air DB°F	Heating Capacity	Power	Heat of Extraction
40	1.084	0.732	1.161
45	1.073	0.764	1.140
50	1.060	0.802	1.117
55	1.046	0.846	1.090
60	1.031	0.893	1.061
65	1.016	0.945	1.031
68	1.006	0.978	1.013
70	1.000	1.000	1.000
75	0.984	1.058	0.968
80	0.968	1.117	0.936

Cooling													
Entering Air WB°F	Total Capacity	Sensible Cooling Capacity Multiplier - Entering DB °F										Power	Heat of Rejection
		60	65	70	75	80	80.6	85	90	95	100		
45	0.876	*	*	*	*	*	*	*	*	*	*	0.981	0.895
50	0.883	1.002	1.099	*	*	*	*	*	*	*	*	0.985	0.901
55	0.903	0.706	0.871	1.060	*	*	*	*	*	*	*	0.989	0.918
60	0.935		0.617	0.844	1.079	*	*	*	*	*	*	0.993	0.945
65	0.979			0.595	0.849	1.098	1.128	*	*	*	*	0.998	0.982
66.2	0.991			0.531	0.789	1.040	1.070	1.284	*	*	*	0.999	0.993
67	1.000			0.486	0.747	1.000	1.030	1.245	*	*	*	1.000	1.000
70	1.035				0.583	0.842	0.873	1.090	1.327	*	*	1.003	1.030
75	1.105					0.552	0.584	0.811	1.057	1.290	*	1.008	1.088

* = Sensible capacity equals total capacity

AHRI/ISO/ASHRAE 13256-1 uses entering air conditions of Cooling - 80.6°F DB/66.2°F WB, 1 and Heating - 68°F DB/59°F WB entering air temperature.

For ClimaDry® equipped units the minimum entering air temperature when cooling is 70°F DB / 61°F WB. Operation below this minimum may result in nuisance faults.

ClimateMaster works continually to improve its products. As a result, the design and specifications of each product at the time of order may be changed without notice and may not be as described herein. Please contact ClimateMaster's Customer Service Department at 1-405-745-6000 for specific information on the current design and specifications. Statements and other information contained herein are not express warranties and do not form the basis of any bargain between the parties, but are merely ClimateMaster's opinion or commendation of its products. The latest version of this document is available at climatemaster.com.

Full Load Performance Data – Correction Tables

Air Flow Correction Table

Airflow	Cooling				Heating		
% of Rated	Total Capacity	Sensible Capacity	Power	Heat of Rejection	Heating Capacity	Power	Heat of Extraction
60%	0.925	0.788	0.913	0.922	0.946	1.153	0.896
69%	0.946	0.829	0.926	0.942	0.959	1.107	0.924
75%	0.960	0.861	0.937	0.955	0.969	1.078	0.942
81%	0.972	0.895	0.950	0.968	0.977	1.053	0.959
88%	0.983	0.930	0.965	0.979	0.985	1.032	0.974
94%	0.992	0.965	0.982	0.990	0.993	1.014	0.988
100%	1.000	1.000	1.000	1.000	1.000	1.000	1.000
106%	1.007	1.033	1.020	1.009	1.006	0.989	1.011
113%	1.012	1.064	1.042	1.018	1.012	0.982	1.019
119%	1.016	1.092	1.066	1.025	1.018	0.979	1.027
125%	1.018	1.116	1.091	1.032	1.022	0.977	1.033
130%	1.019	1.132	1.112	1.037	1.026	0.975	1.038

Entering Air Correction Table

Heating			
Entering Air DB°F	Heating Capacity	Power	Heat of Extraction
40	1.052	0.779	1.120
45	1.043	0.808	1.102
50	1.035	0.841	1.084
55	1.027	0.877	1.065
60	1.019	0.915	1.045
65	1.010	0.957	1.023
68	1.004	0.982	1.010
70	1.000	1.000	1.000
75	0.989	1.045	0.974
80	0.976	1.093	0.946

Cooling													
Entering Air WB°F	Total Capacity	Sensible Cooling Capacity Multiplier - Entering DB °F										Power	Heat of Rejection
		60	65	70	75	80	80.6	85	90	95	100		
45	0.832	*	*	*	*	*	*	*	*	*	*	0.946	0.853
50	0.850	1.004	1.174	*	*	*	*	*	*	*	*	0.953	0.870
55	0.880	0.694	0.902	1.115	*	*	*	*	*	*	*	0.964	0.896
60	0.922		0.646	0.875	1.103	1.329	*	*	*	*	*	0.977	0.932
65	0.975			0.639	0.869	1.096	1.123	1.320	*	*	*	0.993	0.979
66.2	0.990			0.582	0.812	1.039	1.066	1.262	*	*	*	0.997	0.991
67	1.000			0.545	0.774	1.000	1.027	1.223	1.444	*	*	1.000	1.000
70	1.040				0.630	0.853	0.880	1.075	1.297	*	*	1.011	1.035
75	1.117					0.601	0.627	0.821	1.046	1.275	1.510	1.033	1.101

* = Sensible capacity equals total capacity

AHRI/ISO/ASHRAE 13256-1 uses entering air conditions of Cooling - 80.6°F DB/66.2°F WB, 1 and Heating - 68°F DB/59°F WB entering air temperature.

For ClimaDry® equipped units the minimum entering air temperature when cooling is 70°F DB / 61°F WB. Operation below this minimum may result in nuisance faults.

Antifreeze & Water Pressure Drop Adder for Options – Correction Tables

Antifreeze Correction Table

Antifreeze Type	Antifreeze %	Cooling			Heating		WPD Corr. Fct. EWT 30°F
		EWT 90°F			EWT 30°F		
		Total Cap	Sens Cap	Power	Htg Cap	Power	
Water	0	1.000	1.000	1.000	1.000	1.000	1.000
Propylene Glycol	5	0.995	0.995	1.003	0.989	0.997	1.070
	15	0.986	0.986	1.009	0.968	0.990	1.210
	25	0.978	0.978	1.014	0.947	0.983	1.360
Methanol	5	0.997	0.997	1.002	0.989	0.997	1.070
	15	0.990	0.990	1.007	0.968	0.990	1.160
	25	0.982	0.982	1.012	0.949	0.984	1.220
Ethanol	5	0.998	0.998	1.002	0.981	0.994	1.140
	15	0.994	0.994	1.005	0.944	0.983	1.300
	25	0.986	0.986	1.009	0.917	0.974	1.360
Ethylene Glycol	5	0.998	0.998	1.002	0.993	0.998	1.040
	15	0.994	0.994	1.004	0.980	0.994	1.120
	25	0.988	0.988	1.008	0.966	0.990	1.200

ClimaDry® Additional Pressure Drop (When Operating in Non-ClimaDry® Mode)

Model	WPD Adders (Part Load)			WPD Adders (Full Load)		
	GPM	PSI	FT	GPM	PSI	FT
026	3.5	1.200	2.771	4.0	1.567	3.620
	5.8	3.294	7.610	6.0	3.526	8.144
038	4.0	0.689	1.592	4.5	0.872	2.015
	6.0	1.551	3.583	6.8	1.992	4.602
049	5.5	1.303	3.011	6.0	1.551	3.583
	8.3	2.968	6.856	9.0	3.490	8.062
064	7.0	1.299	3.001	7.5	1.491	3.445
	10.5	2.923	6.752	11.3	3.385	7.820
072	7.5	1.491	3.445	8.5	1.915	4.425
	11.3	3.385	7.820	12.8	4.344	10.034

ECM Control

The ECM fan is controlled by an interface board that converts thermostat inputs and field selectable CFM settings to signals used by the ECM motor controller. Fan speeds are selected with a DIP switch setting. To take full advantage of the ECM motor features, a multi-stage thermostat should be used (2-stage heat/2-stage cool or 3-stage heat/2-stage cool).

Note: Power must be off to the unit for at least three seconds before the ECM motor will recognize a speed change. The motor will recognize a change in the CFM Adjust or dehumidification mode settings while the unit is powered.

There are four different airflow settings from lowest airflow rate (speed tap 1) to the highest airflow rate (speed tap 4). The charts below indicate settings for the ECM interface board, followed by detailed information for each set

Cooling settings

Tap Setting	DIP Switch	
	SW1	SW2
1	ON	ON
2	ON	OFF
3	OFF	ON
4	OFF	OFF

Heating settings

Tap Setting	DIP Switch	
	SW3	SW4
1	ON	ON
2	ON	OFF
3	OFF	ON
4	OFF	OFF

CFM Adjust settings

Tap Setting	DIP Switch	
	SW7	SW8
TEST	ON	ON
-	ON	OFF
+	OFF	ON
NORM	OFF	OFF

Dehum Mode settings

Tap Setting	DIP Switch	
	SW9	
NORM	ON	
Dehumid	OFF	

Only DIP switch numbers 1 to 4 and 7 to 9 are used.

WARNING! When the disconnect switch is closed, high voltage is present in some areas of the electrical panel. Exercise caution when working with energized equipment.

Cooling Settings: The cooling setting determines the cooling (normal) CFM for all units with ECM motor. Cooling (normal) setting is used when the unit is not in dehumidification mode. Tap 1 is the lowest CFM setting, while tap 4 is the highest CFM setting. To avoid air coil freeze-up, tap 1 may not be used if the dehumidification mode is selected. Consult submittal data or specifications catalog for the specific unit series and model to correlate speed tap setting to airflow in CFM.

Heating Settings: The heating setting determines the heating CFM. Tap 1 is the lowest CFM setting, while tap 4 is the highest CFM setting. Consult submittal data or specifications catalog for the specific unit series and model to correlate speed tap setting to airflow in CFM.

CFM Adjust Settings: The CFM adjust setting allows four selections. The NORM setting is the factory default position. The + or – settings adjust the airflow by +/- 5%. The +/- settings are used to “fine tune” airflow adjustments. The TEST setting runs the ECM motor at 400 cfm/ton, which causes the motor to operate like a standard PSC motor, and disables the CFM counter.

ECM Control

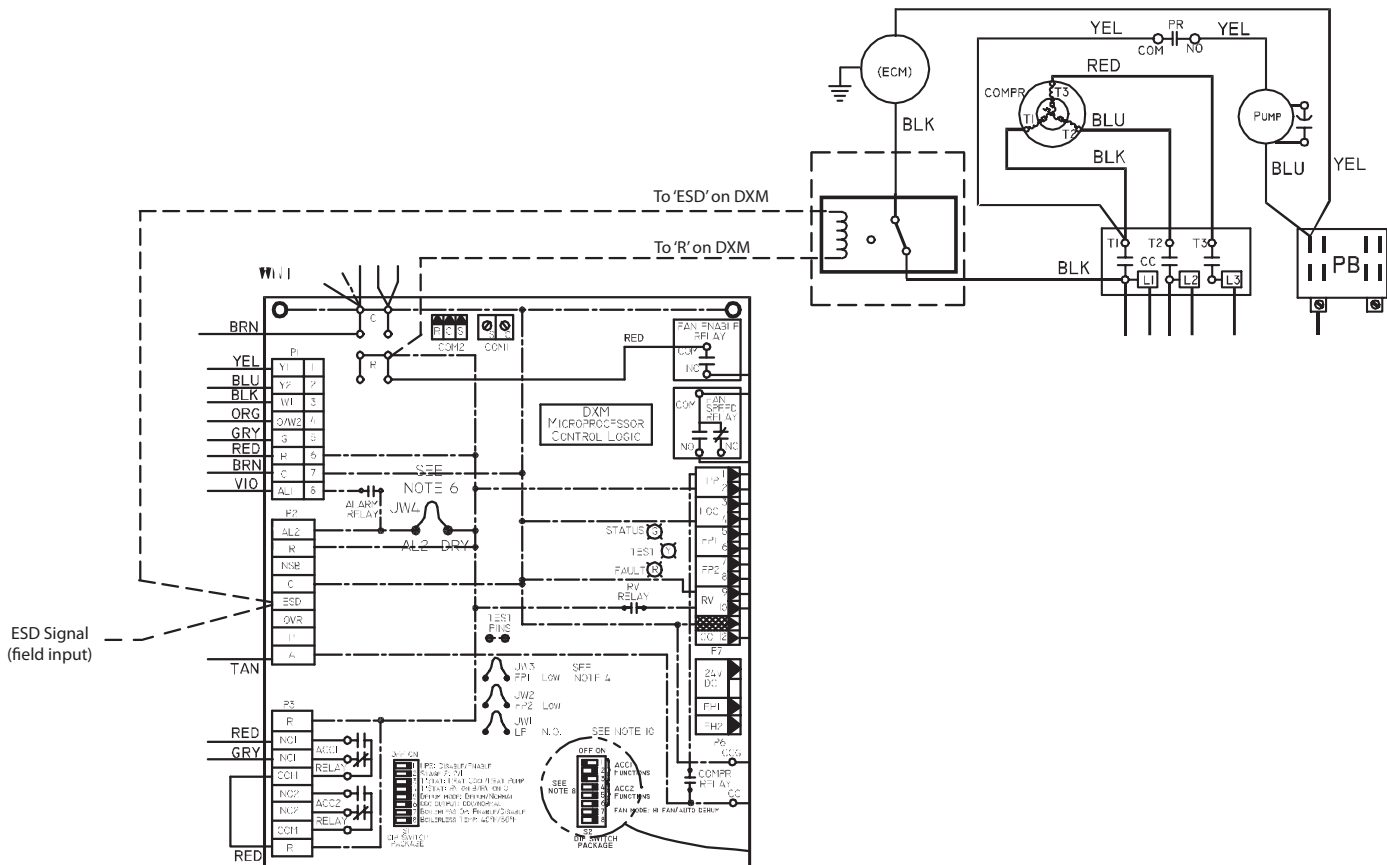
Dehumidification Mode Settings: The dehumidification mode setting provides field selection of humidity control. When operating in the normal mode, the cooling airflow settings are determined by the cooling tap setting above. When dehumidification is enabled there is a reduction in airflow in cooling to increase the moisture removal of the heat pump. Consult submittal data or specifications catalog for the specific unit series and model to correlate speed tap to airflow in CFM. The dehumidification mode can be enabled in two ways.

1. Constant Dehumidification Mode: When the dehumidification mode is selected (via DIP switch), the ECM motor will operate with a multiplier applied to the cooling CFM settings (approx. 20-25% lower airflow). Any time the unit is running in the cooling mode, it will operate at the lower airflow to improve latent capacity. The "DEHUM" LED will be illuminated at all times. Heating airflow is not affected. NOTE: Do not select dehumidification mode if cooling setting is tap 1.
2. Automatic (Humidistat-controlled) Dehumidification Mode: When the dehumidification mode is selected (via DIP switch) AND a humidistat is connected to terminal DH, the cooling airflow will only be reduced when the humidistat senses that additional dehumidification is required. The DH terminal is reverse logic. Therefore, a humidistat (not dehumidistat) is required. The "DEHUM" LED will be illuminated only when the humidistat is calling for dehumidification mode. Heating airflow is not affected.
NOTE: Do not select dehumidification mode if cooling setting is tap 1.

The ECM motor includes "soft start" and "ramp down" features. The soft start feature is a gentle increase of motor rpm at blower start up. This creates a much quieter blower start cycle.

The ramp down feature allows the blower to slowly decrease rpm to a full stop at the end of each blower cycle. This creates a much quieter end to each blower cycle and adds overall unit efficiency.

The ramp down feature may be eliminated during an ESD (Emergency Shut Down) situation when using a DXM unit controller. A relay is required to break the line voltage to the ECM motor during ESD. This relay can be wired as shown below to eliminate the ramp down (and operation) of the ECM blower.



Blower Performance Data

Airflow in CFM with wet coil and clean air filter

Model	Max ESP (in. wg)	Fan Motor (hp)	Tap Setting	Cooling Mode			Dehumid Mode			Heating Mode		
				Stg 1	Stg 2	Fan	Stg 1	Stg 2	Fan	Stg 1	Stg 2	Fan
026	0.50	1/2	4	810	950	475	630	740	475	920	1060	475
	0.50	1/2	3	725	850	425	560	660	425	825	950	425
	0.50	1/2	2	620	730	370	490	570	370	710	820	370
	0.50	1/2	1	520	610	300				600	690	300
038	0.50	1/2	4	1120	1400	700	870	1090	700	1120	1400	700
	0.50	1/2	3	1000	1250	630	780	980	630	1000	1250	630
	0.50	1/2	2	860	1080	540	670	840	540	860	1080	540
	0.50	1/2	1	730	900	450				730	900	450
049	0.75	1	4	1460	1730	870	1140	1350	870	1560	1850	870
	0.75	1	3	1300	1550	780	1020	1210	780	1400	1650	780
	0.75	1	2	1120	1330	670	870	1040	670	1200	1430	670
	0.75	1	1	940	1120	560				1010	1200	560
064	0.75	1	4	1670	2050	1020	1300	1600	1020	1860	2280	1020
	0.75	1	3	1500	1825	920	1160	1430	920	1650	2050	920
	0.75	1	2	1280	1580	790	1000	1230	790	1430	1750	790
	0.75	1	1	1080	1320	660				1200	1470	660
072	0.75	1	4	1620	2190	1050	1270	1650	1050	1690	2230	1050
	0.75	1	3	1500	1950	980	1170	1520	980	1600	2100	980
	0.75	1	2	1400	1830	910	1100	1420	910	1400	1850	910
	0.75	1	1	1320	1700	850				1240	1620	850

Factory shipped on Tap Setting 2

During Auxiliary operation (residential units only) the CFM will run at the higher if the heating (delay jumper) or AUX settings

Airflow is controlled within +/- 5% up to Max ESP shown with wet coil and standard 1" fiberglass filter

Do not select Dehumidification mode if HP CFM is on setting 1

All units AHRI/ISO/ASHRAE 13256-1 rated HP (Cooling) Delay (Heating) CFM Setting 3

ClimaDry units are factory wired to operate in Stage 2 airflow.

Tranquility® 30 (TT) Series with ClimaDry® Reheat

All Tranquility® 30 (TT) units have an ECM fan motor as a standard feature. The small additional pressure drop of the reheat coil causes the ECM motor to slightly increase RPM to overcome the added pressure drop, and maintain selected CFM up to the maximum ESP.

ClimaDry® II - Benefits and Application

ClimaDry® II Modulating Reheat

ClimateMaster's patented ClimaDry® II Dehumidification is an innovative means of providing modulating reheat without the complication of refrigeration controls. ClimaDry® II is hot gas generated reheat, which utilizes one of the biggest advantages of a Water-Source Heat Pump (WSHP), the transfer of energy through the water piping system. ClimaDry® II simply diverts condenser water through a water-to-air coil that is placed after the evaporator coil. If condenser water is not warm enough, the internal "run-around" loop increases the water temperature with each pass through the condenser coil (see figure 1, below).

ClimaDry® II Benefits

ClimaDry® II is like no other reheat option on the market. Proportional reheat is controlled to the desired leaving air temperature setpoint (factory setpoint of 72°F, 22°C), no matter what the water loop temperature is. Since dehumidification operation will occur under less than full load cooling conditions a good percentage of the time, it is important to have a reheat function that provides 100% reheat in the spring and fall when the water loop is cool. Supply air temperature is field adjustable to +/- 3°F [+/- 1.7°C] for even greater flexibility with the optional potentiometer. It is recommended that the ClimaDry® supply air temperature be set to match the space cooling setpoint so that ClimaDry® does not impact room temperature. Competitors without ClimaDry® II typically use an on/off (non-modulating) refrigeration based reheat circuit, typically referred to as "Hot gas reheat" (HGR).

HGR needs higher condensing temperatures to work well, typically 85°F [29°C] entering water temperature (EWT). With HGR, cooler water temperatures produce cooler supply air temperatures, which could overcool the space, requiring additional space heating from another source or a special auto-change-over relay to allow the unit to switch back and forth between reheat and heating. Rarely does HGR provide 100% reheat, like ClimaDry® II. ClimaDry® II has a simple and easy to troubleshoot refrigerant circuit. No switching valves or hard to diagnose leaky check valves are utilized. No unusual refrigerant pressures occur during the reheat mode. The ClimaDry® II refrigerant circuit is like every other ClimateMaster unit (without reheat), so everything the technician already knows applies to troubleshooting the ClimaDry® II refrigeration circuit. Plus, the water loop portion of the ClimaDry® II option is easy to understand and diagnose.

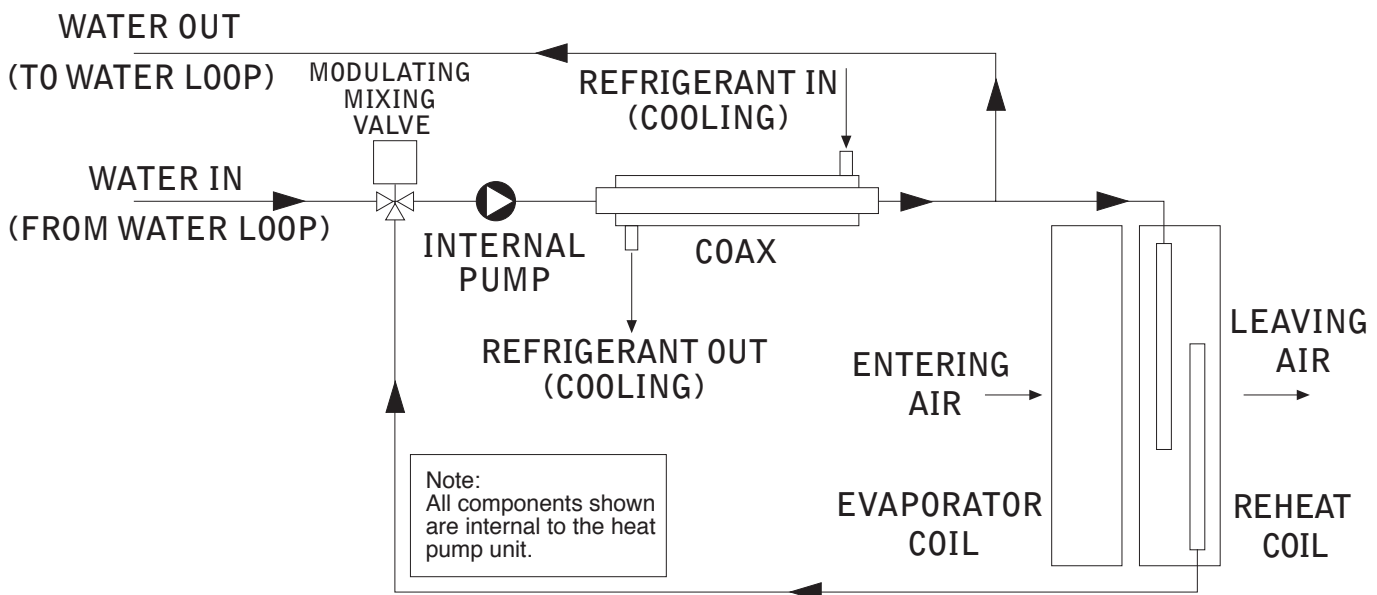
ClimaDry® II Applications

ClimaDry® II can be applied to a number of common applications, such as:

- Classrooms.
- Condominiums.
- Apartments.
- Computer rooms.
- Spaces with high latent loads like auditoriums, theaters, convention centers, etc.
- Most applications where humidity is a problem.

(Note: ClimaDry® is not for use in high fraction outdoor air applications or in applications with corrosive atmospheres, such as pool rooms.)

Figure 1: ClimaDry® II Schematic



ClimaDry® II - Benefits and Application

With the ClimaDry® II, return air from the space is cooled by the air-to-refrigerant (evaporator) coil, and then reheated by the water-to-air (reheat) coil to dehumidify the air, but maintain the same space temperature (thus operating as a dehumidifier).

The moisture removal capability of the heat pump is determined by the unit's latent capacity rating. Latent capacity equals Total capacity minus Sensible capacity. Using unit performance data from submittals (climatemaster.com) select the correct model, use your maximum entering water temperature (EWT) and flow rate to select TC and SC. For example, at 80°F [26.7°C] EWT and 6.8 GPM, the moisture removal capability (latent capacity) of a ClimateMaster TT038 is 11.8 Mbtuh [3.5kW] as shown below.

Dividing the latent capacity by 1,069 BTU/LB of water vapor at 80°F DB and 67°F WB [26.7°C DB and 19.4°C WB] moist air enthalpy, converts the amount of moisture removal to pounds per hour (multiply pounds per hour by 0.4536 to obtain kg/hr). Calculations are shown below.

Most ClimateMaster heat pumps have a sensible-to-total (S/T) ratio of 0.72 to 0.82. Therefore, approximately, 25% of the cooling capacity is dedicated to latent cooling capacity (moisture removal). When selecting a unit with ClimaDry® II, the space sensible and latent loads should be calculated. If the unit will be used for space cooling, a unit with at least enough capacity to satisfy the building sensible load should be selected. If the latent cooling load is not satisfied by the selection, a larger unit with enough latent capacity will be required. If the unit will be used for dehumidification purposes only, the latent capacity is the only consideration necessary. In this case, sensible load is immaterial.

Example TT038 Performance

EWT °F	GPM	WPD		Cooling - EAT 80/67°F							Heating - EAT 70°F					
		PSI	FT	Airflow CFM	TC	SC	Sens/ Total Ratio	kW	HR	EER	Airflow CFM	HC	kW	HE	LAT	COP
70	4.5	1.1	2.5	1080	37.8	25.7	0.68	2.22	45.3	17.0	1080	44.0	2.71	34.8	107.7	4.75
	4.5	1.1	2.5	1250	38.7	28.2	0.73	2.32	46.6	16.7	1250	44.8	2.60	36.0	103.2	5.05
	6.8	2.9	6.7	1080	39.1	26.2	0.67	2.08	46.1	18.8	1080	46.4	2.79	36.9	109.8	4.88
	6.8	2.9	6.7	1250	40.0	28.8	0.72	2.17	47.4	18.4	1250	47.3	2.67	38.2	105.0	5.19
80	4.5	1.0	2.3	1080	35.8	24.8	0.69	2.44	44.2	14.7	1080	48.3	2.84	38.6	111.4	4.98
	4.5	1.0	2.3	1250	36.7	27.2	0.74	2.55	45.4	14.4	1250	49.2	2.73	39.9	106.5	5.29
	6.8	2.8	6.6	1080	37.2	25.4	0.68	2.29	45.0	16.3	1080	51.1	2.93	41.1	113.8	5.10
	6.8	2.8	6.6	1250	38.0	27.9	0.73	2.39	46.2	15.9	1250	52.1	2.81	42.5	108.6	5.43
85	4.5	1.0	2.2	1080	34.8	24.3	0.70	2.57	43.6	13.6	1080	50.5	2.92	40.6	113.3	5.08
	4.5	1.0	2.2	1250	35.6	26.7	0.75	2.68	44.8	13.3	1250	51.5	2.80	41.9	108.1	5.40
	6.8	2.8	6.4	1080	36.2	25.0	0.69	2.40	44.4	15.0	1080	53.5	3.02	43.2	115.9	5.20
	6.8	2.8	6.4	1250	37.0	27.4	0.74	2.51	45.6	14.7	1250	54.5	2.89	44.7	110.4	5.53
90	4.5	0.9	2.1	1080	33.8	23.9	0.71	2.70	43.0	12.5	1080	52.7	2.99	42.5	115.2	5.17
	4.5	0.9	2.1	1250	34.6	26.2	0.76	2.81	44.2	12.3	1250	53.7	2.86	44.0	109.8	5.50
	6.8	2.7	6.2	1080	35.1	24.5	0.70	2.52	43.8	13.9	1080	55.9	3.10	45.3	117.9	5.29
	6.8	2.7	6.2	1250	36.0	26.9	0.75	2.63	45.0	13.7	1250	57.0	2.97	46.9	112.2	5.62

$$LC = TC - SC = 37.2 - 25.4 = 11.8 \text{ Mbtuh}$$

$$11,800 \text{ Btuh} \div 1069 = 11.0 \text{ lbs/hr}$$

Dividing the latent capacity by 1,069 BTU/LB of water vapor at 80°F DB and 67°F WB [26.7°C DB and 19.4°C WB] moist air enthalpy, converts the amount of moisture removal to pounds per hour (multiply pounds per hour by 0.4536 to obtain kg/hr).

ClimaDry® II - Sequence of Operation

ClimaDry® II Sequence of Operation - A heat pump equipped with ClimaDry® II can operate in three modes; cooling, cooling with reheat (dehumidification), and heating. The cooling/heating modes are like any other ClimateMaster WSHP. The reversing valve ("O" signal) is energized in cooling, along with the compressor contactor(s) and blower relay. In the heating mode the reversing valve is de-energized. Almost any thermostat will activate the heat pump in heating or cooling modes. The DXM microprocessor board, which is required with the ClimaDry® II option, will accept either heat pump (Y,O) thermostats or non-heat pump (Y,W) thermostats. The reheat mode requires either a separate humidistat/dehumidistat or a thermostat that has an integrated dehumidification function for activation. The DXM board is configured to work with either a humidistat or dehumidistat input to terminal "H". Upon receiving an "H" input, the DXM board will activate the cooling mode and engage reheat. Table 4 shows the relationship between thermostat input signals and unit operation. There are four operational inputs for single stage units and six operational inputs for dual stage units:

- Fan Only
- 1st Stage Cooling
- 2nd Stage Cooling
- 1st Stage Heating
- 2nd Stage Heating
- Reheat Mode

Fan Only: A (G) call from the thermostat to the (G) terminal of the DXM control board will bring the unit on in fan only mode.

1st Stage Cooling: A simultaneous call from (G), (Y1), and (O) to the (G), (Y1), (O/W2) terminals of the DXM control board will bring the unit on in 1st Stage Cooling.

2nd Stage Cooling: A simultaneous call from (G), (Y1), (Y2), and (O) to the (G), (Y1), (Y2), and (O/W2) terminals of the DXM control board will bring the unit on in 2nd Stage Cooling. When the call is satisfied at the thermostat the unit will continue to run in 1st Stage Cooling until the 1st Stage Cooling call is removed or satisfied, shutting down the unit. **NOTE: Not all units have two-stage cooling functionality.**

Table 2: Humidistat/Dehumidistat Logic and DXM (2.1, 2.2., 2.3) DIP Settings

Sensor	2.1	2.2	2.3	Logic	Reheat (ON) - H	Reheat (OFF) - H
Humidistat	OFF	OFF	OFF	Reverse	0 VAC	24 VAC
Dehumidistat	OFF	ON	OFF	Standard	24 VAC	0 VAC

Table 3: ClimaDry® II Operating Modes

Mode	Input					Output				
	O	G	Y1	Y2 ³	H	O	G	Y1	Y2 ³	Reheat
No Demand	ON/OFF	OFF	OFF	OFF	OFF	ON/OFF	OFF	OFF	OFF	OFF
Fan Only	ON/OFF	ON	OFF	OFF	OFF	ON/OFF	ON	OFF	OFF	OFF
Cooling 1st Stage	ON	ON	ON	OFF	OFF	ON	ON	ON	OFF	OFF
Cooling 2nd Stage	ON	ON	ON	ON	OFF	ON	ON	ON	ON	OFF
Cooling & Dehumidistat ¹	ON	ON	ON	ON/OFF	ON	ON	ON	ON	ON/OFF	OFF
Dehumidistat Only	ON/OFF	OFF	OFF	OFF	ON	ON	ON	ON	ON	ON
Heating 1st Stage	OFF	ON	ON	OFF	OFF	OFF	ON	ON	OFF	OFF
Heating 2nd Stage	OFF	ON	ON	ON	OFF	OFF	ON	ON	ON	OFF
Heating & Dehumidistat ²	OFF	ON	ON	ON/OFF	ON	OFF	ON	ON	ON/OFF	OFF

¹Cooling input takes priority over dehumidify input.

²DXM is programmed to ignore the H demand when the unit is in heating mode.

³N/A for single stage units; Full load operation for dual capacity units.

⁴ON/OFF = Either ON or OFF.

ClimaDry® II - Sequence of Operation

1st Stage Heating: A simultaneous call from (G) and (Y1) to the (G) and (Y1) terminals of the DXM control board will bring the unit on in 1st Stage Heating.

2nd Stage Heating: A simultaneous call from (G), (Y1), and (Y2) to the (G), (Y1), and (Y2) terminals of the DXM control board will bring the unit on in 2nd Stage Heating. When the call is satisfied at the thermostat the unit will continue to run in 1st Stage Heating until the call is removed or satisfied, shutting down the unit. **NOTE:** Not all units have two-stage heating functionality.

Reheat Mode: A call from the Humidistat/Dehumidistat to the (H) terminal of the DXM control board will bring the unit on in Reheat Mode if there is no call for cooling at the thermostat. When the Humidistat/Dehumidification call is removed or satisfied the unit will shut down. **NOTE:** Cooling always overrides Reheat Mode. In the Cooling mode, the unit cools and dehumidifies. If the cooling thermostat is satisfied but there is still a call for dehumidification, the unit will continue to operate in Reheat Mode.

Note: Care must be taken when using a humidistat to operate ClimaDry®. When the DIP switch on the DXM controller is set for 'humidistat' it reverses the control logic so that an "open" control circuit initiates a ClimaDry® run cycle. If a humidistat is not connected, or if a manual switch on the humidistat is set to "off", ClimaDry® will see the open circuit and call for dehumidification.

ClimaDry® II Component Functions

The ClimaDry® II option consists of the following components:

Motorized Valve/Proportional Controller

Supply Air Sensor

Loop Pump

Hydronic Coil

Low Air Temperature Switch

The Proportional Controller operates on 24 VAC power supply and automatically adjusts the water valve based upon the Supply Air Sensor. The Supply Air Sensor senses supply air temperature at the blower inlet providing the input signal necessary for the proportional control to drive the motorized valve during the reheat mode of operation. The Motorized Valve is a proportional actuator/three-way valve combination used to divert the condenser water from the coax to the hydronic reheat coil during the reheat mode of operation. The proportional controller signals the motorized valve based on the supply air temperature of the supply air sensor.

The Loop Pump circulates condenser water through the hydronic reheat coil during the reheat mode of operation. In this application, the loop pump is only energized during the reheat mode of operation. The Hydronic Coil is utilized during the reheat mode of operation to reheat the air to the setpoint of the proportional controller. Condenser water is diverted by the motorized valve and pumped through the hydronic coil by the loop pump in proportion to the control setpoint. The amount of reheating is dependent on the setpoint and how far from setpoint the supply air temperature is. The factory setpoint is 72°F [22°C], generally considered "neutral" air.

ClimaDry® II Application Considerations

The reheat coil adds a small amount of resistance to the air stream. Consult the submittal data or the Installation/Operation/Maintenance (I.O.M.) manual for the specific heat pump to review blower tables.

Unlike most hot gas reheat options, the ClimaDry® II option will operate over a wide range of EWTs. Special flow regulation (water regulating valve) is not required for low EWT conditions.

Unit minimum entering air temperature while in the dehumidification, cooling, or continuous fan modes is 65°F DB/55°F WB. Operation below this minimum may result in nuisance faults.

Water-source heat pumps with ClimaDry® II should not be used as make-up air units. These applications should use equipment specifically designed for make-up air.

Physical Data

Model	026	038	049	064	072
Compressor (1 Each)	Two-Stage Scroll				
Factory Charge (HFC-410A) (oz) [kg]	60 [1.70]	64 [1.81]	81 [2.30]	142 [4.03]	140 [3.97]
ECM Fan Motor & Blower					
Fan Motor (hp) [W]	1/2 [373]	1/2 [373]	1 [746]	1 [746]	1 [746]
Blower Wheel Size (dia x w) - (in) [mm]	9 x 7 [229 x 178]	11 x 10 [279 x 254]	11 x 10 [279 x 254]	11 x 10 [279 x 254]	11 x 10 [279 x 254]
Water Connection Size					
FPT (in)	3/4	3/4	1	1	1
HWG Connection Size					
FPT (in)	1/2	1/2	1/2	1/2	1/2
Coax Volume					
Volume (US Gallons) [liters]	0.76 [2.88]	0.92 [3.48]	1.24 [4.69]	1.56 [5.91]	1.56 [5.91]
Vertical Upflow					
Air Coil Dimensions (h x w) - (in) [mm]	28 x 20 [711 x 508]	28 x 25 [711 x 635]	32 x 25 [813 x 635]	36 x 25 [914 x 635]	36 x 25 [914 x 635]
Standard Filter - 1" [25.4mm] Throwaway, qty (in) [mm]	28 x 24 [711 x 610]	28 x 30 [711 x 762]	2 - 16 x 30 [406 x 762]	1 - 16 x 30 [813 x 762] 1 - 20 x 30 [508 x 762]	1 - 16 x 30 [813 x 762] 1 - 20 x 30 [508 x 762]
Weight - Operating, (lbs) [kg]	266 [121]	327 [148]	416 [189]	443 [201]	443 [201]
Weight - Packaged, (lbs) [kg]	276 [125]	337 [153]	426 [193]	453 [205]	453 [205]
Horizontal					
Air Coil Dimensions (h x w) - (in) [mm]	18 x 31 [457 x 787]	20 x 35 [508 x 889]	20 x 40 [508 x 1016]	20 x 45 [508 x 1143]	20 x 45 [508 x 1143]
Standard Filter - 1" [25.4mm] Throwaway, qty (in) [mm]	2 - 18 x 18 [457 x 457]	1 - 12 x 20 [305 x 508] 1 - 20 x 25 [508 x 635]	1 - 18 x 20 [457 x 508] 1 - 20 x 24 [508 x 610]	2 - 20 x 24 [508 x 610]	2 - 20 x 24 [508 x 610]
Weight - Operating, (lbs) [kg]	332 [151]	393 [178]	482 [219]	509 [231]	509 [231]
Weight - Packaged, (lbs) [kg]	342 [155]	403 [183]	492 [223]	519 [235]	519 [235]

Notes:

All units have TXV expansion device and 1/2" & 3/4" electrical knockouts.

Unit Maximum Water Working Pressure	
ClimaDry®	145 [999]

TT - Horizontal Dimensional Data

Horizontal Model		Overall Cabinet		
		*A Width	B Length	C Height
026	in	22.4	62.2	19.3
	cm	56.8	158.0	48.9
038	in	25.4	71.2	21.3
	cm	64.5	180.8	54.0
049	in	25.4	76.2	21.3
	cm	64.5	193.5	54.0
064 & 072	in	25.4	81.2	21.3
	cm	64.5	206.2	54.0

*Does not include air filter supports. Add 2" (5.1cm) when a 1" (25.4mm) filter is used, add 3" (7.6cm) when a 2" (50.8mm) filter is used.

Horizontal Model		Water Connections						
		1	2	3	4	5		
		Loop In D	Loop Out E	HWG In F	HWG Out G	H	Water Loop FPT	HWG FPT
026	in	2.1	10.0	13.9	16.9	3.5	3/4"	1/2"
	cm	5.2	25.4	35.2	42.9	8.9		
038	in	3.4	10.8	15.6	18.9	3.4	3/4"	1/2"
	cm	8.6	27.5	39.7	47.9	8.6		
049	in	3.4	10.8	15.6	18.9	3.4	1"	1/2"
	cm	8.6	27.5	39.7	47.9	8.6		
064 & 072	in	3.4	10.8	15.6	18.9	3.4	1"	1/2"
	cm	8.6	27.5	39.7	47.9	8.6		

Water Connections - Units with ClimaDry®	
1	2
Loop In D	Loop Out E
2.1	10.0
5.2	25.4
6.01	13.1
15.1	33.4
6.01	13.1
15.1	33.4
6.01	13.1
15.1	33.4

Horizontal Model		Electrical Knockouts		
		J 1/2"	K 1/2"	L 3/4"
		Low Voltage	External Pump	Power Supply
026	in	3.6	6.1	8.6
	cm	9.2	15.6	21.9
038	in	3.6	6.1	8.6
	cm	9.2	15.6	21.9
049	in	3.6	6.1	8.6
	cm	9.2	15.6	21.9
064 & 072	in	3.6	6.1	8.6
	cm	9.2	15.6	21.9

Notes:

1. While clear access to all removable panels is not required, installer should take care to comply with all building codes and allow adequate clearance for future field service.
2. Horizontal units shipped with filter bracket only. This bracket should be removed for return duct connection.
3. Discharge flange and hanger brackets are factory installed.
4. Condensate is 3/4" FPT.
5. CCP and BSP requires 2' service access.
6. Blower service access is through back panel on straight discharge units or through panel opposite air coil on back discharge units.

Legend:

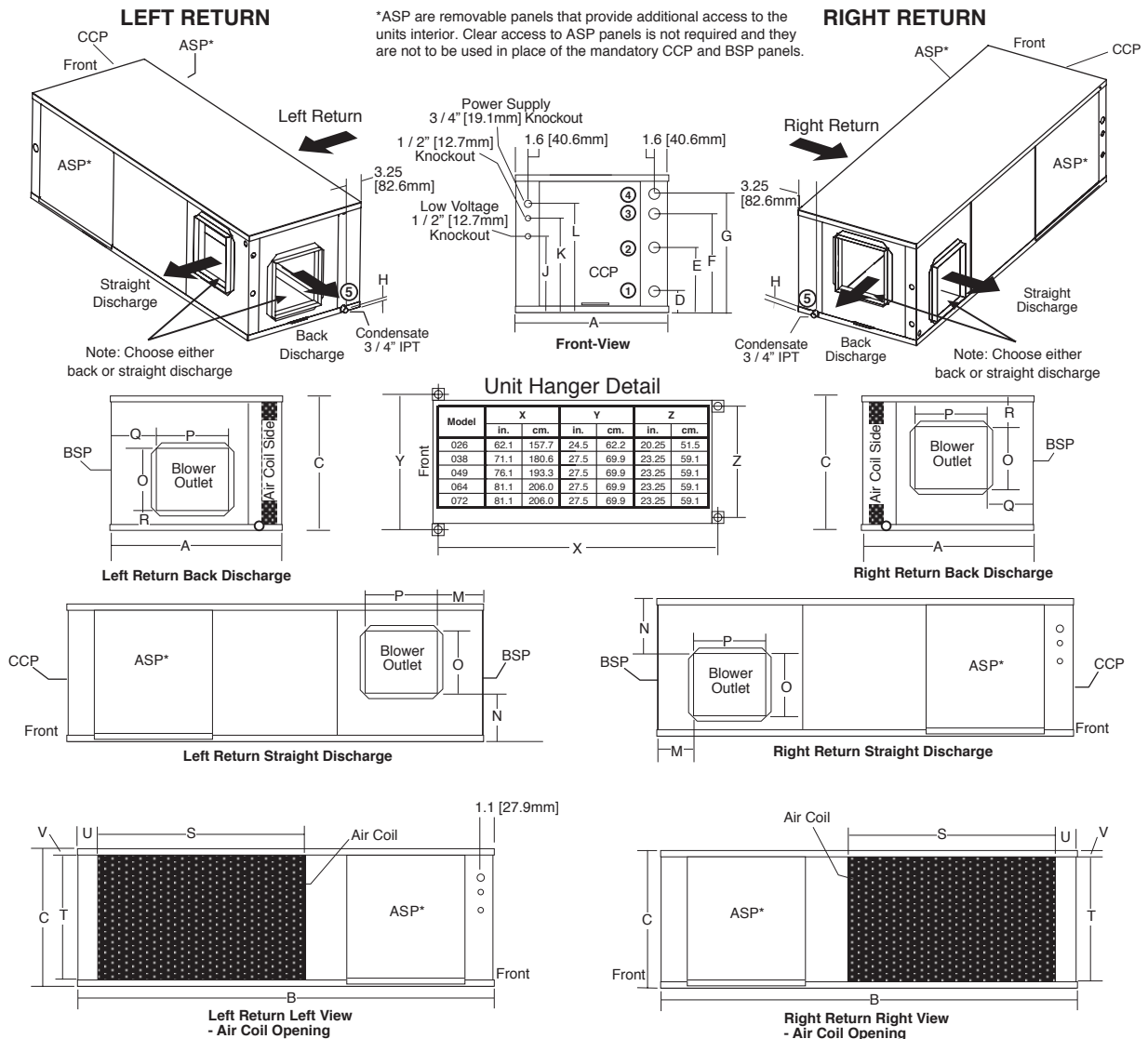
CCP = Control/Compressor Access Panel
 BSP = Blower Service Panel
 ASP = (Optional) Additional Service Panel

TT - Horizontal Dimensional Data

Horizontal Model		Discharge Connection Duct Flange Installed						Return Connection Using Return Air Opening				Return Connection Using Optional Air Filter Frame			
		M	N	O Supply Height	P Supply Width	Q	R	S Return Width	T Return Height	U	V	S Return Width	T Return Height	U	V
026	in cm	3.6 9.3	2.0 5.1	15.5 39.4	12.5 31.8	3.6 9.2	2.0 5.2	32.1 81.5	17.3 43.9	2.3 5.8	1.0 2.5	33.8 85.8	16.2 41.0	2.3 5.8	1.7 4.3
038	in cm	*3.1 7.9	1.2 3.1	19.0 48.3	17.5 44.5	*3.1 7.9	1.0 2.6	36.1 91.7	19.3 49.0	2.3 5.7	1.0 2.5	34.8 88.3	18.2 46.1	3.1 7.8	1.7 4.3
049	in cm	3.1 7.9	1.2 3.1	19.0 48.3	17.5 44.5	3.1 7.9	1.0 2.6	41.1 104.4	19.3 49.0	2.3 5.7	1.0 2.5	39.8 101.0	18.2 46.1	3.1 7.8	1.7 4.3
064 & 072	in cm	3.1 7.9	1.2 3.1	19.0 48.3	17.5 44.5	3.1 7.9	1.0 2.6	46.1 117.1	19.3 49.0	2.3 5.7	1.0 2.5	44.8 113.7	18.2 46.1	3.1 7.8	1.7 4.3

*For units with modulating reheat option this dimension is 2.9" (7.4 cm).

All dimensions are +/- 0.20 in. (+/-5.1 mm).



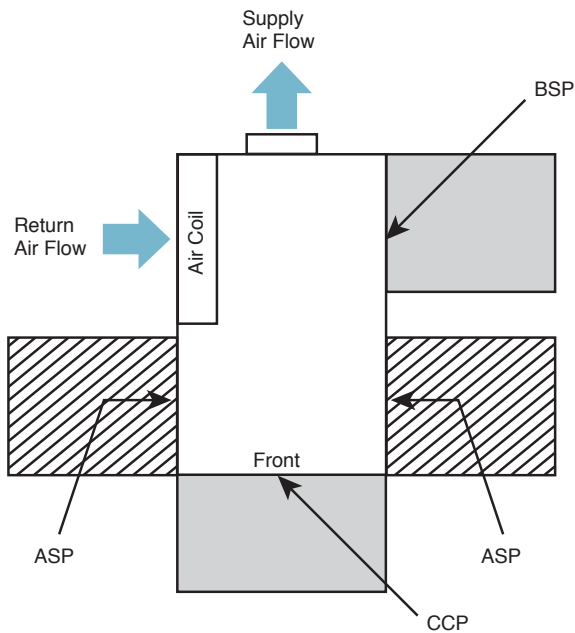
Filter Rails Removed

See Aff ---- for accessory air filter frame with duct collar

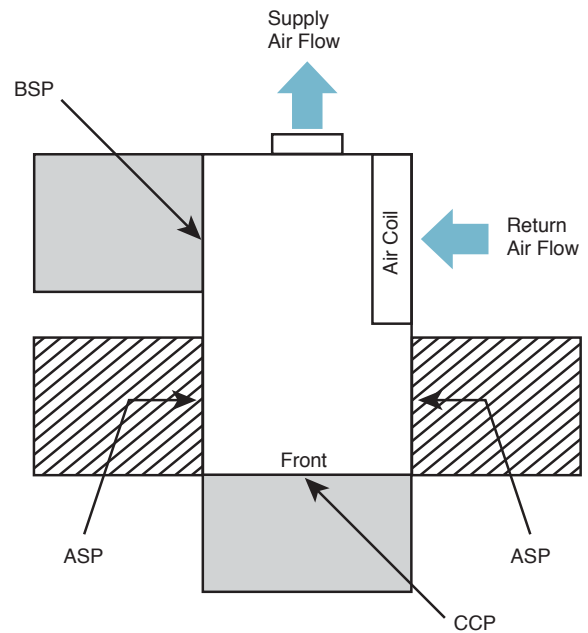
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TT - Horizontal Service Access

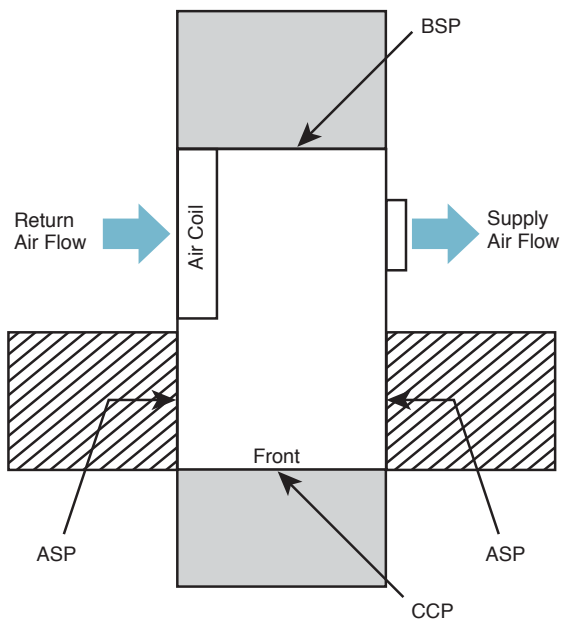
Left Return Back Discharge



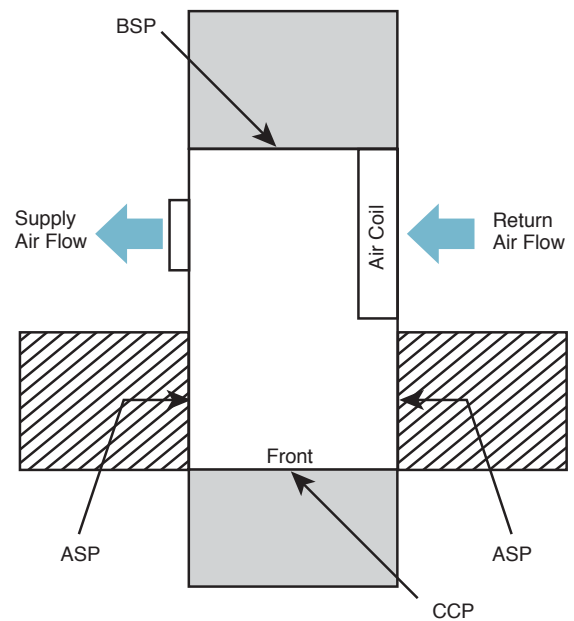
Right Return Back Discharge



Left Return Straight Discharge



Right Return Straight Discharge



Notes:

1. While clear access to all removable panels is not required, installer should take care to comply with all building codes and allow adequate clearance for future field service.
2. CCP and BSP requires 2' service access.
3. Blower service access is through back panel on straight discharge units or through panel opposite air coil on back discharge units.
4. ASP are removable panels that provide additional access to the units interior. Clear access to ASP panels is not required and they are not to be used in place of the mandatory CCP and BSP panels.

 = mandatory 2' service access

 = (optional) additional 2' service access

Legend:

CCP = Control/Compressor Access Panel

BSP = Blower Service Panel

ASP = (Optional) Additional Service Panel

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TT - Vertical Upflow Dimensional Data

Vertical Upflow Model		Overall Cabinet		
		*A Width	B Depth	C Height
026	in cm	22.4 56.8	25.6 65.1	48.5 123.2
038	in cm	25.4 64.5	30.6 77.8	50.5 128.3
049	in cm	25.4 64.5	30.6 77.8	54.5 138.4
064 & 072	in cm	25.4 64.5	30.6 77.8	58.5 148.6

*Does not include air filter supports. Add 2" (5.1cm) when a 1" (25.4mm) filter is used, add 3" (7.6cm) when a 2" (50.8mm) filter is used.

Vertical Upflow Model		Water Connections							Water Connections - Units with ClimaDry®	
		1	2	3	4	5			1	2
		Loop In D	Loop Out E	HWG In F	HWG Out G	H	Water Loop FPT	HWG FPT	Loop In D	Loop Out E
026	in cm	2.1 5.2	10.0 25.4	13.9 35.2	16.9 42.9	7.8 19.8	3/4"	1/2"	2.1 5.2	10.0 25.4
038	in cm	3.4 8.6	10.8 27.5	15.6 39.7	18.9 47.9	7.8 19.8	3/4"	1/2"	6.0 15.1	13.1 33.4
049	in cm	3.4 8.6	10.8 27.5	15.6 39.7	18.9 47.9	7.8 19.8	1"	1/2"	6.0 15.1	13.1 33.4
064 & 072	in cm	3.4 8.6	10.8 27.5	15.6 39.7	18.9 47.9	7.8 19.8	1"	1/2"	6.0 15.1	13.1 33.4

Vertical Upflow Model		Electrical Knockouts		
		J 1/2"	K 1/2"	L 3/4"
		Low Voltage	External Pump	Power Supply
026	in cm	3.6 9.2	6.1 15.6	8.6 21.9
038	in cm	3.6 9.2	6.1 15.6	8.6 21.9
049	in cm	3.6 9.2	6.1 15.6	8.6 21.9
064 & 072	in cm	3.6 9.2	6.1 15.6	8.6 21.9

Notes:

1. While clear access to all removable panels is not required, installer should take care to comply with all building codes and allow adequate clearance for future field service.
2. Front & Side access is preferred for service access. However, all components may be serviced from the front access panel if side access is not available.
3. Discharge flange is field installed.
4. Condensate is 3/4" FPT PVC and is switchable from front to side.

Legend:

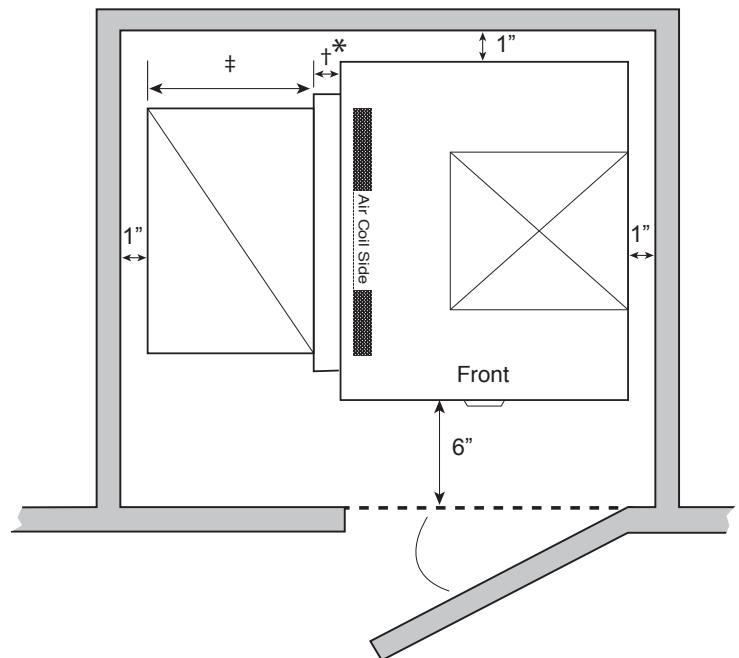
CCP = Control/Compressor Access Panel

BSP = Blower Service Panel

ASP = (optional) Additional Service Panel

Recommended Minimum Installation Clearances for Vertical Units*	
1"	Back of unit
	Side opposite return air
6"	Front if hard piped
Return Air Side	
1"	Ducted return
	- ± *Add for duct width
	- † Add 2" for 1" filter frame/rail or 3" for 2" filter frame/rail
	Free (open) return - calculate required dimension for a maximum velocity of 600 fpm

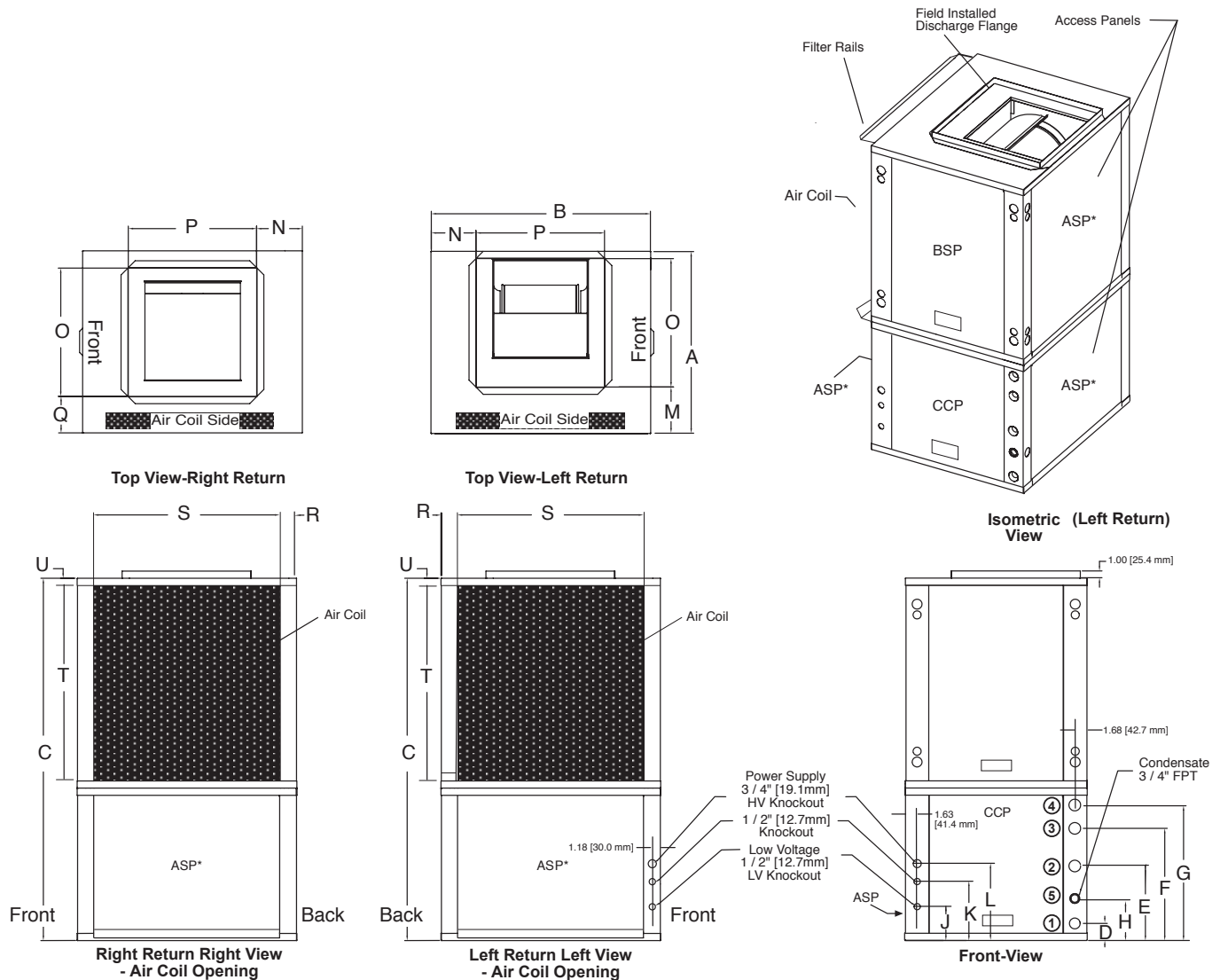
*Field installed accessories (hoses, air cleaners, etc.) and factory WSE option will require additional space. Top supply air is shown, the same clearances apply to bottom supply air units.



TT - Vertical Upflow Dimensional Data

Vertical Upflow Model		Discharge Connection Duct Flange Installed					Return Connection Using Return Air Opening				Return Connection Using Optional Air Filter Frame			
		M	N	O Supply Width	P Supply Depth	Q	R	S Return Depth	T Return Height	U	R	S Return Depth	T Return Height	U
026	in	7.2	5.8	14.0	14.0	4.9	2.3	21.1	27.7	1.0	1.7	22.2	26.2	1.7
	cm	18.3	14.8	35.6	35.6	12.4	5.8	53.6	70.4	2.5	4.3	56.4	66.5	4.3
038	in	6.4	6.3	18.0	18.0	5.3	2.3	26.1	27.7	1.0	1.7	27.2	26.2	1.7
	cm	16.1	16.0	45.7	45.7	13.5	5.8	66.3	70.4	2.5	4.3	69.1	66.5	4.3
049	in	6.4	6.3	18.0	18.0	5.3	2.3	26.1	31.7	1.0	1.7	27.2	30.2	1.7
	cm	16.1	16.0	45.7	45.7	13.5	5.8	66.3	80.5	2.5	4.3	69.1	76.7	4.3
064 & 072	in	6.4	6.3	18.0	18.0	5.3	2.3	26.1	35.7	1.0	1.7	27.2	34.2	1.7
	cm	16.1	16.0	45.7	45.7	13.5	5.8	66.3	90.7	2.5	4.3	69.1	86.9	4.3

All dimensions are +/- 0.20 in, (+/-5.1 mm).

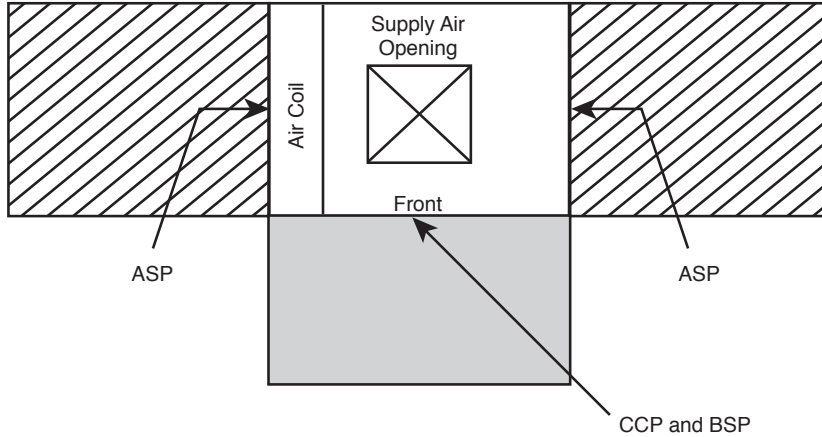


*ASP are removable panels that provide additional access to the units interior. Clear access to ASP panels is not required and they are not to be used in place of the mandatory CCP and BSP panels.

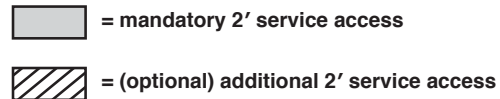
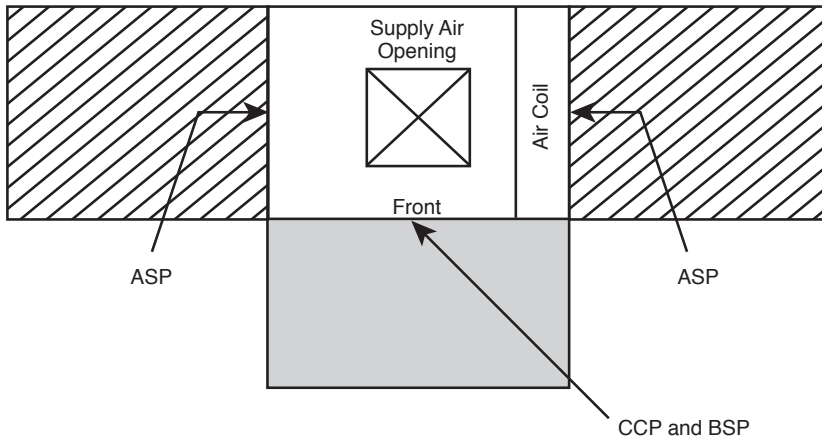
See Aff ---- for accessory air filter frame with duct collar

Vertical Units

Left Return



Right Return



Notes:

1. While clear access to all removable panels is not required, installer should take care to comply with all building codes and allow adequate clearance for future field service.
2. Front & Side access is preferred for service access. However, all components may be serviced from the front access panel if side access is not available.
3. ASP are removable panels that provide additional access to the units interior. Clear access to ASP panels is not required and they are not to be used in place of the mandatory CCP and BSP panels.
4. Top supply air is shown, the same clearances apply to bottom supply air units.

Legend:

CCP = Control/Compressor Access Panel
 BSP = Blower Service Panel
 ASP = (optional) Additional Service Panel

Corner Weights

Corner Weights for TT Series Horizontal Units

Model		Total	Left-Front*	Right-Front*	Left-Back*	Right-Back*
026	Lbs	266	78.8	67.2	69.9	50.2
	kg	121	35.7	30.5	31.7	22.7
038	Lbs	327	104.4	74.9	83.7	64.0
	kg	148	47.4	34.0	38.0	29.0
049	Lbs	416	145.0	92.6	98.1	80.3
	kg	189	65.8	42.0	44.5	36.4
064	Lbs	441	182.3	72.5	78.4	107.8
	kg	200	82.7	32.9	35.6	48.9
072	Lbs	441	182.3	72.5	78.4	107.8
	kg	200	82.7	32.9	35.6	48.9

*Front is control box end.

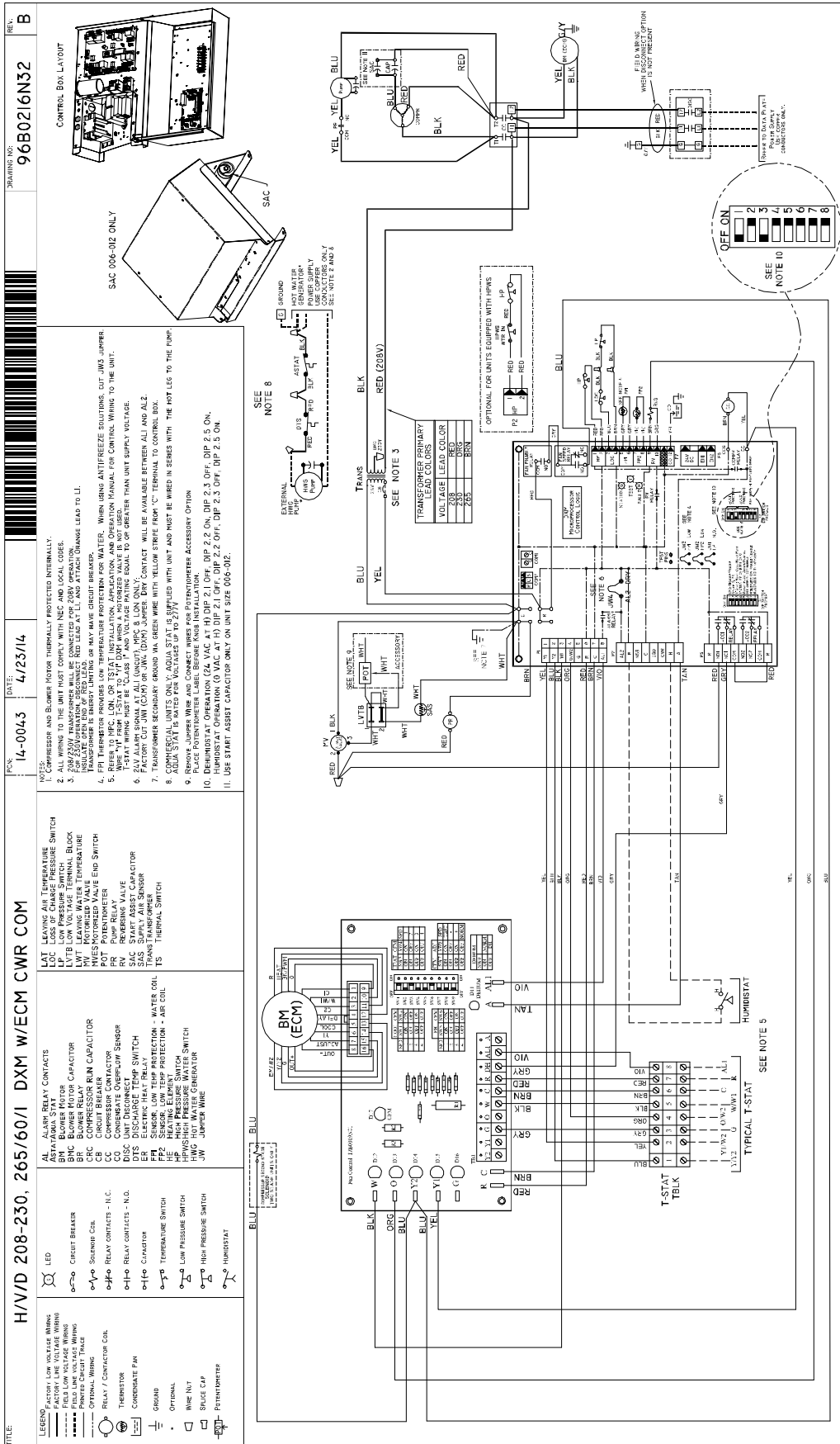
Electrical Data

TT Model	Volt Code	Rated Voltage	Voltage Min/Max	Compressor			Internal	Fan	Total	Min	Max
							Pump	Motor	Unit	Circ	Fuse/
				RLA	LRA	Qty	FLA	FLA	FLA	Amp	HACR
026	G	208/230/60/1	197/252	11.7	58.3	1	0.8	3.9	16.4	19.3	30
	E	265/60/1	239/292	9.1	54.0	1	0.7	3.2	13.0	15.3	20
	H	208/230/60/3	197/252	6.5	55.4	1	0.8	3.9	11.2	12.8	15
	F	460/60/3	414/506	3.5	28.0	1	0.7	3.2	7.4	8.3	15
038	G	208/230/60/1	197/252	15.3	83.0	1	0.8	3.9	20.0	23.8	35
	E	265/60/1	239/292	13.0	72.0	1	0.7	3.2	16.9	20.2	30
	H	208/230/60/3	197/252	11.6	73.0	1	0.8	3.9	16.3	19.2	30
	F	460/60/3	414/506	5.7	38.0	1	0.7	3.2	9.6	11.0	15
049	G	208/230/60/1	197/252	21.2	104.0	1	1.1	6.9	29.2	34.5	50
	E	265/60/1	239/292	16.0	109.7	1	1.1	6.0	23.1	27.1	40
	H	208/230/60/3	197/252	14.0	83.1	1	1.1	6.9	22.0	25.5	35
	F	460/60/3	414/506	6.4	41.0	1	1.1	6.0	13.5	15.1	20
064	G	208/230/60/1	197/252	27.1	152.9	1	1.1	6.9	35.1	41.8	60
	E	265/60/1	239/292	22.4	130.0	1	1.1	6.0	29.5	35.1	50
	H	208/230/60/3	197/252	16.5	110.0	1	1.1	6.9	24.5	28.6	45
	F	460/60/3	414/506	7.2	52.0	1	1.1	6.0	14.3	16.1	20
072	G	208/230/60/1	197/252	29.7	179.2	1	1.1	6.9	37.7	45.1	70
	H	208/230/60/3	197/252	17.6	136.0	1	1.1	6.9	25.6	30.0	45
	F	460/60/3	414/506	8.5	66.1	1	1.1	6.0	15.6	17.7	25

Wire length based on one way measurement with 2% voltage drop
 Wire size based on 60°C copper conductor
 All fuses Class RK-5

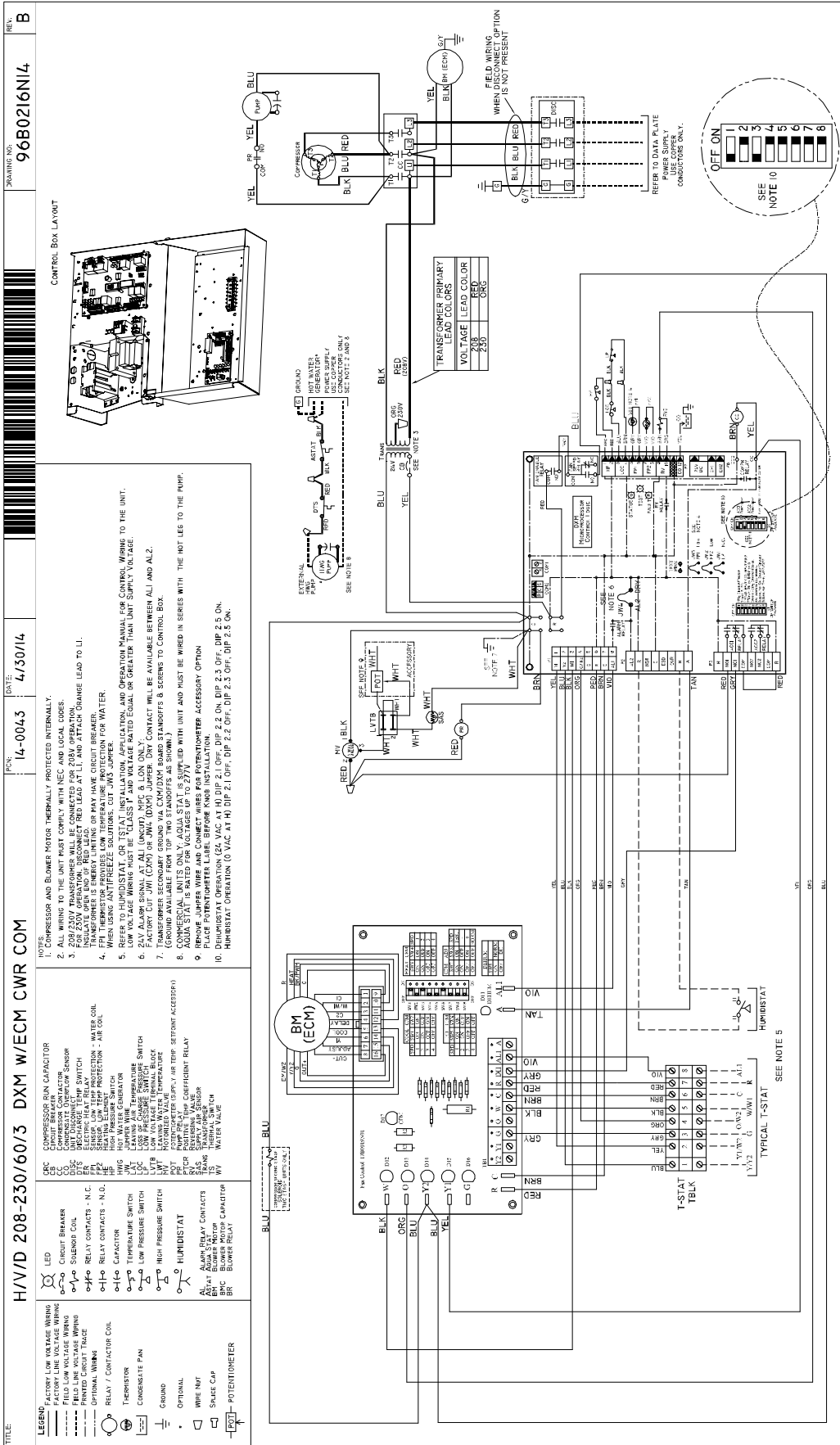
*** NEUTRAL CONNECTION REQUIRED! All F Voltage (460 vac) units with ECM motors require a four wire power supply with neutral.**
Motor and ClimaDry® pump are 265 volt and wired between one hot leg and neutral.

Typical Wiring Diagram – Single Phase TT Units



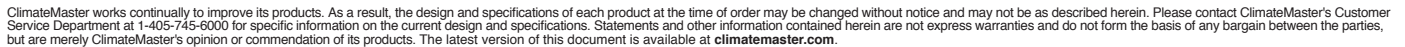
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Typical Wiring Diagram – Three Phase 208/230V TT Units

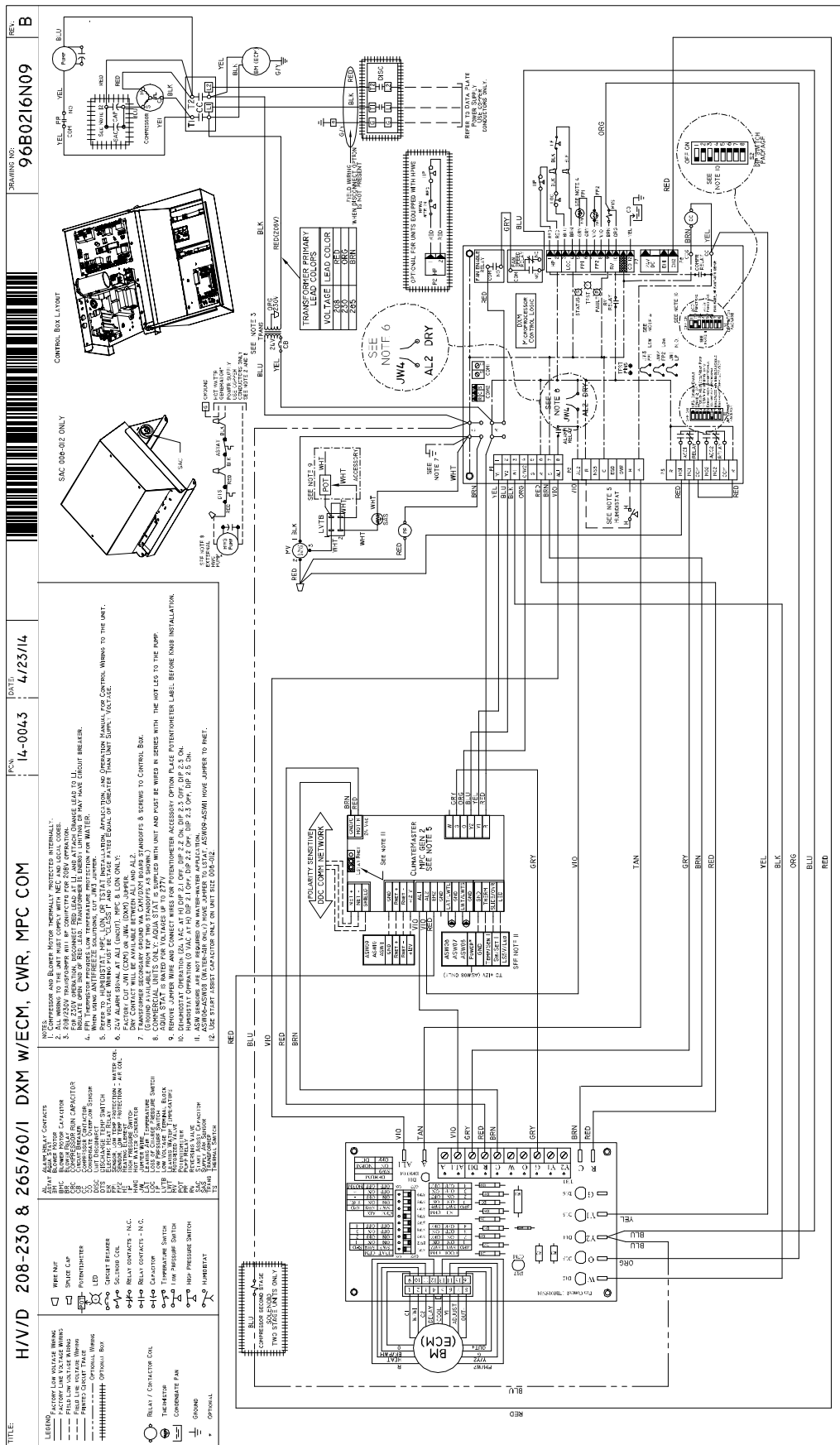


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Note: 460V Units Require A Neutral Wire.

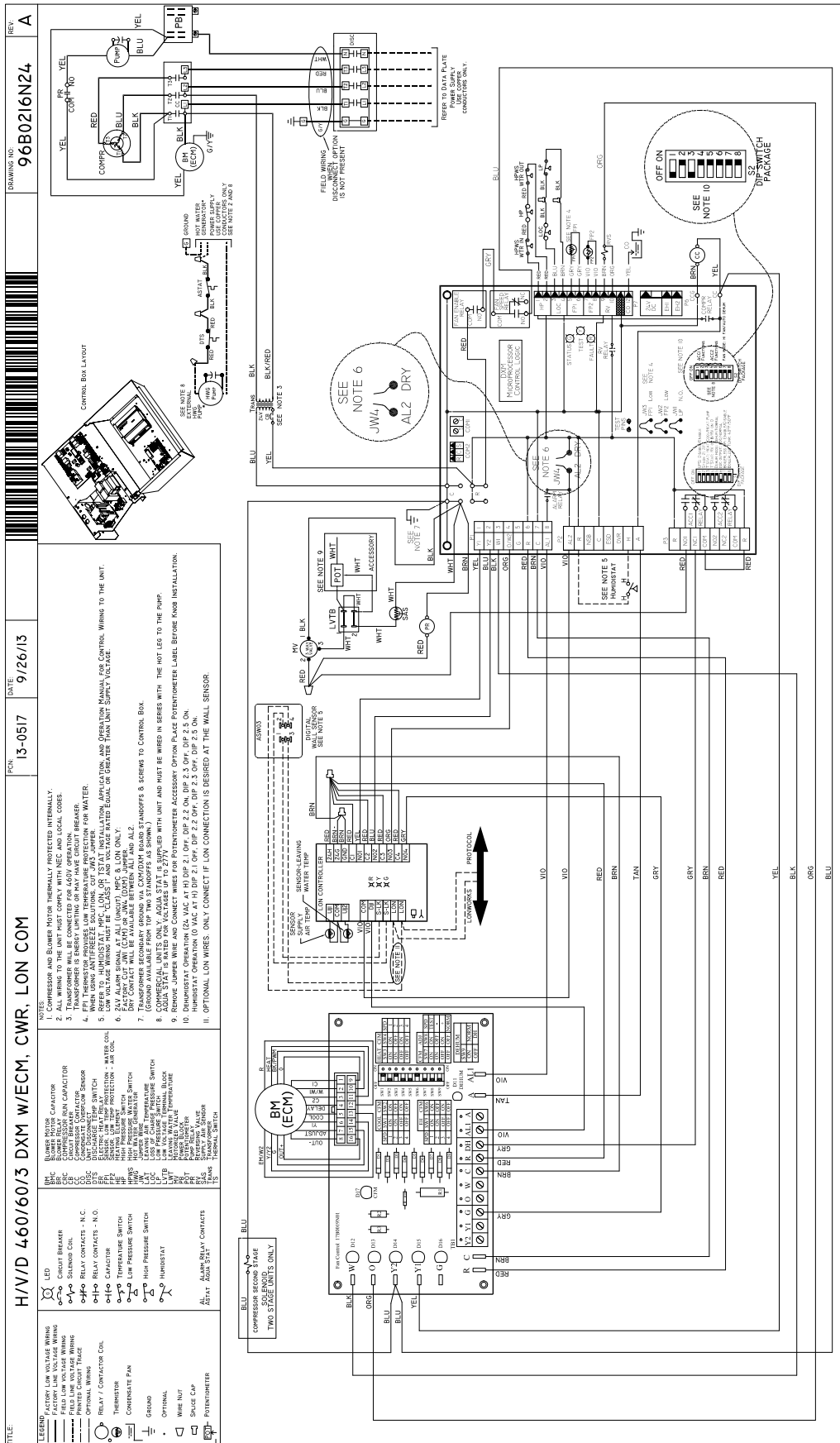


Typical Wiring Diagram – Single Phase TT Units with MPC Controller



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Typical Wiring Diagram – Three Phase 460v TT Units with LON Controller



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Tranquility® 30 (TT) Series 60Hz Engineering Specifications – Page 1

General:

Furnish and install ClimateMaster Tranquility® “TT” Water Source Heat Pumps, as indicated on the plans. Equipment shall be completely assembled, piped, and internally wired. Capacities and characteristics as listed in the schedule and the specifications that follow.

Units shall be supplied completely factory built capable of operating over an entering water temperature range from 20° to 120°F (-6.7° to 48.9°C) as standard. Equivalent units from other manufacturers may be proposed provided approval to bid is given 10 days prior to bid closing. All equipment listed in this section must be rated and certified in accordance with Air-Conditioning, Heating and Refrigeration Institute/International Standards Organization (AHRI/ISO 13256-1). All equipment must be tested, investigated, and determined to comply with the requirements of the standards for Heating and Cooling Equipment UL-1995 for the United States and CAN/CSA-C22.2 NO.236 for Canada, by Intertek Testing Laboratories (ETL). The units shall have AHRI/ISO and ETL-US-C labels.

All units shall pass a factory acceptance test. The quality control system shall automatically perform the factory acceptance test via computer. A detailed report card from the factory acceptance test shall ship with each unit. **(Note: If unit fails the factory acceptance test it shall not be allowed to ship. Unit serial number will be recorded by factory acceptance test and furnished on report card for ease of unit warranty status.)**

Basic Construction:

Horizontal units shall have one of the following air flow arrangements: Left Inlet/Straight (Right) Discharge; Right Inlet/Straight (Left) Discharge; Left Inlet/Back Discharge; or Right Inlet/Back Discharge as shown on the plans. Units must have the ability to be field convertible from straight to back or back to straight discharge with no additional parts or unit structure modification. Horizontal units will have factory installed hanger brackets with rubber isolation grommets packaged separately.

Vertical Units shall have one of the following air flow arrangements: Left Return/Top Discharge, Right Return/Top Discharge, Left Return/Bottom Discharge, Right Return/Bottom Discharge as shown on the plans.

If units with these arrangements are not used, the contractor is responsible for any extra costs incurred by other trades. All units (horizontal and vertical) must have a minimum of three access panels for serviceability of compressor compartment. **Units having only one access panel to compressor/heat exchangers/expansion device/refrigerant piping shall not be acceptable.**

Compressor section interior surfaces shall be lined with 1/2 inch (12.7mm) thick, 1-1/2 lb/ft³ (24 kg/m³) acoustic type glass fiber insulation. Air handling section interior surfaces shall be lined with 1/2 in (12.7mm) thick, 1-1/2 lb/ft³ (24 kg/m³) **foil-faced** fiber insulation for ease of cleaning. Insulation placement shall be designed in a manner that will eliminate any exposed edges to prevent the introduction of glass fibers into the air stream. **Units without foil-faced insulation in the air handling section will not be accepted.** The heat pumps shall be fabricated from heavy gauge galvanized steel with powder coat paint finish. Both sides of the steel shall be painted for added protection.

Standard cabinet panel insulation must meet NFPA 90A requirements, air erosion and mold growth limits of UL-181, stringent fungal resistance test per ASTM-C1071 and ASTM G21, and shall meet zero level bacteria growth per ASTM G22. **Unit insulation must meet these stringent requirements or unit(s) will not be accepted.**

All horizontal units to have factory installed 1”(25.4mm) discharge air duct collars, 1”(25.4mm) filter rails with 1”(25.4mm) filters factory installed, and factory installed unit-mounting brackets. Vertical units to have field installed discharge air duct collar, shipped loose and 1”(25.4mm) filter rails with 1”(25.4mm) filters factory installed. **If units with these factory-installed provisions are not used, the contractor is responsible for any extra costs to field install these provisions, and/or the extra costs for his sub-contractor to install these provisions.**

Tranquility® 30 (TT) Series 60Hz Engineering Specifications – Page 2

All units must have an insulated panel separating the fan compartment from the compressor compartment. Units with the compressor in the air stream are not acceptable. Units shall have a factory installed 1 inch (25.4mm) wide filter bracket for filter removal from either side. Units shall have a 1 inch (25.4mm) thick throwaway type glass fiber filter. The contractor shall purchase one spare set of filters and replace factory shipped filters on completion of start-up. Filters shall be standard sizes. If units utilize non-standard filter sizes then the contractor shall provide 12 spare filters for each unit.

Cabinets shall have separate holes and knockouts for entrance of line voltage and low voltage control wiring. All factory-installed wiring passing through factory knockouts and openings shall be protected from sheet metal edges at openings by plastic ferrules. Supply and return water connections shall be copper FPT fittings, and shall be securely mounted flush to the cabinet corner post allowing for connection to a flexible hose without the use of a back-up wrench. Water connections that protrude through the cabinet or require the use of a backup wrench shall not be allowed. All water connections and electrical knockouts must be in the compressor compartment corner post as to not interfere with the serviceability of unit. Contractor shall be responsible for any extra costs involved in the installation of units that do not have this feature. Contractor must ensure that units can be easily removed for servicing and coordinate locations of electrical conduit and lights with the electrical contractor.

Option: Contractor shall install 2-inch (50.8mm) filter racks with removable access door and 2 inch (50.8mm) MERV11 pleated throwaway filters on all units.

Option: UltraQuiet package shall consist of high technology sound attenuating material that is strategically applied to the compressor and air handling compartment casings and fan scroll in addition to the standard ClimaQuiet system design, to further dampen and attenuate sound transmissions.

Option: The unit will be supplied with internally factory mounted two-way water valve for variable speed pumping requirements. A factory-mounted or field-installed high pressure switch shall be installed in the water piping to disable compressor operation in the event water pressures build due to water freezing in the piping system.

Option: The unit will be supplied with internally factory mounted automatic water flow regulators.

Option: The unit will be supplied with internally mounted secondary pump for primary/secondary applications, including one-pipe systems.

Option: The unit shall be supplied with extended range insulation option, which adds closed cell insulation to internal water lines, and provides insulation on suction side refrigeration tubing including refrigerant to water heat exchanger.

Fan and Motor Assembly:

Blower shall have inlet rings to allow removal of wheel and motor from one side without removing housing. Units shall have a direct-drive centrifugal fan. The fan motor shall be an ECM variable speed ball bearing type motor. The ECM fan motor shall provide soft starting, maintain constant CFM over its static operating range and provide airflow adjustment on its control board. The fan motor shall be isolated from the housing by rubber grommets. The motor shall be permanently lubricated and have thermal overload protection. A special dehumidification mode shall be provided to allow lower airflows in cooling for better dehumidification. The dehumidification mode shall be selectable via a jumper on the control board or may be controlled externally from a humidistat. Airflow/Static pressure rating of the unit shall be based on a wet coil and a clean filter in place. **Ratings based on a dry coil, and/or no air filter, shall NOT be acceptable.**

Refrigerant Circuit:

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Tranquility® 30 (TT) Series 60Hz Engineering Specifications – Page 3

All units shall contain an EarthPure®(HFC-410A) sealed refrigerant circuit including a high efficiency two-stage scroll compressor designed for heat pump operation, a thermostatic expansion valve for refrigerant metering, fin and tube or micro channel refrigerant to air heat exchanger, reversing valve, coaxial (tube in tube) refrigerant to water heat exchanger, and safety controls including a high pressure switch, low pressure switch (loss of charge), water coil low temperature sensor, and air coil low temperature sensor. Access fittings shall be factory installed on high and low pressure refrigerant lines to facilitate field service. Activation of any safety device shall prevent compressor operation via a microprocessor lockout circuit. The lockout circuit shall be reset at the thermostat or at the contractor supplied disconnect switch. **Units that cannot be reset at the thermostat shall not be acceptable.**

Hermetic compressors shall be internally sprung. The compressor shall have a dual level vibration isolation system. The compressor will be mounted on specially engineered sound-tested EPDM vibration isolation grommets to a large heavy gauge compressor mounting plate, which is then isolated from the cabinet base with rubber grommets for maximized vibration attenuation. All units shall include a discharge muffler to further enhance sound attenuation. Compressor shall have thermal overload protection. Compressor shall be located in an insulated compartment away from air stream to minimize sound transmission.

Refrigerant to air heat exchangers shall utilize aluminium fin with copper tube or all aluminium micro channel construction and be rated to withstand 625 PSIG (4309 kPa) refrigerant working pressure. Refrigerant to water heat exchangers shall be of copper inner water tube and steel refrigerant outer tube design, rated to withstand 625 PSIG (4309 kPa) working refrigerant pressure and 500 PSIG (3445 kPa) working water pressure. The refrigerant to water heat exchanger shall be "electro-coated" with a low cure cathodic epoxy material a minimum of 0.4 mils thick (0.4 – 1.5 mils range) on all surfaces. The black colored coating shall provide a minimum of 1000 hours salt spray protection per ASTM B117-97 on all external steel and copper tubing. The material shall be formulated without the inclusion of any heavy metals and shall exhibit a pencil hardness of 2H (ASTM D3363-92A), crosshatch adhesion of 4B-5B (ASTM D3359-95), and impact resistance of 160 in-lbs (184 kg-cm) direct (ASTM D2794-93).

Refrigerant metering shall be accomplished by thermostatic expansion valve only. Expansion valves shall be dual port balanced types with external equalizer for optimum refrigerant metering. Units shall be designed and tested for operating ranges of entering water temperatures from 20° to 120°F (-6.7° to 48.9°C). Reversing valve shall be four-way solenoid activated refrigerant valve, which shall default to heating mode should the solenoid fail to function. If the reversing valve solenoid defaults to cooling mode, an additional low temperature thermostat must be provided to prevent over-cooling an already cold room.

Option: The unit will be supplied with a cupro-nickel coaxial water to refrigerant heat exchanger.

Option: The unit shall be supplied with a hot water generator (desuperheater).

Option: The refrigerant to air heat exchanger shall be coated.

Option: Unit shall include ClimaDry® reheat option. Only modulating reheat that will adjust capacity based upon supply air temperature to provide "neutral" (72°F, 22.2°C) constant air temperature will be accepted. "Neutral" supply air temperature shall be provided regardless of entering loop water temperatures (above 55°F, 12.8°C) or refrigerant condensing pressures. Control of reheat must be accomplished via a humidistat or dehumidistat contact closure. Refrigerant circuit must be AHRI certified. Approved equal manufacturers may provide pre-engineered integrated modulating hot gas reheat within the unit cabinet, or the installing contractor in conjunction with the "approved equal" unit manufacturer can provide for approval (during the submittal phase) an engineered system consisting of: a duct mounted hot water coil, small circulating pump, modulating control valve, and associated piping using the discharge condenser water off of the unit as the heating medium. All design costs and costs of field installed items including additional power wiring to pump, and control wiring to and from pump and control valve to unit shall be borne by

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Tranquility® 30 (TT) Series 60Hz Engineering Specifications – Page 4

mechanical contractor. Refrigerant circuits that are not AHRI certified when the reheat option is applied will not be accepted. (See ClimaDry® submittal for more details and unit availability.)

Drain Pan:

The drain pan shall be constructed of 304 Stainless Steel to inhibit corrosion. This corrosion protection system shall meet the stringent 1000 hour salt spray test per ASTM B117. If plastic type material is used, it must be HDPE (High Density Polyethylene) to avoid thermal cycling shock stress failure over the lifetime of the unit. Drain pan shall be fully insulated. Drain outlet shall be located at pan as to allow unobstructed drainage of condensate. Drain outlet for horizontal units shall be connected from pan directly to FPT fitting.

No hidden internal tubing extensions from pan outlet extending to unit casing (that can create drainage problems) will be accepted. The unit as standard will be supplied with solid-state electronic condensate overflow protection. **Mechanical float switches will NOT be accepted.**

Vertical units shall be furnished with a PVC FPT condensate drain connection and an internal factory installed condensate trap. If units without an internal trap are used, the contractor is responsible for any extra costs to field install these provisions, and/or the extra costs for his sub-contractor to install these provisions.

Electrical:

A control box shall be located within the unit compressor compartment and shall contain a 50VA transformer, 24 volt activated, 2 or 3 pole compressor contactor, terminal block for thermostat wiring and solid-state controller for complete unit operation. Reversing valve and fan motor wiring shall be routed through this electronic controller. Units shall be name-plated for use with time delay fuses or HACR circuit breakers. Unit controls shall be 24 Volt and provide heating or cooling as required by the remote thermostat/sensor.

Option: Units shall be supplied with factory installed non-fused electrical service disconnect switch.

Solid State Control System (CXM):

Units shall have a solid-state control system. **Units utilizing electro-mechanical control shall not be acceptable.** The control system microprocessor board shall be specifically designed to protect against building electrical system noise contamination, EMI, and RFI interference. The control system shall interface with a heat pump type thermostat. The control system shall have the following features:

- a. Anti-short cycle time delay on compressor operation.
- b. Random start on power up mode.
- c. Low voltage protection.
- d. High voltage protection.
- e. Unit shutdown on high or low refrigerant pressures.
- f. Unit shutdown on low water temperature.
- g. Condensate overflow electronic protection.
- h. Option to reset unit at thermostat or disconnect.
- i. Automatic intelligent reset. Unit shall automatically reset the unit 5 minutes after trip if the fault has cleared. If a fault occurs 3 times sequentially without thermostat meeting temperature, then lockout requiring manual reset will occur.
- j. Ability to defeat time delays for servicing.
- k. Light emitting diode (LED) on circuit board to indicate high pressure, low pressure, low voltage, high voltage, low water/air temperature cut-out, condensate overflow, and control voltage status.
- l. The low-pressure switch shall not be monitored for the first 120 seconds after a compressor start command to prevent nuisance safety trips.
- m. 24V output to cycle a motorized water valve or other device with compressor contactor.
- n. Unit Performance Sentinel (UPS). The UPS warns when the heat pump is running inefficiently.
- o. Water coil low temperature sensing (selectable for water or anti-freeze).

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Tranquility® 30 (TT) Series 60Hz Engineering Specifications – Page 5

p. Air coil low temperature sensing.

NOTE: Units not providing the 8 safety protections of anti-short cycle, low voltage, high voltage, high refrigerant pressure, low pressure (loss of charge), air coil low temperature cut-out, water coil low temperature cut-out, and condensate overflow protections will not be accepted.

Solid State ECM Fan Control Board:

Airflow selection shall be accomplished via jumper or dip switch settings on the ECM control board. Actual airflow shall be indicated by the CFM LED with each 100 CFM being represented by one flash of the LED. Airflow shall be automatically maintained ($\pm 5\%$) by the ECM motor regardless of external static pressure up to its maximum output capacity. A jumper shall allow selection of a special dehumidification mode, which reduces airflow in cooling by 25% to increase the latent capacity of the unit. A terminal shall be provided on the control board to allow an external humidistat to activate dehumidification mode.

Note: To achieve full benefit of the two-stage compressor and ECM fan, a 2 Heat/2 Cool thermostat (or a 3 Heat/2 Cool thermostat when electric backup heat is required) should be employed.

Option: Enhanced solid state control system (DXM):

This control system features two-stage control of cooling and two stage control of heating modes for exacting temperature and dehumidification purposes.

This control system coupled with a multi-stage thermostat will better dehumidify room air by automatically running the heat pump's fan at lower speed on the first stage of cooling thereby implementing low sensible heat ratio cooling. On the need for higher cooling performance the system will activate the second stage of cooling and automatically switch the fan to the higher fan speed setting. This system may be further enhanced with a humidistat. **Units not having automatic low sensible heat ratio cooling will not be accepted; as an alternate a hot gas reheat coil may be provided with control system for automatic activation.**

Control shall have all of the above-mentioned features of the CXM control system along with the following expanded features:

- a. Removable thermostat connector.
- b. Night setback control.
- c. Random start on return from night setback.
- d. Minimized reversing valve operation (Unit control logic shall only switch the reversing valve when cooling is demanded for the first time. The reversing valve shall be held in this position until the first call for heating, ensuring quiet operation and increased valve life.).
- e. Override temperature control with 2-hour timer for room occupant to override setback temperature at the thermostat.
- f. Dry contact night setback output for digital night setback thermostats.
- g. Ability to work with heat pump or heat/cool (Y, W) type thermostats.
- h. Ability to work with heat pump thermostats using O or B reversing valve control.
- i. Emergency shutdown contacts.
- j. Boilerless system heat control at low loop water temperature.
- k. Ability to allow up to 3 units to be controlled by one thermostat.
- l. Relay to operate an external damper.
- m. Ability to automatically change fan speed from multistage thermostat.
- n. Relay to start system pump.
- o. 75 VA control transformer. Control transformer shall have load side short circuit and overload protection via a built in circuit breaker.

Digital Night Setback with Pump Restart (DXM w/ATP32U03/04)

The unit will be provided with a Digital Night Setback feature using an accessory relay on the DXM controller with an ATP32U03/04. ClimateMaster works continually to improve its products. As a result, the design and specifications of each product at the time of order may be changed without notice and may not be as described herein. Please contact ClimateMaster's Customer Service Department at 1-405-745-6000 for specific information on the current design and specifications. Statements and other information contained herein are not express warranties and do not form the basis of any bargain between the parties, but are merely ClimateMaster's opinion or commendation of its products. The latest version of this document is available at climatemaster.com.

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thermostat and an external, field-provided time clock. The external time clock will initiate and terminate the night setback period. The thermostat will have a night setback override feature with a programmable override time period.

An additional accessory relay on the unit DXM controller will energize the building loop pump control for the duration of the override period. **(Note: this feature requires additional low voltage wiring. Consult Application Drawings for details.)**

Remote Service Sentinel (CXM/DXM):

Solid state control system shall communicate with thermostat to display (at the thermostat) the unit status, fault status, and specific fault condition, as well as retrieve previously stored fault that caused unit shutdown. The Remote Service Sentinel allows building maintenance personnel or service personnel to diagnose unit from the wall thermostat. The control board shall provide a signal to the thermostat fault light, indicating a lockout. Upon cycling the G (fan) input 3 times within a 60 second time period, the fault light shall display the specific code as indicated by a sequence of flashes. A detailed flashing code shall be provided at the thermostat LED to display unit status and specific fault status such as over/under voltage fault, high pressure fault, low pressure fault, low water temperature fault, condensate overflow fault, etc. **Units that do not provide this remote service sentinel shall not be acceptable.**

Option: Lonworks interface system

Units shall have all the features listed above (either CXM or DXM) and the control board will be supplied with a LONWORKS interface board, which is LONMark certified. This will permit all units to be daisy chained via a 2-wire twisted pair shielded cable. The following points must be available at a central or remote computer location:

- a. space temperature
- b. leaving water temperature
- c. discharge air temperature
- d. command of space temperature setpoint
- e. cooling status
- f. heating status
- g. low temperature sensor alarm
- h. low pressure sensor alarm
- i. high pressure switch alarm
- j. condensate sensor alarm
- k. hi/low voltage alarm
- l. fan "ON/AUTO" position of space thermostat as specified above
- m. unoccupied/occupied command
- n. cooling command
- o. heating command
- p. fan "ON/AUTO" command
- q. fault reset command
- r. itemized fault code revealing reason for specific shutdown fault (any one of 7)

This option also provides the upgraded 75VA control transformer with load side short circuit and overload protection via a built in circuit breaker.

Option: MPC (Multiple Protocol Control) interface system

Units shall have all the features listed above (either CXM or DXM) and the control board will be supplied with a Multiple Protocol interface board. Available protocols are BACnet MS/TP, Modbus, or Johnson Controls N2. The choice of protocol shall be field selectable/changeable via the use of a simple selector switch. Protocol selection shall not require any additional programming or special external hardware or software tools. This will permit all units to be daisy chain connected by a 2-wire twisted pair shielded

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cable. The following points must be available at a central or remote computer location:

- a. space temperature
- b. leaving water temperature
- c. discharge air temperature
- d. command of space temperature setpoint
- e. cooling status
- f. heating status
- g. low temperature sensor alarm
- h. low pressure sensor alarm
- i. high pressure switch alarm
- j. condensate overflow alarm
- k. hi/low voltage alarm
- l. fan "ON/AUTO" position of space thermostat as specified above
- m. unoccupied/occupied command
- n. cooling command
- o. heating command
- p. fan "ON/AUTO" command
- q. fault reset command
- r. itemized fault code revealing reason for specific shutdown fault (any one of 7)

This option also provides the upgraded 75VA control transformer with load side short circuit and overload protection via a built in circuit breaker.

Warranty:

Climate Master shall warranty equipment for a period of 12 months from start up or 18 months from shipping (which ever occurs first).

Option: Extended 4-year compressor warranty covers compressor for a total of 5 years.

Option: Extended 4-year refrigeration circuit warranty covers coils, reversing valve, expansion valve and compressor for a total of 5 years.

Option: Extended 4-year control board warranty covers the CXM/DXM control board for a total of 5 years.

FIELD INSTALLED OPTIONS

Hose Kits:

All units shall be connected with hoses. The hoses shall be 2 feet (61cm) long, braided stainless steel; fire rated hoses complete with adapters. Only fire rated hoses will be accepted.

Valves:

The following valves are available and will be shipped loose:

- a. Ball valve; bronze material, standard port full flow design, FPT connections.
- b. Ball valve with memory stop and PT port.
- c. "Y" strainer with blowdown valve; bronze material, FPT connections.
- d. Motorized water valve; slow acting, 24v, FPT connections.

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Hose Kit Assemblies:

The following assemblies ship with the valves already assembled to the hose described:

- a. Supply and return hoses having ball valve with PT port.
- b. Supply hose having ball valve with PT port; return hose having automatic flow regulator valve with PT ports, and ball valve.
- c. Supply hose having "Y" strainer with blowdown valve, and ball valve with PT port; return hose having automatic flow regulator with PT ports, and ball valve.
- d. Supply hose having "Y" strainer with blowdown valve, and ball valve with PT port; return hose having ball valve with PT port.

Thermostats:

The thermostat shall be a ClimateMaster mechanical or electronic type thermostat as selected below with the described features:

- a. Single Stage Standard Manual Changeover (ATM11C11)
Thermostat shall be a single-stage, horizontal mount, manual changeover with HEAT-OFF-COOL system switch and fan ON-AUTO switch. Thermostat shall have a mechanical temperature setpoint indicator. Thermostat shall only require 4 wires for connection. Mercury bulb thermostats are not acceptable.
- b. Single Stage Digital Auto or Manual Changeover (ATA11U01)
Thermostat shall be a single-stage, digital, auto or manual changeover with HEAT-OFF-COOL-AUTO system switch and fan ON-AUTO switch. Thermostat shall have an LCD display with temperature and setpoint(s) in °F or °C. The Thermostat shall provide permanent memory of setpoint(s) without batteries. A fault LED shall be provided to display specific fault condition. Thermostat shall provide temperature display offset for custom applications.
- c. Single Stage Digital Automatic or Manual Changeover with Two-Speed Fan Control (ATA11C04) – DXM and PSC Fan Required
Thermostat shall be a single-stage, digital, auto or manual changeover with HEAT-OFF-COOL-AUTO system switch, fan ON-AUTO switch, and fan LO-HI switch. Thermostat shall have an LCD display with temperature and set-point(s) in °F or °C. A fault LED shall be provided to display specific fault condition. Thermostat shall allow use of an accessory remote temperature sensor (AST009), but may be operated with internal sensor via orientation of a jumper.
- d. Multistage Digital Automatic Changeover (ATA22U01)
Thermostat shall be multi-stage (2H/2C), manual or automatic changeover with HEAT-OFF-COOL-AUTO-EM HEAT system settings and fan ON-AUTO settings. Thermostat shall have an LCD display with temperature, set-point(s), mode, and status indication. The temperature indication shall be selectable for °F or °C. The thermostat shall provide permanent memory of set-point(s) without batteries. A fault LED shall be provided to indicate specific fault condition(s). Thermostat shall provide temperature display offset for custom applications. Thermostat shall allow unit to provide better dehumidification with optional DXM controller by automatically using lower fan speed on stage 1 cooling (higher latent cooling) as main cooling mode, and automatically shifting to high speed fan on stage 2 cooling.
- e. Multistage Manual Changeover Programmable 5/2 Day (ATP21U01)
Thermostat shall be 5 day/2 day programmable (with up to 4 set points per day), multi-stage (2H/1C), manual changeover with HEAT-OFF-COOL-EM HEAT system settings and fan ON-AUTO settings. Thermostat shall have an LCD display with temperature, set-point(s), mode, and status indication. The temperature indication shall be selectable for °F or °C. The thermostat shall provide permanent memory of set-point(s) without batteries. Thermostat shall provide convenient override feature to temporarily change set point.
- f. Multistage Automatic or Manual Changeover Programmable 7 Day (ATP32U03)

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Thermostat shall be 7 day programmable (with up to 4 set points per day), multi-stage (3H/2C), automatic or manual changeover with HEAT-OFF-COOL-AUTO-EM HEAT system settings and fan ON-AUTO settings. Thermostat shall have a blue backlit dot matrix LCD display with temperature, setpoints, mode, and status indication. The temperature indication shall be selectable for °F or °C. Time display shall be selectable for 12 or 24 hour clock. Fault identification shall be provided (when used with ClimateMaster CXM or DXM controls) to simplify troubleshooting by providing specific unit fault at the thermostat with red backlit LCD during unit lockout. The thermostat shall provide permanent memory of setpoints without batteries. Thermostat shall provide heating set-point range limit, cooling set-point range limit, temperature display offset, keypad lockout, dead-band range setting, and inter-stage differential settings. Thermostat shall provide progressive recovery to anticipate time required to bring space temperature to the next programmed event. Thermostat shall provide an installer setup for configuring options and for setup of servicing contractor name and contact information. Thermostat shall allow the use of an accessory remote and/or outdoor temperature sensor (AST008). Thermostat navigation shall be accomplished via five buttons (up/down/right/left/select) with menu-driven selections for ease of use and programming.

g. Multistage Automatic or Manual Changeover Programmable 7 Day with Humidity Control (ATP32U04)

Thermostat shall be 7 day programmable (with up to 4 set points per day), multi-stage (3H/2C), automatic or manual changeover with HEAT-OFF-COOL-AUTO-EM HEAT system settings and fan ON-AUTO settings. Separate dehumidification and humidification set points shall be configurable for discreet outputs to a dehumidification option and/or an external humidifier. Installer configuration mode shall allow thermostat dehumidification mode to operate with ClimaDry reheat or with ECM fan dehumidification mode via settings changes. Thermostat shall have a blue backlit dot matrix LCD display with temperature, relative humidity, set-points, mode, and status indication. The temperature indication shall be selectable for °F or °C. Time display shall be selectable for 12 or 24 hour clock. Fault identification shall be provided (when used with ClimateMaster CXM or DXM controls) to simplify troubleshooting by providing specific unit fault at the thermostat with red backlit LCD during unit lockout. The thermostat shall provide permanent memory of set-points without batteries. Thermostat shall provide heating set-point range limit, cooling set-point range limit, temperature display offset, keypad lockout, dead-band range setting, and inter-stage differential settings. Thermostat shall provide progressive recovery to anticipate time required to bring space temperature to the next programmed event. Thermostat shall provide an installer setup for configuring options and for setup of servicing contractor name and contact information. Thermostat shall allow the use of an accessory remote and/or outdoor temperature sensor (AST008). Thermostat navigation shall be accomplished via five buttons (up/down/right/left/select) with menu-driven selections for ease of use and programming.

DDC Sensors:

ClimateMaster wall mounted DDC sensor to monitor room temperature and interfaces with optional interface system described above. Several types as described below:

- a. Sensor only with no display (LON and MPC).
- b. Sensor with override (LON only).
- c. Sensor with setpoint adjustment and override (MPC only).
- d. Sensor with setpoint adjustment and override, LCD display, status/fault indication (LON and MPC).

Performance Sheet

SUBMITTAL DATA - S-I UNITS

Unit Designation: _____

Job Name: _____

Architect: _____

Engineer: _____

Contractor: _____

PERFORMANCE DATA

Cooling Capacity: _____ kW

EER: _____

Heating Capacity: _____ kW

COP: _____

Ambient Air Temp: _____ °C

Entering Water Temp (Clg): _____ °C

Entering Air Temp (Clg): _____ °C

Entering Water Temp (Htg): _____ °C

Entering Air Temp (Htg): _____ °C

Airflow: _____ l/s

Fan Speed or Motor/RPM/Turns: _____

Operating Weight: _____ (kg)

ELECTRICAL DATA

Power Supply: _____ Volts

_____ Phase _____ Hz

Minimum Circuit Ampacity: _____

Maximum Overcurrent Protection: _____

SUBMITTAL DATA - I-P UNITS

Unit Designation: _____

Job Name: _____

Architect: _____

Engineer: _____

Contractor: _____

PERFORMANCE DATA

Cooling Capacity: _____ Btuh

EER: _____

Heating Capacity: _____ Btuh

COP: _____

Ambient Air Temp: _____ °F

Entering Water Temp (Clg): _____ °F

Entering Air Temp (Clg): _____ °F

Entering Water Temp (Htg): _____ °F

Entering Air Temp (Htg): _____ °F

Airflow: _____ CFM

Fan Speed or Motor/RPM/Turns: _____

Operating Weight: _____ (lb)

ELECTRICAL DATA

Power Supply: _____ Volts

_____ Phase _____ Hz

Minimum Circuit Ampacity: _____

Maximum Overcurrent Protection: _____

Notes:

Revision History

Date:	Item:	Action:
11/15/16	Updated Document Design	Updated
10/12/16	Page 25	Added ClimaDry Note
3/22/16	Electrical Data table	Reformatted
3/2/16	Pages 23,24,25,26	Update ECM and factory test information
07/31/15	Unit Features and Engineering Specifications	Edit Compressor Mount Text
07/06/15	Decoder, Electrical Data	Miscellaneous Edits
02/03/15	Decoder, ClimaDry Option Notes	Update Coil Description and Minimum EAT
10/30/14	All	First published